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AN INTEGRATED SOCIAL-COGNITIVE MODEL FOR PREDICTING EXERCISE COMPLIANCE AMONG PATIENTS WITH A CARDIAC DIAGNOSIS

Ralph Maddison MSc

A thesis submitted to the faculty of the University of Auckland in partial fulfilment of the requirements for the degree of Master of Science in the Department of Sport and Exercise Science, Division of Science and Technology.

July 2000
DECLARATION

The material presented in this thesis is the original work of the author except as acknowledged in the text. I hereby declare that I have not submitted this material in part or whole for a degree at this or any other institution.

Ralph Maddison
The aim of the present study was to determine whether Maddux’s (1993) integrated social cognitive model of health behaviour could predict compliance and intention to exercise among patients with a cardiac diagnosis. Forty-one participants (29 male and 12 female—mean age of 63 SD ±9.81 years) with documented cardiac disease enrolled in an 18-week, supervised walking-based exercise programme. Participants completed scales (e.g., intention, self-efficacy, barrier efficacy, outcome expectancy, outcome value and perceived social norm) related to Maddux’s model at the beginning of the programme (phase I) and again at weeks six (phase II) and twelve (phase III). In addition, compliance behaviour was assessed through daily attendance and exercise energy expenditure measures—via Metabolic Equivalents (MET) calculations (ACSM guidelines, 1995).

Insofar as exercise behaviour is concerned, results showed that during phase I barrier efficacy and intention frequency were significant predictors of attendance behaviour (adjusted $R^2 = .26$) and outcome expectancy added an additional 14.3%. Intention frequency predicted energy expenditure (adjusted $R^2 = .19$) and outcome value contributed an additional 10%. Results also showed that during phase II intention frequency and time significantly predicted attendance behaviour (adjusted $R^2 = .38$). Intention frequency and time also predicted energy expenditure (phase II, adjusted $R^2 = .26$). For phase III attendance was significantly predicted by barrier efficacy and intention frequency (adjusted $R^2 = .56$).

Insofar as intention is concerned, results showed that self-efficacy and outcome expectancy significantly predicted intention intensity in phase I (adjusted $R^2 = .43$) whereas self-efficacy alone predicted intention intensity in phase II (adjusted $R^2 = .25$). In phase III self-efficacy and outcome value significantly predicted intention intensity (adjusted $R^2 = .43$).

Using Baron and Kenny’s (1986) suggestion for testing mediation results showed no evidence to support the notion that intention might mediate relations between self-efficacy and exercise behaviour. In addition, a significant difference was found between compliers versus dropouts on the social-cognitive variables at phase I. Specifically those participants that dropped out of the programme had higher outcome expectancy (i.e., vulnerability and severity towards current behaviour) than compliers. Finally, a cross lag correlation design showed that the direction of relations was strongest for exercise behaviour leading to the social-cognitive variables. These results, taken in concert, provide partial support for Maddux’s model. Recommendations for future research are discussed.
ACKNOWLEDGEMENTS

The author would like to thank Dr. Harry Prapavessis for his valuable assistance and guidance with this project. Dr. Prapavessis it has been a pleasure working under your supervision and your continued support remains invaluable.

Additional thanks to Dr. Rob Doughty for your support and contribution to the cardiological component in this work. The author also wishes to thank Dr. Stewart Robinson who has provided valuable input into the physiological component with the present study. I wish to thank the Sport and Exercise Department at the University of Auckland for providing the generous funding for the equipment used in the present study. Finally, I wish to thank Alison and my son Otis for your continued support and humour throughout this endeavour.
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CHAPTER I

Statement of the Problem

Cardiovascular disease is a leading cause of death in the United States of America with 43% of all deaths currently attributed to cardiovascular causes. Mortality among the 1.5 million persons who have had a myocardial infarction (MI) accounts for more than 485,000 deaths per year (Balady, et al., 1998). In New Zealand, cardiovascular disease is by far the leading cause of death, accounting for 43% of all deaths, with coronary heart disease on its own accounting for 25% of the total deaths in 1993. (Hay, 1996).

In New Zealand between 1968 and 1993, the standardised age mortality rate from coronary artery disease (CAD) had fallen by 58% in men and women aged 45-64, and by 37% in men, and 22% in women aged 65 years and older (Hay, 1996). This reduction in mortality has been associated with improved medical management of patients with coronary artery disease and with modification of lifestyle factors (Balady et al., 1998; Ellis et al., 1998).

The modification of lifestyle includes the reduction of coronary risk factors, such as hyperlipidaemia, smoking, hypertension, obesity, sedentary lifestyle etc. Thus lifestyle modification has been directed toward patients, stopping smoking, losing weight, reducing hyperlipidaemia with improvements in diet, and increasing physical activity (Ellis et al., 1998; Mullinax, 1995; Oldridge, 1988; Radtke, 1989). Cardiac rehabilitation programmes have been reported to be instrumental in assisting patients to modify the above risk factors (Franklin & Kahn, 1996; Todd, Wosornu, Stewart & Wild, 1992).

Cardiac rehabilitation is defined as the “process through which cardiac patients are restored to optimal medical, physiological, psychological, social and vocational performance following recovery from an acute cardiac event. Implicit in the process is restoration and maintenance of performance capacity and the use of the principles of secondary prevention throughout the remainder of the patient’s life” (Ginzel, 1996; Naughton, 1992). It has been shown that cardiac rehabilitation and efforts targeted at exercise, lipid management, hypertension control and smoking cessation can reduce cardiovascular mortality, improve functional capacity, attenuate myocardial ischaemia, and retard the risk of further coronary events (cf. Balady et al., 1998, Dubbert, Rappaport & Martin, 1987). Exercise training and activity prescriptions are some of the many objectives of a cardiac rehabilitation programme.
Unfortunately, compliance to medical recommendations such as exercise for patients with coronary artery disease (CAD) continues to be low. It has been estimated that up to 65% of CAD patients who start an exercise programme drop out within the first 6 months (Dishman, 1994). It is not surprising then, that understanding the underlying motives for adopting and maintaining exercise and physical activity has received a great deal of research attention in both clinical and non-clinical populations. Social cognitive models of health behaviour have driven most of this research. The models that have received the most empirical investigation and support for explaining exercise behaviour include: the Health Belief Model (Rosenstock, 1974); Protection Motivation Theory (Maddux & Rogers, 1983); Theory of Reasoned Action (Fishbein & Ajzen, 1975); Theory of Planned Behaviour (Ajzen, 1985) and Self-Efficacy Theory (Bandura, 1986).

These models share a strong expectancy-value foundation. In other words, these theories assume that human beings are goal-directed, self-regulating and capable of forethought, planning, and rational decision-making (Maddux, 1993). One of the unfortunate developments in this area, however, has been the lack of discussion among exercise scientists about those theories that can be used together to better understand and explain exercise behaviour (Brawley, 1993). Brawley argued that greater understanding can be gained through the joint use of theory than obtained through the use of a single model approach – “the joint use of theories expands opportunities to explain exercise behaviour because unique aspects of each model have the potential to capture variation that is not shared by their similar aspects” (p. 97).

According to Maddux (1993) the social-cognitive models that have driven exercise behaviour share a number of specific components as well as different components that allow for theory integration to take place. As a result, it can be suggested through these models, a small number of factors influence exercise decision-making and exercise behaviour (a) outcome expectancy (b) outcome value (c) self-efficacy and (d) intention (see Figure 1). Situational cues and habits are included in this model to explain the dynamic nature of the relationship between the major social cognitive variables and targeted behaviour. That is, as the targeted behaviour (i.e., exercise) becomes more automated, the individual moves into a habit phase, and the cognitive variables emphasised in the model described in Figure 1 become less salient. It is this integrated social cognitive model that will be used to predict intention and compliance to a structured walking based aerobic exercise programme for patients with a cardiac diagnosis.
Figure 1: Schematic Representation of Maddux’s (1993) Social Cognitive Model (Adapted from Maddux, Brawley & Boykin, 1995).
Research Hypotheses

Through this integrated model the following propositions will be tested:

1) Exercise behaviour is a direct result of two factors: intention and self-efficacy.
2) Intention is the most immediate and powerful determinant of exercise behaviour.
3) Self-efficacy influences exercise behaviour both directly and indirectly through the influence of intention.
4) Intention is determined by self-efficacy, outcome expectancy, outcome value and perceived social norm.

Significance

1. This is the first attempt to test the utility of Maddux’s (1993) integrative model to predict exercise compliance and intention to exercise in a clinical population.
2. The present study has the potential to add to the current body of knowledge by potentially explaining unique variance that is not explained in any one of the social-cognitive models alone.
3. If the model has utility in predicting exercise compliance then it is possible that the salient variables can be addressed and included in an intervention to improve future compliance to exercise programmes.

De-limitations

1. Empirical literature that has focused on cardiac rehabilitation and exercise will be reviewed. When there are no data to review from clinical based exercise programmes, other clinical-based exercise programmes will be examined.
2. Participants were able to enrol in the exercise programme only after having had completed a post-discharge 6-week cardiac education programme. This ensured that patients had been reviewed by their cardiologist and been approved to exercise.
3. Only those participants that could read and speak English were able to enrol in the study. Funding was not available to translate the relevant questionnaires.
4. Participants were aged less than 80 years. This figure was chosen so as not to confound study results due to age-related factors.

5. Participants were included with the following cardiac conditions, stable angina, myocardial infarction, post coronary artery bypass graft and percutaneous transluminal coronary angioplasty. It was considered acceptable to group these patients as those with coronary artery disease. Hence, other cardiac patients with conditions such as heart failure, valvular heart disease, etc. were not included in the present study.

Limitations
1. A limitation of the present study is the small sample size. The number of participants available did not permit the use of statistical techniques such as Structural Equation Modelling.

2. The generalisability of the results will be restricted to the population studied. Generalisation to other populations such as younger adults and non-clinical populations may be limited.

3. The use of correlational analysis makes it difficult to infer causality.

4. The study failed to account for any cultural differences. Although ethnic background was not assessed, a small number of individuals within the study represented Polynesian and Maori decent. However, specific cultural issues relevant to cardiac rehabilitation were not addressed.

Definition of Terms
1. Physical Activity - Any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen, Powell & Christenson, 1985).

2. Exercise - Planned, structured and repetitive bodily movement done to improve or maintain one or more components of physical fitness (Caspersen, Powell & Christenson, 1985).

3. Physical Fitness - A set of attributes that people have or achieve that relates to the ability to perform physical activity (Caspersen, Powell & Christenson, 1985).

4. Adherence - To stick to, hold fast, and stay attached to regular exercise and physical activity (Carron, Hausenblas & Estabrooks, 1999).
Compliance - Action in accordance with a request. To continue and complete prescribed exercise (Sykes, 1987) In the present study attendance compliance was deemed evident when participants exercised equal to or greater than the minimum 12 sessions per 6-week phase.

Dropout - Any subject that withdrew from and did not complete the entire exercise programme.

Body Mass - Body mass was assessed from measurements of the height and weight of each individual using standardised equipment. Body mass index (BMI) was calculated from the equation BMI = weight (kg) / height (m)^2.

Angina Pectoris - A paroxysmal thoracic pain, often radiating to the arms, particularly the left, sometimes accompanied by a feeling of suffocation and impending death; it is most often due to ischaemia of the myocardium and precipitated by excitement (Dorland’s Medical Dictionary, 1994).

Coronary Artery Bypass Grafts (CABG) - A technique that involves an auxiliary flow being established using a section of vein or other artery grafted between the aorta and a coronary artery distal to an obstructive coronary artery lesion (Dorland’s Medical Dictionary, 1994).

Hyperlipidaemia - A general term for elevated concentrations of any or all of the lipids in the plasma including hypertriglyceridaemia, and hypercholesterolaemia (Dorland’s Medical Dictionary, 1994).

Myocardial Infarction (AMI or MI) - That occurring during the period when circulation to a region of the heart is obstructed and necrosis is occurring, it is usually characterised by severe pain, frequently associated with pallor, perspiration, nausea, dyspnoea, and dizziness (Dorland’s Medical Dictionary, 1994).

Percutaneous Transluminal Coronary Angioplasty (PTCA) - Dilatation of a coronary artery by means of a balloon catheter inserted through the skin and through the lumen of the vessel to the site of the narrowing, where the balloon is inflated inside the artery, stretching the intima, and flattening the plaque against the artery wall (Dorland’s Medical Dictionary, 1994).

Pedometer - A portable instrument worn on a belt that counts the number of steps walked in response to vertical acceleration of the body, which causes a lever arm to
move vertically and a ratchet to rotate (Montoye, Kemper, Saris & Washburn, 1996, chapter 7).

14. **VO₂ (oxygen uptake)** - The volume of oxygen uptake per unit of time. Under certain conditions VO₂ provides a measure of the energy cost exercise (ACSM, 1995).

15. **VO₂ max (maximal oxygen uptake)** - The rate of oxygen uptake during maximal exercise – indicates the capacity for oxygen transport and utilisation during exercise (ACSM, 1995).

16. **Metabolic Equivalents (MET)** - An estimate of energy expenditure. One MET is equivalent to 3.5 ml·kg⁻¹·min⁻¹ oxygen uptake.
CHAPTER II
REVIEW OF LITERATURE

Cardiovascular disease is a leading cause of death in the United States of America with 43% of all deaths currently attributed to cardiovascular causes. Mortality among the 1.5 million persons who have a myocardial infarction (MI) accounts for more than 485,000 deaths per year (Balady, et al., 1998; Oldridge, 1988). In New Zealand cardiovascular disease is also the leading cause of death accounting for 43% of all deaths (Hay, 1996), with coronary heart disease on its own accounted for 25% of the total people in 1993. Hay (1996) also reported that in New Zealand between 1968 and 1993, the age standardised mortality rate from coronary artery disease has fallen by 58% in men and women aged 45-64, and by 37% in men and 22% in women in those aged 65 years and older. It has been postulated that the reduction in mortality has been associated with various factors such as improved medical management and through the modification of lifestyle factors (Ellis, et al., 1998; Mullinax, 1995; Radtke, 1989).

These lifestyle factors include the reduction of coronary risk factors, e.g., hyperlipidaemia, smoking, hypertension, obesity, sedentary lifestyle etc, (Oldridge, 1998). A sedentary lifestyle has been reported to be an independent risk factor for cardiovascular disease; compared to active patients it doubles the risk of cardiovascular disease (Petrella, 1999). Secondary treatment measures are aimed at lifestyle modification to assist patients in quitting smoking, losing weight, reducing hyperlipidaemia with improvements in diet, and increasing physical activity (Ellis, et al., 1998; Mullinax, 1995; Oldridge, 1988a; Radtke, 1989).

Cardiac exercise rehabilitation programmes have been instrumental in assisting patients to modify the above risk factors (Balady et al., 1998). Two meta-analyses of clinical trials of cardiac rehabilitation after myocardial infarction (MI) have demonstrated a significant reduction (25%) in fatal events with rehabilitation (Oldridge, Guyatt, Fisher & Rimm, 1988), the other demonstrated a reduction in the risk of fatal reinfarction by 25%, cardiovascular mortality by 22% and of total mortality by 20%, (O’Connor, Buring, Yusuf et al., 1989). Ellis et al., (1998) suggested that whilst the benefits of cardiac exercise rehabilitation programmes were modest, there is sufficient evidence to support the recommendations that, “patients with
coronary heart disease without significant residual ischaemia or other contraindications should be advised to take regular aerobic exercise for 20-30 minutes at least three times per week” (p, 170).

It has been reported that incremental levels of regular physical activity have been associated with a reduction in long term mortality when controlled for the presence of other risk factors (Balady, et al., 1998). Increases in physical activity among San Francisco Longshoremen and Harvard Alumni was associated with a reduction in mortality from coronary artery disease in the absence of other coronary risk factors in two longitudinal studies, (Paffenbarger & Hyde, 1988). Regular physical activity has also been shown to reduce the risk of mortality in persons older than 60; whereas inactivity is associated with a 30-40% increased risk of premature death (Pate, Pratt, Blair et al., 1995).

Cardiac rehabilitation has been defined as that process through which cardiac patients are restored to optimal medical, physiological, psychological, social and vocational performance following recovery from an acute cardiac event. Implicit in the process is restoration and maintenance of performance capacity and the use of the principles of secondary prevention throughout the remainder of the patient’s life (Balady, et al., 1998; Ginzel, 1996, Naughton, 1992).

Exercise training and activity prescription is the cornerstone of a cardiac rehabilitation programme (Leon, 2000). Whilst the positive benefits of exercise within cardiac rehabilitation programmes has been demonstrated, patient compliance and adherence is problematic in that patients do not continue to comply to prescribed regimens (Ginzel, 1996; Johnson & Heller, 1998; Lewin, Ingleton, Newens & Thompson, 1998; Mullinax, 1995; Oldridge, 1988; Paffenbarger & Hyde, 1988). Outcomes of exercise focused rehabilitation, other than morbidity and mortality have been investigated and documented with varying degrees of rigor (Hofman-Bang et al., 1999; Morocutti, Tuniz & Foretti, 1999). These include: (a) the various clinical benefits that are associated with regular surveillance; (cf. Bethell, 1999, cf., Newell, Bowman & Cockburn, 2000), (b) physiological benefits such as increases in exercise tolerance and decreases in sub-maximum myocardial oxygen demand; (Balady, Jette, Scheer, & Downing, 1996; Blumenthal, et al., 1988; DeBusk, et al., 1990) and (c) associated behavioural benefits such as decreased depression, increased self-esteem, and increased self-efficacy (cf. Bethell, 1999; Balady et al. 1998; Oldridge, 1988a;), (d) improved quality of life (Cohen et al.,
Poor compliance with medical advice or therapy is a significant problem and is frequently seen in interventions such as cardiac rehabilitation programmes, particularly when they are of long duration, and require substantial lifestyle alteration. Oldridge and Streiner (1990). Dropout rates of 40-50% have been seen from supervised cardiac rehabilitation programmes within 6-12 months for numerous reasons (Oldridge & Streiner, 1990; Oldridge, 1988a) see Figure 2. Oldridge (1988a) has suggested that there is a necessity to distinguish between the dropout and the complier, as the literature is difficult to interpret due to the lack of a consistent definition of exercise compliance. Methods for describing compliance have included; the number of sessions actually attended; the number of sessions or weeks missed; or meeting some physiological objective (Oldridge 1988a). Despite these limitations compliance rates remain relatively consistent across studies.

It is apparent that the real issue then is not only to identify what factors predict those that are likely to be non-compliant or drop-out, but also identify how to decrease both poor compliance and drop-out behaviour. Recent attempts to address this issue have been made by Ades et al., (2000). A home-based monitoring programme, transtelephonically monitored rehabilitation programme with simultaneous voice and electrocardiographic transmission to a nurse-co-ordinator was compared to a standard on-site programme. Results showed that the home-based participants improved aerobic capacity to a similar level to those in the on-site programme. Both groups also improved similarly for quality of life factors. Further work is required to identify measures to improve compliance.

Dishman (1988) has been critical of the atheoretical nature of exercise compliance research. Much of the research literature can be dichotomised as follows (1) determinants of exercise adherence/compliance in non-clinical, and clinical populations; (2) theory-driven research examining exercise adherence/compliance in non-clinical and clinical populations. This review will address the literature under these headings.
Determinants of Exercise Adherence in Non-Clinical Populations

The work of Dishman, Sallis and Orenstein, (1985) and Sallis et al., (1989) Dishman, Sallis and Orenstein, (1985) reviewed the available literature regarding the determinants for spontaneous participation in physical activity and for the participation in supervised exercise programmes. These determinants were dichotomised into, personal characteristics, lifestyle habit, characteristics of the environment, and characteristics of the activity itself. For supervised exercise programmes the personal characteristics that were related to a decreased probability of exercise participation included: blue-collar occupation, smokers, being overweight, and mood disturbances.

Past participation in an exercise programme was the most reliable correlate of current participation and accounted for 30-50% variance in participation in activity over the first few months. These results were consistent across gender, and for treatment programmes in clinical groups (cardiac patients). Health beliefs and knowledge of exercise was related to exercise initiation, yet motivation for continued participation appeared to be derived from personal enjoyment, and general feelings of well-being. Personality aspects that were related to decreased compliance were mood disturbance, depression, and introversion.

Environmental characteristics that influenced compliance to supervised exercise were spousal support with increased support being positively related to compliance. Poor compliance was related to perceived barriers to exercise, namely, disruptions in routine, lack of time and proximity of the exercise facility. Previous participation in physical activity was again related to participation in current spontaneous exercise. Interestingly, while attitudes regarding exercise are related to sport participation in youth and adulthood, they were unrelated to leisure activity or fitness programmes in adults. Being well educated emerged as a determinant of increased participation in spontaneous physical. Increasing age, and being a blue-collar worker was associated with decreased exercise activity. No evidence was found to support the association between increased knowledge about exercise and enhanced exercise participation.

Sallis et al, (1989) extended Dishman et al’s (1985) work by examining determinants of vigorous exercise in a large community based sample (n=2298). This study attempted to correct methodological shortcomings in the determinant literature (i.e., studies conducted on small, selected samples, and a lack of a theoretical framework). Sallis and colleague’s study
attempted to identify correlates of vigorous exercise and to compare various modifiable variables identified through social learning theory. Twenty-four variables were identified and included in a survey that was distributed to American community residents.

Examples of the variables were self-efficacy, modelling, support from friends and family perceived barriers to and benefits of exercise. Exercise behaviour was assessed by asking participants, “during a usual week, about how often do you do physical exercise in your free time for at least 20 minutes without stopping, which is hard enough to make your heart rate and breathing increase a large amount?” (P, 21). This response (which was scored as times per week) was compared to two questions pertaining to physical activity. Results showed that the variables that correlated with physical activity were; self-efficacy, benefits of and barriers to physical activity, friend support, modelling, co-ordination, and home equipment. Self-efficacy showed the greatest correlation with exercise. A multiple regression excluding self-efficacy was performed and showed that barriers, diet, age, modelling, friend support, home equipment, benefits, smoking, co-ordination, and education together explained 27% of the variance in vigorous exercise.

Interestingly, when barriers were analysed, the highest correlation was for lack of interest in exercising, followed by lack of enjoyment, lacks of self-discipline and lack of company. When more distal variables were examined it was shown that age and health habits were significant correlates. Among males, smoking was inversely related to exercise frequency. Dietary habits, consistent with previous research correlated with exercise behaviour, whilst exercise did not. These two papers by Dishman, Sallis and Orenstein (1985) and Sallis et al., (1989) provide the foundation for subsequent determinant research. A more recent review was performed by Abby King, and colleagues (1993) that generally provided support the work of Dishman et al., (1985) and Sallis et al., (1989).

The determinant research can be categorised and is reviewed under the following sub-headings: Demographic factors (e.g., age, body mass index & gender,), personal factors (e.g., social support, cohesion, personality & motivation) and environmental factors (e.g., barriers to exercise). The findings of King et al., (1993) will be incorporated into the present review.
Demographic Factors

Age  A decrease in habitual activity has been identified as age increases from childhood to adulthood and is seen as primarily a biological trend. (Conger, 1973; Dishman, 1980; Sallis & Patrick, 1994). Results from the Amsterdam Growth Study, showed that adolescent participants demonstrated a significant decrease in the amount of time spent during habitual physical activity between the ages of 13-27 years (Kemper, et al., 1997). The decrease in physical activity was greater in males. An overall perspective suggested that between the ages of 13 to 27-years of age, an increasingly sedentary lifestyle was observed.

The establishment of habitual physical activity patterns in adults may well be related to the physical activity patterns established during childhood and adolescence (Telama et al., 1994). Socialisation into sport is easiest in childhood and it can be safely assumed that the physical skills, attitudes, and habits that have been acquired during childhood will be of importance for physical activity in adulthood. If children and adolescents are not physically active, then predictions for later physical activity in adulthood are poor (Telama et al., 1994). Numerous authors have highlighted the concern regarding the age-related decrease in physical and the implications this might have on physical activity patterns in later adulthood (Rowland, 1990; Rowland, 1996). One area that has shown some optimistic results is that persistent participation in sport at an early age increases the probability of physical activity in later life (Kemper et al., 1997; Telama et al., 1997). However, in a review of physical activity and health among adolescence Aaron and LaPorte (1997) have argued that there is insufficient evidence for the belief that physically active adolescents will be active adults. Moreover, the above authors argued that, those studies that do provide support are limited by their small sample sizes and retrospective designs (cf., Aaron & LaPorte, 1997).

Steptoe et al., (1997) examined the correlates of leisure-time physical activity in young adults from among 21 countries. The results showed that leisure-time physical activity was generally low among younger adults within the various European countries. There was an association between physical activity and health beliefs - those with stronger health beliefs, tended to exercise more. A modest but significant association between risk awareness and physical exercise was observed, in that 54% of the physically active compared to the 51% of sedentary persons were aware of the link with heart disease.
Figure 2: Compliance to Cardiac Rehabilitation Exercise Classes

(adapted from Oldridge, 1995).
In accordance with determinant literature there was an inverse relation between smoking and exercise behaviour for both males and females. In other words males and females that smoked performed less exercise than their non-smoking counterparts.

Fletcher and Hirdes (1996) examined physical activity correlates among Canadians aged over 55 years. Data were collected at baseline (1981) and again 7 years later (1988). Baseline physical activity levels in 1981 were predictive of physical activity in 1988. That is, those who were more active in 1981, were still significantly more active in 1988, compared to those inactive in 1981. Moreover, Galgali, Norton and Campbell (1998) have also demonstrated decreased physical activity participation among older adults. These authors recently examined physical inactivity patterns older people. Using study participants from the control population from a Hip Fracture Study, a case control study was performed between 1991 and 1994 to identify and provide an assessment of the contribution of modifiable risk factors for hip fractures among people aged 60 years and older. Forty percent of this population did not engage in any leisure activity whilst sixty percent did not engage in any activities at all. Age was one of the key factors related to reduced activity.

**Body Mass Index** The link between the size of an individual as assessed using body mass index (BMI) and exercise behaviour is equivocal. Fletcher and Hirdes (1996) showed that BMI in 1981 was a significant independent variable for poor self-related health and exercise behaviour in 1988. Steptoe et al., (1997) categorised individuals into low, average and high BMI groups. Based on this categorisation there was no apparent association between BMI and physical activity among females, as females tended to exercise similarly among all three groups. Yet males exercised less as BMI increased, this association was significant in 8 of the 21 countries.

**Gender** Being female has been shown to be related to reduced physical activity among older adults (Galgali, Norton & Campbell, 1998; cf., King et al., 1993). Specifically, studies have shown lower levels of vigorous activity among women compared to their male counterparts (Sallis, Haskell, Wood et al., 1985; Stephens, Jacobs, & White, 1985). The apparent gender difference is not as apparent when leisure time physical activity is included (Stephens, Jacobs & White, 1985).
Environmental Factors

Educational demands Understanding what happens during childhood and adolescence has been examined to determine whether mature exercise behaviour can be better explained. As the age of a child increases, their level of spontaneous intense physical activity decreases as the child enters the confines of the classroom, and come under the influence of television, and computers (Rowland, 1990; Telama, Yang, Laakso & Viikari, 1997). Participation in organised sport or social activities may continue, but the increased demands of school, tertiary education, exams, and work often decrease the amount of time adolescents can give to sport, or physical activity.

In 1994-1995 the New Zealand Public Health Commission provided advice to the Minister of Health related to school health. It is evident that within New Zealand despite limited data there is evidence to suggest that there are good levels of participation in physical activity by most children, but, there is a drop off in adolescence especially for girls (Riddoch, & Boreham, 1995). The Hillary Commission cited various factors as reasons for decreases in physical activity, one being lack of time, due to other commitments (Hopkins et al., 1991).

Barriers to Exercise The role of perceived barriers and the relationship to exercise is an area that has received particular research attention. Using a qualitative feminist perspective Whaley and Ebbeck (1996) reported 26 self-identified constraints to exercise among adults (mean age 76.7 years). Ten of the 26 constraints differed from those previously highlighted in the literature. The top three constraints highlighted were “get enough exercise/physical activity elsewhere”, health reasons, and that participants were busy all the time. This study provides support for the role that perceived barriers or obstacles has for those attempting physical activity in a structured programme, but also highlights the unique nature of each individual’s obstacles. Whaley and Ebbeck (1996) also highlighted that constraints to exercise are both universal and unique, however, despite this, some researchers may choose to impose constraints that are not necessarily perceived as such by the individuals themselves.

