PHYSICAL ACTIVITY AND DEPRESSION IN PEOPLE WITH CORONARY HEART DISEASE

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STUDENT DECLARATION

“I, Michelle Catherine Rogerson, declare that the PhD thesis entitled *Physical Activity and Depression in People with Coronary Heart Disease* is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, and references. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work”.

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ABSTRACT

The aim of this thesis was to investigate the relationship between physical activity (PA) and depression in people with coronary heart disease (CHD). I conducted three studies to explore this topic. In Study 1, I examined the relationship between PA and depression, over time, in people with CHD. In Study 2, I explored the PA experiences of people with both depression and CHD, and in Study 3, I designed and implemented a PA adherence intervention, with the aim of increasing adherence to PA for people with depression and CHD. Study 1 consisted of two phases: baseline and follow-up. In the baseline phase, I recruited 102 participants who had experienced a cardiac event within the 12 months prior to recruitment. Participants completed a demographic questionnaire, the Cardiac Depression Scale (CDS), and the Scottish Physical Activity Questionnaire (SPAQ). Approximately six months later, I sent out follow-up questionnaire packages, including the CDS and SPAQ, to all participants who had expressed an interest in further research. The results from both phases of the study highlighted the prevalence and severity of depression after a cardiac event. At baseline, approximately 60% of participants were experiencing at least minor depression, with those individuals who had recently had their cardiac event (i.e., 1-6 months previously) having higher mean depression scores on the CDS ($M = 90.1$) compared to participants who had experienced their cardiac event 7-12 months previously ($M = 81.7$). At follow-up, 50% of participants were still experiencing at least minor depression. Overall, I found PA levels to be high at baseline and follow-up. I also found, in general, small, negative correlations between depression and PA at baseline and follow-up. Another consistent finding at baseline and follow-up was that those individuals, who perceived themselves as regularly physically active according to the transtheoretical model, were significantly less depressed than those who believed they were not regularly active. Given the findings of Study 1, and those of previous research indicating the negative relationship between depression and PA for people with CHD, I conducted Study 2, which utilized in-depth interviews to explore experiences of individuals with depression and CHD, in terms of participation or non-participation, in PA. Fifteen participants from Study 1 who had scored above 95 on the CDS (indicating “more severe” or “major” depression) took part in the interviews. Based on inductive content analysis, I identified two general dimensions (termed “barriers” and “facilitators”) and 13 second-order themes. The barriers general dimension referred to the common factors that participants claimed hindered or prevented their participation in PA, and included negative perceptions of life changes resulting from the heart disease, depression/low mood, lack of motivation, perceived and actual physical restrictions, negative perceptions and uncertainties of exercise, perceived external obstacles, lack of social support, and effects of past sedentary behaviour. Participants reported depression to be a barrier to PA in its own right and in addition, depression was highly associated with a number of the other barriers (e.g., negative perceptions of life changes, lack of motivation, and physical restrictions). The facilitators general dimension referred to the common factors that participants claimed encouraged their participation in PA, and included having a reason for exercising, experiencing the psychological and physical benefits of exercise, the positive role of others, enjoyment of exercise, and using psychological strategies. Using the information gained in Studies 1 and 2, I constructed and implemented a PA adherence intervention that was suitable for people with depression and CHD. The purpose of Study 3 was to explore the relationship between, and changes in, PA, exercise stage of change (SOC), and depression, following the 12-week intervention. I recruited 20 cardiac patients to take part in an exercise consultation intervention, based on the guidelines of Loughlan and Mutrie (1995) and Kirk, Barnett, and Mutrie (2007). The intervention consisted of a face-to-face consultation at baseline and six follow-up fortnightly phone calls that were specifically tailored to the individual's exercise SOC. During the intervention, I utilised various psychological strategies, such as goal setting, increasing self-efficacy, and encouraging social support to assist participants with PA adherence. At baseline, Week 10, and Week 24, participants completed the CDS, the Community Health Activities Model Program for Seniors (CHAMPS) PA questionnaire, and the Exercise Motivational Stage Measure (to measure exercise SOC). After they had completed the Week 10 questionnaires, participants were asked about their experiences with the intervention. Overall, mean depression levels decreased slightly from baseline to the end of the intervention at Week 10, and then continued to decrease until the final measurement at Week 24. Mean PA levels and exercise SOC increased over the course of the intervention, but then decreased from Week 10 to Week 24. None of these results, however, were statistically significant. As determined by the CDS, nine participants were at least mildly depressed at baseline, and 11 participants were not depressed at baseline. Results also indicated that people with depression at baseline were more likely to have lower PA levels, in particular, lower moderate intensity PA levels, and to perceive themselves as being less active compared to people who were not depressed at baseline, at all time points throughout the study. The findings from Study 3 also suggested that the intervention may have been particularly effective for those participants with depression at baseline, in decreasing depression levels, increasing PA, and moving exercise SOC to more active levels. The qualitative responses highlighted participants' satisfaction with the intervention, in addition to the success of the intervention, particularly in increasing levels of PA. Overall, the findings of the present thesis highlight the prevalence and severity of depression after a cardiac event and the ongoing negative relationship between depression and PA, and depression and exercise SOC, in people with CHD. In addition, the intervention study showed promising results for an adherence intervention based on an exercise consultation approach, and these findings suggest that exercise adherence interventions have potential for reducing depression and increasing PA in people with CHD. The implications of the current thesis are applicable to researchers and practitioners alike. Many suggestions are made throughout the thesis for interesting and important areas of further research, including research using qualitative techniques, and randomised controlled trial intervention research, using large sample sizes with long follow-up periods. This thesis may have implications for people who work with, or care for, an individual or group of people with CHD, in particular, cardiac rehabilitation staff, psychologists, exercise professionals, and partners, family members, and friends of people who have experienced a cardiac event. Finally, the findings of the current thesis should also be applicable to people with other chronic physical conditions and depression, especially where PA is a key component of the treatment for the physical condition.

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CHAPTER 1: INTRODUCTION

CHD is the largest single cause of death in Australia, accounting for 18% of all deaths (Australian Institute of Health and Welfare [AIHW], 2004). According to the World Health Organisation (WHO), by the year 2020, the burden of CHD will be the leading cause of disability, followed by clinical depression, which is one of the most common psychiatric disorders in adults (WHO, 2008). There is strong and consistent evidence that depression is an independent risk factor for the development (Bunker et al., 2003) and poor prognosis (Borowicz et al., 2002; Carney et al., 2008) of CHD. Depression is common among people with CHD, with prevalence rates of at least mild depression being reported in almost half of all people recovering from a cardiac event (Schleifer et al., 1989; Schrader, Cheok, Hordacre, & Guiver, 2004). Even up to 12 months after a cardiac event, high prevalence rates of depression are still evident (Grace et al., 2005).

PA has been shown to be a beneficial treatment for people with CHD (Thompson et al., 2003), depression (Blumenthal et al., 1999), and both CHD and depression (Blumenthal et al., 2005). Despite the known benefits of PA, however, approximately half of all Australian adults, including those with CHD, do not engage in sufficient PA for health gain (AIHW, 2006). People with CHD and depression are at particular risk of not adhering to regular PA (Dorn, Naughton, Imamura, & Trevisan, 2001). Research has shown that in cardiac populations, adherence to PA decreases with increasing time since the cardiac event (Reid et al., 2006). Little is known, however, about how the relationship between depression, and both self-reported PA and perceived PA (exercise SOC) changes over time, particularly in the first 18 months after experiencing a cardiac event.

Researchers have investigated the factors associated with non-adherence to cardiac rehabilitation (CR) (e.g., Cooper, Jackson, Weinman, & Horne, 2002) and PA (Yates, Price-Fowlkes, & Agrawal, 2003) in numerous quantitative studies in cardiac populations. Much fewer studies, however, have used qualitative techniques to ascertain the relevant barriers and facilitators to participating in regular PA following a cardiac event, especially for people with depression. In extensive searches of the literature, I found no qualitative studies that have examined PA experiences of people with both depression *and* CHD. Little, if anything, therefore, is known about what may hinder and facilitate participation in PA, particularly following the conclusion of hospital-based CR, among people with CHD who are depressed; similarly, means by which people with CHD and depression attempt to overcome these barriers and enhance the facilitators are also unknown.

The negative impact of depression on adherence to PA is often interpreted in the literature as implying that depression causes poor adherence. Wing, Phelan, and Tate (2002) suggested an alternative model, indicating that the poor adherence to PA may precede and influence depression. They proposed that it may be more effective to directly focus on increasing the behaviour, in this case, PA, and that this increase in a desired behaviour will positively affect both depression and health outcome. Wing et al., therefore, suggested that interventions designed to increase adherence to PA, in addition to other health and quality of life benefits, may be effective in leading to a decrease in depression in people with CHD.

Exercise adherence interventions, which are based on psychological principles, rather than on pure exercise prescription techniques, have been shown to be successful in increasing adherence to PA in the general population (Dunn et al., 1999), in the cardiac population (Scholz, Knoll, Sniehotta, & Schwarzer, 2006), and in people with depression (Richardson, Avripas, Neal, & Marcus, 2005). Exercise consultation is one type of exercise adherence intervention that utilises the transtheoretical model (also known as the “stages of change” model), and uses a range of psychological techniques, such as goal setting, increasing self-efficacy, relapse prevention, and exploring relevant barriers and facilitators to increase adherence to PA (Kirk et al., 2007). In recent years, researchers have been using exercise consultation to successfully increase adherence to PA in people with Type 2 diabetes (Kirk, Mutrie, MacIntyre, & Fisher, 2004b) and CHD (Hughes, Mutrie, & MacIntyre, 2007). Although I am not aware of any studies that have specifically conducted exercise consultation interventions for people with depression, according to the recommendations made by Seime and Vickers (2006) on interventions designed to encourage PA participation in people with depression, I believe that exercise consultation would be most suitable for this population. Further research on the appropriateness and effectiveness, in terms of increasing PA and possibly decreasing depression, of an exercise adherence intervention for people with CHD and depression is clearly warranted.

There were three main purposes of this thesis that were linked through three studies. The first study aimed to examine the relationship between PA and depression in people with CHD, the second explored the PA experiences of people with both depression and CHD, and the third investigated the effectiveness of an intervention designed to increase adherence to PA for people with depression and CHD.