Booth et al., (1997) identified various barriers such as insufficient time, lack of motivation, and childcare responsibilities among young Australian adults, whilst older adults reported barriers such as injury and poor health (Booth et al., 1997). Similarly, Hirvensalo et al., (1998) reported that the main obstacles for older aged adults not exercising was health reasons. During their eight-year follow-up study of exercise activity among older adults (65-
84 years), the number of reported obstacles to exercising increased with time. Other reported barriers to exercise for older participants have included discomfort, social isolation, access to facilities and unfavourable weather (Dunlap & Barry, 1999).

**Occupation**  The relationship between exercise and physical activity is not well demonstrated in non-clinical population. Folsom et al., (1991) provided evidence to suggest that there was minimal linkage between occupation and leisure-time physical activity. Whereas, King, Carl, Birkell and Haskell (1988) reported reduced levels of leisure time physical activity among individuals with greater levels of occupational physical activity compared to those with white-collar workers. However, when total activity is considered rather than leisure time the same individuals might have equivalent or increased physical activity levels than white-collar workers (Sallis et al., 1985).

**Personal Factors**

**Social Support**  Interpersonal attachment has been posited to be a fundamental motive (Baumeister & Leary, 1995), thus social support has implications for promoting adherence to exercise and physical activity (Carron, Hausenblas & Estabrooks, 1999). The role between social support and adherence to physical activity and exercise has been examined widely (Carron, Hausenblas & Mack, 1996; Di Lorenzo, Stucky-Ropp, Vander-Wal & Gotham, 1998; Duncan, Duncan & McAuley, 1993; Duncan & McAuley, 1993; King & Fredriksen, 1984; Steptoe et al., 1997; Wankel, 1985).

Duncan, Duncan and McAuley, (1993), examined the domain specific combinations of support that could be identified as important precursors of adherence to a prescribed exercise regimen. Participants were those previously identified as sedentary “at risk” males and females who were already in the 10th week of a federally funded exercise programme. Demographic data was not significantly different among those that adhered and those that did not. All participants completed the Social Provisions Scale (SPC) (domain specific) (Russell & Cutrona, 1987) and a general version of the SPC. The Social Provisions Scale was developed to assess the six relational provisions identified by Weiss (1974). Weiss’s theoretical framework described six different social functions or provisions which may be obtained from social relationships: “attachment, or emotional support; social integration, or network support; reassurance of worth, or esteem support; reliable alliance, or tangible aid;
guidance, or informational support; and the opportunity for nurturance, in which assisting others bolsters one’s own sense of self worth” (Duncan, et al., 1993). The general scale assessed general support from a variety of sources (e.g. family support, friends, co-workers etc.). Internal consistencies for the provisions were analysed and were adequate. The exercise leader, who kept detailed records on each patient including, intensity, frequency and duration of exercise determined adherence. Those participants that voluntarily discontinued the programme were classified as non-adherers. Participants were given the instruments ten weeks into the programme, a time deemed sufficient for people to develop social ties within the group. Results indicated that adherers perceived themselves to be recipients of adequate levels of guidance and feedback concerning their competence and self-worth from members of the exercise programmes. Non-adherers perceived themselves to have less guidance and reassurance of worth than adheres. A gender difference was apparent in this study. For females, reassurance of their self worth from the instructor and other participants appeared to be of primary importance, in that this type of support contributed to enhanced self-esteem as an exerciser and subsequently to a desire to adhere. These findings are supported by Cain (1996) who noted a 48% attrition rate in a female exercise group that did not receive instruction compared to a 35% attrition rate in women that did receive instruction and support. Among males the two main provisions that appeared important were social integration and guidance when differentiating adherers with non-adherers (Duncan, et al., 1993). With regard to the general provisions scale, no differences existed between adherers and non-adherers (Duncan et al., 1993).

Extending on the work of Duncan et al., (1993) Duncan and McAuley (1993) examined whether self-efficacy cognitions served to mediate the relationship between social support and physical activity. Results showed that social support alone did not influence exercise behaviour, but did so indirectly. Duncan and McAuley argued that the relationship between social support and exercise behaviour provided support for the role of self-efficacy as a mediating variable in health related behaviour. Self-efficacy will be addressed in detail later in the review.

Carron, Hausenblas and Mack (1996) performed a meta-analysis to examine the influence of six sources of social influence (important others family, exercise leaders, co-exercisers, social cohesion and task cohesion) on exercise behaviour. The study performed by
Carron et al., (1996) operationalised exercise adherence as behaviour that is self-selected and initiated whereas exercise compliance was seen to be behaviour that is required or prescribed by others. An additional purpose was to examine the impact of social support on intention to exercise, self-efficacy, satisfaction and attitude. Results showed that most of the effect sizes were in the moderate range. Exceptions to this were, the impact of family support on affect associated with exercise involvement, important others on affect associated with exercise involvement, family support on compliance behaviour, and task cohesion in the exercise class on adherence behaviour which were all of a moderate to large effect size. Interestingly the effect size for social support and adherence to exercise was of a moderate size (\( ES = 0.32 \)) yet the effect size between social support and compliance to exercise was nearly twice that of the impact of social support and adherence to exercise. More recent support for the positive relations between social support and exercise participation has been reported for children (Di Lorenzo, Stucky-Ropp, Vander-Wal & Gotham, 1998) and for adolescents and young adults (Leslie et al., 1999).

**Group Cohesion**  Cohesion and its relationship with adherence to exercise has been examined. Cohesion has been defined as the “dynamic process reflected by the tendency of a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs” (Carron, Brawley & Widmeyer, 1998). Carron, Widmeyer and Brawley (1988) provided early evidence of the effect of group cohesion on exercise adherence. An adapted Group Environment Questionnaire (GEQ, cf., Carron, Brawley & Widmeyer, 1998) was used to assess cohesion among participants in an exercise setting. Results showed that adherers and non-adherers were classified correctly (61%) by a function of two cohesion measures (attraction to group task, ATG-T, and attraction to group social, ATG-S). Furthermore, a relationship did exist between adherence and group cohesion.

Carron and Spink (1993 & 1994) have performed a number of studies that have provided further support for the relationship between exercise adherence and cohesion. The first study showed that ATG-T and AGT-S were negatively associated with absenteeism from a women’s exercise class. Carron and Spink (1994) performed two prospective studies – the first study showed that adherers and non-adherers were discriminated by the group cohesion measure ATG-T. Furthermore GI-T (group integration task), GI-S (group integration social)
and ATG-T successfully categorised exercise adherers, non-adherers and dropouts. In study 2 Carron and Spink showed that ATG-T and GI-S distinguished adherers and non-adherers among participants in a 13-week private fitness exercise programme. A function containing ATG-T, and GI-S successfully categorised 65% of the participants.

Carron and Spink (1993) provided a team building intervention to improve cohesion within an exercise setting. The intervention addressed five core group dynamic principles: “(a) development of a feeling of distinctiveness, (b) assignment of group roles, (c) development of group norms, (d) provision of opportunities to make sacrifices for the group, and (e) development of interaction and communication within the group” (p, 64 cited from Estabrooks, 2000). Results showed that after week 8, those participants in the intervention group had greater ATG-T than the control group. Moreover in a second intervention study, greater perceptions of cohesion (ATG-T) was associated with fewer dropouts and reduced lateness.

Estabrooks and Carron (1999) initially reported that cohesion was related to adherence to a structured exercise programme. A follow up study showed that a team-building intervention had an effect on cohesion among older aged participants. Specifically, those in the team building group were more adherent and had greater return to exercise rates after a 10-week break, than did the participants in the control group. Hence sufficient evidence is available in non-clinical settings to suggest that individuals with greater perceptions of group cohesion, attend more exercise sessions, are more likely to be punctual, and are less likely to dropout (c.f., Estabrooks, 2000). Estabrooks (2000) highlighted that further work is required to address measurement issues associated with group cohesion, particularly as modified versions of the GEQ in exercise settings has been problematic.

**Personality and Motivation** Another avenue that has been pursued with respect to determinants of physical activity participation and compliance to exercise has been the domain of personality attributes. Recent work has focussed on identifying personality aspects that are related to exercise compliance (Welsh, Labbe & Delaney, 1991) and also examination of the personality differences between those that exercise and those that do not (Szabo, 1992; Yeung & Hemsley, 1997). It is evident from the literature that both neuroticism and extraversion are related to exercise. Neuroticism has been shown to be negatively related whilst extraversion has been shown to be positively related to exercise (Courneya & Hellsten, 1998).
Courneya and Hellsten (1998) have recently argued that research into personality and adherence to exercise is limited in that most has measured global personality dimensions. In addition, specific personality traits have been addressed, yet no research had been “performed using the dominant framework for studying personality” (p, 626), – the Five Factor Model (FFM, McRae & John, 1992). Thus, Courneya and Hellsten (1998) attempted to expand the understanding of exercise and personality by using the Five-Factor Model (FFM, McCrae and John, 1992) as a framework. The FFM is a version of trait theory that measures 5 hierarchical personality dimensions – neuroticism, extroversion, openness to experience, agreeableness, and conscientiousness. Other relationships examined were those of exercise and barriers to exercise, motives, and preferences. University students (n=264) responded to a battery of questionnaires. Results showed that the personality constructs that were related to exercise behaviour and adherence were neuroticism (in a negative direction), extroversion (in a positive direction) and conscientiousness (in a positive direction). Openness made a unique contribution in the explanation of moderate exercise, whereas extroversion and conscientiousness both made a unique contribution to strenuous exercise. Neuroticism emerged as a significant predictor for exercise adherence. The personality dimensions that were related to barriers to exercise were neuroticism (positive correlation) and extroversion (negative relation). Extroversion demonstrated a negative relationship with the exercise barrier - lack of energy. Relationships were also observed between personality dimensions and various exercise motives. This study extends the understanding of the personality dimensions that are related to exercise behaviour and exercise adherence, using a valid framework (i.e., FFM). Further support for the FFM is provided by Courneya, Bobick and Schinke (1999) who reported that neuroticism, extroversion and conscientiousness were related to exercise behaviour.

Kavussanu and McAuley (1995) examined whether optimism and pessimism could differentiate between highly active and less active individuals. Participants were 166 university volunteers and 27 health club members. Individuals completed a physical self-efficacy measure, a trait anxiety measure and a scale assessing optimism and pessimism. Self-reported physical activity was also collected. Results showed a positive link between optimism and increased physical activity. Furthermore, those with higher physical self-
efficacy and low trait anxiety had greater levels of physical activity than did the inactive/low active members.

The role that motivation plays in exercise adherence has also been examined by a number of researchers (Dishman, 1987; Markland, 1999; Thompson & Wankel, 1980; Wankel, 1993). It has been argued that although early involvement in exercise might be prompted by outside factors such as the perceived benefits of exercise, ongoing participation may well be related to intrinsic motivation for exercise (Dishman, 1987; Markland, 1999; Wankel, 1993). Thompson and Wankel (1980) reported that individuals who were more motivated to exercise, had greater attendance and intentions for continued attendance if they believed that their preferred activities had been addressed in designing the exercise programme. King et al., (1993) cited evidence suggesting that self-motivation may reflect the presence of self-regulatory skills that have been shown to be meaningful in sustaining physical activity.

Vallerand and Fortier (1998) have suggested that each day when individuals engage in exercise this decision is characterised by two forms of motivation. The first is intrinsic motivation (which deals with behaviour that is performed for the inherent pleasure and satisfaction inherent derived inherently from the activity) the second is extrinsic motivation (which deals with behaviour performed for means to an end e.g., for rewards). Vallerand and Losier (1999) have argued that motivation is an important factor when examining persistence to a given activity. Moreover, within the context of sport Vallerand and Losier (1999) suggested that it is possible for a causal link to exist between motivation and persistence among athletes. This application may certainly exist in exercise settings, hence the proposed motivational sequence involving social factors, psychological mediators, motivation, and consequences could possibly be addressed in an intervention.

Li (1999) recently presented three studies on the development and validation of the Exercise Motivation Scale (EMS). Based on the continuum of extrinsic motivation and intrinsic (cf., Vallerand & Fortier, 1998), Li’s EMS scale assessed eight facets of the exercise motivation construct (amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, intrinsic motivation to learn, intrinsic motivation to accomplish tasks and intrinsic motivation to experience sensations). When analysis was performed for those considered frequent exercisers and non-frequent exercisers it was shown
that frequent exercisers had greater levels of intrinsic motivation to learn, intrinsic motivation to experience sensations, integrated regulation, and identified regulation that did their non-frequent exercising counterparts. In addition more self determined forms of motivation (e.g., intrinsic motivation to learn, to accomplish tasks and to experience sensations) were positively related to exercise effort.

**Summary of Determinants of Exercise Adherence in Non-Clinical Populations**

Much of the work examining determinants of physical activity adherence has been performed by Dishman, Sallis and Orenstein, (1985), and Sallis et al., (1989). In summary, the work has shown the individuals most likely to engage regularly in spontaneous physical activity “are well educated, self-motivated and have the behavioural skills to plan an exercise programme and prepare for relapses” (p, 186). Other determinants were examined under the following headings: demographic: personal and environmental factors. There is a relationship between age and physical activity that is as age increases there is a general trend to decreased levels of physical activity. Other demographic factors related to decreased adherence to exercise include smoking, blue-collar occupation and obesity. Of the personal factors social support has been implicated as an important variable in the exercise adherence relationship. Generally results have shown that increased support from friends and family has a positive effect on adherence behaviour. Personality factors such as neuroticism have reported to be inversely related to exercise adherence whereas extroversion is positively associated. Moreover, evidence is available to suggest that the Five- Factor Personality Model has utility in understanding, the amount of exercise individuals perform, exercise motives, and barriers to exercise. Increased physical activity has been positively associated with increased levels of physical activity. Motivation has been identified as an important factor in understanding exercise behaviour. Those intrinsically motivated to exercise appear to exercise more frequently and may be more persistent in their behaviour than those with less intrinsic motives. Of the environmental factors, barriers to exercise have been shown to have predictive value. Typical barriers such as lack of access to facilities, insufficient time have been reported among non-clinical populations.
Determinants of Exercise Adherence in Clinical Populations

The Work of Oldridge and Colleagues  Andrew, Oldridge, Parker et al., (1981) investigated factors that contributed to the dropout rate from the 7-yr Ontario Exercise Heart Collaborative Study of post-coronary men engaged in exercise programmes. Participants (n=728) received a questionnaire to ascertain important programme-related and psychosocial variables. Participants previously randomised according to four prognostic risk factors (occupation, personality, hypertension, and angina) were assigned into two exercise groups (low intensity exercise, and high intensity exercise). Results showed that 41.7% (266/639) of respondents were classified as dropouts. Three main categories were associated with a high dropout rate: convenience aspects of the exercise centre, perceptions of the exercise program, and family/lifestyle factors.

Again using participants from the Ontario Exercise-Heart Collaborative Study Oldridge et al., (1983) reported that of the 678 participants who could have participated for at least 3 years, 315 (46.5%) dropped out of the high-intensity exercise programme. Results also showed that for patients with or without reinfarction the statistically significant predictors of dropout behaviour were smoking and a blue-collar occupation. Angina was significantly associated with dropout only when reinfarctions were excluded. Oldridge et al., (1983) argued that it might be worthy considering the above factors when considering the potential for compliance-improving strategies in reducing dropout from exercise rehabilitation programs.

Demographic Factors

Age  Tooth, McKenna & Colquhon (1992) investigated compliance to a six-week walking exercise programme for cardiac patients. Age did not yield significant results in the prediction of exercise behaviour. Occupation was a demographic variable that was able to predict compliance behaviour (i.e., those with lower social standing were less compliant compared to those of higher social standing). Ades, Waldmann, McCann, and Weaver (1992) however have reported a decrease in cardiac participation with advancing age. Results showed that the participation rate among older participants (mean age 70.4 years) was only 21%. King et al., (1993) have cited evidence to show that younger patients in cardiac rehabilitation were more likely to be poor compliers than were older patients. Ginzel (1996) has also argued that the average older age of females attending rehabilitation is not necessarily
a factor in compliance. Ginzel cited evidence to show that as age increased so too did compliance. More recently, Evenson, Rosamond and Luepker, (1999), examined factors associated with outpatient utilisation of cardiac rehabilitation facilities. An important demographic factor related to greater utilisation of cardiac rehabilitation was younger age (older participants were less likely to use the services). Interestingly, cardiac rehabilitation utilisation decreased monotonically with increasing age despite gender. Contrary to accepted literature those participants with a history of MI who had a history of smoking, or familial history, hypercholesterolaemia were more likely to participate in rehabilitation. Similarly those patients with angina, had a history of smoking, and elevated cholesterol were also more likely to attend rehabilitation. Among those patients with a diagnosis of MI patients, age was predictive of rehabilitation (i.e., younger patients were more likely to attend). These results did not hold for patients with a history of angina, rather, coronary artery bypass graft surgery (CABG) that was the strongest predictor of rehabilitation.

**Gender** Some studies have reported a greater rate of drop out from cardiac rehabilitation among women when compared to men. Oldridge et al (1978) reported a higher one year dropout from cardiac rehabilitation for women (18/28; 64%) when compared to their male counterparts (65/153; 42%). Oldridge, Lasalle and Jones (1980) supported these results, and showed that women were less likely to attend the programme than males, and had a greater drop out rate. McGee and Horgan, (1992), performed a retrospective review to determine the rates of cardiac rehabilitation adoption for patients discharged from the coronary care unit. Results suggested that female gender was independently associated with decreased cardiac rehabilitation uptake. McHugh, Shuster, Wright and Tomich (1995) showed that women generally performed poorly with respect to lifestyle changes, showing decreased exercise adherence, less ability to control stress, than did males. Females also did not show a significant increase in knowledge about their medical condition. Evidence is also available to suggest that women are referred less to cardiac rehabilitation programmes than males (Ades, Waldmann, Polk, Coflesky, 1992; Evenson, Rosamond & Luepker, 1999). Halm, Penque, Doll and Beahrs (1999) also reported that males were referred more often to, and completed cardiac rehabilitation compared to their female counterparts.
Personal Factors

Social Support Early reports have shown a positive relationship between social support and compliance in clinical populations (Caplan et al., 1977; Holm, Christman & Ashley, 1985; Mann, Garrat, Farhi & Murray, 1969). Contrary to this, Hilbert (1985) showed that spousal support did not increase husband’s self-reported compliance to cardiac rehabilitation. Despite these results more recent research supports the relationship between compliance and social support (cf., Dracup, 1994; cf., Shumaker & Czajkowski, 1994). However, the mechanism behind the effect of social support is unknown (Rodin & Salovey, 1989). Social support among cardiac patients has also been implicated as having an effect on mood and physical responses post MI (Bennett & Connell, 1999; Ell & Haywood, 1986). The Carron, Hausenblas and Mack (1996) meta-analysis included reports from clinical population, hence the findings can also be implicated in this section of the review. That is, the encouragement of others such as family friends and physician involvement is likely to have a positive impact on compliance. Physician’s involvement has been implicated as a factor that has a direct impact on referral to cardiac rehabilitation. King, Humen and King (1999) provided evidence from a retrospective review of 1328 clinical records indicating that a quarter of patients that attended a rehabilitation were referred their physician at the tertiary centre. Rather, it was presumed that referral to cardiac rehabilitation was from an alternative source (e.g., a family physician).

Group Cohesion There is an apparent dearth of empirical literature examining group cohesion in clinical settings, however, Fraser and Spink (1999) have recently examined the effect of social support and cohesion on compliance to a clinical exercise group. A total of 70-participants completed a modified version of the Group Environment Questionnaire (GEQ) and the Social Provisions Scale (SPC). Results showed that discriminant function analysis could discriminate between those classified as high and low attenders, and between graduates and dropouts. Those that participated the greatest proportion of exercise sessions scored higher on ATG-T and had lower scores on guidance. These results provide initial support for the effect of cohesion on exercise compliance.

Personality and Motivation Within the domain of cardiac rehabilitation, there has been a general lack of support for the role of personality variables in exercise compliance. That is, personality variables have been shown not to be related to compliance behaviour (Ades, 1992;
Motivation has been highlighted as an important factor in the compliance to cardiac rehabilitation. Radtke (1989) investigated whether post myocardial infarction (MI) patients complied with home-based, self-monitored exercise programmes. Specifically, the relationship with self-motivation and compliance to prescribed exercise was examined. This exploratory study used a mail survey to collect data from 28 post MI patients discharged during a three-month period. The instruments used included the Exercise Compliance Questionnaire (ECQ) and the self-motivation inventory (SMI). The ECQ had been developed by the investigator and was used to determine how well patients complied with their prescribed exercise programmes. The first six questions were designed to assess the frequency, method, intensity, and duration of exercise. Other questions pertained to taking of the patients’ pulse before and after exercise. The SMI is a 40-item questionnaire that assesses self-motivation and has good validity and reliability. At 6 weeks all patients were sent the questionnaires by mail. The mean score for the ECQ at 6 weeks and at 6 months indicated moderate compliance. Other results suggested that participants do comply with home programmes in the early discharge phase but tend to be less compliant after six months. SMI scores at 6 weeks and at 6 months suggested that the patients were moderately and consistently motivated. This study is limited because of its use of retrospective self-reported measures to assess compliance. Despite the limitations of the above study, motivation was shown to be an integral part of exercise compliance. Tardivel (1998) who recently argued that
the lower attendance and decreased compliance to rehabilitation might be related to lack of motivation echoed these sentiments.

As mentioned earlier, medical physicians have a role in the referral of patients to cardiac rehabilitation programmes. Oldridge and Pashkow (1999) have also argued that physicians have a unique role in motivating patients and for encouraging compliance to cardiac rehabilitation. Wilder (1994) has described the “Pygmalion effects” in which the clinicians’ expectations may be positively related to exercise compliance, such that high patient involvement philosophies by physicians hold promise for improving patient compliance.

Environmental Factors.

Perceived Barriers  Ades et al., (1992a) have shown that participant’s perceptions of barriers to access were predictive of cardiac rehabilitation participation, whereas physical factors such as left ventricular ejection fraction, and creatine kinase were not. More recently Sluijs, Kok and van der Zee (1993) identified various factors associated with compliance to physical therapy. Two hundred and twenty-two physical therapists and 475 patients were questioned to determine whether patient compliance with exercise regimens was related to characteristics of the patient and the illness, to the patient’s attitude, or to the physical therapists’ behaviour. Thirty-five patients were considered fully compliant to treatment, yet when those that were considered partially compliant were included in the analyses the figure rose to 76%. Results showed that the three major factors that distinguished the non-compliers were perceived barriers, perceived helplessness, and the lack of positive feedback.

Summary of Determinants of Exercise Adherence in Clinical Populations

Many of the determinants studied in relation to adherence to physical activity among non-clinical populations hold true for compliance among clinical population. Demographic factors such as smoking, blue-collar workers and obesity are again determinants of reduced compliance to exercise. Yet, more specific clinical determinants of compliance include angina, and history of myocardial infarction (MI). Females compared to males were shown to have decreased referral to and greater drop-out from cardiac rehabilitation programmes. Personality and motivation have both been implicated as important factors in understanding
compliance to cardiac rehabilitation. In addition, the Physician’s referral has been shown to increase motivation and compliance to exercise programmes. Finally, perceived barriers to exercise among clinical populations has also been shown to be related to compliance.

Theory-Driven Research of Exercise Adherence in Non-Clinical and Clinical Populations

Self-Efficacy Theory

Self-efficacy theory (Bandura, 1977, Bandura, 1986) refers to people’s beliefs about their capabilities to exert control over events that affect their lives, and their beliefs in their capabilities to mobilise the motivation, cognitive resources, and courses of action needed to exercise control over task demands (Maddux, 1993). Bandura (1977) stated that “efficacy expectations are distinguished from response outcome expectancies” (p, 193). An outcome expectation is related to the individual’s estimation that a given behaviour will result in a certain outcome, whereas self-efficacy is the confidence the individual has that they can perform the behaviour (Godin, 1994a). Bandura goes on to explain that these two component differ, because “individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behaviour” (p, 193). Self-efficacy beliefs are derived from sources including: vicarious experiences; mastery accomplishments; social modelling; social persuasion and the interpretation of physiological states. One’s perception of self-efficacy may determine, the initiation of any given task, the persistence the individual demonstrates when faced with difficulties etc. (see Figure 3).

Non-Clinical Population Research  Individuals starting an exercise programme who develop strong self-efficacy beliefs based on their initial early success are considered more likely to persist compared to those individuals that experience initial failure and hence have low self-efficacy (Maddux, Brawley & Boykin, 1995). Self-efficacy theory has produced an immense amount of literature within the exercise and physical activity domain. Self-efficacy has been shown to be an important determinant in the choice of activities in which individuals participate, the degree of effort they expend on such activities and the level of persistence an individual shows when faced with failure or adverse conditions (McAuley & Blissmer, 2000). This research will now be addressed.
Desharnais, Bouillon and Godin (1986) studied young adults that participated in an 11-week exercise programme to investigate the role of self-efficacy in exercise adherence. Results showed that both self-efficacy and outcome expectations were significant predictors of exercise adherence, however self-efficacy was the more central determinant. Those with lower self-efficacy to perform the exercise at the beginning of the programme were less adherent that those with greater self-efficacy perceptions. Self-efficacy was more able to predict adherence for those classified as adherers and those classified as dropouts. Dzewaltowski (1989) has reported similar findings - among students with greater self-efficacy to adhere to an eight-week physical-education skills programme there was a main effect for exercising more days per week. Exercise outcome did not account for a significant amount of variance in behaviour.

McAuley and colleagues have performed a series of studies that have examined self-efficacy and exercise behaviour. First, McAuley and Jacobson (1991) demonstrated that barrier self-efficacy (the capability to successfully continue to exercise in the face of potential barriers) predicted exercise levels in females over an eight-week low impact aerobic exercise programme. Second, McAuley (1992) examined self-efficacy, physiological and behavioural variables to determine the prediction of exercise behaviour during a five-month structured exercise programme. To ensure generalisability for a middle-aged population among the community, the exercise programme was designed for previously sedentary, middle-aged adults. Results showed that self-efficacy predicted exercise frequency and intensity over the first 3 months of the exercise programme. In addition, when frequency and intensity of previous exercise behaviour was controlled, it was shown that self-efficacy at 3 months was not a significant predictor of exercise behaviour at 5 months. McAuley (1992, cited in McAuley, 1993) argued that “as individuals adapt physiologically and psychologically to the demands placed upon them by exercise participation, and as exercise becomes part of their daily schedule and possibly less demanding, the role of self-efficacy cognitions is diminished” (p, 104).

In a follow up study McAuley (1993) used the self-efficacy, physiological and behavioural variables that were measured at the end of the fifth month in his preceding study to assess exercise behaviour over the subsequent four-month period. Eighty percent of the previous participants agreed to telephone interviews. Results of this study showed that self-
efficacy alone explained a significant contribution of the unique variance (approximately 13%) of exercise behaviour. Whereas, a combination of self-efficacy, behavioural and psychological variables accounted for 30% of the variance of overall exercise behaviour.

Self-efficacy has also been examined and shown to be a good predictor of intention to exercise. Desharnais, Bouillon and Godin (1986) showed that among experienced exercisers, self-efficacy and outcome expectancy/value predicted intention. In contrast, Rodgers and Brawley (1993) demonstrated that for less experienced exercisers participating in a “How to Weight Train” workshop that pre-exercise outcome expectancy and value were better predictors of intention than was self-efficacy. Yet, self-efficacy was a better predictor of intentions for ongoing exercise than was outcome expectancy. Maddux et al (1995) discussed these findings and suggested that together these studies show that people who are new to specific exercise behaviour, could well base their decisions to start mainly on their beliefs about the likelihood and value of potential benefits.