CHAPTER 2: LITERATURE REVIEW

Introduction

The literature relevant to this thesis is reviewed in the present chapter. I begin the chapter by defining the important terms, and providing information on CHD and depression. Next, I explore the relationship between CHD and depression, focussing on depression as a risk factor for the development and prognosis of CHD. I discuss the role of PA and CR in managing CHD, focussing on the effects of PA on all-cause and cardiac-related mortality, morbidity, markers of cardiovascular risk, and depression. I then address the theories explaining the anti-depressant effects of exercise. I examine the problem of non-adherence to PA and CR for people with CHD, and explore the relevant factors associated, particularly for individuals with co-morbid depression. Towards the end of the chapter, I provide a critical review of interventions that have been conducted to increase adherence to PA for people with CHD or depression, and explore the background, guidelines and evidence for one particular intervention type, known as exercise consultation. The final section of the chapter includes a statement of the purpose of this thesis.

Background Information

Definitions of Terms

Physical Activity, Exercise, and Lifestyle Physical Activity

The terms “physical activity” (PA) and “exercise” are often used interchangeably in PA literature, therefore, definitions of these terms are necessary. PA is defined as “bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level. PA can be categorized in various ways, including type, intensity, and purpose” (US Department of Health and Human Services, 1996, p. 20). PA, therefore, incorporates all activities, such as exercise, sport, and lifestyle PA. The term exercise is used to indicate a subcategory of PA and is defined as "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is the objective" (Caspersen, Powell, & Christenson, 1985, p. 2). Lifestyle PA is defined as "the daily accumulation of at least 30 minutes of self-selected activities, which includes all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity and could be planned or unplanned activities that are part of everyday life" (Dunn, Andersen, & Jakicic, 1998, p. 399). It is considered as an alternative to more prescribed exercise programs, and can include activities such as increasing the amount of daily walking, using the stairs rather than lifts or elevators, and engaging in housework and gardening at home. Throughout this thesis, I use the term physical activity on most occasions to describe any bodily movement that increases energy expenditure above the basal level. I employ the terms exercise, exercise training, or lifestyle PA when researchers have used these terms, or if what the researchers have described was specifically one of these terms, according to the definitions used in this thesis.

Adherence and Compliance

The terms "adherence" and "compliance" are often used interchangeably in the CR literature, and at times, can refer to different outcomes, such as program attendance, achievement of program goals and desired outcomes, and maintenance of a particular behaviour at the conclusion of the treatment (Bock, 2002). According to Meichenbaum and Turk (1987), adherence is used to imply "an active, voluntary collaborative involvement of the patient in a mutually acceptable course of behaviour to produce a desired preventative or therapeutic result" (p. 20). In contrast, Meichenbaum and Turk defined compliance as "the extent to which patients are obedient and follow the instructions, proscriptions and prescriptions of health care providers" (p. 20). Throughout this chapter, I use the term adherence in preference to compliance to recognise the importance of the active role of the individual in carrying out requests and advice of the healthcare practitioner. When referring to previous research, however, I employ the term mentioned by the authors (e.g., adherence or compliance), and include a brief description of how adherence or compliance was measured.

Coronary Heart Disease

CHD is one type of cardiovascular disease (CVD). CHD, also known as ischemic heart disease or coronary artery disease, is the largest single cause of death and the most common cause of sudden death in Australia. It accounts for 18% of all deaths in Australia (AIHW, 2004). Similar (or higher) death rates are reported in other countries, such as the United States of America (USA) (National Heart Lung and Blood Institute [NHLBI], 2004) and the European Union (Petersen et al., 2005). However, Australia's CHD death rates are still 1.5 – 3 times higher than countries, such as Korea, France, and Japan (AIHW, 2008). The age-standardised prevalence for CHD is one third higher for males compared to females, and males are more than twice as likely to die from CHD as females. Prevalence rates of CHD increase rapidly with age. Approximately 8% of Australians aged 55-64 reported having CHD, increasing to 20% for those aged over 75 years (AIHW, 2004). CHD remains one of the major causes of disability in Australia, with many people requiring assistance with self-care, mobility and communication (AIHW, 2004). The direct economic cost (e.g., hospital care, physician services, medication, home care) of CHD in the USA in 2004 was approximately US$65 billion, although indirect costs were in excess of double this amount (NHLBI, 2004). In Australia, direct health care costs resulting from CVD were the most expensive disease group in 2004-05, at approximately AU$5.9 billion (AIHW, 2008), and direct costs from CHD alone exceeded AU$1.7 billion (Access Economics, 2005).

CHD is a type of blood vessel disorder and occurs when the arteries that supply blood to the heart muscle become hardened and narrowed, due to a build-up of plaque (NHLBI, 2004). This process is called atherosclerosis, and is known as hardening of the arteries (Griego & House-Fancher, 1996). If the coronary arteries become too clogged, then the flow of blood, and therefore, oxygen supply to the heart, is reduced, and the heart may be unable to cope with the demands placed on it during periods of exercise or stress (NHLBI, 2004). Exactly what causes the initiation of atherosclerosis remains a topic under investigation. The leading theory for the cause of atherosclerotic disease is the concept of endothelial injury (Griego & House-Fancher, 1996). Experts in the heart disease field argue that injury occurs to the inner lining of the arteries, known as the endothelial layer, which is responsible for allowing the blood to flow easily through the arteries (Jackson & Goble, 2002). This area of injury attracts monocytes (immune cells), platelets (clotting factors), cholesterol, and other blood components to come into contact with, and stimulate, the proliferation of smooth muscle cells. The smooth muscle cell proliferation ingests lipids, which are calcified over time, causing the artery to narrow (Griego & House-Fancher, 1996; Santiago & Kaplan, 2004). When modifiable risk factors, such as smoking, untreated hypertension, and high cholesterol, persist, there is less time for the lesion to heal and the atherosclerotic process will continue and progress (Santiago & Kaplan, 2004).

The two major clinical forms of CHD are angina and heart attack (AIHW, 2004). Angina is a chronic condition in which short bouts of chest pain or discomfort around the chest area can occur periodically. This pain is a result of the heart getting insufficient blood flow, often occurring during exercise or when the person experiences strong emotion. For people with angina, the plaque in the coronary arteries is usually hard and stable, which causes the artery walls to become hard and thickened. A heart attack, or acute myocardial infarction (AMI), is a life-threatening event, and occurs when the blood flow to the heart muscle is completely blocked, due to either hard and stable, or soft and unstable plaque in the arteries (NHLBI, 2004).

The main treatments for CHD include lifestyle changes, medications, and therapeutic interventions. The goals of treatment are to reduce symptoms, slow or stop atherosclerosis by reducing or controlling the risk factors, widen or bypass clogged arteries and ultimately, to reduce cardiac events (NHLBI, 2004). It is most likely that people with CHD will be advised to make some lifestyle changes, such as eating a healthy diet, to prevent high cholesterol and high blood pressure, and to maintain a healthy weight, to exercise regularly, to quit smoking, to lose weight if required, and to reduce stress (NHLBI, 2004). For some people, lifestyle changes may be the only treatment required. For many people though, medications may be needed in addition to lifestyle changes to decrease the workload on the heart, relieve symptoms, or prevent or delay the need for other therapeutic interventions. Common medications prescribed for people with CHD include statins (cholesterol-lowering medications), beta blockers (slow heart rate), ACE inhibitors (lower blood pressure), calcium channel blockers (relax blood vessels and lower blood pressure), nitrates (prevent or relieve chest pain), and anti-platelet medication (prevents formation of clots), such as aspirin (Jackson & Goble, 2002; NHLBI, 2004). Although all are important medications for individual cases, betablockers, aspirin, and cholesterol lowering medications have been medically proven to lengthen the life of people with CHD (Jackson & Goble, 2002).

If lifestyle changes and medications have been unable to improve symptoms for a cardiac patient, and symptoms are worsening, there are two main therapeutic interventions that may be required; percutaneous transluminal coronary angioplasty (PTCA) with or without stenting, and coronary artery bypass graft (CABG) surgery. A PTCA is used to open blocked or narrowed coronary arteries (NHLBI, 2004). During a PTCA, a catheter equipped with an inflatable balloon tip is inserted into the affected coronary artery. When the blockage is located, the catheter is passed through and just past the blockage, the balloon is inflated, and the atherosclerotic plaque is compressed, resulting in a widening of the artery. If required, an expandable, mesh-like structure, know as a stent, can be placed over the angioplasty site to hold the artery open (Griego & House-Fancher, 1996). A CABG is usually recommended for people with significant coronary artery obstruction, or if at least two arteries have proven to be unresponsive to other medical procedures such as PTCA (Griego & House-Fancher, 1996). A CABG requires the removal of a vein or artery from another area of the body, such as the arm or leg. This section of vein or artery is attached to the affected coronary artery beyond the blockage and the other end is attached to the aorta which is the main artery leading from the heart. The narrowing or obstruction, therefore, is bypassed, and blood flow can be improved (Jackson & Goble, 2002). In comparison to the CABG, the major advantages of the PTCA include decreased recovery time, fewer days spent in hospital, a more rapid return to work, and a less invasive procedure (Griego & House-Fancher, 1996).

There are a number of risk factors that have been statistically associated with a high incidence of CHD. They can be categorised as being modifiable or unmodifiable

(Griego & House-Fancher, 1996). Unmodifiable risk factors include age, gender, race, and genetic inheritance. Generally speaking, the incidence of CHD is most common for the Caucasian, middle-aged man (AIHW, 2004; Griego & House-Fancher, 1996). The risk of developing CHD increases after the age of 45 for men, and 55 for women (NHLBI, 2004). Although the exact mechanism is not fully understood, genetic predisposition is an important factor in the development of CHD. People with a father or brother diagnosed with CHD before the age of 55, or a mother or sister diagnosed before the age of 65, are considered to be at higher risk of developing heart disease (NHLBI, 2004).

Modifiable risk factors for CHD are tobacco smoking, high blood pressure, high blood cholesterol, insufficient PA, and overweight and obesity. Nutrition factors and diabetes have also been identified as risk factors. Those people at higher risk of developing CHD, compared with other Australians include males, older Australians, Aboriginal and Torres Strait Islander peoples, and people from lower socio-economic groups (AIHW, 2004). In addition, psychosocial factors, such as depression, social isolation, and lack of quality support, are independent risk factors for developing CHD (Bunker et al., 2003). Approximately 90% of the Australian adult population have at least one of the cardiovascular risk factors, and 10 percent of the adult population have three or more modifiable risk factors. In 2004, for Australians aged 25 and over, 30% had high blood pressure, 51% had high blood cholesterol, 60% were overweight or obese, 54% did not exercise regularly, and 20% smoked daily (AIHW, 2004).