Poag-DuCharme and Brawley (1993) performed two studies to determine whether self-efficacy (cognitive component) and intention (behavioural component) could predict adherence to different exercise programmes. Improvements to previous studies were reported in that, self-efficacy was assessed in three different ways, barrier self-efficacy (individual’s confidence in their ability to exercise regularly despite potential barriers), scheduling self-efficacy (individual’s confidence that they could successfully schedule exercise into their life) and in-class self-efficacy (individual’s confidence in their skills and abilities to complete the various components of the exercise class). To avoid previous limitations Poag-DuCharme and Brawley also asked participants to indicate the anticipated frequency of barriers to exercise occurring during the respective four-week periods. Intention to exercise was assessed by participant’s indicating their proposed frequency (times per week) and duration (number of weeks) of exercise. Attendance at the exercise programme constituted exercise behaviour. Results showed that in Study 1 for the beginner female exercisers, barrier and scheduling self-efficacy predicted intention at week 1 and 9. For the more experienced male and female exercise group in study 2, in-class self-efficacy, barrier and scheduling self-efficacy predicted intention to a lesser extent for weeks 1 and 9. For beginning exercisers, barrier and scheduling self-efficacy and intention were unable to predict attendance to the first half (eight-weeks) of the exercise programme. Scheduling self-efficacy was able to explain 16% variance of
attendance in those that continued to adhere for the latter half of the programme (weeks 9-16). Among experienced exercisers, scheduling, barrier and in-class self-efficacy and intention, predicted attendance for both parts of the exercise programme. In the initial part of the exercise, only scheduling self-efficacy and behavioural intention captured the unique variation in attendance. The same two variables successfully explained larger amounts of variance in attendance among adherers to the exercise programme. Thus, self-efficacy and intention have been demonstrated to be important in the prediction of exercise behaviour.

McAuley, Courneya, Rudolph and Lox (1994) extended these results in a population of sedentary middle aged males and females. McAuley et al., (1994) demonstrated that an efficacy-based intervention programme had a significant effect on reducing the attrition rate from a 20-week aerobic exercise programme. Participants were sedentary middle-aged males and females. Self-efficacy was assessed using a measure that determined the participants’ beliefs in their ability to continue to exercise on a regular basis at a prescribed frequency and intensity. Self-efficacy was assessed at various intervals - the beginning of the programme and at the end of each month. Participants were randomised into a control or intervention group. The intervention was based upon self-efficacy theory, hence, information was provided from the sources of self-efficacy (mastery accomplishments, social modelling, social persuasion and interpretation of physiological states). Results showed that individuals in the intervention group exercised more frequently, walked more minutes per month and walked further per week than the control group. For months 2-5 after the intervention, the treatment group walked further, longer and more frequently than did the control group. Effect sizes after the first month were of a medium magnitude (ES > 0.40), however the effect sizes were more pronounced for months 4-5 (ES > 0.50). A path analysis with a series of hierarchical regressions used to determine whether the intervention would influence exercise behaviour though the mediation of self-efficacy showed that there was not a direct effect of the intervention on self-efficacy. Rather, the intervention had a direct effect on exercise frequency at the end of month 2, as well as an indirect effect on self-efficacy through frequency. Self-efficacy had a direct effect on efficacy at the end of month 2. Exercise frequency at month 4, predicted exercise adherence at the end of the programme. These finding provide support for the importance of self-efficacy in the prediction of exercise behaviour.
Figure 3: Schematic Representation of Self-Efficacy Theory.
In a recent review McAuley and Mihalko (1998) have suggested that future research into the study of exercise behaviour that incorporates self-efficacy as a predictor of exercise behaviour (adherence) might consider two factors. The first, is the assessment of beliefs in ability to exercise at some prescribed frequency, duration, and intensity over ascending periods of time (e.g., months), and the second to include some assessment of efficacy to overcome barriers to exercise. Typically, previous reports have examined self-efficacy from one aspect only (e.g., efficacy to perform the behaviour alone). Other studies have used single item scales. These methods of assessing self-efficacy have raised concerns and is best summed up by McAuley and Mihalko (1998) who asked the following question – is it parsimonious to have multiple measures of self-efficacy? They suggested that as the relationship between exercise and self-efficacy has remained consistent this lays “testimony to the robustness of the association” (p, 378). Choice of appropriate and sufficiently comprehensive self-efficacy, scheduling and barrier efficacy measures need to be considered apriori in the planning of research related to understanding self-efficacy and its relationship to exercise behaviour (antecedents and consequences) (McAuley & Mihalko, 1998).

Clinical Population Research  Self-efficacy, has been shown to be an important theoretical construct in understanding return to physical activity and compliance to exercise in patients post-cardiac event (Brown, Laschinger, Hains & Parry, 1992; Ewart, Taylor, Reese & Debusk, 1983; Ewart et al., 1986a; Ewart et al., 1986b; Ewart, 1995; Gulanick, 1991; Jeng & Braun, 1997; Oldridge & Rogowski, 1990; Robertson & Keller, 1992). Ewart and colleagues at the Stanford Cardiac Rehabilitation Programme have performed a number of studies examining the role that self-efficacy has among those patients recovering post myocardial infarction. Ewart, Taylor, Reese and Debusk, (1983) demonstrated that among patients exercising on a treadmill, self-efficacy influenced performance. Specifically, post-treadmill perceptions of efficacy were better predictors of domestic physical activity than was the performance on the treadmill. Taylor et al., (1985) provided further support for the findings of Ewart et al., (1983) and showed that the combined spousal (wife’s) self-efficacy and patient self-efficacy was predictive of cardiac function during a follow up treadmill test.

Ewart et al., (1986) have also provided evidence to show that self-efficacy perceptions predicted physical activity over-exertion which in turn has called for the development of self-
efficacy scales to identify those at risk of dangerous over exertion due to their unrealistic perception of their physical capacity. Similar findings among patients post coronary artery bypass grafts (CABG) have been reported showing that self-efficacy is an important and independent predictor of physical activity and degrees of exertion (Gortner et al., 1988; Gortner & Jenkins, 1990).

Contrary to the above findings Brown et al., (1992) showed no relationship between post-operative self-efficacy and functional ability as determined by a pre-discharge low level graded exercise test (LL-GXT). The authors did suggest that the lack of relationship might be derived from the lack of vicarious or performance experience following cardiac surgery. It is evident that one’s self-efficacy to perform exercise will decrease following a huge operation such as CABG. However, once the individual performs physical activity at increasing levels, this could provide the enactive attainment required increasing self-efficacy.

Oldridge and Rogowski (1990) investigated whether a standardised education/counselling programme together with two exercise rehabilitation programmes would effect self-efficacy among cardiac patients. Physical activity self-efficacy was assessed as patients were discharged from hospital and again at 7 and 28 days post discharge. Patients were randomly assigned into either an early hospital ward gradual-ambulatory exercise programme or to daily treadmill walking at an exercise centre. Results showed that self-efficacy at discharge and at 7 days post discharge did not differ between both groups. Self-efficacy scores were higher at 28 days among the exercise centre patients when compared to the ward-ambulating cohort. A repeated measure analysis of variance illustrated significant improvements in self-efficacy for all physical activities, among both patient groups. This study suggested that as patients return to normal physical activity confidence to perform the given task increase somewhere between the 7th and 28th day of discharge. Similarly, self-efficacy has been shown to be predictive of self-reported physical activity (personal care and social behaviours) among cardiac patients. In addition, a group nursing intervention to reduce depression and anxiety had positive effect on self-efficacy expectations for general activity during hospitalisation (Ruiz, Dibble, Gilliss & Gortner, 1992). Gilliss et al., (1993), showed that patients recovering from cardiac surgery that had been exposed to supplemental in-hospital education, reported significantly greater self-efficacy expectations for physical activity.
In an attempt to understand whether self-efficacy could mediate the relationship between self-care agency and self-care/recovery behaviour Carroll (1995) prospectively collected data from 133 patients prior to coronary artery bypass graft surgery (CABG) and prior to discharge at 6, and also at 12 weeks post discharge. Applying the model of self-care and self-efficacy theory the authors assessed self-care agency (the decision making phase of self-care) and self-care/recovery behaviours (the productive phase of self-care). Regression equations showed that there was a significant influence of self-efficacy expectation as a mediator between self-care agency (ESCA, Exercise of Self-Care Agency Scale) and general activities at discharge. At six weeks post-operatively there were significant effects of self-efficacy expectations as a mediator between self-care agency and all the self-care/recovery behaviours. At twelve weeks post-operatively a main effect for self-efficacy as a mediator for walking and general activities was evident.

Jeng and Braun (1997) examined how self efficacy influenced compliance and exercise intensity, as well as how compliance and exercise intensity influence cardiac rehabilitation outcomes of patients with coronary artery disease (CAD). Baseline self-efficacy perceptions (Exercise Confidence Scale, ECS, Jeng & Braun, 1995) of one’s ability to exercise predicted subsequent improvement in performance or physiological response to exercise (Jeng, & Braun 1997). Contrary to the extent of empirical literature, there was no relationship between self-efficacy and compliance rate, or between exercise self-efficacy and exercise intensity. Yet, the changes in exercise self-efficacy post exercise, rather than initial self-efficacy was related to exercise outcomes. Compliance to the exercise programme (87% of participants) was more important in predicting improvements in the quality of life measures than exercise intensity (Jeng & Braun, 1997). A limitation of this study was that it only assessed one facet of self-efficacy (i.e., using the exercise confidence Scale (ECS), whereas other self-efficacy measures (e.g., barrier efficacy) were not included.

More recently, in a longitudinal study Bennett, Mayfield, Lowe and Morgan (1999) observed 43-MI patients discharged from a coronary care unit 3-months later to determine whether social-cognitive factors predicted exercise behaviour, alcohol consumption, smoking and diet. Intention accounted for 51% of the variance of light exercise. As demonstrated in non-clinical populations Bennett et al., (1999) showed that in a cardiac population (although
not consistently) that efficacy and outcome expectations were significantly associated with behavioural intentions.

Together these studies provide compelling support for the role that self-efficacy has in health related behaviour such as physical activity and exercise. It is apparent that an individual’s self-efficacy perceptions can influence both physical activity performance and compliance to the behaviour.

Theory of Reasoned Action

The theory of reasoned action was designed to identify the determinants of behavioural intentions in an attempt to understand human behaviour. Ajzen (1991) explained that the TRA is based on the assumption that human beings invariably behave in “a sensible manner; that they take into account of available information and implicitly or explicitly consider the implications of their actions” (p. 117). The foundation of TRA is an expectancy by value summation of beliefs about performing a given behaviour (McAuley & Courneya, 1993). According to the theory of reasoned action (TRA) intention to perform behaviour is determined according to the individual’s attitude toward the given behaviour, and also to the social pressure to perform or not perform a given behaviour (social norms), see Figure 4.

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Godin et al., (1987) reported a longitudinal study in which TRA was used to explain exercise behaviour. Results of structural equation modelling (SEM) showed that intention to exercise was influenced not only by attitude toward the behaviour but also by the variable habit (taken from Triandis’s, 1977 Theory of Interpersonal Behaviour). In this study proximal behaviour was that recorded 3-weeks after reporting intention to exercise. Distal behaviour was that recorded two months after beginning the study. Proximal behaviour was shown to be the result of habit only, whereas both intention and proximal behaviour explained distal behaviour. Structural Equation Modelling (Bentler, 1985) is an “analytical procedure that permits specification of models depicting hypothetical relationships (direct effects, indirect effects, correlations) between different theoretical constructs (each construct defined by one or more indicators) and evaluation of the plausibility of these models by the degree of similarity between the observed sample correlations (or
covariances) among measures used to define the constructs and the reproduced correlations (or covariances) generated by the hypothesised models” (Hays, 1989, p. 600).

Concern regarding the work of Godin et al., (1987) was raised by Hays (1989). It was suggested that Godin et al., only presented the initial model and this model contained 12 direct effects between variables, of which 7 were non-significant. Hays stated that “in SEM applications it is important to remove non-significant parameters from models (i.e., to fix them at zero) and re-estimate the model” (p. 600). Thus, Hays (1989) re-examined the original model proposed by Godin et al (1987), to determine the effect of trimming the model by removing non-significant effects. The trimmed model did not alter the original conclusion presented by Godin and colleagues.

Reynolds et al., (1990) examined psychological predictors of physical activity among school based adolescents. These predictors were founded among behavioural scientific theory namely, self-efficacy theory (Bandura, 1986), Ajzen and Fishbein’s Theory of Reasoned Action (1980), stress from theory and research on the effects of stress, and direct social influence from theory and research on the effects of stress. Predictor variables (intention, self-efficacy, and social influence) were assessed at baseline, 4 and 16 months. This study used data from participants in the control sample of the Stanford Adolescent Heart Health Program (SAHHP), a multiple risk factor intervention programme for 10th grade students. Physical activity was measured via self-report. Results showed that for males, baseline activity, and self-efficacy were significant predictors of physical activity at four months. In females, baseline activity, intention, stress, and social influence contributed to the prediction of physical activity at four months. Results at 16 months showed that for males, baseline activity, and intention were significant predictors of physical activity. In females, body mass index (BMI), intention, stress, and self-efficacy contributed to the prediction of physical activity at four months. A limitation of this study was the use of self-reports to assess physical activity. Unfortunately this method whilst practical is limited by recall or self-reporting biases (Ainsworth, Montoye, Leon, 1996).
Figure 4: Schematic Representation of the Theory of Reasoned Action (Ajzen, Fishbein, 1980) Adapted from Blue, (1995, p, 106).
More recently, Godin (1993) reviewed the literature that had applied the theory of reasoned action to the study of exercise behaviour. Godin reported that the TRA was very useful in understanding the “decision making process that underlies exercise behaviour” (p, 143). In the review the two variables (attitude and norms) within TRA were able to explain 30% of the variance in intention to exercise behaviour. Furthermore attitude was the predominant associating factor with intention, whereas perceived social norms did not appear as a consistent variable for interpreting exercise behaviour.

**Theory of Planned Behaviour**

The theory of planned behaviour (TPB) is an extension of the theory of reasoned action and includes an additional variable – Perceived Behavioural Control (Ajzen, 1989; Ajzen, 1991, see Figure 5). Ajzen (1991) explained that not all behaviour is completely volitional. That is, performing some behaviour may be determined by various other factors beyond one’s control. Thus control over behaviours may be viewed as a continuum, one end the individual having virtually complete control over the behaviour and the other extreme – the individual has no control over the behaviour. The TPB also proposes that intention and PBC are determinants of behaviour. Perceived behavioural control is also related to the individual’s perceptions of the available resources and capabilities to perform the behaviour. The TPB also proposes the degree of perceived control an individual has over a given behaviour can influence intention, as can attitude, and perceived social norms (Godin, 1994b).

**Non-Clinical Population Research** Godin (1993) performed an early review of literature to determine the contribution of perceived behavioural control to explain intention and behaviour over and above the variables with the TRA. Eight studies were presented, and an average of 8% (range 4-20%) additional variance was explained by perceived behavioural control. These findings provided initial support for TPB in the prediction of exercise behaviour. More recent support has been provided by a number of authors (Courneya & McAuley, 1995; Hausenblas, Carron & Mack, 1997).

Before embarking further it is important to note that controversy exists within the TRA and TPB literature is the failure to distinguish between expectation, and intention (Courneya & McAuley, 1994; Warshaw & Davis, 1985; Hausenblas, Carron & Mack, 1997). Warshaw and
Davis (1985) have identified a conceptual distinction between intention and expectation. The concern presented is that, research on intention has not clearly defined the construct, and in studies where it has been defined, it is presented as an expectation. In an attempt to clarify this issue Warshaw and Davis (1985) defined behavioural intention as “the degree to which a person has formulated conscious plans to perform or not to perform some specified future behaviour: (p.214), and behavioural expectation as “the individual’s estimation of the likelihood that he or she will perform some specified future behaviour” (p.215).

Courtnea and McAuley suggested that if one accepts the above definitions then there is some evidence to suggest these two variables (intention and expectation) have been used interchangeably in the study of exercise and physical activity. Thus, Courneya and McAuley (1994) examined whether expectation would better predict physical activity than intention. Results showed that the correlations between expectation and intention were high (0.88 -0.97). Expectation was a stronger correlate for exercise frequency, intensity and duration than was intention.

Carolyn Blue (1995) examined the predictive capacity of both the theory of reasoned action and the theory of planned behaviour. A total of 23 studies were reviewed with 16 of these related to the TRA and TPB. Findings from this review showed that for studies that reported a correlation between the variable intention and a specific behaviour (i.e., exercise); intention was predictive of a person’s performance of that specific behaviour. Most of the studies assessed behaviour that was measured 2 weeks to 2 months after that of intention. Antecedents of behavioural intention were also reviewed. Blue reported that the contribution of attitude to intention to engage in exercise was significant in all of the studies that assessed both of these variables. When subjective norms was examined a positive correlation with intention was reported. However, this correlation was non-significant in all bar five studies. Indirect measures of attitude (i.e., behavioural beliefs x evaluation) and subjective norm (i.e., normative beliefs x motivation to comply) were included in 11 studies. The component of behavioural belief was predictive of attitude in 87% of the studies. Normative belief correlated significantly with subjective norm in 5 studies. Furthermore, the addition of perceived behavioural control significantly increased the prediction of intention to exercise, yet there were mixed results in the prediction of exercise behaviours. Blue (1995) suggested
that these differences in studies may have been a result of the early developmental stage of measures of control beliefs and perceived behavioural control.

Courneya and McAuley (1995) have provided further support for the theory of planned behaviour in its ability to explain exercise intention. A path analysis was performed showing that intention was the sole determinant of exercise adherence. Results showed that both perceived behavioural control and attitude determined intention. Courneya and McAuley reported that two distinct paths from social influence to exercise adherence were evident: i) “social support $\prod$ perceived behavioural control $\prod$ intentions $\prod$ exercise adherence and ii) cohesion $\prod$ attitude $\prod$ intentions $\prod$ exercise adherence” (p, 510).

Hausenblas, Carron and Mack (1997) performed a meta-analysis examining the utility of both the theories of reasoned action and planned behaviour. Results showed that effect sizes (ES) for the relationship between intention and subjective norms were of a moderate size (ES = 0.50), whilst for the relationship between intention and attitude, and perceived behavioural control, and for the relationship between behaviour and intention, perceived behavioural control and attitude were of a large size (ES = 0.80). The effect size for the relationship between behaviour and subjective norm were less than ES = 0.10. Hausenblas et al., (1997) proposed that as far as exercise behaviour is concerned, intention was more strongly related to the construct of attitude. Perceived behavioural control demonstrated a large effect on both intention to exercise (ES = 0.97) and exercise behaviour (ES = 1.01). These results highlighted the importance of the construct perceived behavioural control for understanding exercise behaviour. The importance of this construct also demonstrated the superiority of the theory of planned behaviour over the theory of reasoned action in its predictive capacity (Hausenblas et al., 1997). Further, it is proposed that both intention and perceived behavioural control together add to the understanding of exercise behaviour. Moreover, there were greater effect sizes (ES = 1.26) for the expectation-behaviour-relationship than for intention-behaviour-relations (ES = 1.04). Hausenblas et al., (1997) suggested that research examining predictions originating from TRA or TPB should consider using the construct intention whereas those specifically attempting to predict exercise behaviour should give consideration to the construct of expectation. Hausenblas and colleagues cited evidence to suggest that the “formation of expectation may involve a variety of factors not presented in an intention, including anticipated changes in intention,
noncognitive habits, ability limitations, and environmental facilitators or constraints” \( (p.39) \). Accepting this argument, expectation rather than intention may well be a better predictor of non-volitional behaviours. Smith and Biddle (1999) tested both the theories of reasoned action and planned behaviour to determine the relationship between attitudes and exercise behaviour. The first study, a prospective study of exercise adherence in a private health club demonstrated that intention was the only variable with a significant relationship with exercise behaviour. Structural equation modelling path analysis revealed that 14% of the variance of intention was predicted from social norm and attitude. Further the attitudinal and social normative components of TRA accounted for 13.1% of the variance in fitness centre visits 4 months later.

Study 2 examined the relationship between the TPB and intention to be physically active and to be sedentary among council employees. Again using structural equation modelling path analysis, 44.5% of the variance in intention was predicted by the variables perceived behavioural control, and attitude. With respect to total physical activity, 11.1% of the variance was explained by a modified model of TPB (i.e., the paths between social norm, and intention, and perceived behavioural control, and total physical activity were dropped.). Finally, study 3 examined whether over an 11-week period the TPB variables altered. Perceived behavioural control, attitude, and social norms measured before the intervention explained 69% of the variance in intention to be physically active. An examination of post intervention measures showed that 42% of the variance to be physically active following the course was explained by TPB variables. No significant multivariate effects for time were observed. The authors cautioned the readers regarding interpretation of the results from study 3 due to the small sample size. However, overall these three studies and the others presented have provided sufficient support for adopting the variables from both the TRA and TPB, when trying to understand and predict adherence to exercise.
Figure 5: Schematic Representation of the Theory of Planned Behaviour (Ajzen, 1989) Adapted from Godin, (1996, p, 88).
Recently, Mummery and Wankel (1999) presented results that training intentions among 116 competitive swimmers predicted adherence to swim training regimens. Furthermore, components of TPB (perceived behavioural control, subjective norm, and attitude) contributed a significant proportion of the variance of behavioural intention.

Clinical Population Research There is a dearth of research specifically examining both theories of reasoned action and planned behaviour among cardiac patients, and compliance to cardiac rehabilitation. However, Godin and Kok (1996) have explained that the TPB has been applied to health-related settings. When research has been conducted only aspects of each model (e.g., intention, normative beliefs, perceived behavioural control, and attitude) have been examined in conjunction with other factors. For example Godin et al., (1991) investigated intention to exercise among patients that had suffered a first uncomplicated myocardial infarction. Multiple regression analysis revealed that attitude and perceived behavioural control contributed approximately 24% of the variance of the prediction of intention. When the variables habit, perceived difficulty and personal normative belief (as borrowed from Triandis’s theory of Interpersonal Behaviour, 1977) the prediction increased to approximately 41%. Interestingly, when variables from Rogers’ Protection Motivation Theory (1975) were added instead of the variables from Triandis, no further variation was explained. In other words, this study provided evidence that showed habit, perceived difficulty and perceived barriers were important predictors of intention among a cardiac population.

In another study Godin et al., (1994) argued that the theory of planned behaviour could provide a suitable framework for providing a uniformed definition of perceived barriers to exercise. Godin and colleagues tried to identify notable perceived barriers to exercise among three different populations (general, cardiac and pregnant women). Correlations between intention to exercise and perceived barriers were negative for all three populations (general, \( r = -0.25 \); cardiac, \( r = -0.37 \); and pregnant women \( r = -0.18 \)). For cardiac participants the strongest perceived barriers were no access to a specialised exercise centre, physician’s counter indication, and chest pain. When intention to exercise was delineated into low and high intenders, differences were evident among the various populations for perceived barriers. That is, in the general population low intenders considered the lack of facility access, lack of time to exercise, difficulty getting an exercise partner as stronger barriers to exercise.
compared to high intenders. Among the cardiac population, time required to exercise, age, psychological problems readapting to life after a coronary event, fear of reinfarction and laziness differentiated high from low exercise intenders. This study has provided evidence to show that differing populations perceive differing yet salient barriers to exercise. The authors also suggested that the observation that high intenders among the cardiac population perceive less barriers to exercise than low intenders is consistent with the proposition that these individuals had an opportunity to form a self-schema concerning their efficacy based on actual experience with exercise since the heart attack).

Support for the TRA in other non-cardiac treatment groups has been shown by Ajzen and Fishbein (1980, chapter 15) who provided research evidence supporting the link between intention and attitude toward the behaviour and social norm in participants joining an alcoholic treatment unit. In addition Godin, et al., (1986) applied the TRA to lower limb-disabled athletes Godin, et al., (1986) and showed that intention as used in TRA predicted exercise behaviour, whereas the other variables in the model did not significantly add to predictions.

Recently, Bennett, Mayfield, Lowe and Morgan (1999) examined the impact of social-cognitive variables (intention, outcome expectancies and self-efficacy) and affect on health protective behaviour. Forty-three participants were questioned pre-discharge regarding their pre-myocardial infarction behaviour and their affect and cognitive state at the time of completing the battery of questionnaires. The questionnaires assessed exercise frequency, smoking, alcohol consumption and food frequency practices. In addition global mood, anxiety, depression, outcome expectancies, intention, and self-efficacy were assessed. All participants were sent the questionnaires three-months later - following discharge from hospital. Results showed that intentions accounted for 52% of the variance for exercise behaviour. It was also show that affect was less predictive (7%) of light exercise. The frequency of self-reported light exercise had increased from time 1 to time 2. Efficacy expectations correlated with intentions to exercise regularly and to drink less or no alcohol. In concert the above studies have provided evidence to support the utility of components of TRA and TPB in predicting exercise behaviour among cardiac and other clinical populations.
The Health Belief Model

The Health Belief Model (Rosenstock, 1974) has four major components. The model postulates that these 4 beliefs influence health behaviour. With respect to exercise behaviour the four components are: (1) perceived susceptibility, the individual’s assessment regarding their risk for a particular health threat due to inactivity, (2) perceived severity of the health threat, (3) the individual’s perception that they may benefit from the recommended activity, and (4) the individual’s perception of potential barriers to the activity, or the extent to which the benefits of physical activity exceed the costs associated with the recommended activity (Maddux, 1993; Marcus et al., 1996). Further, it is proposed that a cue to action act as the stimulus regarding the likelihood of the individual taking the action. Cues to action may be internal (e.g., chest-pain, some other indicator of illness) or they may be external (e.g., television advertisement). This model was originally developed to explain poor compliance with public health programmes such as immunisation (Maddux, 1993, Marcus et al., 1996) see Figure 6.

Non-Clinical Population Research  Research examining the predictive ability of the Health Belief Model in exercise settings is limited (Ferrini, Edlestein & Barrett-Conner, 1994; Slenker Price, Roberts & Jur, 1984). Various studies have shown weak but positive relationships between health-related knowledge or beliefs and health behaviour (Bettinghaus, 1986; Näslund, Fredrikson, Hellenius & de-Faire, 1996; Nemcek, 1990), whilst others have demonstrated that health beliefs were not related to positive health behaviour (Weissfield, Kirsch & Brock, 1990).

Dishman (1991) showed that those who had perceptions that exercise was of minimal health value or that their health was poor, exercised infrequently. An interesting concept raised by Marcus et al., (1996) was that the relationships highlighted by Dishman might be causal or rather, it might be that these sedentary individuals acquire beliefs minimising the health value of exercise to rationalise their inactivity. Future study could determine whether this is so. Ronis (1992) combined the health belief model and the theory of subjective expected utility (Luce & Raiffè, 1957) to assist in the understanding of health –related behaviour. Ronis proposed that the subjective expected utility theory would complement the health belief model in that it makes more specific predictions about the relations among beliefs.
and the relations between beliefs and behaviours” (p, 127). Subjective expected utility theory (SEU) is a mathematical concept regarding decision making. It postulates that people evaluate the expected utility (desirability) of alternative actions and select the action with the highest SEU. SEU is equal to the sum of perceived probability of outcome/s multiplied by the desirability of the perceived outcome. The theory does not detail which outcomes are beliefs are the most relevant, rather salient beliefs need to be identified to utilise the SEU. In a study examining dental flossing behaviour, hypotheses derived from an integration of the HBM and SEU theory were tested and mainly supported.

Ferrini et al. (1994) examined the relation between health-related attitudes and health behaviours among an older cohort. Participants involved in a larger ongoing population study were mailed questionnaires to examine health behaviour change, health attitudes, and health maintenance practices. Questionnaires were created to determine health beliefs which included the value of diet and exercise in health promotion, willingness to spend money on healthy things, motivation to exercise, eat healthy food, and confusion about what to do to stay healthy. Results showed that more women reported decreasing dietary fat and salt, changing diet and reading self-help materials than their male counterparts. The younger participants (50-69 years of age) reported more positive health behaviour changes in diet and exercise than did the participants aged 70-89 years. Those with positive health beliefs regarding diet and exercise spent more money on healthy items and also reported more behaviour change compared to those who disagreed that diet and exercise were important for optimum health. Participants who reported a lack of motivation to exercise or reported confusion regarding staying healthy were less likely to make positive lifestyle changes.

Hayslip and colleagues (1996) extended research into the Health Belief Model (HBM) through the development of scales that assessed perceptions of factors that influenced physical activity in younger and older adults as derived from the HBM. Results showed that the scales could distinguish between two populations: (1) younger adults (mean age 21.5 years) and (2) older adults (mean age 71.8 years). Younger adults were more frightened about ageing, perceived greater barriers to exercise, felt less vulnerable to health difficulties, had access to more social support influencing their exercise and health habits and were more strongly motivated by cues to action (Hayslip et al., 1996). Using self-reports of physical activity the model was able to also distinguish between the diversity of physical activity among the two
groups. The younger group reported greater diverse activity than did their older counterparts. It must be noted that the older group were considered “equally healthy and independent community residing individuals” (Hayslip et al., 1996, p. 317). Further support for the HBM has been reported by Näslund et al., (1996) who showed that perceived barriers were useful in predicting poor compliance to health dietary habits among men aged 35-60 years of age. Furthermore, compliers to increased intake of dietary fibre were those participants with a higher level of health knowledge.

Clinical Population Research The health belief model (HBM) has been used as the basis to predict compliance and dropout to cardiac rehabilitation (Hijeck, 1984; Mirotznik, Feldman, Stein, 1995; & Oldridge and Streiner, 1990) and to describe health beliefs of those patients with coronary artery disease (Muench, 1987). In an early meta-analysis Janz and Becker (1984) showed that the HBM was significantly related to behaviour, with no significant differences evident between retrospective and prospective studies. Hijeck (1984) developed a questionnaire for predicting patient entry into a cardiac rehabilitation programme based on the health belief model (HBM). The 14-item scale provides a score by utilising values derived from perceived susceptibility, perceived severity and the difference between the benefits and value of the proposed behaviour. Hijeck reported adequate content and construct validity of this instrument.

Holm et al., (1985) described health beliefs of cardiac patients who had completed a phase II cardiac exercise programme. Variables related to compliance that demonstrated a significant correlation were as follows; perceptions of severity of illness and general motivation; perceptions of severity of illness and re-susceptibility; cues to action and satisfaction with health staff. A limitation evident in this study is the lack of regression analysis to determine the predictive ability of these numerous variables.

In another study, Oldridge and Streiner (1990) utilised the health belief model and the health locus of control constructs to predict compliance and dropout behaviour from a cardiac rehabilitation programme. One hundred and twenty patients with coronary heart disease enrolled into a 6-month exercise programme. Sessions lasted 90-minutes and occurred twice weekly.
Figure 6: Schematic Representation of the Health Belief Model (Adapted from Godin, 1994).
Participants completed physical testing procedures and completed the health belief model standardised Compliance questionnaire and the Health Locus of Control multi-dimensional HLC form. Dropouts were classified as those that dropped out of the programme for unavoidable or avoidable reasons, whereas compliers were those that attended more than 50% of all exercise sessions. Results showed that perceived severity of disease threat was the only variable to distinguish between compliers and total dropouts. The HBM model predicted compliance and dropout behaviour 64% of the time, explaining 5.2% of the variance. Oldridge and Streiner showed that the health belief model was able to add to the prediction of compliance over and above that of demographics and health belief variables alone.

Hiatt, Hoenshall-Nelson and Zimmerman (1990) have provided further support for the HBM. The above authors highlighted the importance of the health belief variables – benefits and barriers to exercise. Results from this study showed those patients that perceived greater benefits and fewer barriers were more likely to enter a cardiac rehabilitation programme than those who did not.

Robertson and Keller (1992) combined both the health belief model and self-efficacy theory in an attempt to develop a single model that explained adherence to exercise among cardiac patients. The variables were assessed using the following scales - benefits, barriers, severity, self-efficacy, and an activity scale. Multiple regression analysis showed that 32% of the variance was explained with the initial independent variables (type of surgery, severity, benefits, barriers, and self-efficacy). In order the variables that contributed the greatest amount of exercise adherence were perceived barriers, self-efficacy, and type of surgery. Whereas perceived benefits and severity were not predictive of exercise adherence. These variables were not included in the second analysis and in the second model. The second model demonstrated that perceived barriers, type of surgery, and self-efficacy explained 31% of adherence to exercise. Furthermore, Robertson and Keller (1992) reported that those patients with greater self-efficacy for exercise were more adherent than those with reduced efficacy perceptions. Interestingly, those that had had coronary artery bypass surgery (CABG) were more adherent than those exposed to percutaneous transluminal coronary angioplasty (PTCA). Those that perceived greater barriers to exercise were less adherent to exercise compared to those who perceived fewer barriers. Finally, perceived severity and perceived
benefits were negatively correlated, that is, an individual that considered their cardiac disease as severe could identify with the benefits of exercise.

In an attempt to reassess the HBM literature Harrison, Mullen, and Green (1992) performed a more recent meta-analysis of research incorporating the health belief model among adults. Harrison, Mullen and Green reviewed predominantly clinical based literature but did include non-clinical studies. For ease of understanding this report will be reviewed in this section. Fifty-one articles were reviewed of which 20 had been included in the earlier review performed by Janz and Becker (1984). Harrison et al., (1992) found significant and positive relations between the HBM dimensions and health related behaviours. Specifically 24 effect sizes were calculated of which 22 were significant. The effect sizes ranged from $ES = 0.01$ to $ES = 0.30$. It was also apparent that effect sizes for the four dimensions of the HBM varied with the different combination of studies. Larger effect sizes were apparent in the retrospective studies for benefits and costs, with smaller effect sizes for severity. In general Harrison et al., (1992) stated that their “findings do not reject the HBM as an important tool in studies of health behaviour, although the small number of studies that met our criteria for operationalisation of the HBM dimensions found relatively weak relationships” (p, 113).

Protection Motivation Theory

Protection Motivation Theory (PMT; Rogers, 1975) is similar to the HBM, but incorporates the concept of self-efficacy. The model has potential to account for some of the exercise behaviour determinants, especially those in a health protective context (Fruin, Pratt & Owen, 1991) and has been utilised for health decision-making and action (Maddux, 1993). Protection Motivation Theory postulates that the intention to perform a protective behaviour (i.e., exercise) is dependent on four main factors. These factors can be grouped into two cognitive processes (1) threat appraisal, thus the assessment of the risks of performing an unhealthy behaviour and (2) coping appraisal, an assessment of the factors that influence the likelihood of performing a preventive behaviour (Maddux, 1993). In the threat appraisal process, the health threat is evaluated in terms of the factors that increase (intrinsic and extrinsic rewards) or decrease (perceived severity and vulnerability of the health threat) the probability of making a maladaptive response. For example, an individual might appraise the threat of a sedentary lifestyle – if the individual perceives that he/she is likely to suffer the
effect of that lifestyle (i.e., cardiac problems) and also perceives the results of this behaviour to be severe (i.e., heart attack) then, it is unlikely the individual will continue to perform the unhealthy behaviour.

Coping appraisal is influenced by response efficacy (the individual’s confidence in the recommended preventive behaviour, i.e., exercise) and self-efficacy, (the individual’s perceived confidence in their ability to perform the desired behaviour). Hence, when an individual makes a coping appraisal higher levels of response efficacy and self-efficacy increase the probability of making an adaptive response. For example an individual that has confidence that exercise will prevent deterioration in health and is also confident they can perform the exercise, then the individual will probably perform the behaviour (exercise). Those with higher levels of perceived response costs (e.g., discomfort) can decrease the probability of the individual performing the coping response (Maddux, 1993). Together these variables combine to form protection motivation theory (see Figure 7).

**Non-Clinical Population Research** Intention, typically is the most commonly assessed index of PMT and research has shown that self-efficacy and response efficacy both to be good predictors of behavioural intention. Wurtele and Maddux (1987) appraised the revised PMT (including severity, vulnerability response efficacy and self-efficacy). Vulnerability and self-efficacy enhanced intentions to exercise. Behaviour (self-reported changes) was predicted by intention. Maddux (1993) suggested that PMT is a useful model for understanding self-protective behaviour. Fruin, Pratt and Owen (1991) supported this suggestion, and showed that active adolescent students adopted adaptive coping strategies compared to their inactive counterparts. Response efficacy, response costs and self efficacy were manipulated – these were shown to be influential of participant’s beliefs regarding efficacy to exercise, costs associated with a exercise programme participation, and beliefs in their ability to complete a programme of exercise. Response efficacy and self-efficacy both influenced which coping strategies the participants endorsed. Response had a main effect on the maladaptive strategies (fatalism and hopelessness). Participants in a high self-efficacy condition also indicated stronger behavioural intention to exercise.
Figure 7: Schematic Representation of Protection Motivation Theory (PMT; Rogers, 1975).
Those participants who exercised at a high level (more than 5hrs per week) endorsed intention to exercise and rational problem solving from the adaptive strategies. Fruin et al., (1991) argued that interventions that promote response and self-efficacy could be useful in promoting adherence to exercise. In a study of another health related behaviour (smoking), Maddux and Rogers (1983) demonstrated that the probability of a threat’s occurrence and the effectiveness of a coping response had a main effect on intentions to take up a preventive behaviour. It was shown that self-efficacy was the most powerful predictor of behavioural intention and had a main effect on intention and interacted with two main variables of PMT – probability of a threat’s occurrence, and coping response efficacy.

**Clinical Population Research**  To the best of my knowledge no studies have examined protection motivation theory in the cardiac rehabilitation setting. However, Taylor and May (1996) examined the theory in a sports injury rehabilitation setting. The study sought to investigate whether participant’s coping and threat appraisals had an effect on compliance to injury rehabilitation. Using a newly developed sport injury rehabilitation belief survey questionnaire (based on PMT theory) participants were questioned at the end of the first, and third rehabilitation appointment. Compliance data was assessed by asking participants to self-report compliance to prescribed treatment, and for the physical therapists to assess compliance to the treatment. Results showed that threat appraisal acted as a motivating process in the choice to comply to prescribed treatment. Those participants deemed compliant had greater levels of perceived susceptibility and severity than the non-compliant. Furthermore it was the variable perceived severity that demonstrated the greatest prediction in compliance behaviour. Partial support for coping appraisal was also found – compliant participants had greater outcome expectations of the benefits of the rehabilitation modalities than those who did not comply. This study provides preliminary evidence for the utility of PMT in understanding compliance behaviour in a rehabilitation setting.

**Transtheoretical Model of Change (TTM)**

Recent research attention has been directed toward understanding exercise adherence and compliance within the Transtheoretical model framework (DiClemente et al., 1991; Prochaska, & DiClemente, 1983). This model (see Figure 8) has been used to understand the
stages that individuals pass through, and the cognitive and behavioural processes they use while changing health behaviours. The model posits that health behaviour change involves graduating through various stages of change - precontemplation, contemplation, preparation and maintenance. Individuals do not necessarily move through these stages in a linear fashion, rather, movement may occur in a cyclical manner.

The model provides a dichotomy of the stages of readiness to engage in a given behaviour, and then measures the use of principle variables that have been shown to effect behaviour change. These principle variables measured by the model can be viewed at three hierarchical levels that are integrated to effect a behaviour change (Gorely & Gordon, 1995, Reed, 1999).

Level I (see Figure 8) focuses on the core structural concept of the TTM, that highlights five stages of readiness to cease an unhealthy or adopt a healthy behaviour (DiClemente, Prochaska, Fairhurst, Velicer, Velasques, & Rossi, 1991; Velicer, Prochaska, Rossi, & Snow, 1992). The stages are: precontemplation (not intending to make a change – I won’t or I can’t stage), contemplation (considering a change – I might stage), preparation, (making small changes – I will stage), action (actively engaging in behaviour change – I am stage), and maintenance (sustaining change over time – I have stage) (Marcus et al., 1992a; Reed, 1999).

The second level (see Figure 8) includes three constructs posited to have an effect on behaviour change: processes of change, decisional balance and self-efficacy. Processes of change are the techniques or strategies people use as they progress through the various stages of behaviour change (Marcus et al., 1992, Reed, 1999). Ten processes derived from commonly used psychotherapy techniques have been placed into two broad categories (factors) – experiential or cognitive processes (consciousness raising, dramatic relief, environmental re-evaluation, self re-evaluation & social liberation) and behavioural processes (counter-conditioning, helping relationship, reinforcement management, self-liberation & stimulus control). Reed (1999) summarised the TTM stating “the TTM uses instruments that measure the four constructs (Stages of change, Decisional Balance, Self-efficacy, and the Processes of change) in order to assess and intervene upon a population’s self-change behaviour” (p 24).
Figure 8: Schematic Representation of the Transtheoretical Model of Change

LEVEL II

SELF-EFFICACY
DECISIONAL BALANCE

PROCESSES OF CHANGE
Experiential Processes:
- Dramatic relief
- Environmental reevaluation
- Self reevaluation
- Social liberation

Behavioural Processes:
- Counterconditioning
- Reinforcement management
- Contingency management
- Stimulus control
- Helping relationships

LEVEL I

PRECONTEMPLATION
CONTEMPLATION
PREPARATION
ACTION

LEVEL III

MAINTENANCE

CONTEXT OF THE GIVEN BEHAVIOUR
To facilitate understanding of this section of the literature, an attempt will be made to define the 10 processes of change. The first of the experiential processes is Consciousness raising which involves elevated awareness regarding, the antecedent, outcomes, and remedies for particular problem behaviour. Dramatic relief – affective aspects of change, often involving intense emotional experiences related to the problem behaviour. Environmental reevaluation – a combination of affective and cognitive assessment by the individual of how the problem affects both the physical and social environment. Self-reevaluation – both cognitive and emotional reappraisal of values by the individual regarding the problem behaviour. Social liberation – the awareness, utility, and acceptance by the individual of selection, problem-free life-styles in society (Figure 8).

Behavioural Processes: Counterconditioning – the requirement of learning healthier behaviours that could replace problem behaviours. Contingency management – the provision of consequences for taking steps - in a given direction. Stimulus control – the control of situations and factors that can stimulate the problem behaviour. Helping relationships – trusting, accepting and being receptive of supportive caring others whilst attempting to alter problem behaviour. Reinforcement management – altering the contingencies that controls or maintains the problem behaviour. Self-liberation – one’s belief that they can change and that they have the commitment to act on a given belief.

Decisional balance relates to the pros and cons of any given decision, and is particularly relevant in the early stages of change (i.e., pre-contemplation, and contemplation), see Figure 8. Self-efficacy relates to an individual’s belief they have the capabilities to perform and accomplish some goal (self-efficacy has been highlighted in previous sections within this review). Within the TTM self-efficacy is determined by one’s level of confidence that he/she will engage in tempting situations (e.g., smoking) or rather adopt positive behaviours in a challenging situation (Reed, 1999), see Figure 8.

Finally, level III addresses the context in which the given behaviour occurs and describes what individuals need to alter to overcome their problem behaviour (Prochaska & DiClemente, 1988). Gorely and Gordon (1995) described this level of change dimension and stated it represents “five distinct but interrelated levels of psychological problems that may be addressed in treatment: symptoms/situational, maladaptive cognitions, current interpersonal conflicts, family/systems conflicts, and intrapersonal conflicts” (p, 316). Moreover, it has
been postulated that these perceived problem levels be targeted when programmes that promote change are initiated.

Non-Clinical Population Research  Prochaska, Velicer and colleagues (Prochaska & DiClemente, 1983, Prochaska & DiClemente, 1988; DiClemente et al., 1991) have examined the TTM quite comprehensively within the study of smoking cessation. More recently the TTM has been applied to the study of health related behaviours such as exercise (Marcus & Owen, 1992; Marcus, Rossi, Selby, Niaura & Abrams, Marcus, Ragowski & Rossi, 1992b; Marcus & Simkin, 1994; Gorely & Gordon, 1995).

Marcus et al, (1992c) reported the following stage of change distribution for exercise behaviour among a worksite sample (precontemplation 24%, contemplation, 33.4%, preparation, 9.5%, action, 10.6%, and maintenance 22%). These results have been generally supported among a number (15) of health risk behaviours (Rossi, 1992). Research by Velicer et al., (1995) demonstrated that smokers had somewhat different stage of change distribution (precontemplation 40%, contemplation 40% with the 20% of smokers in the preparation stage).

Within the domain of exercise those individuals in the preparation, action, and maintenance stages consistently report differing levels of exercise behaviour, with those in the action and maintenance exercising more than those in the preparation stage (Marcus, Rossi, et al., 1992b; Marcus & Simkin, 1994, Gorely, & Gordon, 1995).

The external validity for the stages of change has been established in a variety of settings and among various problem behaviours. As mentioned the greatest empirical support for the TTM remains within the area of smoking cessation. However, studies examining concurrent validity of the stages of change for exercise behaviour, particularly exercise adoption have been made. Similar attempts have been made to develop measures relevant to the various aspects and processes of change of the TTM. These studies will be addressed within this part of the literature review.

Marcus et al, (1992c) examined the application of the two components of the stages of change - the stages and processes of change to exercise. In this study scales were developed to determine the stages and the processes of behaviour change for exercise. The sample consisted of 1172 participants from a worksite sample. The Processes of Change
Questionnaire (PCQ) was derived according to appropriate sequential scale development procedures. The sample was randomly divided for (a) initial item development and testing and (b) confirmatory factor analysis and testing. Further model confirmation was obtained by comparing two structural hierarchical models, and by investigating the relations between processes of change and the stages of exercise adoption (Stage x Processes analyses). Results demonstrated that the underlying stages and process of behaviour change seen in a smoking population could also be generalised to exercise behaviour.

Those attempting to exercise utilised all 10 processes of change. The processes were organised hierarchically – “two higher order constructs that may be globally characterised as experiential and behavioural processes of change” (Marcus et al., 1992c, p, 393). Marcus et al., discussed that the major difference in their results and those seen in smoking cessation studies was that the use of behavioural processes in smoking cessation studies declined as individuals moved from action to maintenance, which was not evident among those adopting exercise. In smoking cessation the use of experiential processes tends to peak in the preparation stage and declines through the action and maintenance stages. However, for exercise adoption, the use of experiential processes peaked in the action stage, and decreased in the maintenance stage.

Marcus, Rokowski and Rossi (1992) investigated the development of a questionnaire relevant to the decisional balance aspect of the TTM with respect to the area of exercise adoption. A sample of 778 employees were administered a Decisional Balance Measure, and a Stages of Exercise Adoption for Exercise measure. Results of a principal component analysis showed that two major factors associated with decisional balance. The two interpretable components, conceptually represented Pros (10-items, positive perceptions of exercise), and Cons (6-items, negative perception of exercise). A one-way analysis of variance was used to determine the relationship between Pros and Cons, and the stages of exercise adoption. Results showed that Pros were significantly higher for participants in the maintenance stage compared to precontemplation, and contemplation; action compared to precontemplation and contemplation, and preparation; and preparation and contemplation compared to precontemplation. Cons were significantly less in for maintenance compared to precontemplation; and all stages compared to contemplation (Marcus Rokowski, and Rossi, 1992). When a decisional balance score was computed (Pros-Cons) it was shown that all
stages were significantly different from all stages. Notably precontemplators scored lowest on decisional balance whilst maintainers scored highest.

Extending on the work of developing exercise related measures of the TTM, Marcus et al. (1992) developed instruments to assess stages of change for exercise and self-efficacy for exercise. In an attempt to determine associations of self-efficacy and stages of adoption and self-efficacy participants from two different worksite samples, responded to self-efficacy and stages of change instruments. Results showed that 34-39% of participants were actors or maintainers. Self-efficacy scores significantly differentiated employees at most stages. In other words, those with less confidence for exercise had not yet begun to exercise.

Marcus and Owen (1992) examined the prevalence of stages of readiness to exercise and their relationship with self-efficacy and to costs and benefits of exercise among American and Australian employees. Results showed that self-efficacy was related to the various stages of readiness across both populations. Again, self-efficacy was able to differentiate most of the stages of change. Finally, decisional balance scores were related to stages of change.

Stages of change have been shown to be positively associated with social cognitive variables. That is, self-efficacy scores for exercise was shown to be higher among participants in the action and maintenance stages, than in precontemplation, contemplation, and preparation stages (Cowan, Logue, Milo, Britton & Smucker, 1997; Gorely & Gordon, 1995).

Gorely and Gordon (1995) extended the above work by examining the relationships between the stages of change, self-efficacy, decisional balance, and the processes of change. Moving the research away from the typical worksite sample Gorely and Gordon chose to include older aged (50-65 years) Australian adult participants. Questionnaires assessing stages of change, self-efficacy, decisional balance and processes of change were distributed to over a thousand participants. Results showed that two cognitive (self-reevaluation and consciousness raising) and three behavioural (counterconditioning, self-liberation and stimulus control) processes of change emerged from the stages of change. Participants in the precontemplation stage used the processes of change less than their counterparts in the other stages. Minimal differences existed between the contemplation and preparation stages for the use of the processes of change, however the use did increase from precontemplation to action or maintenance. Self-efficacy results showed an increase through the stages of change from precontemplation to maintenance. Gorely and Gordon (1995) argued that self-efficacy
appeared to increase the more individuals participated in the behaviour. Despite this, the authors could not infer causation or state whether the link between self-efficacy and stages of change was predictive of behaviour or, rather, self-efficacy was more a reflection of increased experience with behaviour. When decisional balance was examined it was shown that the balance between Pros and Cons shifted with different stages of change. Specifically, greater evidence of Cons was seen in the precontemplation, contemplation and preparation stages, whereas Pros were more evident in the action and maintenance stages. Gorely and Gordon (1995) remarked that this result was similar to that of other exercise studies (Marcus & Owen, 1992; Marcus, Eaton, Rossi & Harlow, 1994). In addition to the above findings Gorely and Gordon (1995) reported findings again consistent with previous literature. Participants in the preparation, action, and maintenance stages of change reported significantly greater exercise frequency than those in the precontemplation and contemplation stages. Moreover, those in the maintenance stages reported exercising longer than participants in the preparation and action stages.

Godin, Desharnais, Valois and Bradet (1995) remarked that despite the consensus regarding the prevalence of stages in the process towards adherence to exercise, no final agreement regarding the specific types and number of stages has been reached. Moreover, Godin et al., (1995) argued that two dimensions are important in the process toward exercise adherence. The two dimensions include a motivation and behavioural aspect. Hence, Godin and colleagues proposed that classifying the stages of change from a motivational and behavioural perspective would enhance an increased understanding of the process toward exercise adherence. Godin et al., investigated and identified the stages in the process of adherence to exercise from a sedentary (stage 1) to an active lifestyle (stage 5) to determine whether this approach had behavioural predictive validity and to characterise these stages according to social cognitive theory. Participants were classified according to 5-stages in the process of exercise by combining habit and intention. Stage 1 included: sedentary individuals with low intention to exercise 3-times per week over the next 6-months; stage 2 were sedentary individuals with high intention to exercise; stage 3 were moderately active with low intention; stage 4 were moderately active with high intention and stage 5 were active individuals with high intention. Social cognitive variables that were assessed included global attitude; global subjective norms, perceived behavioural control, belief-based measures of
attitude and subjective norms, and perceived barriers to exercise. Results from the 347-
participants showed that exercise behaviour increased almost linearly by the stages in the
process of exercise adherence. Results also showed that stage 2 (sedentary individuals with
high intention to exercise 3 times per week in the next 6-months) was a critical stage and
could provide an explanation for the 50% attrition from exercise programmes. Godin et al.,
suggested that those participants in stage 2 could be considered optimistic in that they perceive
few barriers to exercise have fairly high levels of perceived behavioural control. In addition
these participants also reported and anticipated significant benefits from exercise. It was
further reported that these optimistic individuals might well become disillusioned with
exercise, which could help in part to account for some the early attrition seen following
initiation to exercise. Finally, participants in stage 3 reported less perceived behavioural
control than individuals in other stages. It was purported that these individuals perceived the
adoption of exercise based on 3-times per week to be difficult.

King, et al, (1996) examined the relationships between self-efficacy, and decisional
balance (cognitive variables) and motivational mechanisms (stages of change) that have been
shown to mediate changes in both exercise and smoking behaviour. A sample consisting of
worksite employees (that smoked) completed questionnaires to assess smoking and exercise
behaviour. Results showed that cognitive mechanisms corresponding with changes in
smoking behaviour were related to the cognitive variables that have shown to be predictive of
exercise behaviour. Significant relationships in mediating mechanisms including decisional
balance and self-efficacy between smoking and exercise provide preliminary information on
how change in one risk behaviour may relate to another. Similarly, Courneya (1995)
demonstrated that stages of readiness were related to the social cognitive variables, intention,
attitude, and perceived control.

Extending the research into the TTM, Velicer, Rossi, Prochaska, and DiClemente
(1996) have argued that limitations exist with current methods of examining health behaviour
change (i.e., smoking cessation and exercise). These limitations were divided into three main
areas - (1) lack of precise definitions, (b) poor statistical power and (c) lack of meaningfulness
for some aspects of the problem. Velicer and colleagues described each aspect in turn. First
definitional problems have hampered study of behaviour change in that there is a lack of
agreement in the definition of the outcome and criterion variables. Second, it is argued that a
loss of statistical power results from the use of the present measures. This loss of statistical power results in a reduction in statistical sensitivity among various studies. Third, Velicer et al., (1996) suggested that the use of these behaviour measurement criterion, suffer a lack of meaningfulness across the spectrum of the behaviour change process, particularly in the early stages of change.

In an attempt to provide an alternative to using these traditional measures Velicer et al., (1996) recently proposed a 3-construct model (the Criterion Measurement Model – CMM). This model includes the constructs of habit strength (learned component of the behaviour), positive evaluation strength (the importance values and beliefs about the behaviour), and negative evaluation strength (the importance of negative values and beliefs about the behaviour). These three constructs were considered to be distinct, yet related - that is, a small positive correlation among the constructs should exist. Velicer et al., stated that “the combination of the three constructs at each stage provides a basis for conceptualising each stage” (p. 566).

Four studies were presented that examined and supported the structure of the Criterion Measurement Model (CMM). Cross sectional confirmatory factor analysis, graphical representations of a cross-sectional sequential dynamic typology, time series analysis, and longitudinal latent variable panel design modelling were used to examine the structure of the CCM.

Exploratory factor analysis showed that the three-construct model fitted the data well. Assessment of the pattern of change for the three constructs across four stages of change was performed. Results were similar to those of Velicer et al., that is, support was provided for the predicted changes over time for positive evaluation strength, and negative evaluation strength, and habit strength. It was shown that positive evaluation strength (Pros) showed a gradual decline across the stages of change with the highest peak in precontemplation and the lowest at maintenance. Negative evaluation strength (Cons) was low at precontemplation and increased sharply for contemplation and gradually decreased to another low point at the maintenance stage. The prediction that habit strength changes would lead to differences in positive evaluation strength was also supported. Further support for the CCM has been provided by Velicer (1999) who tested predictions from movement within the first three stages
Clinical Population Research The transtheoretical (stages of change) model has recently been applied to understanding exercise compliance behaviour among cardiac patients. Jue and Cunningham (1998) reported that 68% of patients post coronary artery surgery were in the maintenance phase of exercise, 10% in action and the remaining 22% evenly distributed between the earlier three stages. Unfortunately the study did not provide clear evidence of differences in the use of processes of change for those in different stages of change. The authors suggested the study had utility in that it provided evidence suggesting the ease in which stages of behaviour change can be identified, allowing for more cost-effective and efficient health promotion being targeted at the specific stage populations.

Hellman (1997) examined whether the stages of change model could predict exercise adherence among older adults with a cardiac diagnosis following discharge from an inpatient phase I cardiac rehabilitation programme. Participants were assessed to determine stages of change, exercise behaviour (Modified 7-Day Activity Interview), perceived health status, perceived barriers and benefits of exercise, prior related physical activity (before hospitalisation), perceived self-efficacy, interpersonal support for exercise, and processes of change. Discriminant function analysis was used to assess predictors of stages of change. Results demonstrated that predictor variables differentiated stages of change in exercise adherence. The variables that contributed significantly to the explanation of exercise adherence were perceived self-efficacy, perceived benefits (Pros) and barriers (Cons) to exercise, and interpersonal support (all stages of change variables).