On a more positive note, however, due to a reduction in some risk factors (e.g., high blood pressure and saturated fat intake), improvements in disease management, and enhanced follow-up care, the death rates for CHD in both Australia and the USA have fallen in recent years by 40% and 50% respectively (AIHW, 2004; NHLBI, 2004).

Depression and Depressed Mood

Mental health problems and mental illness are among the greatest causes of disability, reduced quality of life, and decreased productivity. People with mental health problems often experience poorer general health and higher rates of death from a range of causes, including suicide, compared to those without mental health problems (Australian Bureau of Statistics, 2006a). Depression is a type of mental illness that can affect emotions, behaviour, perceptions, and social well-being of individuals. According to the WHO, clinical depression is one of the most common psychiatric disorders in adults and is currently ranked as the third leading cause of disability out of all diseases (WHO, 2008). By the year 2020, it is likely that the burden of depression will become the second leading cause of disability, behind only CHD. In the developed regions, it is predicted that by 2020, depression will be the highest-ranking cause of burden of disease (WHO, 2008).

The term depression is widely used in research to describe a range of symptoms and conditions, from mild depressive symptoms to clinical depression, as diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association [APA], 2000). The *DSM-IV-TR* specifies that, for an individual to be diagnosed as having a Major Depressive Episode (MDE; also known as unipolar depression or clinical depression), five or more of the following symptoms need to be present during the same two-week period, nearly every day for most of the day and represent a change from previous functioning: depressed mood, loss of interest or pleasure in activities, significant weight or appetite loss or gain, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive or inappropriate guilt, diminished ability to think or concentrate, and recurrent thoughts of death. At least one of the symptoms needs to be either (1) depressed mood or (2) loss of interest or pleasure (anhedonia). Some people with a MDE may appear to function superficially, however, increased effort is required to continue with normal activities. A MDE can be classified as mild, moderate, or severe, and can be part of either a major depressive disorder (MDD) or a bipolar disorder (APA, 2000).

Other mood disorders classified according to the *DSM-IV-TR* (APA, 2000) are dysthymic disorder and depressive disorder not otherwise specified. Dysthymic disorder is a chronically-depressed mood that occurs for most of the day, more days than not, for at least two years. In addition, it also includes two or more of the following symptoms: poor appetite or overeating, insomnia or hypersomnia, low energy or fatigue, low self-esteem, poor concentration or difficulty making decisions, and feelings of hopelessness. Depressive disorder not otherwise specified includes minor depressive disorder, which is described as episodes of at least 2 weeks, with two to four of the depressive symptoms required for MDD, and recurrent brief depressive disorder, which are depressive episodes (same symptom criteria as MDD, i.e., at least five of the depressive symptoms) lasting from 2 days up to 2 weeks, occurring at least once a month for 12 months.

Another type of depression, known as subsyndromal (or subthreshold) depression does not receive a classification in the DSM-IV-TR (APA, 2000). According to Judd, Rapaport, Paulus, and Brown (1994), the definition of subsyndromal depression is “any two or more simultaneous symptoms of depression, present for most or all of the time, at least 2 weeks in duration, associated with evidence of social dysfunction, occurring in individuals who do not meet criteria for diagnoses of minor depression, major depression and/or dysthymia" (p. 27). Subsyndromal depression has been demonstrated to be associated with significant levels of psychological dysfunction (Wells et al., 1989), decreased quality of life (Goldney, Fisher, Dal Grande, & Taylor, 2004), and functional impairment (Judd, Martin, Wells, & Rapaport, 1996).

Determining precise prevalence rates of depression is difficult. The prevalence rates of depression found in individual studies can vary considerably depending on the diagnostic tool used to measure depression and the criteria used to define depression (Jacobi et al., 2005). It is also possible that in some studies, depression rates may be an underestimate of the true figures, because of the stigma that is still often associated with mental illness in many societies (AIHW, 2008). According to the DSM-IV-TR (APA, 2000), the point prevalence (i.e., prevalence at a particular time) of MDD, in adults in a community sample varies from 5 - 9% for women and 2 - 3% for men. The National Survey of Mental Health and Well-Being (Australian Bureau of Statistics, 2007) found that, from their sample of Australian adults, 4.1% of individuals had experienced a MDE in the 12 months prior to completing the survey. Women experienced a higher rate of MDE than men (5.1% compared with 3.1%).

The WHO reported the prevalence of MDD (as determined by clinical interview) in primary health care settings in countries around the world to be, on average, 10.4%. The lowest rates were found in Japan and China (less than 4%), the US and UK had prevalence rates of 6% and 17% respectively, and Chile reported the highest rates of MDD, with almost 30% (Goldberg & Lecrubier, 1995). These figures may reflect true differences in prevalence rates across countries, or they may be the result of different cultural perceptions of illness and tendency to seek help.

Minor depression and subsyndromal depression have received considerable attention in the past 20 years. In one of the earliest large-scale, community-based studies, Judd et al. (1994) found that nearly 12% of people met the criteria, for subsyndromal depressive symptoms during a 1-year period. Approximately two-thirds of the participants with subsyndromal depression were women and one-third, men. Similar results were found in a large-scale Australian sample, with 13% of individuals experiencing subsyndromal depressive symptoms, and another 4% having minor depression (Goldney et al., 2004).

Caution needs to be exercised when comparing depression rates among studies, and it is particularly important that definitions of, and tools used to measure depression in each study, are known. It is for these reasons that throughout this literature review, I mention the type of depression measured, and the tool to measure depression in each of the studies discussed.

Depression incurs substantial direct and indirect costs, and results in high numbers of hospitalisations (AIHW, 2005). Total health expenditure in Australia in 2004-05 was approximately $81 billion, and of this total allocated expenditure, the direct costs of mental health problems was $4.1 billion (AIHW, 2008). Depression accounts for a substantial proportion (just over $1 billion) of this total (AIHW, 2005). Indirect costs, such as costs associated with social and economic burden on carers and family, and costs of lost quality and quantity of life, are not included in this figure, therefore, total costs would be far higher than this amount (AIHW, 2008).

The aetiology or development of depression can be explained by numerous theoretical models. The biological model of depression incorporates the role of genetics, and/or disturbances in the biochemical, neuroendocrine, immune, or chronobiological systems (Schotte, Van Den Bossche, De Doncker, Claes, & Cosyns, 2006). Research has shown there is a significant genetic predisposition to depression, particularly for first-degree relatives with earlier onset depression (Cleare, 2004; White & Clare, 2002). An in-depth discussion of the biological models is beyond the scope of this thesis (see Cleare, 2004, for a review of these models). However, in summary, the various biological models suggest that changes in hormone secretion, such as cortisol, changes in feedback at the hypothalamus and pituitary, decreases in monoamine neurotransmitters, such as serotonin, norepinephrine, and dopamine, abnormalities in the circadian system, and possible changes in the structure and function of certain areas of the brain, may all play a part in development of depression (Cleare, 2004). The cognitive model of depression suggests that there is a strong connection between people's construal of events, their behaviour, and their emotional state (Bieling & Segal, 2004). According to the cognitive model, in depression, information is often processed in a negative or dysfunctional way, which can generate negative emotions and problematic behaviours (Bieling & Segal, 2004; Schotte et al., 2006). Various theories suggest the role of other psychological factors, such as personality, self-esteem, and major life events, and the social environment, such as social interactions and social support, as being possible causal factors in the development of depression (Gilbert, 2004; White & Clare, 2002).

In the past two decades, however, many health professionals and researchers have accepted a more integrative, multi-factorial approach to understanding the development and treatment of depression. This model, known as the biopsychosocial model, challenges dualistic ideas that depressive illnesses are either psychological or physical in nature (White & Clare, 2002). Rather, it accepts and promotes the notion that depressive illnesses can be caused by a number of interconnected biological, psychological, and social factors. Akiskal and McKinney (1975) were amongst the earliest researchers to document an integrative theory of depression. Their theory related to a combination of interacting and reciprocal processes; physiological (e.g., genes and stress hormones), psychological (e.g., negative beliefs, thoughts, and emotions), and social (e.g., life events and social support). The biopsychosocial model of depression refers to the interaction between psychological and biological vulnerability to depression (current and past), and stressors or life events, in the development of depression (Schotte et al., 2006). In addition to providing an understanding of the various risk factors and their interactions in the development of depression, the model also suggests treatments based on social, psychological, and biological strategies (Gilbert, 2004; Schotte et al., 2006).

Once a diagnosis of depression has been established, the type of treatment is usually based on the severity of the depressive episode. Mild depression usually requires psychotherapeutic treatment alone, whereas moderate to severe depression would, most likely, require a combination of psychotherapy and pharmacotherapy (Norman, Olver, & Burrows, 2004). Most antidepressant medications aim to correct the biological disturbances that occur in depression, in particular, addressing the problems that occur with the monoamine neurotransmitters, such as serotonin, norepinephrine, and dopamine (Ebmeier, Berge, Sempel, Shah, & Steele, 2004). Common antidepressants used nowadays include selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (TCAs), and serotonin noradrenaline reuptake inhibitors (SNRI) (see Hale, 2005, for a thorough review of antidepressant medications). Research has shown that antidepressants given in adequate doses, for a sufficient period of time, to correctly diagnosed patients, will be effective in reducing clinical depression in 60-70% of patients (Healy, 1997). Antidepressants are widely used to treat depression, and despite potential problems with side effects and interactions with other medications, when given to correctly diagnosed patients, are relatively safe drugs (Norman et al., 2004).

The psychotherapeutic treatments that have been shown to be most effective in treating depression include cognitive behavioural therapy (CBT) and interpersonal therapy (IPT). These therapies have seen significant advances in the past 30 years, with a great deal of research being undertaken into their effectiveness for treating depression (McKenzie, Carter, & Luty, 2004). They are known as “brief” psychotherapies, as they tend to be required for shorter periods of time, compared to other therapies, such as psychodynamic therapy, to achieve benefits of decreased depressive symptoms (Hale, 2005; McKenzie et al., 2004). There is evidence from studies utilising brief psychological therapies for treating depression, that for mild to moderate depression, psychological treatments are as effective as antidepressant medications, but take a little longer to work (Hale, 2005). The clinical benefits of psychotherapy should be evident within 6-8 weeks, whereas antidepressant medications should be effective within 4-6 weeks (Whooley & Simon, 2000). Psychotherapy should be provided by a qualified psychotherapist, typically for six to 16 sessions, in order to achieve maximal benefits (Whooley & Simon, 2000). Psychotherapy may be used alone, for instance, in mild to moderate depression, or in combination with medication, particularly for moderate to severe depression (McKenzie et al., 2004).