Extending on the above findings Bock and colleagues (1997) examined whether the TTM could predict exercise adherence following a phase II cardiac rehabilitation programme. The study sought also sought to investigate the cognitive (self-efficacy, and decisional balance, processes of change) and behavioural changes made by participants participating in a cardiac rehabilitation. Sixty-two participants commenced the rehabilitation programme, and 16 (25.8%) dropped out within the 12 weeks. Results showed that at pre-treatment more than half of the participants were considered sedentary, and were represented in the following stages of change; contemplation (30%), preparation (27%), action (26%), and maintenance
(17%). For participants in the more advanced stages of readiness, self-efficacy, and the processes of change were rated higher, whilst perceived costs of exercise were rated lower when compared to individuals in the earlier (less advanced) stages of change. Furthermore, post-treatment (after cardiac rehabilitation) analysis revealed that participants had advanced stages of change, such that 64% were in action, 32% in maintenance and 4% in preparation. Participants also increased the level of exercise performed - moderate intensity from 5.86 hours to 8.44 hrs and hard intensity from 1.28-2.1 hours. Moreover, increases in self-efficacy, use of processes of change and decreases in the ratings of exercise cons emerged after the cardiac rehabilitation programme. Interestingly, results at 3-month follow up revealed that regression to previous stages of change had occurred for some participants. Stage of change representation was Contemplation 8%, Preparation 12%, Action 16%, and Maintenance 64%. Nearly half of the participants had decreased their exercise levels since the post-treatment analysis. A logistic regression analysis using stepwise entry showed that scores for self-efficacy, and endorsement of behavioural processes of change had decreased whereas scores for negative decisional balance (Cons) increased (Bock et al., 1997). Bock et al., (1997) concluded that the results indicated that the maintenance of exercise behaviour post cardiac rehabilitation is allied with changes in cognitive and behavioural constructs that have also been predictive of other health behaviour (i.e., smoking cessation, and exercise adoption). Further, motivational models of behaviour change are more dynamic than other theoretical models that have been used to understand and predict adherence to health related behaviour. These models can provide valuable information to assist the tailoring of interventions to promote exercise adoption and maintenance (Bock et al., 1997).

**Summary of Theory-Driven Non-Clinical Population Research**

A number of social-cognitive theories were addressed in the preceding literature review. A brief summary of the pertinent theories will follow. Self-efficacy theory has received a great deal of attention in the empirical literature. Self-efficacy has generally been reported to be an important predictor of physical activity, and compliance to exercise. Specifically, self-efficacy has been predictive of exercise adherence but not dropout behaviour. Other research has shown that barrier efficacy to be predictive of exercise behaviour among females. Moreover, an intervention based on self-efficacy showed that
participants in the intervention group exercised longer and more frequently compared to those in the control group. In addition, research has shown self-efficacy to be related to behavioural intention. There is an extensive body of literature that has examined the theories of reasoned action and planned behaviour in an exercise domain for non-clinical populations. Generally it is apparent that these models have been successful in predicting exercise behaviour. Intention has been shown to predict exercise behaviour to varying degrees. Evidence has also supported and refuted the direct relationship between perceived behavioural control with exercise and with intention. In addition, evidence is available to support that attitude is a more reliable predictor of intention than subjective norm. Perceived behavioural control appears to explain additional variance in intention equal to that of attitude. There is limited support for the health belief model to predict exercise behaviour within non-clinical populations. The greatest success of the HBM has been demonstrated using the variables - perceived benefits and perceived barriers to exercise behaviour. That is, those that perceive fewer barriers and greater benefits were more likely to exercise and adhere to exercise programmes than those who did not. Protection motivation theory has been examined within non-clinical populations. Generally, self-efficacy has been a strong predictor of intention, and also has an effect on the perceived probability of a threat occurrence, and perceived coping response efficacy. A revised PMT model (including severity, vulnerability response efficacy, and self-efficacy) has shown that vulnerability and self-efficacy enhanced intentions to exercise, and also predicted intention. The TTM has been studied extensively within exercise behaviour among both clinical and non-clinical populations. The TTM is a dynamic model and the level I constructs - stages of change have been useful in understanding exercise behaviour. Furthermore, the level II constructs including decisional balance, self-efficacy, and the processes of change have demonstrated relationships with exercise behaviour. Evidence has also been provided to differentiate the use of self-efficacy, decisional balance and processes of change across the various stages of change. Recent evidence has provided support for the criterion measurement model (CMM, a three-construct outcome model that includes; habit strength, positive evaluation strength, and negative evaluation strength).
Summary of Theory-Driven Clinical Population Research

Many of the research findings from non-clinical research hold true for clinical-based research. Self-efficacy has been shown to be predictive of exercise effort among patients undergoing treadmill testing. Self-efficacy has utility in predicting exercise overexertion among cardiac patients. Not only has the relationship between self-efficacy and physical activity been examined, it is apparent that self-efficacy is related to self-care activities. Again, as reported in the non-clinical population support for the relationship between self-efficacy and behavioural intention exists. There is also sufficient evidence in the literature to provide support for the mediation role-played by self-efficacy in predicting adherence to exercise. Unlike the self-efficacy literature there is a dearth of research that has examined the TRA and TPB among cardiac populations. Of the evidence that is available - attitude and perceived behavioural control were both good predictors of intention, and exercise behaviour. Within the cardiac rehabilitation setting the health belief model has been used to predict compliance and dropouts. Health belief variables such as perceived severity, barriers and benefits of the behaviour have predicted exercise compliance. As with TPB, protection motivation theory has received limited testing in the clinical domain, specifically among cardiac rehabilitation. The one study that was examined in a clinical situation (injury rehabilitation) showed that perceived severity demonstrated the greatest prediction in compliance behaviour. In addition, participants that were more adherent had greater outcome expectations of the benefits of the rehabilitation modalities than those who did not comply. It is clear that the PMT has utility to contribute to the explanation of exercise behaviour but has not fully been tested, particularly among clinical groups. The reasons for this might be due to measurement issues. That is, scales to assess the variables within PMT have not fully been developed. The TTM has also been studied among clinical populations. As with the non-clinical populations, self-efficacy, decisional balance, and the processes of change have had utility in differentiating compliers from non-compliers. In addition, stages of change have been shown to differentiate patients participating in cardiac rehabilitation. That is, there have been greater percentages of participants in the action and maintenance stages at the end of the rehabilitation programme than were evident at the beginning. Self-efficacy, decisional balance and process of change have been able to predict exercise behaviour.
Toward an Integrated Model.

The preceding review has focussed on examining the empirical literature related to the predominant social cognitive models that have been applied to exercise behaviour. Whilst these theoretical models have obvious differences they also share a number of similarities. Brawley (1993b) has argued that too often theoretical models for understanding behaviour change are pitted against each other in an attempt to determine whether one model is superior to the other in that it can account for a greater degree of variance of the behaviour than its counterpart. It is possible that the joint use of theory could enrich the explanation of behaviour as the unique aspects of each model have the potential to capture variation that is not shared by their similar aspects. In other words, if one model is used to predict behaviour it may miss or ignore some aspect, whereas the joint use of models decreases the possibility of this occurring. Brawley (1993b) has therefore suggested that need exists to consider the similarities offered by joint use of theory rather than just considering the existence of differences.

Attempts have been made to examine competing theories of health related behaviour Weinstein (1993). Having examined four theories – health belief model, theory of reasoned action, protection motivation theory, and subjective utility theory, Weinstein (1993) remarked that many reviews of health behaviour have overlooked the theoretical similarities as well as their differences.

If models are to be integrated or used together to examine and understand behaviour they must be related, conceptually similar and applied to specific classes of health behaviour such as promotion, prevention, and detection (Brawley, 1993). Brawley argued that models such as the Theory of Reasoned Action/Theory of Planned Behaviour, and Self-Efficacy Theory provide such similarities. The rationale for such an assumption is as follows; (1) approximately fifty-percent of the 37 determinants of the probability of exercise summarised by Dishman, Sallis and Orenstein (1985) can be accounted through the variables in the models. (2) these models have characteristics that form the foundation for theoretically based exercise and health promotion. (3) the change and development of the social cognitive variables that occur through the perpetual process of social learning are commonly accepted within the TRA/TPB, and SET models. Strategies and interventions can potentially affect
these socially learned variables. This also implies that the variables can differ over time, which reflects the need to assess these variables longitudinally.

In an initial attempt to integrate theory Rodgers and Brawley (1993) provided an intervention based upon both the theories of planned behaviour and self-efficacy. This intervention (a-videotape to influence behaviour change) was used in a self-help weight control group containing twenty-seven participants. Additional purposes of the study were to determine various changes in psychological reactions to the intervention and to predict behavioural intentions in those participants keen to regulate their weight. Various psychological measures were assessed relevant to the related theories (attitude, subjective norms, intention, perceived behavioural control, and self-efficacy). It is important to note that the latter two variables were the same variable applied to both theories (TPB and SET). Outcome expectancy was calculated from the product of participant’s ratings of the outcome likelihood and outcome value, previously determined in pilot testing, (Rodgers and Brawley, 1993). Participants were expected to attend 10 weekly hour and a half sessions. The measurement instruments were distributed a total of five times over the weight loss programme. Adherers and dropouts from the programme were distinguished. Dropouts were those participants that did not attend more than four classes, including three consecutive classes, and also having not attended the ninth and tenth classes.

Various results were presented; first, perceived behavioural control (TPB) significantly predicted the behavioural intention for exercise at weeks seven and nine. In relation to self-efficacy theory, behavioural intention was predicted by outcome expectancy early in the programme, and by self-efficacy later in the programme. Attitude predicted dropouts (adjusted $R^2 = 0.65$). Discriminant function analyses following the first class, after the intervention, showed that the theoretical groupings of TPB and SET both distinguished dropouts from adherers. Dropout’s self-efficacy and outcome expectancy scores decreased over time whereas the self-efficacy and most outcome expectancy scores did not significantly change. The importance of this study is its ability to demonstrate that both self-efficacy theory and the theory of planned behaviour were similar in their prediction of adherers and dropouts, for exercise behaviour. Also, this study illustrates that there is a commonality among the variable self-efficacy and perceived control (Maddux, 1993; Rodgers & Brawley, 1993).
Maddux (1993) examined the conceptual similarities among the following social-cognitive models; health belief, self-efficacy, theory of reasoned action/planned behaviour, protection motivation, and habit theory. Based on the similarities of these models, Maddux proposed that the major features of the relevant models should be incorporated into a single inclusive model, which would then require investigation. The theory of planned behaviour was suggested to provide a satisfactory framework on which to build the integrated model. Maddux (1993) proposed the following advantages by using the TPB: self-efficacy has similarities to perceived behavioural control (from TPB). The TPB also includes perceived social norm variables – which is not particularly featured in other models. The assessment of attitudes toward the behaviour in TPB incorporates outcome expectancy and outcome value in its assessment of beliefs about the expected consequences and the value associated with these consequences. Finally, intention (from the TPB) provides a link between attitudes and beliefs to behaviour.

Maddux provided an explanation of the modifications of TPB using variables from other models that would be required. These modifications were the incorporation of perceived vulnerability/susceptibility and severity (i.e., outcome expectancy) from the health belief and protection motivation theories into the attitude component. An argument is presented for the replacement of perceived behavioural control (as highlighted in TPB) with self-efficacy. Maddux also suggested incorporating the concept of situational cues (as highlighted in HBM) and habit. Habit theory assumes that individuals attempting behaviour change will move through various stages, as highlighted through the TTM.

In presenting the integrated model Maddux posited that behaviour is a result of two factors: intention and self-efficacy. Intention relates to what one plans to do and is the most powerful determinant of behaviour. Intention is determined by self-efficacy, outcome expectancy, outcome value and perceived social norms. Attitude toward the current and new behaviour incorporates outcome expectancy (the expected costs and benefits) and outcome value (the importance applied to the benefits and costs). Maddux also argued that the assessment of attitude toward the current behaviour should include an appraisal of perceived vulnerability and severity to negative health outcomes. Moreover, assessment of attitude toward the new behaviour should similarly include an assessment of perceived vulnerability and severity of negative health outcomes. Maddux also stated that perceived social norms
(i.e., support from friends and family) are concerned with the responses of others toward the new behaviour and the value associated with these responses. Situational cues and habit are also included in this model to explain the dynamic nature of the relationship between the major social cognitive variables and targeted behaviour. That is, as the targeted behaviour (i.e., exercise) becomes more automated, the individual moves into a habit phase, and the cognitive variables emphasised in the model described in Figure 1 become less salient. To date, no one has tested the validity of this model in an exercise setting. Hence, as stated earlier the aim of the present project is to use Maddux’s (1993) social-cognitive integrated model to predict compliance and intention to exercise among cardiac patients.
CHAPTER III
METHODS

Participants

The sample was comprised of 41 (males $N = 29$ and females $N = 12$) discharged patients with a cardiac diagnosis. The mean age for the entire sample was 63.65 years ($SD = \pm 9.81$). The demographic information of all participants is provided in Table 1. As can be seen from Table 1, the majority of the participants were older retired adults, with an above average BMI. There was also an even distribution of non-smokers and previous smokers. Participants generally attended 11-13 sessions per exercise phase. As can be seen from Table 1 the majority of participants were in the preparation to the maintenance stages of change (Stages of Change Questionnaire adapted from Marcus, Rossi, Selby, Niaura & Abrams, 1992, see Appendix N).

Measures Corresponding to Maddux’s Integrated Social-Cognitive Model.

Intention  Intention to exercise was measured using a scale adapted from Courneya, and McAuley (1994). Courneya and McAuley (1994) have recently stated that, “a lack of scale correspondence occurs when the magnitudes, frequencies, or response formats used for the intention scale are different from those used for the behaviour scale” (p. 281). To address the issue of scale correspondence three dimensions of intention were assessed. The first assessed intention time by asking participants to indicate the number of minutes they intended to exercise. A key was provided to assist in the completion of the intention scale. For example the key explained to participants that each exercise session would last 50 minutes in duration, hence values ranged from 1-50. The second component of intention assessed intensity. Participants were asked to indicate the intensity that they intended to walk at a continuous pace. Four levels of intensity were presented with examples provided of respective levels (i.e., easy, moderate, moderately fast and fast). Scores for intention intensity could range from 1-4.
Table 1: Demographic Data for the Entire Sample.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No MI</th>
<th>One MI</th>
<th>Multiple MI’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial Infarction</td>
<td>14</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Occupation</td>
<td>Retired</td>
<td>White-collar</td>
<td>Blue collar</td>
</tr>
<tr>
<td></td>
<td>26 (63.4%)</td>
<td>4 (9.8%),</td>
<td>6 (14.6%),</td>
</tr>
<tr>
<td>Smoking History</td>
<td>Current</td>
<td>Never smoked</td>
<td>Previous smoker</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>BMI</td>
<td>Mean</td>
<td>SD</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>27.32</td>
<td>4.02</td>
<td>19.12–38.65</td>
</tr>
<tr>
<td>Stages of change</td>
<td>Precontemplation</td>
<td>Contemplation</td>
<td>Preparation</td>
</tr>
<tr>
<td>Phases I</td>
<td>0%</td>
<td>7.3%</td>
<td>31.7%</td>
</tr>
</tbody>
</table>
The third intention assessment was frequency. Intention frequency represents a combination of participants’ perceptions of intention to exercise a given number of session per week (1-5) and or a specific number of weeks (1-6), scores could range from 1-30. Intention scores were derived for each phase of exercise. The complete intention scale is located in Appendix A.

**Barrier Efficacy**

The Barriers Efficacy Scale (McAuley, & Mihalko, 1998) was used to assess participants’ perceived barriers to exercise. Participants rated their confidence to overcome 13 common reasons preventing people from participating in exercise sessions on a scale ranging from 0% (no confidence at all) to 100% (completely confident). The strength of efficacy is calculated by summing the confidence scales and dividing by total number of items used. Barrier efficacy scores were presented for each phase of exercise. Cronbach’s alpha values were follows for each of the three phases of exercise phase 1, $\alpha = .88$, phase II, $\alpha = .86$, and phase III, $\alpha = .92$. The complete Barrier Efficacy Scale can be found in Appendix B.

**Self-Efficacy**

The Self-Efficacy Scale was used to assess participants’ confidence to successfully perform increasing levels (duration, and difficulty) of physical activity (i.e., walking). The scale was adapted from McAuley, and Mihalko (1998). Participants rated their confidence on a scale ranging from 0% (no confidence at all) to 100% (completely confident). Scores were summed with greater values indicating greater efficacy to exercise for longer periods of time and at a greater level of intensity. Cronbach’s alpha values were follows for each of the three phases of exercise phase 1, $\alpha = .96$, phase II, $\alpha = .92$, and phase III, $\alpha = .92$. The complete scale is located in Appendix C.

**Outcome Expectancy and Outcome Value Measures**

All measures were generated for the present study by the investigator according to the model presented by Maddux (1993). In developing items for the relevant scales, examples of respective items were sent to Dr Maddux to ensure congruence with the proposed model. Maddux highlighted that the importance of separating statements that assess a person’s perceptions of the probability that something will occur as a result of a behaviour being performed or not (J. E. Maddux, personal communication, 17th July, 1999). All measures required participants to indicate the extent to which they agreed or disagreed with the various statements presented, on an eight point Likert-type scale from 0 completely disagree to 7
completely agree. Scales with internal consistency equal to or greater than $\alpha = .60$ were accepted for subsequent analysis. The complete scales can be found in Appendices D to M.

### Outcome Expectancy of Current Behaviour Perceived Vulnerability to Negative Health Outcomes (OECV)

Three items were generated that assessed expectations of the likelihood that the current behaviour would contribute to some negative health outcome. An example of such an item is, “if I continue with my current lifestyle I am likely to have further heart problems”. Cronbach’s alpha values were; phase I, $\alpha = .82$; phase II, $\alpha = .73$; phase III, $\alpha = .72$. The complete scale is located in Appendix D.

### Outcome Value of Current Behaviour Perceived Vulnerability to Negative Health Outcomes (OVCV)

Three items were generated that assessed the value associated with the likelihood that the current behaviour would not contribute to negative health outcomes. An example of such an item is, “it is important to me that I do not have further heart problems”. Cronbach’s alpha values were; phase I, $\alpha = .60$; phase II, $\alpha = .15$; phase III, $\alpha = .40$. The complete scale is located in Appendix E.

### Outcome Expectancy for Current Behaviour Perceived Severity to Negative Health Outcomes (OECS)

Three items generated that assessed expectations that the current behaviour might contribute to a serious negative health outcome. An example of such an item is, “my current lifestyle may seriously worsen my heart condition”. Cronbach’s alpha values were; phase I, $\alpha = .75$; phase II, $\alpha = .73$; phase III, $\alpha = .75$. The complete scale is located in Appendix F.

### Outcome Value of Current Behaviour Perceived Severity to Negative Health Outcomes (OVCS)

Three items were generated that assessed the value associated with the likelihood that the current behaviour will not be likely to cause a serious negative health outcome. An example of an item is, “it is important to me that if I do not have serious heart problems”. Cronbach’s alpha values were; phase I, $\alpha = .13$; phase II, $\alpha = .33$; phase III, $\alpha = .35$. The complete scale is located in Appendix G.

### Outcome Expectancy of New Behaviour Perceived Vulnerability to Negative Health Outcomes (OENV)

Four items were generated that assessed expectations that the new behaviour would not lead to a negative health outcome. An example of such an item is, “exercise could be detrimental to my heart”. Cronbach’s alpha values were; phase I, $\alpha = .65$; phase II, $\alpha = .31$; phase III, $\alpha = .63$. The complete scale is located in Appendix H.
Outcome Value of New Behaviour Perceived Vulnerability to Negative Health Outcomes (OVNV) Three items were generated that assessed the value associated with the likelihood of the new behaviour not contributing to negative health outcomes. An example of the items used is, “the possibility that my heart condition will worsen is important to me”. Cronbach’s alpha values were; phase I, $\alpha = .14$; phase II, $\alpha = .40$; phase III, $\alpha = .77$. The complete scale is located in Appendix I.

Outcome Expectancy of New Behaviour Reducing the Probability of Threat of Negative Health Outcomes (OENRPT) Four items were generated that assessed the expectations that the new behaviour would reduce the probability of negative health outcomes from occurring. An example of this item is, “engaging in exercise, will improve my heart condition”. Cronbach’s alpha values were; phase I, $\alpha = 0.55$; phase II, $\alpha = 0.82$; phase III, $\alpha = 0.50$. The complete scale is located in Appendix J.

Outcome Value of New Behaviour Reducing the Probability of Threat of Negative Health Outcomes (OVNRPT) Four items were generated that assessed the value the individual placed on the likelihood that the new behaviour would reduce the probability of negative health outcomes. An example of such an item is, “I value the likelihood of preventing further heart problems from occurring”. Cronbach’s alpha values were; phase I, $\alpha = .42$; phase II, $\alpha = .57$; phase III, $\alpha = .84$. The complete scale is located in Appendix K.

Outcome Expectancy Perceived Social Norms (OEPSN) Eight items were generated assessed expectations that friends and family would provide support during attempts to exercise. An example of such an item is, “If I regularly attend my exercise class-my family will support me”. Cronbach’s Alpha Values were; phase I, $\alpha = .91$; phase II, $\alpha = .95$; phase III, $\alpha = .95$. The complete scale is located in Appendix L.

Outcome Value Perceived Social Norms (OVPSN) Eight items were generated that assessed the value associated with the support received from friends and family during attempts to exercise. An example of such an item is, “the support of family is important to me”. Cronbach’s alpha values were; phase I, $\alpha = .89$; phase II, $\alpha = .95$; phase III, $\alpha = .94$. The complete scale is located in Appendix M.
Exercise Behaviour

No “gold standard” measurement technique for assessing physical activity exists (Dishman, 1994). Hence, a variety of operational measures have used to assess compliance behaviour to exercise (Ainsworth, Montoye, & Leon, 1994). In the present study two measures of exercise behaviour were assessed: (1) attendance; (2) energy expenditure. Attendance at the programme was assessed by having an exercise leader record arrival to all exercise session. Attendance for each session was summed to calculate attendance per phase and attendance for the entire programme. Energy expenditure was estimated using a calculation based on Metabolic equivalents (MET). In the present study it was not feasible to measure oxygen uptake ($VO_2$) using laboratory equipment. The American College of Sports Medicine (ACSM, 1995) have argued that readily accurate estimates of $VO_2$ can be made for steady state exercise such as walking, and these estimations can be derived using MET calculations. “Regression equations have been derived from laboratory data relating mechanical measures of work rate and their metabolic equivalents” (p 273, Appendix D, ACSM guidelines, 1995). It must be noted that caution has been offered when using MET calculations. For instance, inter-subject variability standard error of estimate has been demonstrated as high as 7% despite the highly reproducible $VO_2$ for an individual. These estimates are to be used for steady state exercise. Non steady state exercise will over-inflate METs. Mechanical problems that influence gait will also have an effect on MET calculations. The MET calculations are not intrinsically affected by environmental conditions unless these conditions affect the person’s gait. These limitations were taken into consideration prior to the inclusion of METs in the present investigation.

Each metabolic equation considers three components of energy expenditure, a resting component $R$, a horizontal component $H$, and a vertical component $V$. The sum of these three equals the entire cost of the activity.

The formula is $VO_2$ (in ml.kg$^{-1}$.min$^{-1}$) = $R$+$H$+$V$

When $VO_2$ is oxygen uptake

$R = 3.5$ ml.kg$^{-1}$ (by definition 1 MET)

$H = 0.1 \times$ walking speed (in m/min)

0.1 is the regression constant for converting ml/min to ml.kg$^{-1} \cdot$ min$^{-1}$

$V = 1.8 \times$ speed (in m/min) x grade (as a decimal)

1.8 is the constant for converting m/min to ml.kg$^{-1} \cdot$min$^{-1}$
The first part of the equation, \( R \), relates to the resting component of the equation and is equivalent to 3.5 ml.kg\(^{-1}\). The second part of the equation \( H \) relates to the horizontal component of the equation (i.e., distance). In the present study, two methods were used to assess the distance walked. The first involved exercise leaders recording exercise distance by using measurements taken from an Omron Pedometer (model HJ-102). The Omron pedometer measures distance by counting steps taken. It has a stride length adjustment, thus, steps counted multiplied by stride length equated to distance covered. Montoye, et al., (1996) have cited evidence suggesting that the same given pedometer can give different results when worn by different individuals. The above authors also highlighted the following recommendations when using pedometers.

- Pedometers require calibration to ensure steps are counted accurately.
- Pedometers are useful in activities that require vertical displacement (i.e., walking), but are not useful in physical activity that does not have vertical displacement (i.e., cycling).
- Finally, pedometers do not calculate energy expenditure rather, they determine distance covered.

In accordance with the above cautionary points, pedometers were used in conjunction with pre-measured walking routes to validate distance covered. Participants also calibrated the pedometers prior to all walking exercise sessions. The distances covered were used to assist in MET calculations. Furthermore, pilot testing of the pedometers revealed that following calibration accuracy was within 1% over 100, 200, and 400 metres.

The second method for assessing walked distance involved instructing participants to walk supervised measured routes. Three separate walking routes were used over the course of the study to alleviate boredom. All route distances had been measured using a 1-metre measuring wheel. The exercise leader documented all distances covered by participants as each participant returned from the walking exercise. The walked distance for each participant was summed to determine distance walked per phase (in metres), and distance covered for the entire programme (in metres). It was also necessary to calculate exercise duration. This allowed the derivation of speed for the Met calculation. The exercise leader recorded exercise duration (time) at each exercise session. The final component of the MET calculation \( V \) relates to vertical movement achieved when walking. When walking on a level treadmill or for walking over ground that begins and ends at the same point, \( V = 0 \) (ACSM, 1995).
It must be noted that indoor exercise was organised during days of inclement weather. For these exercise sessions an alternative method was used to derive METs. Estimation of METs was taken from the compendium of physical activity (Ainsworth, et al., 1992). The compendium of physical activity is a coding system that classifies the energy cost of physical activities. It has been suggested that this compendium can be useful for coding physical activity in clinical settings (Ainsworth, et al., 1992). A mean MET value was calculated for each participant for each phase of exercise.

Other Related Measures

Physical Fitness Assessment The Cooper’s (1968) 12-minute walk test was used to estimate oxygen uptake (VO₂). The full procedure of the 12-minute walk test is outlined in Appendix P. These procedures are consistent with those presented by Guyatt et al., (1984), and Steele (1996) suggesting that repeated walk tests require standardisation regarding encouragement and performance with the test. In addition it is necessary to reduce effects of subject learning, hence, all participants had to perform three consecutive tests.

Cooper (1968) designed the 12-minute running test as a way to correlate fitness with maximal oxygen intake (VO₂max) among healthy men. The Correlation between maximal oxygen consumption (as assessed on a treadmill) and 12-minute run-walk performance was 0.89. This test has been adapted to determine exercise tolerance in-patients with bronchitis (McGavin, Gupta & McHardy, 1976). Since this time the 12-minute and a 6-minute walk test has been used for patients with pulmonary (Bernstein et al., 1994; Butland, et al., 1982) and cardiac disease (Guyatt, et al., 1985; cf., Steele, 1996). Butland et al., (1982) demonstrated high correlations between 2-, 6-, and 12-minute walk tests, suggesting that the tests were similar measures of exercise tolerance. The 12-minute distance has also been shown to be highly reproducible. Thus the 12-minute walk test afforded an easy reproducible measure of patient’s functional ability. It was anticipated that this test, conducted at different time points, would also provide evidence of functional improvement, deterioration, or no change, from baseline. The 12-minute walk test provided data for distance and time that allowed for speed to be calculated which in turn permitted METs and oxygen uptake (VO₂) to be determined.

For all walk tests participants were asked to cover as much ground as possible. When multiple tests were performed, the furthest distance was typically used. A plateau effect showing minimal difference between tests is optimal. Exercise testing on a treadmill or cycle
ergometer assessing haemodynamic and ventilatory function is considered ideal, yet, these tests are expensive, and time consuming for all involved (Steele, 1996). Steele (1996) argued that “walking test may be a better measure of functional exercise capacity defined as a patient’s ability to undertake physically taxing activities encountered in everyday life that are not reflected by conventional exercise testing” (p. 25).

Procedure

Recruitment Procedures Participants were recruited from 2 New Zealand hospitals (within the Auckland region) through direct contact at a weekly cardiac education programme and also by accessing discharge cardiological and cardiothoracic summary sheets from the hospital cardiac rehabilitation nurse. The investigators made initial contact with all potential participants to determine their interest in the proposed study. Participation criteria for entry in the exercise study included, being adult patients aged less than 80-years and with documented Coronary Artery Disease (CAD) by a cardiologist. Participants potentially inclusive were those with stable angina, post myocardial infarction, post-percutaneous transluminal coronary angioplasty (PTCA) or post coronary artery bypass graft surgery (CABG). In addition, participants had to have approval from their cardiologist to participate in exercise, have no recurrent chest-pain and be capable of exercising (i.e., walking without impediment from leg problems, such as arthritis or intermittent claudication). Finally, participants were required to be able to write, read and speak English and to be first time-participants in a cardiac exercise programme.