CBT focuses on identifying and challenging negative or self-critical thoughts that can cause or perpetuate depression (Whooley & Simon, 2000). By educating patients to challenge their negative or pessimistic thinking, and to consider alternative rational and positive interpretations, the damaging cycle of negative thinking can be broken (Hale, 2005). In addition, CBT encourages behaviour change using cognitive and behavioural strategies, to increase involvement in rewarding activities and decreasing behavior that reinforces depression (Whooley & Simon, 2000). Gloaguen, Cottraux, Cucherat, and Ivy-Marie (1998) concluded that CBT was effective in treating mild to moderate depression, more so than waiting-list placebo and even antidepressants.

IPT places emphasis on current interpersonal relationships, and investigates ways to improve them, by helping the patient identify, understand, and solve problems. IPT also deals with issues associated with role disputes, social isolation, prolonged grief, or role transition (Whooley & Simon, 2000). IPT aims to help the patient develop positive and constructive ways of relating with others, which is believed to reduce depressive symptoms (Hale, 2005). Similar to CBT, IPT has been shown to be as effective as antidepressant medication in treating mild to moderate depression, with no adverse effects reported (Gloaguen et al., 1998).

In summary, research has shown that psychological therapies of CBT and IPT are at least as effective as medication in treating mild to moderate depression. Further research needs to investigate the effectiveness of these therapies in treating severe depression, and researchers also need to learn more about what particular personal characteristics predict good treatment response to psychological treatment.

Another effective form of treatment, particularly for people with mild to moderate depression, is exercise. Exercise can be used either on its own, or as an adjunct to psychotherapy and/or medication, to reduce depressive symptoms (Craft & Perna, 2004). Exercise has been shown to be as effective as antidepressants in treating mild to moderate depression (Blumenthal et al., 1999), and the effects of exercise in preventing relapse from depression are very promising (Babyak et al., 2000). The use of exercise in treating depression is discussed in further detail in later sections of this chapter.

Major depression and dysthymic disorder often occur in conjunction with other mental health problems. For example, those people who have experienced a single or recurrent episode of MDD are approximately 5 times more likely to experience an anxiety disorder, and those people with dysthymic disorder are more than 8 times more likely to also have anxiety (Jacobi et al., 2005). People with MDD and other mood disorders are also more likely to have alcohol and drug abuse problems compared to those without MDD (Todd & Sellman, 2004). Depression and physical illnesses also commonly co-exist, with about a quarter to a third of medical inpatients and outpatients experiencing symptoms of depression (Ellis & Barnfield, 2004). Depression is particularly prevalent in physical illnesses, such as neurological disorders, endocrine diseases, cancer, and CVD (Ellis & Barnfield, 2004). In addition, depression is often associated with higher all-cause mortality (e.g., Cuijpers & Smit, 2002), and both disease-specific (e.g., CHD) mortality rates (Frasure-Smith, Lesperance, & Talajic, 1993, 1995), and worse disease prognosis (Carney et al., 1988). The complex and reciprocal relationship between CHD and depression is discussed in detail in the coming sections.

Coronary Heart Disease and Depression

Measuring Depression in People with Coronary Heart Disease

Over the past two decades, there has been a great deal of research interest in the comorbidity of depression and CHD. Since the first major review articles investigating the links between depression and CHD in the late 1990s, there have been over 100 additional reviews, numerous meta-analyses, and more than 60 studies using prospective designs (Lichtman et al., 2008). Measuring depression in people with

CHD can, however, present particular diagnostic challenges. Particularly in some of the early studies of the 1960s and 1970s, prevalence rates of post-myocardial infarction depression varied widely from 10% to 87% (Rudisch & Nemeroff, 2003). The varying methods of diagnosing or measuring depression, the different inclusion/exclusion criteria used to define depression, the exact timing of depression measurement, and the different samples of cardiac populations involved in research are some of the factors likely to account for the large discrepancies in rates of depression. In their review, Frasure-Smith and Lesperance (2006) found 32 different measures had been used to ascertain depression levels in studies published over the years 2004-05, which was an increase from the 23 measures used during the period 2001-03 (Frasure-Smith & Lesperance, 2005).

It is quite surprising, given the range of tools used to measure varying levels of depression in cardiac populations, that many studies have demonstrated significant links between depression and development and prognosis of CHD (Frasure-Smith & Lesperance, 2005). Although the underlying concept of depression is robust, it would prove extremely beneficial, for research purposes, to standardise depression measurement in people with CHD (Davidson, Rieckmann, & Rapp, 2005; Frasure-Smith & Lesperance, 2006).

The “gold standard” for diagnosing major depression is considered to be the clinical interview (Blumenthal, 2008). These structured diagnostic interviews establish, both the inclusion and exclusion criteria for diagnosis of depression, in a reliable and accurate manner that can be checked for methodological rigour (Wulsin, 2004). Commonly used instruments include the National Institute of Mental Health Diagnostic Interview Schedule (DIS; Robins, Helzer, Crougham, & Ratliff, 1981) and the Composite International Diagnostic Interview (CIDI; WHO, 1990). Trained professionals are required to administer these interviews, and they are most effective for use in epidemiologic studies, or when a diagnostic classification is required for a research trial (Davidson et al., 2005). The Depression Interview and Structured Hamilton (DISH) is a semi-structured interview, which has more flexibility than the DIS, and can also assess the severity of depression (Davidson et al., 2005). These clinical interview assessment tools allow for a DSM-IV diagnosis of MDD, minor depression, and dysthymia, which can be easily compared across research studies.

Self-report questionnaires, such as the Beck Depression Inventory (BDI; Beck, Ward, & Mendelsohn, 1961), the Centre for Epidemiological Studies Depression Scale (CES-D; Hautzinger, 1988), the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), the Cardiac Depression Scale (CDS; Hare & Davis, 1996), the Hamilton Rating Scale for Depression (HAM-D; Hamilton, 1960), and the Patient Health Questionnaire (PHQ; Kroenke, Spitzer, & Williams, 2001) are psychometric questionnaires that are commonly used with cardiac populations to measure depression. Self-report questionnaires do not require administration by a trained professional, and they are commonly used as a continuous (as opposed to categorical) assessment of depressive symptoms (Davidson et al., 2005). They do not, therefore, classify depression according to the DSM-IV categories; instead, they measure depressive symptomatology, or depressed mood. Some of the questionnaires, such as the BDI and the CDS, have validated cut-off points to distinguish between mild/minor, moderate, and major/severe levels of depression. Self-report questionnaires each have varying psychometric properties, especially in terms of sensitivity and specificity for detecting depression (Davidson et al., 2005).

The CDS (Hare & Davis, 1996) is one questionnaire that was specifically developed to measure depression in people with CHD. The CDS was designed to be sensitive and responsive to levels of depression commonly seen in cardiac patients. Even though it is capable of measuring severe depression, the CDS is known to be particularly useful in detecting less severe, “reactive” depression, which is the more typical depression seen in the cardiac population (Hare & Davis, 1996). The CDS has been shown to be a reliable, sensitive, and valid measure of depression in cardiac populations (e.g., Birks, Roebuck, & Thompson, 2004; Wise, Harris, & Carter, 2006), and importantly, is easy to complete and score. More information on the CDS is provided in Chapter 3 of this thesis.

The type of measure used for detecting depression in cardiac populations will depend on numerous factors, such as the type of research being conducted, the feasibility and appropriateness of using a particular method, and the resources available to the researcher. Davidson et al. (2005) recently published a report for the National Heart, Lung, and Blood Institute, in which they reviewed diagnosis and measurement of depression and evaluated the applicability of depression instruments in CHD patients for research purposes. They made recommendations of particular depression instruments for different research purposes, in the hope that future researchers would be able to make more uniform and comparable assessments of depression in people with CHD. For more information on the instruments recommended to be the most appropriate for various research purposes, refer to Davidson et al. Due to the variety of instruments and definitions used in research studies to measure depression, when discussing the following studies, I mention the tool used to measure depression, and the type of depression being measured (e.g., MDD/clinical depression, minor depression, depressive symptoms/depressed mood).

Depression as a Risk Factor for Coronary Heart Disease

In 1988, the National Heart Foundation of Australia (NHFA) published a report titled “Stress and cardiovascular disease”, which concluded that there was insufficient evidence to suggest that psychosocial risk factors were able to consistently predict future development of CHD (Stress Working Party, 1988). The authors of that report found that, although some psychosocial risk factors may have an effect on conventional risk factors, they did not have an independent effect on the development and progression of CHD. Since then, however, numerous prospective longitudinal studies, review papers, and meta-analyses have examined the link between various psychosocial risk factors, including depression, and CHD (e.g., Barefoot & Schroll, 1996; Ford et al., 1998; Frasure-Smith & Lesperance, 2006; Kubzansky & Kawachi, 2000; Musselman, Evans, & Nemeroff, 1998; Wulsin & Singal, 2003). Despite methodological differences from study to study, overall, the adequately powered studies strongly suggest that there is an increased risk of developing CHD in individuals who experience depression.

In separate review papers, Frasure-Smith and Lesperance (2006), Glassman and Shapiro (1998), Musselman et al. (1998), Rudisch and Nemeroff (2003), and Wulsin (2004), concluded that people with depression, as measured using a range of diagnostic methods, were at significantly greater risk of developing CHD than those without depression. Rozanski, Blumenthal, and Kaplan (1999) also concluded that the risk for CHD associated with depression exists along a continuum, according to the magnitude of depressive symptoms. Thus, people with depressive symptoms through to major depressive episodes are at risk of future cardiac events. According to Wulsin (2004), the research is reasonably consistent in highlighting a dose-response effect (i.e., the greater the severity or duration of the depression, the greater the risk for

CHD onset and progression). Similarly, in two independent meta-analyses, Wulsin and Singal (2003), and Rugulies (2002), concluded that the relative risk of depression leading to CHD was 1.64. Rugulies also suggested a stronger link between clinical depression and CHD than between depressive symptomatology and CHD.

There have been a number of large-scale, epidemiological studies on depression and CHD in recent years that have employed a longitudinal design, with follow-up periods in excess of 13 years. Ford et al. (1998) conducted the study with the longest follow-up period. They reported on 1,190 male medical students from Johns Hopkins University followed for a median of 37 years. Information was collected on the participants' family history, health behaviours, CVD end points, and clinical depression. They found that, after controlling for smoking, men who reported clinical depression, as measured by self-report, were at a significantly greater risk of developing CHD and myocardial infarction (MI) than those men who were free of depression. Although this study was well-designed and the results were convincing, the findings should be generalised with caution. Ford et al. noted that the sample consisted of Caucasian men with a similar degree of education and income. They suggested that the high socioeconomic status of the participants might have helped protect them from some of the adverse effects of depression, and therefore, the estimate of the risk related to depression may have been conservative.

Another long-term study followed 409 men and 321 women from Glostrup, Denmark for an average of 27 years (Barefoot & Schroll, 1996). Barefoot and Schroll established participants' baseline risk factors, disease status, and level of depressive symptomatology, as measured by the Minnesota Multiphasic Personality Inventory (MMPI). After controlling for smoking and physical health, their findings indicated that individuals with high levels of depressive symptomatology were 65% more likely to develop CHD, than those with low levels of depression. Barefoot and Schroll also found that elevated depression scores were associated with a significant increase in all natural causes of death. They did not specify, however, whether the increased mortality rate was specifically due to CHD.

Pratt et al. (1996) conducted a large-scale study ($N = 1{,}551$) of individuals from the Baltimore cohort of the Epidemiologic Catchment Area study, with a follow-up period of 13 years. Their aim was to determine whether a major depressive disorder, as measured by the DIS, increased the risk of MI. They concluded that a diagnosis of major depression increased the risk of MI more than fourfold, after controlling for medical risk factors and other psychiatric diagnoses. The large sample size and the inclusion of male and female, African American and Caucasian participants were particular strengths of this study.

A recent study conducted in Sweden utilised the family CHD database and compared incidence ratios of CHD among people with and without depression, as classified by the WHO’s *International Classification of Diseases* (Sundquist, Li, Johansson, & Sundquist, 2005). They found that, after accounting for socioeconomic status and geographical regions, depression was a clinically significant risk factor for developing CHD, particularly in men and women aged between 25 and 50 years. Sundquist et al. also found that, for people with depression, the risk of developing CHD decreased with increasing age, and that people who were aged over 70 years at the onset of depression, did not have an increased risk of developing CHD.

As a result of the considerable research undertaken in recent years on the effect of depression on the development of CHD, an Expert Working Group of the NHFA released an updated position statement on this issue (Bunker et al., 2003). They concluded, “there was strong and consistent evidence across all the reviews that depression is an independent risk factor for clinical CHD and its prognosis" and "the strength of the association is of similar magnitude to that of standard risk factors, such as smoking" (p. 273). Evidence such as that presented in the position statement by the NHFA (2003) and other numerous large-scale, longitudinal research studies, such as Ford et al. (1998) and Barefoot and Schroll (1996), suggests convincingly that depression is likely to be a risk factor for the development of CHD.

Depression as a Sequela of Coronary Heart Disease

Prevalence of Depression in People with Coronary Heart Disease

Over the past two decades, numerous studies have been conducted to investigate the prevalence of depression in cardiac populations. As previously mentioned, varying levels of depression have been measured, depending on the tool used by the researchers (e.g., major depression, minor depression). Overall, researchers have reported high rates of depression among individuals with CHD. Many studies have utilised the clinical interview for diagnosing or measuring MDD, and have found consistent prevalence rates of MDD. For example, Carney et al. (1988), Frasure-Smith et al. (1993), and Hance, Carney, Freedland, and Skala (1996) assessed individuals, who had recently experienced a cardiac event, using the DIS, and found that 17%, 16%, and 17% respectively, of their samples were experiencing MDD. Hance et al. also reported levels of minor depression to be 17%. Schleifer et al. (1989) also used psychiatric diagnostic criteria and found that 18% of people post-MI had major depression, and that another 27% were experiencing minor depression, as defined by the Research Diagnostic Criteria (Spitzer, Endicott, & Robins, 1978).

Self-report measures, such as the BDI, PHQ, CDS, HADS, and CES-D have also been used to determine prevalence rates of depression in cardiac populations. Parashar et al. (2006) used the PHQ with their sample of recent MI patients, and reported prevalence rates of 21% for moderate to severe depressive symptoms. In an Australian study, Schrader et al. (2004) measured depression with the CES-D and HADS, and found 18% of their participants had moderate to severe depression, and another 24% had mild depression. In their Australian sample, Wise et al. (2006) found that 22% of individuals had major depression, and 17% had minor depression, according to the CDS.

High prevalence rates of depression are still evident up to 12 months after a cardiac event. Ladwig, Roll, Breithardt, Budde, and Borggrefe (1994) initially interviewed 552 male participants, who had recently experienced a heart attack, and then re-interviewed 377 of them six months later. They found that immediately after the heart attack, as measured by a questionnaire designed and validated by the first author of the paper, approximately 15% of their sample were severely depressed compared with 13% six months post-heart attack, and 22% were moderately depressed both immediately after and six months post-heart attack. Schleifer et al. (1989) reported that the prevalence of major depression had dropped slightly to 15%, and minor depression still affected 18% of their sample three months after their initial interviews. Using the BDI to measure depressive symptomatology, Grace et al. (2005) found that 31% of their CHD participants had mild to moderate depression immediately following the cardiac event. These figures decreased slightly to 25% six months post-event, and 21% 12 months post-event. Schrader et al. (2004) found there to be virtually no change in CES-D and HADS depression scores, three months after hospitalisation for a cardiac event. Some studies have even demonstrated an increase in depression over time. Using the BDI to measure depression, Lane, Carroll, Ring, Beevers, and Lip (2002) found that 31% of individuals were experiencing depressive symptoms immediately after their cardiac event, and this figure increased to 37% at both the four and 12 month time-points.

As previously mentioned, links between depression and development of heart problems have been reported in the literature. Much of the research on prevalence of depression after a cardiac event has not distinguished between depression that was present before the cardiac event, which continues after an event and depression that arose after the event, often as a reaction to the impact of the cardiac event. Lesperance, Frasure-Smith, and Talajic (1996) attempted to ascertain the link between a history of depression and depression levels immediately following the cardiac event, and six and 12 months post-infarction. They found that 25% of individuals with a history of depression were depressed immediately following the event compared to 12% of individuals without a history of depression. At some point during the year following the infarction, 30% of individuals with a history of depression, compared to 17% of individuals without a history of depression would become depressed.

Previous research, therefore, indicates that approximately one in six people, who have experienced a cardiac event, are also experiencing major depression, and up to one in two people are experiencing at least mild depression. It is disturbing to note that these prevalence rates often do not reduce dramatically 12 months after the cardiac event. In addition, those individuals who have experienced a MI and have a history of depression may be at an increased risk of developing depression in the year following the event, compared to individuals without a history of depression. As previously mentioned, this research does need to be interpreted with caution, especially when comparing prevalence rates *between* studies, as a number of different measures have been used to determine depression, and particular measures are sensitive to different levels of depression (e.g., mild to moderate depression, compared to MDD). Nonetheless, these problems are reduced somewhat when the issue being examined is changes in depression over time *within* a study, and the same measure is used at different times. In addition, overall results from different studies show a high degree of consistency.

Associated Outcomes of Depression in People with Coronary Heart Disease

In addition to identifying that depression is a risk factor for developing CHD, researchers have reported increasing evidence that depression is a risk factor for poor outcomes following a cardiac event, such as increased cardiac-related morbidity (Borowicz et al., 2002; Ladwig et al., 1994; Parashar et al., 2006), cardiac-related mortality (Barefoot et al., 1996; Barefoot & Schroll, 1996; Frasure-Smith et al., 1993, 1995), all-cause mortality (Barefoot et al., 1996; Barefoot & Schroll, 1996; Carney et al., 2008), future cardiac events (Carney et al., 1988; Whooley et al., 2008), and decreased quality of life (Parashar et al., 2006). Some studies have also shown a dose-response relationship between depression severity and cardiac outcome severity, with more severe depression being associated with earlier and more severe cardiac events (e.g., Rugulies, 2002).

With reference to morbidity, Borowicz et al. (2002) found that higher depression scores one month, one year, and five years after coronary artery bypass surgery were associated with chest pain five years after surgery. In particular, the presence of depression one month after surgery was an important risk factor for poorer outcomes five years after surgery. Also, Ladwig et al. (1994) reported that individuals with moderate and severe depression were two and three times more likely, respectively, to experience chest pain than were people without depression.

Two major studies conducted by Frasure-Smith and colleagues provided convincing evidence for the link between depression and increased risk of death from cardiac or other causes in people who had experienced a myocardial infarction (MI). Frasure-Smith et al. (1993) conducted structured psychiatric interviews with 222 participants 5 to 15 days after they experienced a MI. Participants were followed up for a period of six months (Frasure-Smith et al., 1993) and 18 months (Frasure-Smith et al., 1995), and the results indicated that depression was an independent risk factor for cardiac-related mortality at both follow-up times. Participants with major depression, following a cardiac event, were approximately three and a half times more likely to die from cardiac causes over a period of six months than were participants without depression. The increase in risk was independent of other factors, such as left ventricular ejection fraction, and was similar to that associated with previous history of MI.

Frasure-Smith et al. (1995) were also interested in measuring the effect of the level of depression (i.e., mild to moderate depression compared to major depression) on cardiac-related mortality. Participants (*N* = 218) completed the BDI and Frasure-Smith et al. found that elevated BDI scores (indicating mild to moderate depression) were significantly related to 18-month cardiac-mortality. In fact, more individuals with mild to moderate depression died between 6 and 18 months post cardiac event than did individuals with major depression. It is possible that those people with elevated BDI scores were merely representing a group of individuals at high risk for developing major depression, or maybe those with major depression were more likely to receive treatment, or be under close medical scrutiny for their depression than those with mild to moderate depression. Regardless, these results indicate that people with mild to moderate depression are at an increased long-term risk of dying from cardiac causes. Further research is needed to investigate this finding in more detail.