Two hundred and twenty individuals were contacted to determine eligibility for the present study. Twenty-five were ineligible due to being; too old, unable to exercise, and having been readmitted to hospital. Of the remaining 195 only 64 recorded a genuine interest to participate. The sixty-four interested individuals were sent an information sheet (Appendix Q), and a map identifying the location of the venue. A follow up letter was sent 1-week prior to the study commencement to encourage participation. Forty-one participants actually enrolled in the present study. The 23 individuals that did not enrol were contacted again to encourage their participation in the study. Despite these attempts no further enrolments occurred.

Familiarisation Procedures Once recruited, all participants attended a two-hour introductory session. The first hour provided a comprehensive outline and detailed the
purpose of the study. Participants were encouraged to ask questions and were given an opportunity to withdraw from the study. Participants completed a consent form (Appendix R), advising them of their freedom to withdraw from the study as anytime. The second hour of the session involved participants completing a demographic sheet, and the measures related to Maddux’s integrated model see Figure 1. When all paper and pencil measures were completed, participants’ height, and weight were assessed and recorded. To provide an indication of participant’s commencement level of fitness, estimation of maximal oxygen uptake VO$_2$$_{\text{max}}$ using a 12-minute walk test (Cooper, 1968) was performed. On day 1 participants performed a 12-minute walk test, with two further consecutive test being performed on day 2. Prior to all exercise tests, participants’ resting heart rate, lying and standing blood pressures (BP) were recorded. All participants were familiarised with the procedures relating to the exercise test, ensuring that individuals fully understood what was expected of them. Participants were instructed to walk for 12-minutes covering as much as distance as possible in the available time: the same course was used for each exercise test. Testing was performed indoors and consisted of participants walking around a pre-measured square course measuring 50-metres in total (12.5 metres per side). Cones were placed on each corner of the test course, and participants were instructed to walk around each cone. Participants were told to start walking when the instructor called “start”. Time elapsed was called out by the tester at 2-minute intervals. When 12 minutes elapsed participants were instructed to stop. Independent lap counters were used to count the number of laps participants walked during the 12-minutes. Encouragement was offered to the participants as described in the procedures. Identical procedures were used for all walk tests (Guyatt et al., 1994). In addition the same investigators were used for each of the walk tests. Finally, heart rate, and RPE’s were collected at the start, at 6 and 12 minutes of the walk test. Blood pressure measurements were recorded on completion of the initial walk test.

**Exercise Procedures** The exercise programme was based at the University of Auckland, Uni Sport, rehabilitation and training facilities. Facilities included a large indoor gymnasium area, containing eight-stationary bicycles, 2-treadmills, and 2-rowing machines. Participants were expected to exercise by walking outdoors over pre-determined and measured walking routes. To encourage participation individuals exercised indoors during periods of inclement weather. The programme consisted of supervised walking with morning and evening exercise sessions offered every weekday for a period of eighteen weeks. This format
was adopted to make available 10 sessions per week ensuring participants had optimal opportunity to attend the programme. Participants were invited to attend as many sessions as they felt they could. Participants were encouraged to exercise at the programme for a minimum of two to three times per week. All exercise sessions were supervised and led by a sports science graduate student (also a registered cardiac nurse). Participants were assessed at three time points – baseline (on arrival to the exercise programme), week 7 (at the first session following completion of week 6), and week 13 (at the first session following completion of week 12). The exercise sessions lasted for 60-minutes with 50-minutes aerobic exercise (walking) encouraged as the level of exercise to attain. Prior to the commencement of all exercise sessions, a 10-minute light aerobic warm-up and gentle stretching was performed.

Recently the American College of Sports Medicine (ACSM, 1998) provided a position stand on the Recommended Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory and Muscular Fitness, and Flexibility in Adults. This paper argued that the combination of frequency, intensity, and duration, of exercise have been found to be effective in providing a training effect. These combined factors are thought to provide an overload stimulus, thus the greater the training stimulus the greater the training effect. Frequency of exercise has been shown to be related to improvements in exercise (cited in Pollock, et al., 1998). Exercising a minimum of three-times per week has been shown to demonstrate an increase in VO\textsubscript{2}\text{max}. The magnitude of change in VO\textsubscript{2}\text{max} is smaller and can plateau when frequency increases above 3 days per week. Further, exercising less than 2-days a week has not resulted in meaningful increases in VO\textsubscript{2}\text{max} (Pollock, et al., 1998).

Pollock et al., (1998) cited evidence to show although 2-days of exercise per week is generally thought to be an insufficient stimulus for developing and maintaining fitness, the health benefits from exercise can be achieved at lower intensities of exercise if frequency and duration are increased appropriately. It has been shown that cardiac patients can demonstrate a spontaneous improvement in aerobic capacity which equates to 2-3 METs (1 MET = 3.5 ml O\textsubscript{2}/kg/min) (Ben-Ari et al., 1989; Franklin, Gordon & Timmis, 1992; Savin et al., 1981; Weiner et al., 1981). These increases in aerobic capacity are thought to be related to self-care and other out-of-hospital activities performed by cardiac patients. Evidence is available to support that slow and faster walking provides a sufficient stimulus to increase fitness particularly among older adults (Mazzeo, et al., 1998; Pollock, et al., 1971; Porcari et al., 1987) and cardiac patients (Franklin, et al., 1983) and may reduce the risk for cardiovascular
events (Manson et al., 1999) and reduce cardiac events requiring hospitalisation (LaCroix, et al., 1996). Balady and colleagues (1996) demonstrated that exercise as part of a cardiac rehabilitation programmes significantly increased exercise tolerance particularly among participants with a Metabolic Equivalent (MET) capacity below 5. Walking at least 20-minutes per day 3-days per week has been shown to be possible in a group that received increased prompting (Lombard, Lombard, & Winett, 1995). Coleman, et al., (1999) have showed that walking prescription of 30-minutes a day on most days of the week with the choice of walking as little as 5-minute bouts was sufficient stimulus to improve cardiovascular health.

Based on this evidence the exercise programme in the present study was aimed at providing a supervised, aerobic, walking exercise programme. Exercise prescription aimed at providing graduated exercise at an intensity of between 50-85% of VO$_2$max. To assist participants to perform exercise at the prescribed intensity (55%-80% of VO$_2$max) individuals wore Polar Accurate Heart Rate Monitors. Heart rate is reported to be one of the easiest physiological variables to assess in the field. When work can be controlled (i.e., on a treadmill) heart rate has been shown to correlate with oxygen uptake (Montoye et al., 1996). Participants were instructed by the exercise leaders on how to place the heart-rate transmitters. Each heart-rate monitor receiver was set by the exercise instructor to record time elapsed (exercise duration), and average heart rate. In addition, an assessment of participants’ perceived exertion was recorded. Rating of perceived exertion (RPE) has been found to be a valuable indicator in monitoring an individual’s exercise tolerance. Perceived exertion ratings have been shown to correlate with measured exercise heart rates and calculated oxygen consumption values (ACSM, 1995). It is noted that Whaley et al., (1997) have provided evidence to show that a significant variability existed between perceived exertion and heart rate reserve in both healthy participants and cardiac patients during graded exercise testing. Because of this variability, Whaley and colleagues have urged users of RPE measures to be cautious.

The Borg (1962) scale was developed to assist participants to rate their level of perceived physical exertion taking into account their level of fitness, environmental factors etc. Typically two scales are used – one (the original) rates physical exertion on a scale of 6-20, the second (a revised scale) rates exertion on a scale from 0-10. The second revised scale uses language readily understood by individuals, thus providing the tester with more reliable
information with which to direct some form of fitness assessment (ACSM’s guidelines, 1995). The revised Borg (1982) RPE Scale was used in the present study. The full scale is presented in Appendix O. All participants were asked to report their perceived level of exertion during and immediately on return from each walking exercise session. Mean perceived exertion values were calculated per phase and for the entire exercise programme.
CHAPTER IV
RESULTS

To provide a full-test of the hypotheses generated from Maddux’s (1993) social-cognitive integrative model three levels of analysis were conducted. The first level included a series of multiple regression analyses using exercise behaviour (i.e., attendance and energy expenditure) and intention as dependent measures. Analysis of all data was performed over three discrete phases of the exercise programme (i.e., phase I weeks 1-6; phase II weeks 7-12; phase III weeks 13-18 weeks). The second level of analysis used ANOVA producers to determine whether differences exist on the social-cognitive variables between compliers and dropouts. The third level of analysis used a cross-lagged correlation design over the three phases of the exercise programme to ascertain whether the exercise behaviour had a greater influence on the social-cognitive variables or whether the social-cognitive variables had a greater influence on the exercise behaviour. Finally, ANOVA procedures were used to determine whether improvements in physical function capacity could be seen across each phase of the exercise programme.

Predicting Exercise Behaviour and Intention
Phase 1 (weeks 1-6) Descriptive statistics for the social cognitive variables as highlighted in Maddux’s (1993) integrated model are presented in Tables 2. Bivariate correlations between all the variables are presented in Table 3. In line with the hypotheses suggested through the model, the social-cognitive variables were entered in the following manner to predict exercise behaviour; step 1 – intention, self-efficacy, barrier efficacy. Step 2 - outcome expectancy and outcome value and perceived social norm. In accordance with the model the variables entered at step 2 should not contribute to the prediction of exercise behaviour. The social-cognitive variables were entered in the following manner to predict exercise intention; step 1 – self-efficacy, barrier efficacy, outcome expectancy, outcome value and perceived social norm. Social-cognitive measures were only used as predictor variables in the hierarchical regression analyses if they demonstrated a significant bivariate relationship with exercise behaviour and/or intention.
Table 4 contains a summary of the hierarchical regression analysis for attendance behaviour. When the variables barrier efficacy and intention frequency were entered together at step 1, a significant contribution to the prediction of attendance behaviour was found, $F(2, 37) = 7.90, p < 0.001$. Results also showed that at step 2 outcome expectancy current behaviour –vulnerability (OECV) significantly contributed to the prediction of attendance behaviour, $F$ change $(3, 36) = 9.22, p < 0.01$. Specifically, OECV increased the $R^2$ by 14.3%. As can be seen in Table 4 all three variables contributed to the prediction of attendance behaviour.

Table 5 contains a summary of the hierarchical regression analysis for energy expenditure. Results showed that when intention frequency was entered together at step 1, a significant contribution to the prediction of energy expenditure was evident, $F(1, 37) = 9.83, p < 0.01$. Results also showed that at step 2 outcome value perceived social norms (OVPSN) significantly contributed to the prediction of energy expenditure, $F$ change $(2, 36) = 5.28, p < 0.05$. Specifically, OVPSN increased the $R^2$ by 10.1%. As can be seen in Table 5 intention frequency and OVPSN both contributed to the prediction of energy expenditure.

Table 6 contains a summary of the hierarchical regression analysis for intention intensity. Results showed that self-efficacy and outcome expectancy new behaviour vulnerability (OENV) contributed significantly to the prediction of intention intensity, $F(2, 38) = 16.34, p<0.001$. As can be seen in Table 6 self-efficacy contributed more to the prediction of intention intensity than OENV.

Phase II (weeks 7-13). Descriptive statistics for the social cognitive variables as highlighted in Maddux’s (1993) integrated model are presented in Table 7. Bivariate correlations of the relationships of all the variables of interest are presented in the Table 8.

Table 9 contains a summary of the hierarchical regression analysis for attendance behaviour. Results showed that at step 1 intention frequency and intention time made a significant contribution to the prediction of attendance behaviour, $F(2, 23) = 8.64, p < 0.01$. As can be seen from Table 9, intention frequency contributed more to the prediction of attendance than intention time.
Table 2: Descriptive Data of all Social-Cognitive Measures from Maddux’s (1993) Integrated Model for Phase I

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
</tr>
</thead>
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<td>41</td>
<td>5-98.75</td>
<td>58.87</td>
<td>24.96</td>
<td>-0.41</td>
</tr>
<tr>
<td>Barrier efficacy</td>
<td>40</td>
<td>21.67-100</td>
<td>74.39</td>
<td>19.22</td>
<td>-0.85</td>
</tr>
<tr>
<td>OECV</td>
<td>41</td>
<td>0-14</td>
<td>5.36</td>
<td>4.36</td>
<td>0.45</td>
</tr>
<tr>
<td>OVCV</td>
<td>41</td>
<td>1-14</td>
<td>12.92</td>
<td>2.32</td>
<td>-3.80</td>
</tr>
<tr>
<td>OECS</td>
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<td>0-13</td>
<td>4.90</td>
<td>4.34</td>
<td>0.46</td>
</tr>
<tr>
<td>OENV</td>
<td>41</td>
<td>0-19</td>
<td>7.51</td>
<td>5.08</td>
<td>0.32</td>
</tr>
<tr>
<td>OEPSN</td>
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<td>0-56</td>
<td>43.0</td>
<td>14.20</td>
<td>-1.41</td>
</tr>
<tr>
<td>OVPSN</td>
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<td>0-42</td>
<td>26.43</td>
<td>11.87</td>
<td>-0.56</td>
</tr>
<tr>
<td>Intention time</td>
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<td>5-50</td>
<td>34.26</td>
<td>13.76</td>
<td>-0.36</td>
</tr>
<tr>
<td>Intensity frequency</td>
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<td>8-22</td>
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<td>Intention intensity</td>
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<tr>
<td>Attendance</td>
<td>41</td>
<td>1-27</td>
<td>10.46</td>
<td>6.15</td>
<td>0.39</td>
</tr>
<tr>
<td>Energy expenditure</td>
<td>39</td>
<td>1.76-7.35</td>
<td>4.97</td>
<td>1.66</td>
<td>-0.65</td>
</tr>
</tbody>
</table>

**Key Abbreviations**

OECV  Outcome expectancy current vulnerability
OECS  Outcome expectancy current severity
OVCV  Outcome value current vulnerability
OEPSN Outcome expectancy perceived social norms
OVPSN Outcome value perceived social norms
OECS  Outcome expectancy new vulnerability
OENV  Outcome expectancy new vulnerability
OVNV  Outcome value new vulnerability
OENRPT Outcome expectancy new reducing probability of threat
OVNRPT Outcome value new reducing probability of threat
Table 3: Bivariate Correlations for Phase I Social-Cognitive Variables from Maddux’s (1993) Integrative Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Attendance</td>
<td>1.00</td>
<td>.427**</td>
<td>.412**</td>
<td>.083</td>
<td>.227</td>
<td>.171</td>
<td>.445**</td>
<td>-.352*</td>
<td>-.234</td>
<td>-.175</td>
<td>-.128</td>
<td>.120</td>
<td>-.010</td>
</tr>
<tr>
<td>2 Energy expenditure</td>
<td>1.00</td>
<td>.458**</td>
<td>.468**</td>
<td>.225</td>
<td>.432**</td>
<td>.228</td>
<td>.065</td>
<td>-.049</td>
<td>-.003</td>
<td>-.313</td>
<td>-.154</td>
<td>-.448*</td>
<td></td>
</tr>
<tr>
<td>3 Intention frequency</td>
<td>1.00</td>
<td>.055</td>
<td>.126</td>
<td>.197</td>
<td>.263</td>
<td>.122</td>
<td>.168</td>
<td>.070</td>
<td>.065</td>
<td>.052</td>
<td>-.263</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Intention Intensity</td>
<td>1.00</td>
<td>.409**</td>
<td>.641**</td>
<td>.128</td>
<td>.019</td>
<td>-.038</td>
<td>.137</td>
<td>-.353*</td>
<td>.205</td>
<td>.025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Intention Time</td>
<td>1.00</td>
<td>.526**</td>
<td>.263</td>
<td>-.079</td>
<td>.045</td>
<td>.096</td>
<td>-.214</td>
<td>.322*</td>
<td>.137</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Self efficacy</td>
<td>1.00</td>
<td>.279</td>
<td>.083</td>
<td>-.035</td>
<td>.237</td>
<td>-.205</td>
<td>.181</td>
<td>.090</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Barrier efficacy</td>
<td>1.00</td>
<td>-.016</td>
<td>-.062</td>
<td>.195</td>
<td>-.084</td>
<td>.542**</td>
<td>.173</td>
<td>.105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 OECV</td>
<td>1.00</td>
<td>.871**</td>
<td>-.194</td>
<td>.441**</td>
<td>.173</td>
<td>.105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9 OECS</td>
<td>1.00</td>
<td>-.176</td>
<td>.435**</td>
<td>.181</td>
<td>.096</td>
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<td></td>
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<tr>
<td>10 OVCV</td>
<td>1.00</td>
<td>.043</td>
<td>.004</td>
<td>.004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11 OENV</td>
<td>1.00</td>
<td>-.039</td>
<td>.185</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 OEPSN</td>
<td>1.00</td>
<td>.645**</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>13 OVPSN</td>
<td>1.00</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note. ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Key Abbreviations
- OENV: Outcome expectancy new vulnerability
- OEPSN: Outcome expectancy perceived social norms
- OECV: Outcome expectancy current vulnerability
- OVPSN: Outcome value perceived social norms
- OECS: Outcome expectancy current severity
- OVCV: Outcome value current vulnerability
Table 4: Hierarchical Regression Analysis Examining Relationships between Attendance and Social-Cognitive Variables for Phase I of the Exercise Programme

Prediction of Attendance Behaviour Phase I

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>t</th>
<th>r</th>
<th>Adjusted R²</th>
<th>R² change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Barrier Efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention frequency</td>
<td>0.55</td>
<td></td>
<td></td>
<td>0.26***</td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier Efficacy</td>
<td>0.42</td>
<td>2.85*</td>
<td></td>
<td>0.42</td>
<td>2.85*</td>
</tr>
<tr>
<td>Intention frequency</td>
<td>0.37</td>
<td>2.65**</td>
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<td>0.37</td>
<td>2.65**</td>
</tr>
<tr>
<td>Outcome Expectancy (OECV)</td>
<td>-0.38</td>
<td>-3.03**</td>
<td>0.66</td>
<td>0.39**</td>
<td>0.14**</td>
</tr>
</tbody>
</table>

Note. * p < 0.05; ** p < 0.01; *** p < 0.0001.
OECV is Outcome Expectancy Current Behaviour Vulnerability to Negative Health Outcome.

Table 5: Hierarchical Regression Analysis Examining Relationships between Energy Expenditure and Social-Cognitive Variables for Phase I of the Exercise Programme

Prediction of Energy Expenditure Phase I

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>t</th>
<th>r</th>
<th>Adjusted R²</th>
<th>R² change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
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</tr>
<tr>
<td>Intention frequency</td>
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<td>Step 2</td>
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<td></td>
</tr>
<tr>
<td>Intention frequency</td>
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<td>2.40*</td>
<td></td>
<td>0.35</td>
<td>2.40*</td>
</tr>
<tr>
<td>Outcome Value (OVPSN)</td>
<td>-0.34</td>
<td>-2.29*</td>
<td>0.56*</td>
<td>0.27*</td>
<td>0.10*</td>
</tr>
</tbody>
</table>

Note. * p < 0.05; ** p < 0.01; *** p< 0.0001.
OVPSN is Outcome Value Perceived Social Norms
**Table 6: Hierarchical Regression Analysis Examining Relationships between Intention Intensity and other Social-Cognitive Variables for Phase I of the Exercise Programme**

<table>
<thead>
<tr>
<th>Prediction of Intention Intensity Phase I</th>
<th>Adjusted $b$</th>
<th>t</th>
<th>r</th>
<th>Adjusted $R^2$</th>
<th>$R^2$ change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1</strong></td>
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<tr>
<td>Self-efficacy</td>
<td>0.59</td>
<td>4.88***</td>
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</tr>
<tr>
<td>Outcome expectancy</td>
<td>-0.23</td>
<td>-1.89</td>
<td>0.68</td>
<td>0.43***</td>
<td></td>
</tr>
<tr>
<td>(OENV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

OENV is Outcome Expectancy New Behaviour Vulnerability to Negative Health Outcomes.
Table 10 contains a summary of the hierarchical regression analysis for energy expenditure. Results showed that step 1 intention frequency and intention time made a significant contribution to the prediction of energy expenditure, $F(2, 23) = 5.18$, $p < 0.05$. As can be seen in Table 10, intention frequency contributed more to the prediction of energy expenditure than intention time.

Table 11 contains a summary of the hierarchical regression analysis intention intensity. Results showed that self-efficacy contributed significantly to the prediction of intention intensity, $F(1, 25) = 9.51$, $p < 0.01$. Self-efficacy was the only variable to be related to intention intensity. Phase III (weeks 13-18) Descriptive statistics for the social cognitive variables as highlighted in Maddux’s (1993) integrated model are presented in Table 12. Bivariate correlations of the relationships of all the variables of interest are presented in the Table 13.

Table 14 contains a summary of the hierarchical regression analysis for attendance behaviour. Results showed that when the variables barrier efficacy, & intention frequency were entered at step 1, a significant contribution to the prediction of the attendance behaviour was found, $F(2, 20) = 14.87$, $p < 0.0001$. As can be seen from Table 14, intention frequency contributed more to the prediction of attendance behaviour than barrier efficacy.

Table 15 contains a summary of the hierarchical regression analysis for intention intensity. Results showed that self-efficacy and outcome value new behaviour vulnerability (OVNV) contributed significantly to the prediction of intention intensity, $F(2, 21) = 9.77$, $p < 0.001$. As can be seen from Table 15 both variables contributed to the prediction of intention intensity.

Test for Mediation

The Maddux (1993) model posits that self-efficacy should influence exercise behaviour both directly and indirectly through the influence of intention. Baron and Kenny (1986) have pointed out that a series of regression models should be estimated as a test for mediation. A variable functions as a mediator when it meets the following conditions: (a) the predictor variable (i.e., self-efficacy) must influence the mediator variable (i.e., intention), (b) the predictor variable must influence the outcome variable (i.e., exercise behaviour), and (c) the mediator must influence the outcome variable when regressed with the predictor variable.
Table 7: Descriptive Data of all Social-Cognitive Measures from Maddux’s (1993) Integrated Model for Phase II

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
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<tr>
<td>Self-efficacy</td>
<td>27</td>
<td>53.75-100</td>
<td>82.01</td>
<td>14.58</td>
<td>-0.42</td>
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<tr>
<td>Barrier efficacy</td>
<td>27</td>
<td>40-100</td>
<td>81.29</td>
<td>13.90</td>
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<tr>
<td>OECV</td>
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<td>0-14</td>
<td>3.66</td>
<td>3.12</td>
<td>1.34</td>
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<td>OECS</td>
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<td>0-7</td>
<td>2.62</td>
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<td>0.45</td>
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<td>OENRPT</td>
<td>27</td>
<td>17-21</td>
<td>20.40</td>
<td>1.11</td>
<td>-1.97</td>
</tr>
<tr>
<td>OEPSN</td>
<td>27</td>
<td>6-56</td>
<td>38.25</td>
<td>15.81</td>
<td>-0.42</td>
</tr>
<tr>
<td>OVPSN</td>
<td>27</td>
<td>0-42</td>
<td>24.92</td>
<td>12.53</td>
<td>-0.35</td>
</tr>
<tr>
<td>Intention time</td>
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<td>20-60</td>
<td>43.70</td>
<td>7.79</td>
<td>-0.34</td>
</tr>
<tr>
<td>Intention frequency</td>
<td>27</td>
<td>9-22</td>
<td>17.78</td>
<td>5.39</td>
<td>0.72</td>
</tr>
<tr>
<td>Intention intensity</td>
<td>27</td>
<td>1-3</td>
<td>2.41</td>
<td>0.64</td>
<td>-0.59</td>
</tr>
<tr>
<td>Attendance</td>
<td>27</td>
<td>0-28</td>
<td>12.88</td>
<td>6.12</td>
<td>0.24</td>
</tr>
<tr>
<td>Energy expenditure</td>
<td>26</td>
<td>3-8.76</td>
<td>5.24</td>
<td>1.29</td>
<td>0.82</td>
</tr>
</tbody>
</table>

Key Abbreviations

OECA Outcome expectancy current vulnerability  OVCV Outcome value new vulnerability
OECS Outcome expectancy current severity     OEPSN Outcome expectancy perceived social norms
OVCA Outcome value current vulnerability     OVPSN Outcome value perceived social norms
OENV Outcome expectancy new vulnerability    OVNRPT Outcome value new reducing probability of threat
OENRPT Outcome expectancy new reducing probability of threat
Table 8: Bivariate Correlations for Phase II Social-Cognitive Variables from Maddux’s (1993) Integrative Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Attendance</td>
<td>1.00</td>
<td>.507**</td>
<td>.577**</td>
<td>-.286</td>
<td>.553**</td>
<td>.016</td>
<td>-.381</td>
<td>-.205</td>
<td>-.204</td>
<td>-.199</td>
<td>-.093</td>
<td></td>
</tr>
<tr>
<td>2 Energy expenditure</td>
<td>1.00</td>
<td>.536**</td>
<td>.097</td>
<td>.396*</td>
<td>.208</td>
<td>.113</td>
<td>-.118</td>
<td>.072</td>
<td>-.048</td>
<td>-.273</td>
<td>-.288</td>
<td></td>
</tr>
<tr>
<td>3 Intention frequency</td>
<td>1.00</td>
<td>-.040</td>
<td>.405*</td>
<td>.126</td>
<td>.107</td>
<td>-.005</td>
<td>.106</td>
<td>-.080</td>
<td>-.156</td>
<td>-.297</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Intention intensity</td>
<td>1.00</td>
<td>.072</td>
<td>.525**</td>
<td>.112</td>
<td>.090</td>
<td>.060</td>
<td>.190</td>
<td>.203</td>
<td>.235</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Intention time</td>
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<td>.303</td>
<td>.257</td>
<td>-.366</td>
<td>-.292</td>
<td>.019</td>
<td>.270</td>
<td>.164</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Self efficacy</td>
<td>1.00</td>
<td>.477*</td>
<td>.079</td>
<td>-.247</td>
<td>-.035</td>
<td>.213</td>
<td>.229</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7 Barrier efficacy</td>
<td>1.00</td>
<td>-.243</td>
<td>-.332</td>
<td>.474*</td>
<td>.141</td>
<td>.101</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>8 OECV</td>
<td>1.00</td>
<td>.525**</td>
<td>-.015</td>
<td>.220</td>
<td>.225</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 OECS</td>
<td>1.00</td>
<td>-.230</td>
<td>-.088</td>
<td>-.063</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>10 OENRPT</td>
<td>1.00</td>
<td>.157</td>
<td>.027</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>11 OEPSN</td>
<td>1.00</td>
<td>.806**</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 OVPSN</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Key Abbreviations
- OECV: Outcome expectancy current vulnerability
- OECS: Outcome expectancy current severity
- OEPSN: Outcome expectancy perceived social norms
- OVPSN: Outcome value perceived social norms
- OENRPT: Outcome expectancy new reducing probability of threat
Table 9: Hierarchical Regression Analysis Examining Relationships between Attendance and Intention *Frequency* for Phase II of the Exercise Programme

<table>
<thead>
<tr>
<th>Prediction of Attendance Behaviour Phase II</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$b$</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Intention <em>frequency</em></td>
<td>0.40</td>
</tr>
<tr>
<td>Intention <em>time</em></td>
<td>0.35</td>
</tr>
</tbody>
</table>

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.0001$.

Table 10: Hierarchical Regression Analysis Examining Relationships between Energy Expenditure and Social-Cognitive Variables for Phase II of the Exercise Programme

<table>
<thead>
<tr>
<th>Prediction of Energy Expenditure Phase II</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$b$</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Intention <em>frequency</em></td>
<td>0.45</td>
</tr>
<tr>
<td>Intention <em>time</em></td>
<td>0.17</td>
</tr>
</tbody>
</table>

Note: * $p < 0.05$; ** $p< 0.01$. 

Table 11: Hierarchical Regression Analysis Examining Relationships between Intention *Intensity* and Self-Efficacy for Phase II of the Exercise Programme

<table>
<thead>
<tr>
<th>Prediction of Intention</th>
<th>Intensity Phase II</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
<td>t</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>-0.52</td>
<td>3.08**</td>
</tr>
</tbody>
</table>

Note. * p < 0.05; ** p < 0.01
Baron and Kenny (1986) also noted that if the preceding three conditions are met the effect of the predictor variable (self-efficacy) on the outcome variable (exercise behaviour) must be less pronounced when regressed with the mediator than when regressed without it. From a theoretical perspective, a reduction demonstrates that the mediator is indeed potent.