A more recent study conducted by Carney et al. (2008) examined whether interview-diagnosed clinical depression affected the survival of participants with CHD, at least 5 years after experiencing an acute MI. Carney et al. found that, after adjusting for other risk factors for mortality, patients with either major or minor depression were at higher risk for all cause-mortality compared to the non-depressed patients. Similarly, in a large scale, longitudinal study, Barefoot et al. (1996) examined the time course of the relation between depression and survival in a large sample (*N* = 1,250) of participants with CHD, over an extended period of time (median of 15.2 years). After controlling for initial disease severity and treatment, they found that depression scores, as measured by the Zung Self-Rating Depression Scale (SDS), were associated with increased risk of subsequent cardiac death and total mortality. Those individuals with moderate or severe depression were 69% more likely to die from cardiac causes and 78% more likely to die from all other causes than the non-depressed participants. This increased risk was still evident 5 to 10 years after the cardiac event. Both of these studies highlight the negative long-term outcomes of major, as well as minor, depression.

Depression has also been identified as a risk factor for the development of a future major cardiac event. Carney et al. (1988) conducted structured psychiatric examinations of 52 patients with confirmed CHD, who were undergoing coronary angiography. They found that major depressive disorder was the best predictor of major cardiac events, such as MI and angioplasty, during the 12 months following the catheterization. This predictive effect was independent of factors, such as severity of CHD and smoking. The severely depressed people, who accounted for 17% of the sample, were almost two-and-a-half times more likely to develop a serious, adverse cardiac complication than those individuals who were not severely depressed.

Similarly, Whooley et al. (2008) found that after controlling for disease severity and comorbid conditions, depressive symptoms, as measured by the PHQ, were associated with 31% more cardiovascular events, compared to those people without depressive symptoms.

In light of the figures reporting the high prevalence rates of minor and major depression in people with CHD, and increasing evidence suggesting that depression is a risk factor for both development and prognosis of CHD, it seems that depression is an important, yet commonly ignored or underestimated, risk factor for cardiac outcomes (Borowicz et al., 2002; Ladwig et al., 1994). Although not disputing these previously mentioned findings, Lane, Carroll, and Lip (2003) suggested that further research needs to control for, or at least identify, the potential confounding effects of variables, such as cardiac disease severity, on the relationship between depression and increased cardiac and other cause mortality and morbidity. It is imperative that more research is conducted to learn how minor and major depression in people with CHD can be treated or alleviated, and its negative effects on cardiac mortality and morbidity, reduced.

Mechanisms to Explain the Link between Depression and Coronary Heart Disease

Although there are no proven mechanisms to explain why depression may contribute to the development and prognosis of CHD, a number of promising hypotheses have emerged over the past 10 years. These include direct biological or pathophysiological (e.g., neuroendocrine, neurochemical, and neuroanatomic), and behavioural (e.g., possible increase in unhealthy lifestyle behaviours and poorer patient compliance) effects. These mechanisms are addressed briefly in this section, however, for further information, a detailed discussion of these explanations can be found in Carney, Freedland, Miller, and Jaffe (2002), Lett et al. (2004), and Skala, Freedland, and Carney (2006).

The biological hypotheses focus on aspects of the dysregulation of the autonomic nervous system (ANS), and dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis (Skala et al., 2006; Wulsin, 2004). Dysregulation of these two systems is characteristic of major depression, and can contribute to the atherosclerotic process (Wulsin, 2004). The ANS is made up of the sympathetic nervous system (SNS) and parasympathetic nervous system (PNS)), and in depression, the ANS can become imbalanced, leading to an overactive SNS and underactive PNS (Carney et al., 2002). This imbalance can result in decreased heart rate variability (Carney et al., 2005) and increased heart rate, both shown to be strong predictors of mortality in CHD (Wulsin, 2004). This pattern of ANS dysfunction can contribute to hypertension and atherosclerosis, both possible precursors to CHD (Wulsin, 2004).

The neuroendocrine changes associated with HPA axis dysregulation that commonly occur in depression, such as high levels of cortisol, may promote platelet activation and development of atherosclerosis and plaque formation (Taylor et al., 2006). HPA axis dysregulation is also related to many CVD risk factors, such as increased blood pressure and high cholesterol (Lett et al., 2004).

Another possible theory is that impaired vascular function may explain the link between depression and CHD. Researchers have proposed that blockages in brain arteries caused by atherosclerosis can reduce blood flow, and therefore damage nerve cells in areas of the brain involved in mood or cognition, possibly leading to depression (Alexopoulos et al., 1997). There is also some preliminary evidence to suggest that alterations in immune functioning and inflammation may mediate the relationship between depression and CHD (Frasure-Smith et al., 2007), or that there may be possible shared genetic factors between depression and CHD (Scherrer et al., 2003). It is likely that any changes to the neuroendocrine system caused by depression, as suggested by the biological hypotheses (e.g., dysregulation of the ANS or HPA axis), would need to be occurring over many years or even decades, either in a chronic or episodically recurring pattern, for CHD to develop (Wulsin, 2004).

In addition to the biological hypotheses proposed to explain the link between depression and CHD, certain behavioural and social characteristics of people with depression may contribute to the development and prognosis of CHD. Some characteristics are lifestyle related, and include diet, exercise, tobacco and alcohol use, and medication adherence (Lett et al., 2004; Lichtman et al., 2008), and others are social characteristics, including social isolation, and chronic life stress (Lichtman et al., 2008). Depression has been shown to be associated with decreased adherence to medications (Lett et al., 2004), and other medical treatment regimens (DiMatteo, Lepper, & Croghan, 2000). In addition, people with depression are less likely to be successful at modifying other cardiac risk factors, such as hypertension (Ziegelstein et al., 2000), and CR attendance is lower for people with depression, compared to those without depression (Glazer, Emery, Frid, & Banyasz, 2002).

To date, it is not known exactly which of these biological and/or behavioural processes can most likely explain the link between depression and CHD. It is highly likely that an alteration of one or more of these processes is associated with depressive symptoms, consistently in a direction that increases cardiovascular risk (Lichtman et al., 2008). Little is known about the interrelations among any of the biological, genetic, and behavioural factors proposed in these hypotheses, making this an interesting and important topic for future research.

Treatment of Depression in People with Coronary Heart Disease

Given the evidence suggesting that depression is a risk factor for both the development and worsening prognosis of CHD, and that depression is highly prevalent in people with CHD, it would appear that treatment of depression is paramount. Treatment can take the form of antidepressant drugs, psychotherapy, and PA, either in combination, or on their own. The most appropriate type of treatment will usually depend on the severity of the depression, available resources, and preference of the individual (Whooley, 2006). This section of the literature review briefly addresses the pharmacological and psychological forms of treating depression, with the next section focussing in more detail on the role of PA in managing or treating depression.

The SSRI class of antidepressants, such as sertraline and citalopram, are currently considered the safest to use for people with CHD (Lichtman et al., 2008). One of these two drugs should be considered first-line treatment for newly diagnosed depression in people with CHD, particularly if the depression has not subsided within the first two months after the cardiac episode (Whooley, 2006). Similar to any of the antidepressant medications, there can be side effects associated with taking SSRI drugs, such as insomnia, gastrointestinal problems, and sexual dysfunction (Whooley, 2006). Most adverse effects, however, tend to diminish over the first month of treatment. In contrast to the SSRI antidepressants, the tricyclic antidepressants are contraindicated for people with CHD, because of their effects on altering heart rate and rhythm (Glassman, Roose, & Bigger, 1993).

In recent years, researchers have investigated the effects of antidepressants, psychotherapy, and exercise, either in combination or alone, on treating depression in people with CHD, in a number of large-scale studies. The first of these studies, known as SADHART (Sertraline Antidepressant Heart Attack Randomised Trial), is to date, the largest randomised trial to evaluate the use of an antidepressant for people with MDD and CHD (Glassman et al., 2002). A total of 369 depressed participants were assigned to either the antidepressant condition (i.e., SSRIs) or the placebo, after being hospitalised for a cardiac event. All participants met full criteria for MDD, according to the DIS, and during the 24-week trial, depression was measured using the Hamilton Depression scale (HAM-D) at four time points. The antidepressant was shown to be safe for people with CHD, but only modestly effective in reducing depressive symptoms. Although SADHART was not designed to evaluate cardiovascular outcomes, Glassman et al. found a non-significant reduction in cardiac deaths in the antidepressant group. A larger trial would be required to evaluate the potential effects of SSRI antidepressants on cardiac outcomes in people with CHD.

Psychological therapy, such as CBT and IPT, can be an alternative to pharmacological treatment for people with depression and CHD, particularly for those who cannot tolerate side effects of antidepressant medication, or who prefer a non-pharmacological or counselling approach to treatment (Lichtman et al., 2008). Psychotherapy, consisting typically of 16 weekly sessions, can also be effective in combination with antidepressants, especially for people with moderate to severe depression (Whooley, 2006).

The Enhancing Recovery in Coronary Heart Disease patients (ENRICHD) randomised trial aimed to alter cardiac prognosis by treating depression (ENRICHD Investigators, 2003). Based on the evidence that shows people with low social support and depression are at higher risk of poor clinical outcomes, people who had experienced a MI within one month, and also had a diagnosis of MDD, minor depression with a history of MDD, dysthymia, or low social support, were randomly assigned to either a psychosocial intervention or usual care. The intervention consisted of up to 6 months of CBT, supplemented by sertraline for participants who did not show improvement after 5 weeks. A total of 2,481 participants were involved in this study, and on average, they were followed up for 30 months. Although the trial found significant, albeit small, differences in depression (measured by the HAM-D) and social support in the intervention compared to usual care group, it failed to demonstrate any effects that treating depression increased survival rates, or decreased rates of recurrent cardiac events, in the overall sample, or the sub-group of depressed individuals.

In a recent study, Lesperance et al. (2007) investigated the effects of a simultaneously administered short-term psychotherapy intervention (IPT) and SSRI antidepressant (citalopram), on reducing depression in people with CHD. This study, termed the Canadian Cardiac Randomised Evaluation of Antidepressant and Psychotherapy Efficacy trial (CREATE), recruited 284 participants with MDD. Participants received 12 weekly sessions of IPT, plus clinical management, or clinical management alone, and 12 weeks of citalopram or matching placebo. Lesperance et al. (2007) found that citalopram was superior to placebo in reducing depressive symptoms, as measured by the HAM-D scale, however, there was no evidence of a benefit of the psychotherapy intervention over clinical management. Similar to the SADHART study (Glassman et al., 2002), this study did not examine the effects of psychotherapy on clinical cardiac outcomes.