Only the relations between self-efficacy, intention intensity and energy expenditure in phase I met the initial conditions of mediation. Results showed that self-efficacy was predictive of energy expenditure, $F(1, 37) = 9.63, p < 0.01$. Intention intensity was also predictive of energy expenditure, $F(1, 37) = 10.85, p < 0.01$. However, when self-efficacy and intention frequency were entered together both contributed to the prediction of energy expenditure (self-efficacy, $\beta = 0.365, p < 0.01$; and intention intensity, $\beta = 0.397, p < 0.01$). Hence, condition (c) was not satisfied.

**Compliers versus Drop-outs**

To ascertain whether the social cognitive variables at phase one differed for those participants that completed the exercise programme ($N=25$) and those that dropped out ($N=16$) a MANOVA was performed. Results showed that a significant difference was found between these two groups, Wilks Lambda = .007, $F(12, 27) = 338.76, p < 0.0001$. To identify the variables that contributed to this difference ANOVA’s showed that outcome expectancy for current behaviour – vulnerability (OECV) and outcome expectancy current behaviour – severity (OECS) significantly differed, $F = 4.64 (p<0.05)$, and $F = 4.75 (p<0.05)$ respectively. Specifically, those participants that dropped out of the programme had higher mean values for OECV and OECS than those that completed the entire programme.

**Cross-Lag Correlations**

A cross lagged correlation design was used to ascertain whether the exercise behaviour had a greater influence on the social-cognitive variables or whether the social-cognitive variables had a greater influence on the exercise behaviour. According to the Maddux model, self-efficacy, barrier efficacy and intention are hypothesised to be directly related to behaviour; hence only these variables were examined in this level of analysis. Figure 9 presents the relations between attendance behaviour and intention frequency.
Table 12: Descriptive Data of all Social-Cognitive Measures from Maddux’s (1993) Integrated Model and Behaviour Measures for Phase III.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>24</td>
<td>47.50-100</td>
<td>82.52</td>
<td>16.49</td>
<td>-0.85</td>
</tr>
<tr>
<td>Barrier efficacy</td>
<td>24</td>
<td>35.83-99.17</td>
<td>82.91</td>
<td>15.20</td>
<td>-1.59</td>
</tr>
<tr>
<td>OECV</td>
<td>24</td>
<td>0-10</td>
<td>2.87</td>
<td>2.96</td>
<td>1.14</td>
</tr>
<tr>
<td>OECS</td>
<td>24</td>
<td>0-10</td>
<td>2.87</td>
<td>2.96</td>
<td>1.14</td>
</tr>
<tr>
<td>OENV</td>
<td>24</td>
<td>0-11</td>
<td>2.45</td>
<td>3.30</td>
<td>1.41</td>
</tr>
<tr>
<td>OVNV</td>
<td>24</td>
<td>0-14</td>
<td>12.75</td>
<td>3.17</td>
<td>-3.31</td>
</tr>
<tr>
<td>OVNRPT</td>
<td>24</td>
<td>17-21</td>
<td>20.58</td>
<td>1.01</td>
<td>-2.80</td>
</tr>
<tr>
<td>OEPSN</td>
<td>21</td>
<td>0-56</td>
<td>34.66</td>
<td>16.83</td>
<td>-0.31</td>
</tr>
<tr>
<td>OVPSN</td>
<td>21</td>
<td>0-42</td>
<td>23.79</td>
<td>12.57</td>
<td>-0.18</td>
</tr>
<tr>
<td>Intention time</td>
<td>24</td>
<td>15-60</td>
<td>42.71</td>
<td>9.08</td>
<td>-1.09</td>
</tr>
<tr>
<td>Intention frequency</td>
<td>24</td>
<td>6-30</td>
<td>17012</td>
<td>6.23</td>
<td>0.35</td>
</tr>
<tr>
<td>Intention intensity</td>
<td>24</td>
<td>1-4</td>
<td>2.46</td>
<td>0.658</td>
<td>0.16</td>
</tr>
<tr>
<td>Attendance</td>
<td>23</td>
<td>1-29</td>
<td>11.47</td>
<td>6.78</td>
<td>0.93</td>
</tr>
<tr>
<td>Energy expenditure</td>
<td>24</td>
<td>3.4-9.55</td>
<td>5.30</td>
<td>1.45</td>
<td>1.36</td>
</tr>
</tbody>
</table>

**Key Abbreviations**
- OECV: Outcome expectancy current vulnerability
- OEPSN: Outcome expectancy perceived social norms
- OVNV: Outcome value new vulnerability
- OENRPT: Outcome expectancy new reducing probability of threat
- OENV: Outcome expectancy new vulnerability
- OVNRPT: Outcome value new reducing probability of threat
- OVPSN: Outcome value perceived social norms
- OVCV: Outcome value current vulnerability
- OECS: Outcome expectancy current severity
Table 13: Bivariate Correlations for Phase III Social-Cognitive Variables from Maddux’s (1993) Integrative Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Attendance</td>
<td>1.00</td>
<td>.528**</td>
<td>.753**</td>
<td>.093</td>
<td>.324</td>
<td>-.363</td>
<td>.418*</td>
<td>-.184</td>
<td>-.259</td>
<td>-.337</td>
<td>.050</td>
<td>.270</td>
<td>-.319</td>
<td>-.269</td>
</tr>
<tr>
<td>2 Energy expenditure</td>
<td>1.00</td>
<td>.307</td>
<td>.079</td>
<td>.342</td>
<td>.243</td>
<td>.203</td>
<td>.043</td>
<td>.047</td>
<td>-.358</td>
<td>.142</td>
<td>.270</td>
<td>-.107</td>
<td>-.440*</td>
<td></td>
</tr>
<tr>
<td>3 Intention frequency</td>
<td>1.00</td>
<td>.166</td>
<td>.424*</td>
<td>-.172</td>
<td>.334</td>
<td>.004</td>
<td>-.084</td>
<td>-.262</td>
<td>.048</td>
<td>.290</td>
<td>.069</td>
<td>.055</td>
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</tr>
<tr>
<td>4 Intention intensity</td>
<td>1.00</td>
<td>.365</td>
<td>.557**</td>
<td>-.009</td>
<td>-.222</td>
<td>-.058</td>
<td>-.101</td>
<td>-.462*</td>
<td>.038</td>
<td>.054</td>
<td>.149</td>
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<td></td>
</tr>
<tr>
<td>5 Intention time</td>
<td>1.00</td>
<td>.184</td>
<td>-.047</td>
<td>.192</td>
<td>.005</td>
<td>-.137</td>
<td>.002</td>
<td>.127</td>
<td>.039</td>
<td>-.023</td>
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<tr>
<td>6 Self efficacy</td>
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<td>.073</td>
<td>-.037</td>
<td>-.051</td>
<td>.082</td>
<td>-.90</td>
<td>-.145</td>
<td>.272</td>
<td>.170</td>
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</tr>
<tr>
<td>7 Barrier efficacy</td>
<td>1.00</td>
<td>-.171</td>
<td>-.554**</td>
<td>-.603**</td>
<td>-.138</td>
<td>.185</td>
<td>.205</td>
<td>.154</td>
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</tr>
<tr>
<td>8 OECV</td>
<td>1.00</td>
<td>.659**</td>
<td>.285</td>
<td>.233</td>
<td>-.077</td>
<td>.195</td>
<td>.081</td>
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<td>9 OECS</td>
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<td>.661**</td>
<td>.172</td>
<td>-.162</td>
<td>.036</td>
<td>.003</td>
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<td></td>
</tr>
<tr>
<td>10 OENV</td>
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<td>.152</td>
<td>-.212</td>
<td>-.134</td>
<td>-.102</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>11 OVNV</td>
<td>1.00</td>
<td>.101</td>
<td>-.380</td>
<td>-.463*</td>
<td>.017</td>
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</tr>
<tr>
<td>12 OVNRPT</td>
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<td>-.014</td>
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</tr>
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<td>13 OEPSN</td>
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<td>.819**</td>
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<tr>
<td>14 OVPSN</td>
<td>1.00</td>
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</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed)

Key Abbreviations:
- OECV: Outcome expectancy current vulnerability
- OECS: Outcome expectancy current severity
- OEPSN: Outcome expectancy perceived social norms
- OVPSN: Outcome value
- OENV: Outcome expectancy new vulnerability
- OVNRPT: Outcome value new reducing probability of threat
Table 14: Hierarchical Regression Analysis Examining Relationships between Attendance and Social-Cognitive Variables for Phase III of the Exercise Programme

<table>
<thead>
<tr>
<th>Prediction of Attendance Behaviour Phase III</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Barrier Efficacy</td>
<td>0.69</td>
</tr>
<tr>
<td>Intention frequency</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Note. * p < 0.05; ** p < 0.01; *** p < 0.001.

Table 15: Hierarchical Regression Analysis Examining Relationships between Intention Intensity and other Social-Cognitive Variables for Phase III of the Exercise Programme

<table>
<thead>
<tr>
<th>Prediction of Exercise Intention Intensity Phase III</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.52</td>
</tr>
<tr>
<td>Outcome Value</td>
<td>-0.42</td>
</tr>
</tbody>
</table>

Note. * p < 0.05; ** p < 0.01; *** p < 0.001

OVNV is Outcome Expectancy New Behaviour Vulnerability
As can be seen from Figure 9, the direction of relations was strongest for attendance behaviour leading to intention frequency in the early stages of the exercise programme. This pattern of results differed later in the exercise programme where relations between the two variables were of similar strength. Figure 10 presents relations between energy expenditure and intention frequency. As can be seen from Figure 10, the direction of relations was strongest for energy expenditure leading to intention frequency for the entire programme. Figure 11 presents relations between energy expenditure and self-efficacy. As can be seen from Figure 11, the direction of relations was strongest for energy expenditure leading to self-efficacy for the early part of the programme only.

Physical Function Capacity

Walk Test Data  As mentioned earlier, analyses were performed to determine whether physical improvements in physical function capacity was evident across the exercise programme. Descriptive data for the respective walk tests is presented in Table 16. Bivariate correlations between oxygen uptake (VO²) perceived exertion (RPE) and heart rate for all phases of the exercise programme are presented in Table 17. An ANOVA was performed to determine whether a difference existed between the distances walked at each different time frame. Wilks Lambda = 0.299, F (3, 14) = 10.96 (p < 0.001). A Bonferroni adjustment on the number of comparisons being made set the alpha at 0.008. Post hoc paired t tests revealed that for Tests 1 and 4 t = -5.969 (p < 0.000); Test 1 and 2, t = -5.815 (p < 0.000); Test 1 and 3, t = -5.278, (p < 0.000). All other combinations 2 & 3, 2 & 4, and 3 & 4 were non-significant.
Figure 9: Cross Lag Comparisons for Attendance Behaviour and Intention Frequency

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance</td>
<td>Attendance</td>
<td>Attendance</td>
</tr>
<tr>
<td>0.51**</td>
<td>0.49**</td>
<td>0.49**</td>
</tr>
<tr>
<td>0.32</td>
<td>0.43**</td>
<td>0.43**</td>
</tr>
<tr>
<td>Intention</td>
<td>Intention</td>
<td>Intention</td>
</tr>
</tbody>
</table>

Figure 10: Cross Lag Comparisons for Energy Expenditure and Intention Frequency

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy expenditure</td>
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</tr>
<tr>
<td>0.54**</td>
<td>0.45*</td>
<td>0.45*</td>
</tr>
<tr>
<td>0.37</td>
<td>0.39</td>
<td>0.39</td>
</tr>
<tr>
<td>Intention</td>
<td>Intention</td>
<td>Intention</td>
</tr>
</tbody>
</table>
Figure 11: Cross Lag Comparison Results for Energy Expenditure and Self-Efficacy

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy expenditure</td>
<td>Energy expenditure</td>
<td>Energy expenditure</td>
</tr>
<tr>
<td>0.39**</td>
<td>-0.02</td>
<td>0.09</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.32</td>
<td>Self-efficacy</td>
</tr>
</tbody>
</table>

**Note:** The symbols ** indicate statistical significance.
Table 16: Descriptive Data of all 12-Minute Walk Tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Range</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk Test 1</td>
<td>39</td>
<td>1274.00</td>
<td>750.00</td>
<td>2024.00</td>
<td>1113.12</td>
<td>238.86</td>
</tr>
<tr>
<td>Walk Test 2</td>
<td>27</td>
<td>1175.00</td>
<td>900.00</td>
<td>2075.00</td>
<td>1310.59</td>
<td>298.52</td>
</tr>
<tr>
<td>Walk Test 3</td>
<td>21</td>
<td>1600.00</td>
<td>900.00</td>
<td>2500.00</td>
<td>1327.38</td>
<td>369.97</td>
</tr>
<tr>
<td>Walk Test 4</td>
<td>22</td>
<td>1212.00</td>
<td>1000.00</td>
<td>2212.00</td>
<td>1384.13</td>
<td>347.84</td>
</tr>
<tr>
<td>VO₂ 1</td>
<td>39</td>
<td>10.62</td>
<td>9.75</td>
<td>20.37</td>
<td>12.77</td>
<td>1.99</td>
</tr>
<tr>
<td>VO₂ 2</td>
<td>27</td>
<td>9.79</td>
<td>11.0</td>
<td>20.79</td>
<td>14.42</td>
<td>2.48</td>
</tr>
<tr>
<td>VO₂ 3</td>
<td>21</td>
<td>13.33</td>
<td>11.0</td>
<td>24.33</td>
<td>14.56</td>
<td>3.08</td>
</tr>
<tr>
<td>VO₂ 4</td>
<td>22</td>
<td>10.10</td>
<td>11.83</td>
<td>21.93</td>
<td>14.56</td>
<td>2.89</td>
</tr>
</tbody>
</table>

Key

Start; (2) at 6 weeks; (3) at 12 weeks; (4) at 18 weeks.

Distance in metre

VO₂ is oxygen uptake as estimated using the MET equation
Table 17: Bivariate Correlation for Heart Rate, Perceived Exertion, and Estimated Oxygen Uptake (VO₂) from all 4- Walk Tests

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. VO₂ I</td>
<td>1.00</td>
<td>.139</td>
<td>.229</td>
<td>.245</td>
<td>.937**</td>
<td>.087</td>
<td>.167</td>
<td>.172</td>
<td>.864**</td>
<td>.224</td>
<td>.217</td>
<td>.197</td>
</tr>
<tr>
<td>2. VO₂ II</td>
<td>1.00</td>
<td>.406**</td>
<td>.487**</td>
<td>.188</td>
<td>.959**</td>
<td>.454**</td>
<td>.505**</td>
<td>.138</td>
<td>.927**</td>
<td>.467**</td>
<td>.502**</td>
<td></td>
</tr>
<tr>
<td>3. VO₂ III</td>
<td>1.00</td>
<td>.700**</td>
<td>.204</td>
<td>.374*</td>
<td>.960**</td>
<td>.671**</td>
<td>.281</td>
<td>.451**</td>
<td>.924**</td>
<td>.689**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. VO₂ IV</td>
<td>1.00</td>
<td>.308</td>
<td>.496**</td>
<td>.711**</td>
<td>.967**</td>
<td>.312*</td>
<td>.554**</td>
<td>.662**</td>
<td>.895**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. HR mean I</td>
<td>1.00</td>
<td>.182</td>
<td>.211</td>
<td>.250</td>
<td>.871**</td>
<td>.298</td>
<td>.237</td>
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<td></td>
</tr>
<tr>
<td>6. HR mean II</td>
<td>1.00</td>
<td>.460**</td>
<td>.542**</td>
<td>.100</td>
<td>.931**</td>
<td>.452**</td>
<td>.522**</td>
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</tr>
<tr>
<td>7. HR mean III</td>
<td>1.00</td>
<td>.711**</td>
<td>.267</td>
<td>.524**</td>
<td>.943**</td>
<td>.744**</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>8. HR mean IV</td>
<td>1.00</td>
<td>.251</td>
<td>.566**</td>
<td>.687**</td>
<td>.945**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. RPE mean I</td>
<td>1.00</td>
<td>.238</td>
<td>.314*</td>
<td>.310*</td>
<td></td>
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<td>11. RPE mean III</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12. RPE mean IV</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Key: VO₂: Oxygen Uptake  
HR Mean: Mean Heart Rate  
RPE: Perceived Exertion (Borg Scale)  
Test I: Programme Start  
Test II: At 6-weeks  
Test III: At 12-weeks  
Test IV: At 18-weeks
CHAPTER V
DISCUSSION

The general purpose of the present study was to test Maddux’s (1993) integrated social cognitive model in its prediction of compliance and intention to exercise among patients with a cardiac diagnosis. A series of correlation and regression analyses were performed to determine relations between the social cognitive variables and exercise behaviour. In general, these analyses provided partial support for Maddux’s model. Beyond this general observation, however, a number of aspects related to specific results should be highlighted.

First, the Maddux (1993) model proposes that intentions are the “most immediate and powerful determinant of behaviour” (Maddux et al., 1995, p, 192). Results from the present study support this tenet. Intention was a strong predictor of both measures of exercise behaviour (attendance, and energy expenditure). These findings support the majority of empirical research in both non-clinical (c.f., Godin, 1993; Rodgers & Brawley, 1993; Courneya & McAuley, 1994; c.f., Blue, 1995; Courneya & McAuley, 1995; Carron & Mack, 1997) and clinical populations (Godin et al., 1986; Bennett et al., 1999). Scale correspondence between intention and exercise behaviour as highlighted by Courneya and McAuley (1994) was addressed in the present study. In general, support for the notion of scale correspondence was found. Intention was assessed across three dimensions (intention, frequency, time and intensity). The response formats used for the intention scale were in line with the behavioural measures (i.e., attendance and energy expenditure). For example, intention frequency was more related to attendance behaviour than was intention intensity. Similarly, intention intensity was more related to energy expenditure than intention time.

Second, the model also posits that self-efficacy influences exercise behaviour both directly and indirectly through the influence of intention. Insofar as the direct effect is concerned, barrier self-efficacy influenced attendance behaviour during the first and third phases of the programme only. In addition, self-efficacy did not directly influence attendance behaviour at any time in the exercise programme. However, self-efficacy did have an effect on energy expenditure early on in the programme (phase I) but no relationships were evident as the programme advanced. These results suggest that participants who perceived themselves as having sufficient resources and confidence to overcome barriers to exercise were more
likely to attend the exercise programme. The fact that barrier efficacy had no effect on behaviour in phase II is somewhat perplexing. One must acknowledge that this may be an aberrant result. Inspection of the means and variances for these 2 variables across the three phases suggest that the non-significant findings at phase II cannot be accounted for by restrictions in range (c.f., McNemar, 1969). Task self-efficacy was related with energy expenditure in phase I suggesting that individuals with greater confidence to walk for longer periods of time at a greater intensity actually did so as seen with the energy expended. Examination of descriptive data demonstrates that self-efficacy values were considerably lower at phase I than in the latter phases (II & III). Hence, as efficacious belief regarding exercise at phase I were lower, one can assume that performing the given exercise had an effect on increasing subsequent self-efficacy levels. Once elevated, self-efficacy regarding one’s ability to perform the exercise may have been less of a factor later in the programme. In other words, once the participants knew they could perform the exercise after their early exposure it was less of a concern later in the programme. The mechanism involved in the increase in self-efficacy was not examined, but one can postulate that vicarious experiences and social modelling might be important sources of efficacious beliefs.

Insofar as the indirect effect of self-efficacy is concerned Maddux (1993) suggested that intentions might mediate relations between self-efficacy and exercise behaviour. Following the recommendations of Baron and Kenny (1986) this proposition was tested. Results showed no evidence to support the notion that intention serves as a mediator of self-efficacy. For mediation to take place the mediator variable must demonstrate a stronger relationship to the outcome variable than the predictor. In the current study intention intensity and self-efficacy were of equal strength and hence support for mediation could not be shown.

Third, in the current study two measures of self-efficacy were assessed - task and barrier efficacy. This approach was adopted to address the suggestions of McAuley & Mihalko (1998) who argued that, “future studies of exercise behaviour that employ the efficacy construct as a predictor of exercise behaviour (adherence) would do well to assess beliefs in ability to exercise at some prescribed frequency, duration, and intensity over ascending periods of time (e.g., months), in addition to barriers to exercise” (p, 378). Despite addressing the above concerns it is believed that room remains to consider other assessments of self-efficacy. Attention might be given to asking participants to state identify salient
perceived barriers early in a study, and assessing their efficacy at overcoming these specific barriers. It is apparent that different populations perceive different barriers as more important than others do (McAuley & Mihalko, 1998; Whaley, & Ebbeck, 1996).

Fourth, the Maddux model posits that intentions are determined by four factors: self-efficacy, outcome expectancy, outcome value and perceived social norms. The present study found partial support for these hypothesised relations, as only self-efficacy and attitude toward the new behaviour were related to intention, whereas attitudes toward the current behaviour and perceived social norms were not. Specifically, and as proposed self-efficacy for the new behaviour (exercise) was related to and predicted intention intensity across all three phases of the programme. In other words, those with greater confidence to perform exercise were more likely to have greater intention to exercise vigorously. These results are supported by those relations seen in the empirical literature for non-clinical (Desharnais et al., 1986; Poag-Du Charme & Brawley, 1993) and clinical populations (Bennett et al., 1999) with self-efficacy being a determinant of intention.

As previously mentioned, attitudes for the new behaviour were related to intention. Expressly, outcome expectancy for new behaviour vulnerability (OENV) was negatively related to intention intensity early in the exercise programme (phase I), whereas outcome value new behaviour vulnerability (OVNV) was related to intention intensity in phase III of the exercise programme. No other outcome expectancy or outcome values were seen to affect intention. The first relation between OENV and intention intensity intuitively makes sense in that, those participants that have expectations that the probability of the new behaviour (exercise) would not result in negative health outcomes would also possess greater intention to exercise. A rationale for this relationship not persisting later in the programme may be as follows; once the behaviour had been performed (i.e., for 6-weeks) participants were then armed with the knowledge that exercise would not result in a negative health outcome. In other words, having performed the behaviour for a period of time without adverse effect then concern regarding the behaviour would be less salient. These results are also in line with those of Bennett et al., (1999) who showed that outcome expectations were significantly associated with behavioural intentions. Moreover, a negative relationship between OVNV and intention intensity would suggest that those individuals who valued that their new behaviour (i.e., exercise) would not contribute to further heart problems had greater intention to exercise.
Again, intuitively this relationship is clear. It was apparent that there were no relations between outcome expectations and values with intention in phase II, the reason for this is not clear. A possible explanation for this lack of relations might be that individuals in phase II of the programme were in an interim period, where exercise cognitions were less salient but established behavioural patterns had not yet emerged.

Fifth, within the present study there were some results that contradicted the model and are worthy of mention. Outcome expectancy current behaviour vulnerability (OECV) had a direct effect on attendance behaviour in phase I. That is, participants that perceived their current behaviour would lead to negative health outcomes were less likely to attend the programme (see Table 4). This direct relationship is contrary to the proposed model and is in the opposite direction to what might be expected. Previous reports have suggested minimal association between the perception of likelihood and severity of disease threat and compliance with cardiac rehabilitation (Muench, 1987). Results from the present study concur with those demonstrated by Oldridge, and Streiner (1990). They found that dropouts that were more anxious or fearful than non-dropouts about their current behaviour provoking symptoms that they were unable to continue to perform the new behaviour (exercise).

Another result that contradicted the model was that outcome value perceived social norms (OVPSN) (see Table 5) had a direct and inverse relationship with energy expenditure. In other words, those participants who perceived that they did not value the support of their friends and family were more likely to perform the exercise behaviour. This contradicts much of the published literature among non-clinical groups, which highlights the need for social support (Carron, Hausenblas, & Mack, 1996; Duncan, Duncan, & McAuley, 1993; Duncan & McAuley, 1993; King, & Fredriksen, 1984; Wankel, 1985; Steptoe et al., 1997). A possible explanation of the present relationship might suggest that those participants who chose to exercise at a vigorous intensity did not require and hence value the support of friends and family.

Sixth, it was evident that the social-cognitive variables at phase I, outcome expectancy current behaviour vulnerability (OECV) and outcome expectancy current behaviour severity (OECS) were able to differentiate dropout from non-dropout behaviour. Specifically, participants that had greater expectations regarding their vulnerability and severity to negative health outcomes if they continued their current behaviour were more likely to dropout than
those with lesser values. These results are contrary to what might be expected. The rationale may be best explained again through the results of Oldridge, and Streiner (1990) who showed that dropouts that were more anxious or fearful than non-dropouts about their current behaviour provoking symptoms that they were unable to continue to perform the new behaviour (exercise). It is possible that a critical vulnerability/severity level exists among cardiac patients above which individuals are too afraid to exercise. Below this critical value, perceptions of vulnerability/severity act as a stimulus for continued participation. An alternative explanation is that those individuals with greater vulnerability/severity cognition were already active and felt the exercise in the present study to be additional. When the descriptive data from the first phase of the exercise programme was reviewed the opposite relationship was found. Results showed that dropouts tended to be in the contemplation and action stages of change, whereas those that completed the programme were predominantly in the action to maintenance stages of change.

A general comment regarding compliance is also worthy of mention at this point. Despite continued attendance among the non-dropout group, it was apparent that a variation in attendance compliance existed. Average compliance for attending more than the minimum 12 sessions per phase of exercise was 62%. This figure is similar, if not slightly better than that reported in the literature (Oldridge, 1988c; Jeng & Braun, 1997). Yet it is difficult to draw direct comparison, as no consistency is evident in the reporting of compliance behaviour. What the findings do suggest is that, despite participants continuing the programme (i.e., non-drop-outs) many (approximately 40%) did not attend what was considered the minimum number of sessions. These findings add weight to the concerns of Oldridge (1988a) who suggested that when studying compliance behaviour one should distinguish between the dropout and the complier. The number of participants that continued the programme (n = 25, 61%) was moderately better than that reported in other cardiac rehabilitation programmes (Oldridge, & Streiner, 1990; Oldridge, 1988a).

Seventh, cross lag correlation comparisons were performed to assess the strength of relations between behaviour and cognition across time. Results showed that the direction was strongest leading between from exercise behaviour to cognition. This suggests that having performed the behaviour (attendance & energy expenditure) participants were more likely to increase intention for exercise at subsequent sessions. Moreover, the direction of the
relationship was strongest from energy expenditure to subsequent self-efficacy early in the programme. This provides support to the notion that performing the behaviour can increase self-efficacy. However once self-efficacy is increased then this becomes less salient as behaviour progresses.

Eighth, participants’ functional ability was assessed across time to ascertain whether the exercise programme had utility in improving fitness. Functional ability was shown to improve across the 18-week exercise programme as evidenced by the serial walk tests performed. Of particular note was the significant difference between the first and all subsequent tests. An explanation for this might be due to the low functional ability seen at the start of the programme. The mean metabolic equivalent (MET) value was approximately 5 at the beginning of the programme, and it is suggested due to this low start point, improvement could only follow. Although the difference between the results between tests 2-3, and 3-4 were not statistically significant the mean walked distance for each test gradually increased from test 1-4. Hence sufficient evidence is provided that participants with a cardiac diagnosis can improve their fitness by participating regularly in a structured walking based aerobic programme. Without a control group it is difficult to conclude that these exercise outcomes were a result of the training. In general, these results do provide some support for those who have shown walking to be sufficient activity to increase fitness for previously less active adults. Strong correlations were evident between oxygen uptake (VO$_2$, as estimated using the 12-minute walk tests) and mean heart rate and perceived exertion. Similarly, strong relations between VO$_2$ and RPE’s, and between VO$_2$ and heart rate (r = .93 and .96) were demonstrated. These results provide some support for the following, (1) the utility of the 12-minute walk test as a satisfactory assessment of functional ability in cardiac patients, and (2) the use of heart rate monitors and perceived exertion as providing readily accessible, practical and useful information in the monitoring of exercise among this population. Results also support previous reports that suggest, perceived exertion ratings correlate well with measured exercise heart rates and calculated oxygen consumption values (ACSM, 1995). At the same time it is important to be vigilant with these measures as evidence is available to suggest that among both healthy participants and cardiac patients variability between perceived exertion and heart rate reserve in both during graded exercise testing exists (Whaley et al., 1997).
Ninth, several limitations from the present study are worthy of discussion. Foremost, were the scales used to assess the social cognitive variables. Whilst every attempt was made to provide reliable and valid scales consistent with the integrated model proposed by Maddux (1993), it is apparent that further development of these measures is required. Internal consistency values for all the measures were not satisfactory (< 0.60) and hence could not be used in subsequent analyses. It is possible, that the wording of some of the items encouraged participants to make an all or none response, which makes it difficult to have sufficient variation in scores among certain scales. This may have contributed to the lack of relations between the variables of interest as proposed in the Maddux model. A more fruitful avenue might be to pursue a dichotomous assessment of the outcome expectancy and outcome value items. For example an individual presumably, either perceives the outcome as severe or not.

An additional consideration with scale development should be how to best assess current and new behaviour questions across time. It was apparent in the present study that as participants commenced the exercise programme, their current behaviour may well have been inactive, and the new behaviour would include exercise. However, as the behaviour became more established then the current behaviour now is one of exercise. The question that must obviously follow is - what then constitutes the new behaviour? It is possible that when beginning a new behavioural change programme one assesses both current and new behaviour. Yet, with time should only current behaviour be considered? A final point of consideration has been raised by Dr Maddux (J.E., Maddux, personal communication, July, 17, 1999), which proposed that items assessing outcome expectancies should separate the behaviour from the outcome of the behaviour. Whilst every attempt was made to do this, it is still possible that some items did not truly make this delineation.

Another limitation was that in the present study the investigator did not ascertain all of the reasons that individuals gave for not participating in the study despite initial agreement. As mentioned earlier, aggressive attempts were made to increase this participation, but no further enrolments were apparent. This begs the question, what is the exercise behaviour of those that did not take-part? Of those that were questioned reasons cited for not wanting to join were, barriers such as time of day, travel constraints etc., whilst more positive comments included “already exercising”. In addition, it is not clear from those that dropped out what their reasons were for discontinuation. Only one-subject stopped for medical reasons. It is possible that the
remaining dropouts chose to exercise elsewhere. Ongoing follow-up of these participants would have answered these questions, but unfortunately were outside the scope of this project.

A final limitation to be addressed is the assessment of compliance. As highlighted by Dishman (1994) definitions of compliance vary across studies making interpretation of results difficult. Satisfactory compliance behaviour was taken as attendance as greater than or equal to the minimum 12 exercise sessions per 6-week phase. Attempts were made to assess physical exertion during the individual sessions using RPE’s and heart rate to provide an assessment of exercise effort. This information whilst relatively simple to collect, was more difficult to equate with satisfactory versus unsatisfactory effort.
CHAPTER VI
SUMMARY and CONCLUSIONS

Summary

The general purpose of the present study was to test Maddux’s (1993) integrated social cognitive model in its prediction of compliance and intention to exercise among patients with a cardiac diagnosis. Forty-one individuals with a cardiac diagnosis were recruited to participate in an 18-week walking based aerobic exercise programme. Assessment of behaviour included attendance to the exercise programme and the calculation of energy expended using the metabolic equivalents (METs) formula. Social cognitive variables from the integrated model were collected at three time points: exercise start: after 6-weeks and after 12-weeks. In addition, functional ability was assessed at the start of the programme and at 6-weekly intervals using the Cooper’s (1968) 12-minute walk test. A series of correlation and regression analyses were performed to determine the relations and predictions of the social cognitive variables with exercise behaviour. The model performed reasonably well and was able to predict two measures of exercise behaviour (attendance, and energy expenditure) and intention. Intention was the strongest predictor of exercise behaviour. Self-efficacy was predictive of exercise behaviour - energy expenditure, whilst barrier efficacy was more related to attendance behaviour. Self-efficacy, and outcome value was related to intention, whereas outcome expectancy and perceived social norms were not. Contrary to the model, outcome expectancy was inversely related to attendance behaviour early in the programme. Outcome value perceived social norms (OVPSN) was inversely related to energy expenditure in the early and latter stages of the exercise programme. The social cognitive variables - outcome expectancy current behaviour, vulnerability (OECV) and severity (OECS) were able to differentiate dropouts from non-dropouts. In total 61% of the participants completed the 18-week exercise programme, and compliance (participation in more than the minimum 12 exercise sessions per phase was similar (60%).

Cross-lag comparisons showed that the direction of the relationship was strongest leading from attendance behaviour to intention frequency early on in the programme, but this pattern of results did not persist. In addition, the direction of the relationship was strongest leading from energy expenditure to self-efficacy early in the programme. Again, this
relationship did not persist later in the programme. The last cross-lag correlation showed that the direction of the relationship was strongest leading from intention intensity to self-efficacy for the entire programme.

Participants increased their functional capacity as assessed by the Cooper’s (1968) 12-minute walk test. The most apparent change was from commencement of the programme to the end of the first 6-weeks. As expected physiological parameters (e.g., heart rate) and perceived exertion (RPE) correlated well with oxygen consumption estimated using metabolic equivalent calculations (MET). Having said this the present study found support for Maddux’s (1993) integrated social cognitive model.

**Conclusions.**

Within the limitations of the present study the following conclusions are drawn.

- Intention is the most immediate and powerful predictor of exercise compliance behaviour.
- Barrier efficacy is a significant predictor of attendance behaviour.
- Self-efficacy is a strong predictor of intention to exercise frequency.
- Outcome value new behaviour vulnerability to negative health outcomes (OVNV) is related to intention intensity.
- Outcome expectancy current behaviour vulnerability to negative health outcomes (OECV) is a predictor of attendance behaviour.
- Outcome value perceived social norms (OVPSN) has a direct and inverse relationship to energy expenditure.
- Outcome expectancy current behaviour vulnerability (OECV) and outcome expectancy current behaviour severity (OECS) both differentiate dropouts from non-dropouts.
- The relationship leading from exercise behaviour to cognition is stronger that from cognition to exercise behaviour.
- Cardiac patients that comply with an 18-week walking based exercise programme can improve functional ability as assessed by the Cooper’s 12-minute walk test.

**Future Research.**

On the basis of the results obtained, it is evident that future research in this area be conducted. Particularly useful avenues of investigation would include:
Further scale development, as mentioned previously, further scale development is required if the utility of the integrated model is to be truly useful in predicting and explaining exercise behaviour. Future scale development should bear in mind the comments of Maddux’s (1999), who argued that the problem that exists with outcome value items is that they refer to the value of the behaviour rather than the value of the possible outcome of the behaviour. In addition Dr Maddux has suggested that items that assess severity and vulnerability particularly in relation to cardiac disease might give little variability. It is necessary to be mindful of these points if one is to generate items that maintain construct validity.

Increasing the sample size would be useful to allow the inclusion of statistical methods such structural equation modelling.

Repeating the study in a different population (e.g., a different clinical and a non-clinical) would permit generalisation of the findings.

To examine utility of the integrated model in other health related situations. It is possible that the model might add to the understanding post-injury rehabilitation behaviour, and is worthy of attention.

The inclusion of a framework that includes the Transtheoretical model. This would allow for the investigation of the variables of interest and the relevant contributions at various behavioural stages of change.

To perform a qualitative study of the participants that completed an exercise programme and to follow those participants that were considered to be dropouts. Such an approach might again yield important information that would augment the quantitative approach.

Consideration might be given to the inclusion of a motivational (i.e., self-determination c.f., Deci, & Ryan, 1985; Vallerand, & Fortier, 1998) theory to augment the present model. It is apparent that one model alone, albeit integrated does not explain all behaviour.

Provision of laboratory-based assessment of physical function would provide accurate and valid assessment of fitness changes.

Developing an intervention based upon the integrated model would be a distant approach to future research. It is possible that an intervention focussed on altering the attitudes toward exercise may have an impact on intention to exercise.
REFERENCES


King, A. C., Carl, F., Birkel, L., & Haskell, W., L. (1988). Increasing exercise among blue collar employees; the tailoring of work programs to meet specific needs. Preventive Medicine, 17, 357-365.


APPENDICES
APPENDIX A: INTENTION TO EXERCISE QUESTIONNAIRE
Intention to Exercise Questionnaire

Adapted from McAuley and Mihalko (1998).

Please complete the following statements by filling-in the blank sections indicating your intention to perform the walking exercise.

I intend to exercise at a ___________ pace\(^1\) continuously for _____ minutes\(^2\) _______ times\(^3\) per week for a period of ___________ weeks\(^4\).

1. The pace indicates the effort that you expect to exercise at or could exercise continuously for.

   **Slow pace** – is an easy pace, there is no shortness of breath or discomfort is experienced. You are able to talk easily whilst exercising.

   **Moderate pace** – is a faster pace in which you will experience some shortness of breath but minimal discomfort. You will be able to talk in between breaths. You will experience some sweating.

   **Moderately fast pace** – at this pace you will definitely experience shortness of breath, some muscular discomfort and sweating. You will be able to say individual words but not hold a conversation.

   **Fast pace** – at this pace you will be short of breath experience much discomfort and heavy sweating. You will not be able to hold a conversation.

2. Please indicate in the space provided the number of minutes you intend to exercise at a continuous pace at the cardiac rehabilitation exercise session. The exercise session will last for 50 minutes, therefore please choose a number from 1-50 only.

3. Please indicate the number of times per week you intend to exercise at the cardiac rehabilitation exercise programme. A total of five sessions are available for you to attend, therefore please choose a number from 1 – 5.

4. Please indicate the number of weeks you intend to exercise at the cardiac rehabilitation exercise programme. *Please note that this questionnaire will be administered at the beginning of the study and again at 12 weeks.* Therefore please choose a number from 1-12 only.
APPENDIX B: BARRIER EFFICACY SCALE
Barrier Efficacy Scale

Adapted from McAuley & Milhalko (1998)

Using the scale below, please indicate how confident you are that you could exercise in the event that any of the following circumstances were to occur.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
No Confidence At all Somewhat Confident Completely Confident

For example if you have complete confidence that you can exercise, even if you are bored by the activity, you should circle 100%. However, if you are absolutely sure that you could not exercise if you failed to make or continue to make progress you would circle 0% (No confidence at all).

I believe that I can exercise 3 times per week if:

1. The weather is very bad (hot, humid, rainy, snow, cold)
2. I was bored by the program or activity
3. I was on holiday
4. I felt pain or discomfort
5. I had to exercise alone
6. Exercise was not enjoyable or fun
7. It became difficult to get to the exercise location
8. I didn’t like the particular activity that I was involved in
9. My work/study schedule conflicted with my exercise
10. I felt self-conscious about my appearance
11. I was not offered encouragement
12. I was under personal stress of some kind
APPENDIX C: SELF-EFFICACY SCALE
Self-Efficacy Scale

Adapted from McAuley & Milhalko (1998)

Please indicate below how confident you are that you can successfully carry out each of the activities below using the following scale.

<table>
<thead>
<tr>
<th>%</th>
<th>No Confidence At all</th>
<th>Somewhat Confident</th>
<th>Completely Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<tr>
<td>1</td>
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<tr>
<td>10</td>
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</table>

For example if you have complete confidence that you can walk for 10 minutes at a moderately fast pace, you would circle 100%. However, if you are not very confident that you can walk 20 minutes without stopping, you would circle a number closer to the zero end of the scale.

I Believe That I Can Exercise

1. For 20 minutes at a easy effort without stopping
2. For 30 minutes at an easy effort without stopping
3. For 40 minutes at an easy effort without stopping
4. For 50 minutes at an easy effort without stopping
5. For 20 minutes at a moderate effort without stopping
6. For 30 minutes at a moderate effort without stopping
7. For 40 minutes at a moderate effort without stopping
8. For 50 minutes at a moderate effort without stopping
9. For 20 minutes at a hard effort without stopping
10. For 30 minutes at a hard effort without stopping
11. For 40 minutes at a hard effort without stopping
12. For 50 minutes at a hard effort without stopping

- NB The effort indicates perceived exertion during continuous exercise.

**Easy effort** – there is minimal shortness of breath or discomfort experienced. You are able to talk easily whilst exercising.

**Moderate effort** – is a harder effort, in which you will experience some shortness of breath and tolerable muscular discomfort. You will be able to talk in between breaths. You will experience some sweating.

**Hard effort** – at this pace you will definitely experience shortness of breath, muscular discomfort and sweating. You will be able to say individual words but not hold a conversation.
APPENDIX D: OUTCOME EXPECTANCY CURRENT BEHAVIOUR VULNERABILITY ITEMS (OECV)
Outcome Expectancy Current Behaviour
Vulnerability (OECV)

Items generated according to the model presented by Maddux (1993)

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely Disagree</td>
<td>Somewhat Agree</td>
<td>Completely Agree</td>
<td></td>
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</table>

For example if you completely disagree with the statement you should circle 0. However, if you completely agree you would circle 7.

If I continue with my current lifestyle I am likely to have further heart problems.

If I continue my current lifestyle, it will contribute to a further heart event.

My current lifestyle will NOT contribute to heart problems. (Reverse code)
APPENDIX E: OUTCOME VALUE CURRENT BEHAVIOUR VULNERABILITY ITEMS (OVCV)
Items generated according to the model presented by Maddux (1993).
Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

0           1                2           3                 4          5                6       7
Completely                           Somewhat                             Completely
Disagree                            Agree                        Agree

For example if you completely disagree with the statement you should circle 0. However, if you completely agree you would circle 7.

It is important to me that I do not have further heart problems.

The likelihood of me having heart problems is high and this is a real concern.

I value that I am NOT likely to suffer from heart problems.
APPENDIX F: OUTCOME EXPECTANCY CURRENT BEHAVIOUR SEVERITY ITEMS (OECS)
Outcome Expectancy Current Behaviour
Severity (OECS)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completely</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Disagree</td>
<td>Somewhat</td>
<td>Agree</td>
<td>Completely</td>
<td>Agree</td>
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</table>

For example if you completely disagree with the statement you should circle 0. However, if you completely agree you would circle 7.

If I continue my lifestyle, I will increase the likelihood of dying from another heart problem.

My current lifestyle may seriously worsen my heart condition.

My current lifestyle will not contribute to further serious heart problems.
APPENDIX G: OUTCOME VALUE CURRENT BEHAVIOUR SEVERITY ITEMS (OVCS)
Outcome Value Current Behaviour
Severity (OVCS)

Items generated according to the model presented by Maddux, (1993)

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

0           1         2            3        4           5            6     7
Completely                       Somewhat               Completely
Disagree                        Agree                   Agree

For example if you *completely disagree* with the statement you should circle 0. However, if you *completely agree* you would circle 7.

It is important to me that I do not have *serious* heart problems

I would value that I am not likely to *die* from heart problems

The likelihood of me having *serious* heart problems is a real concern to me.
APPENDIX H: OUTCOME EXPECTANCY NEW BEHAVIOUR VULNERABILITY ITEMS (OENV)
Outcome Expectancy New Behaviour
Vulnerability (OENV)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

0          1                2             3           4         5           6     7
Completely                       Somewhat               Completely
Disagree                        Agree                   Agree

For example if you *completely disagree* with the statement you should circle 0. However, if you *completely agree* you would circle 7.

If I exercise this may cause further heart problems

Exercise could be detrimental to my heart

Exercise will make my heart condition worse

I am concerned how my heart will respond to exercise
APPENDIX I: OUTCOME VALUE NEW BEHAVIOUR VULNERABILITY ITEMS (OVNV)
Outcome Value New Behaviour
Vulnerability (OVNV)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

<table>
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<tr>
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<th>4</th>
<th>5</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Completely Disagree</td>
<td>Somewhat Agree</td>
<td>Completely Agree</td>
<td></td>
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</tbody>
</table>

For example if you *completely disagree* with the statement you should circle 0. However, if you *completely agree* you would circle 7.

The possibility that my heart condition will worsen is important to me

The likelihood that I will NOT suffer more heart problems is important to me

I value the likelihood of me NOT experiencing chest pain
APPENDIX J: OUTCOME EXPECTANCY NEW BEHAVIOUR REDUCING THE PROBABILITY OF THREAT ITEMS (OENRPT)
Outcome Expectancy New Behaviour
Reducing the Probability of Threat).

(OENRPT)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

<table>
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<tr>
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<th>5</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Completely Disagree</td>
<td>Somewhat Agree</td>
<td>Completely Agree</td>
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</table>

For example if you completely disagree with the statement you should circle 0. However, if you completely agree you would circle 7.

If I exercise I will reduce the chance of having further heart problems

If I don’t exercise I will increase the chance of having further heart problems

Engaging in exercise will improve my current heart condition

Engaging in exercise will NOT improve my current heart condition (Reverse code)
APPENDIX K: OUTCOME VALUE NEW BEHAVIOUR REDUCING THE
PROBABILITY OF THREAT ITEMS (OVNRPT)
Outcome Value New Behaviour
Reducing the Probability of Threat).
(OVNRPT)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

0         1           2         3              4          5                  6                7
Completely                       Somewhat               Completely
Disagree                        Agree                   Agree

For example if you completely disagree with the statement you should circle 0. However, if you completely agree you would circle 7.

I value the likelihood of preventing further heart problems from occurring

Reducing the chance of further heart problems is important to me

It is important to me that I reduce the likelihood of suffering from further heart problems

I place a great deal of importance on the prevention of further heart problems
APPENDIX L: OUTCOME EXPECTANCY NEW BEHAVIOUR PERCEIVED SOCIAL NORMS ITEMS (OEPSN)
Outcome Expectancy New Behaviour Perceived Social Norms
(OEPSN)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

<table>
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<tr>
<th>0</th>
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<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>Completely Disagree</td>
<td>Somewhat Agree</td>
<td>Completely Agree</td>
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</table>

For example if you completely disagree with the statement you should circle 0. However, if you completely agree you would circle 7.

If I regularly attend my exercise class my family will support me.
If I regularly attend my exercise class my friends will support me.
If I regularly attend my exercise class my family will approve of me.
If I regularly attend my exercise class my friends will approve of me.
My friends will approve of me if I continue to exercise.
My family will approve of me if I continue to exercise.
My family will think more of me if I change my lifestyle and exercise.
My friends will think more of me if I change my lifestyle and exercise.
APPENDIX M: OUTCOME VALUE NEW BEHAVIOUR PERCEIVED SOCIAL NORMS
ITEMS (OVPSN)
Outcome Value New Behaviour Perceived Social Norms (OVPSN)

Items generated according to the model presented by Maddux (1993).

Using the scale below, please indicate the extent to which you agree or disagree with the following statements.

0 1 2 3 4 5 6 7
Completely Disagree Somewhat Agree
Disagree Agree

For example if you *completely disagree* with the statement you should circle 0. However, if you *completely agree* you would circle 7.

The support of family is important to me
The support of friends is important to me
The approval of family is important to me
The approval of friends is important to me
It is important that family support me during my effort to exercise.
It is important that friends support me during my effort to exercise.
APPENDIX N: STAGES OF CHANGE QUESTIONNAIRE
Stages of Change Questionnaire

Adapted from Marcus, Rossi, Selby, Niaura, & Abrams (1992).

Please choose ONE of the five responses that best describe your exercise behaviour immediately before your current heart condition was evident or before your admission to hospital.

I do not exercise and do not intend to start in the next 6 months.
I do not exercise but intend to start in the next 6 months
I exercise some but not regularly (regular exercise means three or more times a week for 20 minutes or longer)
I exercise regularly but have done so for less than 6 months
I exercise regularly and have done so for more than 6 months
APPENDIX O: THE BORG PERCEIVED EXERTION SCALE (10-POINT)
The Borg Scale of Perceived Exertion

Adapted from Pashkow, Harvey & Froelicher, (1999)

**10 point scale**

0     = Nothing at all  
0.5   = Very very light 
1     = Very light  
2     = Light  
3     = Moderate  
4     = Somewhat hard  
5     = Hard  
6     
7     = Very hard  
8     
9     
10    Very, very hard
APPENDIX P: PROTOCOL FOR THE COOPER’S 12-MINUTE WALK TEST FOR CARDIAC PATIENTS
Protocol for the Cooper’s 12-Minute Walk Test
for Cardiac Patients

Adapted from Steele, B (1996).

Procedure:
1. Prior to the first walk collect the following information: Blood pressure, resting heart rate, rating of perceived exertion (10-point Borg scale). Any medications should be self-administered before the test (i.e., nitrolingual spray).
2. Walks will take place at approximately the same time of day.
3. Participants will be asked to walk around the measured field, covering as much ground as possible in 12-minutes.
4. Ambient temperature at the location will be recorded.
5. Two walks will be carried out with at least 15-minutes of rest between each walk.
6. The following instructions will be given to participants:
   “The purpose of this test is to find out how far you can walk in 12-minutes. You will start from this point (indicate marker at the corner of the course) please follow the white line that is around the field ensuring to go around each cone. When you arrive back at the start, you will continue on around the course trying to go as far as possible in the 12-minutes. If you need to, you may stop and rest. Please remain where you are until you can go on again. However the most important thing about the test is that you cover as much ground as you can. I will tell you the time at 2, 4, 6, 8, 10, and 12 minutes when the time is up. When I say ‘stop’ please stand right where you are.
7. At the halfway point during the walk and after the walk you will be asked to rate your perceived level of exertion via the 1-10 scale.
8. Participants will be asked to repeat the instructions and asked whether they have any questions - to validate understanding.
9. Staff will be on each side of the walking area to record the level of perceived exertion and distance covered and to offer assistance if required.
10. The longest distance walked of the two trials will be noted, however all distances will be recorded.
11. Immediately following completion of each walking test, patients will be asked to rate their perceived exertion.
12. Following completion of each walking test, blood pressure will be recorded.
APPENDIX Q: PARTICIPANT’S INFORMATION SHEET
Sports Science Research Participant Information

Project Title
Understanding Exercise Behaviour.

Researchers and Contact Address.
Dr Harry Prapavessis and Ralph Maddison, Department of Sport and Exercise Science, Tamaki Campus, University of Auckland, Private Bag 92019, Auckland, and Dr Rob Doughty, Department of Cardiology, Auckland Hospital.

Ralph Maddison (Master of Science Student)
Phone: 09 3737599 ext. 6887 or 6302459 (hm) or 021 985 613 mobile, e-mail: ralph.m@clear.net.nz

Dr Harry Prapavessis (Senior Lecturer, Sport and Exercise Science)
Phone: 09 3737599 ext. 6860, e-mail: h.prapavessis@auckland.ac.nz

Background Information
Cardiac disease is the leading cause of death in New Zealand. Recovery from a cardiac event includes modification of risk factors such as reducing cholesterol, controlling weight, stopping smoking, and avoiding a sedentary lifestyle. The aim of a cardiac rehabilitation programme is to assist people in the restoration of optimal physical, psychological, social, and vocational performance following an acute cardiac event.

Whilst this sounds good in principle, research has shown that people do not stick at cardiac rehabilitation programmes. Therefore the purpose of this study is to examine factors that influence individuals compliance to exercise programmes.

Project Objectives
The purpose of this study is to provide a 6-month, structured, walking-based aerobic exercise programme for patients post-a cardiac event and to observe factors that influence exercise behaviour.

Subject Requirements
To be included in this study you need to have had one of the following cardiac events, heart attack, angina, coronary angioplasty or stent. Your Doctor (cardiologist) must give consent for you to exercise, and you must be able to physically exercise (i.e., walk unimpeded by any disability). Additionally, you must be not be experiencing any cardiac symptoms at the time you enter the exercise programme. You will be encouraged to attend the walking-based exercise programme, which will be available, every weekday. Each exercise session will last for approximately one and a half-hours and will be available in the morning as well as in the afternoon. A qualified exercise instructor will be available at every session to provide supervision, encouragement and first aid if required.

Questionnaires will be distributed to all individuals before starting the exercise programme, again at 6-weeks, 3 months and again at 6-months. Whilst participating in the exercise individuals will be asked to wear a heart-rate monitor and a pedometer (which the exercise instructor will help you with). Follow up information will be obtained from all patients after the programme has finished. A report of the results will be sent to all participants one the study is completed.

Risks
The risks of participating in this study are considered minimal, and include the fatigue, and discomfort associated with exercise. It is anticipated you will experience some shortness of breath. It is not expected that the exercise will worsen your cardiac condition, however if cardiac symptoms become evident, the exercise will immediately cease and you will be referred back to your doctor. The exercise instructor is available at all times to provide immediate first aid and to call for paramedical assistance. If you experience psychological concerns whilst participating in this study, appropriate support will be available to discuss these concerns.

**Benefits**

The main two benefits of this study are to provide you with a safe walking-based aerobic cardiac rehabilitation exercise programme. Secondly this project will make a significant contribution to understanding exercise behaviour. No financial incentives will be available to you in this study. All participants who participate in this study will be invited to a presentation of the completed study at the end of 1999. As mentioned a written report of this study will be sent to all of you.

**Freedom of Consent**

It is the researchers’ intentions to include only those individuals that freely choose to participate in this study. Participation is voluntary and you are free to withdraw consent at any time. Your withdrawal will have absolutely no influence on your present and or future involvement with the University of Auckland. Your consent to participate in this research will be indicated by your signing and dating of the consent form. Signing the consent form indicates that you have freely given your consent to participate, and there has been no coercion to participate.

**Confidentiality**

All data collected for this research will be treated with absolute confidentiality. All questionnaires will be numerically coded and no names will be included in the data collection or analysis. Reported results will not include names of the participants.

**Data and Results**

Recorded data will be retained for a period of six years in a secure place within the Department of Sport and Exercise, at the University of Auckland, under the care of Dr Harry Prapavessis. This is to conform to the University’s Code of Practice.

**Inquiries**

Any questions concerning the research are welcome at any time. Please feel free to ask for clarification of any point, which you feel, has not been explained to your complete satisfaction.

The researchers can be contacted as follows,

Ralph Maddison (Master of Science Student)  
Phone: 09 3737599 ext. 6887 or 6302459 (hm) or 021 985 613 mobile, e-mail: ralph.m@clear.net.nz

Dr Harry Prapavessis (Senior Lecturer, Sport and Exercise Science)  
Phone: 09 3737599 ext. 6860, e-mail: h.prapavessis@auckland.ac.nz

Any queries regarding ethical concerns please contact:  
Dr Dennis Moore, Chair, University of Auckland, Private Bag 92019, Auckland; phone (09) 3737599 ext. 8939: facsimile (09) 373 7432

**APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE**  
On___/___/___ for a period of ______ years, from ___/___/___ Reference ____/____
APPENDIX R: PARTICIPANT CONSENT FORM
Sport Science Research

Consent to Participate in Research

(This consent form will be held for a period of six years)

Project Title: Understanding Exercise Behaviour.

Researchers: Dr Harry Prapavessis (PhD) and Ralph Maddison (BHSc) and Dr Rob Doughty (MBChB; MNZCP).

Aim: The purpose of this study is to develop a greater understanding of why people continue to participate during cardiac rehabilitation exercise programmes.

The researchers conducting this study support the principles governing both ethical conduct of research, and the protection at all times of the interests, comfort and safety of the participants. This form and the accompanying Subject Information Package are given to you for your own protection. They contain a detailed outline of the procedures. Your signature below indicates seven things:

1. I have been given and understood an explanation of the research study. I have had an opportunity to ask questions and have them answered.
2. I understand that I may withdraw myself or any information traceable to me at anytime without giving a reason and that, this in no way will affect my future involvement with the University of Auckland.
3. I understand that participation in this study is confidential and no material that could identify me will be used in any reports on this study.
4. I agree to complete all the questionnaires.
5. I have had time to consider whether to take part in this research project.
6. I know whom to contact if I have any concerns as a result of participation in this study.
7. I am aware of the risks involved in exercising and do not hold the researchers responsible for any adverse cardiac problems I may experience.

I (name printed clearly)……………………………………………………………………………………………………
Consent to being a subject in the understanding of exercise behaviour during a cardiac rehabilitation exercise programme conducted by Ralph Maddison.

Signed (subject): …………………………………………………………………………………… Date …/……/……

Signed (witness): …………………………………………………………………………………… Date …/……/……

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE - May 1999 for a period of three years.
APPENDIX S: GENERAL INFORMATION SHEET
Cardiac Exercise History

Name

Contact details
Address

Telephone

Occupation

Number of previous heart attacks

Smoking history