In summary, the current research indicates that pharmacological treatment, in the form of SSRI medication, can be safe and effective in reducing depression in people with CHD. The benefits of using psychotherapy for treating depression in people with CHD has been demonstrated, however, there were no positive effects of treating the depression on cardiac mortality or morbidity. The effects of treating depression on cardiac mortality and morbidity is an area that requires further research, as is the use of psychotherapy in treating depression in people with CHD. A possible advantage in using psychotherapy over antidepressant medication to treat depression in people with CHD, is that psychotherapy could also assist people dealing with problems associated with the CHD, such as introducing and maintaining lifestyle changes, and addressing possible financial and employment changes that have resulted because of the cardiac event. Also, because not all cardiac patients with depression can tolerate the side effects associated with antidepressant medication, there is a need to identify alternative approaches to treat, particularly mild to moderate depression. As discussed in the next section, with its positive effects on both CHD and depression, exercise may be one such approach.

Physical Activity and Cardiac Rehabilitation

Introduction to Cardiac Rehabilitation and Physical Activity

Cardiac Rehabilitation (CR) is recognised by the WHO, the NHFA (Goble & Worcester, 1999), and the American Heart Association (Balady et al., 2000), as being integral to, and necessary for, the comprehensive care of patients with CVD. The CR program should consist of a multidisciplinary, professional team to educate and advise patients during their recovery, so they can resume a full and active life following a cardiac event. Issues such as necessary treatment and lifestyle changes that may help reduce cardiovascular risk factors, are addressed in an attempt to prevent further cardiac episodes (Balady et al., 2000; Feaver, 2000).

There are three recognised phases of CR: inpatient rehabilitation (Phase 1); ambulatory outpatient rehabilitation (Phase 2); maintenance (Phase 3) (Goble & Worcester, 1999; NHFA & Australian Cardiac Rehabilitation Association [ACRA], 2004). Inpatient CR takes place in the hospital as soon as possible after the cardiac event. Ambulatory outpatient rehabilitation usually takes place soon after discharge from the hospital, and in Australia, commonly continues for 6-8 weeks (Goble & Worcester, 1999). This phase of rehabilitation is typically more formal and structured, and consists of a light to moderate PA program, as well as education, discussion, counselling and behavioural interventions, addressing topics such as basic anatomy and physiology of the heart, risk factors for heart disease and how to modify them for secondary prevention, skills for behaviour change and maintenance, resumption of physical, sexual, and daily living activities, psychosocial issues, and medications (NHFA & ACRA, 2004). Maintenance CR is a lifetime, usually open-ended, maintenance stage that follows ambulatory rehabilitation. It involves sustained activities and behaviours to reduce cardiovascular risk factors, and maintain a healthy and active lifestyle (Goble & Worcester, 1999; NHFA & ACRA, 2004). Unless otherwise stated, from this point, any reference made to CR refers to the Phase 2 exercise component of the program.

Recent recommendations outlined by the NHFA (Briffa et al., 2006) state "that people with established clinically stable cardiovascular disease should aim, over time, to achieve 30 minutes or more of moderate intensity physical activity on most, if not all, days of the week" (p. 71). The report also encourages regular low-to-moderate level resistance training, under the supervision of an exercise professional. For people with advanced CVD, less intense, shorter bouts of activity with more rest periods may suffice.

The American College of Sports Medicine and the American Heart Foundation recently updated their PA guidelines (Nelson et al., 2007). In their guidelines, they deemed it appropriate to issue two sets of recommendations for adults: one for healthy adults aged less than 65, and another for adults aged more than 65, or adults aged 50-64 with chronic medical conditions. The guidelines for healthy adults aged less than 65 are as follows; to engage in moderately intense aerobic exercise for 30 minutes a day, five days a week, or to do vigorously intense aerobic exercise for 20 mins, three days per week, and to do strength training exercises twice a week. The set of guidelines for adults over the age of 65, or less than 65 and experiencing a chronic condition, are essentially the same except they have the additional guidelines of performing flexibility exercises, balance exercises if the individual is at risk of falling, and having a PA plan (Nelson et al., 2007). The European Society of Cardiology recommends similar levels to the Australian and US guidelines, of moderate intensity aerobic exercise for people who have experienced a cardiac event (Giannuzzi et al., 2003).

Evidence supporting the positive effects of PA on the prevention and treatment of cardiac disease is compelling (Thompson et al., 2003), and is discussed in more detail in the coming sections. Despite this, approximately half of all Australian adults, including those with CHD, do not engage in sufficient PA for health gain (AIHW, 2006). Similar rates of inactivity are reported in the US. In a recent study, Zhao, Ford, Li, and Mokdad (2008) found that 60% of people with CHD, and 51% of people without CHD, were not meeting PA guidelines.

People with mental health problems are also less likely to be physically active. The National Health Survey conducted in Australia in 2004-2005, reported that 75% of people with mental and behavioural problems aged 15 and over had low levels of exercise (sedentary or low exercise level), compared to 69% of those without such problems (Australian Bureau of Statistics, 2006b). Issues associated with adherence to

PA for people with CHD and depression are addressed in more detail in the coming sections of this chapter.

Physical inactivity is associated with higher all-cause mortality, and also an increased risk of poor health, including CVD, Type 2 diabetes, obesity, colon and breast cancer, osteoporosis, and depression (AIHW, 2008). In Australia, low levels of PA are estimated to have accounted for approximately 7% of the burden of disease and injury in 2003, ranking fourth among the more direct determinants of ill health, behind only tobacco smoking, high blood pressure (HBP), and overweight/obesity (AIHW, 2008). Considering the links between physical inactivity and HBP and body weight, the actual burden of physical inactivity could in fact be even higher than these figures suggest. In addition to the health problems associated with physical inactivity, the financial impact is significant. In the years 2006-07, the direct cost of physical inactivity in Australia was $1.5 billion per annum (AIHW, 2008). Therefore, the negative effects of physical inactivity are experienced in numerous aspects of individual, community, and societal life. On a more positive note, however, the benefits of maintaining regular PA are far reaching. Before I begin discussing the benefits of PA for cardiac populations, I briefly discuss the issues associated with measuring PA using self-report instruments, particularly in cardiac populations.

Measuring Physical Activity in Cardiac Populations

Similar to the issues discussed in the section on measuring depression, ascertaining PA levels of any population can be challenging, and at times, the results of research have been inconsistent. Numerous questionnaires have been used in research to measure PA, and they can vary greatly in their detail, the period surveyed, and their psychometric properties, such as reliability, validity, and specificity (Shephard, 2003). The actual content found in PA self-report questionnaires can vary in terms of reporting on intensity, frequency of activities over a specified timeframe, duration, types of activities undertaken, and settings for PA (Bauman & Merom, 2002; Shephard, 2003). Questionnaires can also be subject to problems associated with recall, such as remembering the exact amount and type of PA undertaken, which can result in an over- or under-estimation of PA (Vanhees et al., 2005). In addition, over-reporting of PA levels may be attributed to a social desirability bias, particularly with interviewer-administered questionnaires (Motl, McAuley, & DiStefano, 2005).

Due to some of these inconsistencies, PA levels and/or energy expenditure reported in the literature can vary greatly. Rutten et al. (2003) experienced this problem in their large-scale investigation of PA levels of people from various parts of Europe. They found that PA levels differed depending on the particular self-report measures used, and that overall trends of PA levels in various countries were not comparable to other studies. Other researchers have found that energy expenditure determined by self-report questionnaires does not always match with that measured by the test considered to be the "gold standard" of estimating total energy expenditure, namely the doubly-labelled water test (Neilson, Robson, Friedenreich, & Csizmadi, 2008). Despite these findings, self-report questionnaires are relatively inexpensive to administer, easily applicable to large populations, and convenient to use for research purposes (Bauman & Merom, 2002; Vanhees et al., 2005). In addition, there are some measures of PA that are reliable and valid, and can be accurately used in PA research (Brown, Trost, Bauman, Mummery, & Owen, 2004). Shephard (2003) suggested that PA questionnaires will become more valuable if a standardised instrument can be developed that will record low intensity activities, typically undertaken in sedentary societies, and if consistent meaning can be given to the terms "light", "moderate", and "vigorous" exercise.

Le Grande, Elliott, Worcester, Murphy, and Goble (2008) conducted an evaluation of self-report PA instruments used in studies with cardiac patients. Within their methodological inclusion criteria, they found that 23 identifiable instruments, and 29 customised or inadequately described instruments had been used in the analysed studies of cardiac patients. This information in itself demonstrates the large variation in PA instruments being used in studies involving cardiac populations. Le Grande et al. found numerous instruments had problems associated with validity, reliability, and sensitivity, especially when measuring low-intensity exercise. In addition, many of the questionnaires were not suitable for use with cardiac patients because they were highly dependent on memory and recall, did not accurately measure lower intensity activity, commonly undertaken by cardiac patients, and were lengthy and cumbersome to complete.

PA can also be measured using objective techniques, such as pedometers and accelerometers. Pedometers are a small device that measure movement of an individual in the vertical direction. They are useful for measuring walking and running behaviour, although cannot register cycling, swimming, and upper body movements, such as weight training (Vanhees et al., 2005). In addition, pedometers do not measure intensity or pace of an activity (Bauman, Phongsavan, Schoeppe, & Owen, 2006; Vanhees et al.). Accelerometers are slightly more complex devices than pedometers because they measure movements in more than one plane (i.e., can measure some movements in the horizontal, as well as vertical plane) (Vanhees et al.). They can also assess the intensity and timing of the movement, which allows for an estimate of energy expenditure (Bauman et al.). Despite some of the advantages of objective techniques as compared to subjective techniques, such as overcoming recall and social desirability biases, objective measures tend to be more expensive to use in larger scale, population-based studies, and they are limited in their ability to register certain movements and types of PA (Bauman et al.; Vanhees et al., 2005).

Choosing the most appropriate instrument to use to measure PA in cardiac populations can be challenging. Ultimately, the decision will be determined according to the purpose of the study, characteristics of the study population, and the resources available to the researchers (Le Grande et al., 2008). Ideally, tools used to measure PA in cardiac populations will be straight forward for participants to complete, measure PA within a suitable timeframe, assess the full range of PA from light to vigorous activity, demonstrate acceptable psychometric properties, and be validated with elderly people (Le Grande et al., 2008).

While not measuring actual amounts of PA undertaken, the transtheoretical model (TTM) of behaviour change (Prochaska & DiClemente, 1983), also known as the stages of change (SOC) model, can help determine individuals' particular level of readiness to change a behaviour, such as exercise. In this model, Prochaska and DiClemente suggested that people pass through specific stages as they attempt to change their behaviour. There are five stages in the TTM: precontemplation (those individuals not intending to change their behaviour in the foreseeable future); contemplation (individuals who are aware that they need to change their behaviour, but are yet to make a commitment and take action); preparation (individuals who have started to change their behaviour, but the behaviour is not yet regular); action (changed their behaviour within the past six months); and maintenance (changed their behaviour over six months previously and have sustained the change). The TTM has been used successfully to describe exercise behaviour in a large-scale exercise promotion study (Marcus, Rossi, Selby, Niaura, & Abrams, 1992), and in the cardiac population (e.g., Kamwendo, 2004). It is a quick and simple measure to complete, requiring people to choose the one stage mentioned above that corresponds most accurately with how they feel about their exercise behaviour. The exercise SOC appears particularly useful in intervention studies, in which strategies or interventions are designed according to individuals' stage of change.

Effects of Physical Activity and Cardiac Rehabilitation

Effects on Mortality, Morbidity, and Markers of Cardiovascular Risk in People with Coronary Heart Disease

Research on the effectiveness of exercise and CR in reducing mortality, morbidity, and cardiovascular risk factors has demonstrated some promising findings in recent years (Blumenthal, 2008). Two major meta-analyses have recently been conducted (Jolliffe et al., 2001; Taylor et al., 2004), in addition to other reviews and original research articles. Throughout this section, the term "exercise" is used instead of "physical activity", due to this being the common reference made by the researchers in this literature.

Exercise and CR have been shown to reduce both all-cause and cardiac-related mortality in people with CHD (Jolliffe et al., 2001; Taylor et al., 2004). Jolliffe et al. (2001), and Taylor et al. (2004) reported that exercise reduced all-cause mortality by 27% and 20%, respectively, and cardiac-related mortality by 31% and 26%. Blumenthal et al. (2004) found regular exercise to be associated with a nearly 40% reduction in the risk of death. The results are mixed, however, when examining the effects of exercise on recurrent non-fatal reinfarctions. Neither Jolliffe et al. nor Taylor et al. found any differences in people who did or did not exercise, in terms of non-fatal reinfarctions and revascularisation. In a recent study by Blumenthal et al. (2004), as part of the ENRICHD trial, however, a difference was found. Over an average of a two-year follow-up period, Blumenthal et al. found that participants who reported they were regular exercisers had a 30% reduction in the risk of recurrent, non-fatal cardiac events, compared to those participants who were not regular exercisers, even after adjusting for medical and demographic variables. A potential limitation with this research is that exercise was measured by a single, self-report item, and all of the participants were depressed, socially isolated, or both. It seems unlikely, however, that those individuals who are not depressed or socially isolated would not benefit from exercise. This is clearly an area that requires further investigation.

In terms of the effects of exercise on cardiovascular risk factors, positive findings have been reported on exercise reducing total cholesterol levels (Jolliffe et al., 2001; Taylor et al., 2004), triglyceride levels, systolic blood pressure, and smoking rates (Taylor et al., 2004). Blumenthal et al. (2005) conducted a randomised controlled trial (RCT) in which participants (*N* = 134) were assigned to either usual medical care, usual medical care plus 16 weeks of aerobic exercise, or usual care plus 16 weeks of stress management training. They found that people who were receiving either the aerobic exercise or stress management training had improved scores on some of the physiological markers of cardiovascular risk factors, such as left ventricular ejection fraction and flow mediated dilation. Although Blumenthal et al. did comment that this small, randomised clinical trial was not powered enough to detect differences in clinical endpoints, such as mortality and morbidity, the findings do offer further support to the potential of interventions, such as exercise, for improving clinical outcomes for cardiac patients.

Even though the findings cited here are positive, further large scale, longitudinal research needs to be conducted to ascertain the effects of exercise on cardiac outcomes and markers of cardiovascular risk factors. Both Jolliffe et al.

(2001), and Taylor et al. (2004) commented in their reviews on the poor methodological quality of many of the trials that have been undertaken to date. Often the researchers did not report on processes of randomisation in their RCTs, and many of the studies were underpowered. In addition, most of the trials have been conducted on middle-aged, Caucasian, low risk, males, and those often most in need of intervention, are excluded from such trials because of age or comorbidities.

Effects on Depression (Clinical Population)

There is growing evidence that exercise may be a safe and effective form of treatment for depression. In a number of studies over the past decade, researchers have investigated the specific effects of PA and exercise on reduction of depression in the clinical population (e.g., Babyak et al., 2000; Blumenthal et al., 1999; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005). Similarly, there have been many reviews and meta-analyses conducted on the literature examining the relationship between exercise and depression (e.g., Brosse, Sheets, Lett, & Blumenthal, 2002; Craft & Landers, 1998; Craft & Perna, 2004; Lawlor & Hopker, 2001; North, McCullagh, & Tran, 1990; Stathopoulou, Powers, Berry, Smits, & Otto, 2006). The research often focuses on comparisons of exercise (mostly aerobic), and/or antidepressant medication, and/or psychotherapy, in treating depression. I begin this section with a brief summary of the findings from the major meta-analyses, then expand on some well-controlled studies published in this area. Please note, in the following meta-analyses, unless otherwise stated, effect sizes are expressed in terms of Cohen’s *d*.

North et al. (1990) published one of the earliest meta-analyses on the effect of exercise on depression. They included studies with varied populations, and found an overall effect size (Hedges's *g*) of -0.53, indicating that exercise decreased depression scores by approximately one half a standard deviation compared to those in comparison groups. North et al. also analysed a sub-group of their studies that had utilised clinical populations, where they found a larger effect size (*g)* of -0.94. These studies, however, often differed in their definition of clinical depression, and participants in the various studies had a wide range of other physical and mental health problems. In an attempt to clarify this relationship further, Craft and Landers (1998) analysed only those studies that had included participants with clinical depression. They found an effect size of -0.77. In addition, Craft and Landers found that when compared to other treatments of depression, exercise was just as beneficial as psychotherapy, antidepressant medication, and other behavioural interventions.

Lawlor and Hopker (2001) conducted a meta-analysis that only included RCTs of participants with clinical depression. They found that exercise was associated with a greater reduction in depressive symptoms when compared to no treatment (effect size of –1.1), and exercise was as effective as psychotherapy, however, they concluded that "the effectiveness of exercise in reducing symptoms of depression cannot be determined because of a lack of good quality research on clinical populations with adequate follow-up" (p. 1). Although Brosse et al. (2002) agreed that there is limited data from well-designed clinical trials, they did not necessarily agree with the conclusion made by Lawlor and Hopker. Similar to Craft and Perna (2004), Brosse et al. proposed that there are many studies that offer considerable evidence for the benefits of exercise in reducing depression in clinical populations.

In the most recent meta-analysis, Stathopoulou et al. (2006) aimed to update and refine the review undertaken by Lawlor and Hopker (2001). Stathopoulou et al. only included studies that were RCTs, targeting clinical depression, and incorporating a non-active control group. They found very large effects ($d = 1.42$) for exercise interventions relative to control groups, in decreasing depression. Strathopoulou concluded that “research on the impact of exercise interventions on mental health has progressed from initial efficacy studies to well-designed clinical trials” and “exercise can be a powerful intervention for clinical depression” (p. 188).

In one of the well controlled studies, Blumenthal et al. (1999) showed that exercise training was as effective in reducing depression over a 16-week trial as anti-depressant medication. Participants (*N* = 156) with major depressive disorder (as assessed according to the *DSM-IV-TR*) were randomly assigned to a program of exercise training, antidepressant medication, or combined exercise and medication. The results indicated that all groups exhibited a significant decline in depressive symptoms (as measured by the BDI and HAM-D), and there was no difference between the three groups in the degree to which symptoms improved. Although the participants in the medication group showed a more rapid initial (within the first few weeks) therapeutic response compared with participants in the other groups, the participants in the combination group with less severe depression seemed to respond particularly well to the exercise training and medication.

In a follow-up study to Blumenthal et al. (1999), Babyak et al. (2000) found participants in the exercise group were more likely than those in the medication or combination groups to be partially or fully recovered from their depression at the 6-month follow up visit. In addition, those in the exercise group, who had been assessed as being in full remission from the depression at the end of the 16-week program, were less likely than participants in the other two groups to relapse after 10 months. These two studies highlight the potential long-term benefits of exercise in reducing depression for people with major depressive disorder.

In addition to determining whether exercise was effective in reducing depressive symptoms, Dunn et al. (2005) aimed to ascertain the dose-response relation of exercise and reduction of depression. Specifically, Dunn et al. randomised 80 participants with mild to moderate depression, as determined by clinical interview and measured using the HAM-D, to one of five groups that differed in total energy expenditure (expressed in terms of kcal/kg/week) and frequency; a low dose of exercise (equivalent to low intensity; 3 times per week), a low dose (5 times per week), the public health dose recommended by the American College of Sports Medicine (equivalent to moderate intensity; 3 times per week), the public health dose (5 times a week), or the exercise placebo control (consisting of stretching and flexibility, 3 times per week). They found, firstly, that exercise was effective in treating mild to moderate depression, and secondly, that the amount of exercise needed to reduce depressive symptoms was equivalent to that recommended by public health experts (i.e., moderate intensity). Lower doses of exercise (i.e., low intensity) were found to be not effective and similar to placebo control. Interestingly, there was no effect of frequency of exercise on depression levels; therefore, it seems that total energy expenditure was the most important factor in reducing depression. In summary, the recent, well-controlled studies demonstrate that exercise can be used as a safe and effective alternative treatment for reducing depressive symptoms.

Longitudinal studies have also been conducted to further highlight the association between exercise and depression (e.g., Fukukawa et al., 2004; Harris, Cronkite, & Moos, 2006). Harris et al. followed a cohort of 424 depressed adults for a period of 10 years, and found that more PA was associated with less concurrent depression at four assessment points over 10 years. PA appeared to counteract the effects of various medical conditions and negative life events on depression. Although

Harris et al. suggested that PA may help reduce depression, they also acknowledged that the link could be reversed, such that the reduced depression could enable higher levels of PA. Harris et al. also highlighted that, although it might be challenging, encouraging people who are experiencing depression and other medical problems, or major life stresses, to be involved in regular PA, is possible, and most importantly, may be effective in treating depression.

Mechanisms to Explain the Antidepressant Effect of Exercise

Similar to the mechanisms explaining the relationship between CHD and depression, the hypotheses underlying the antidepressant effects of exercise remain unclear. A number of physiological/neurobiological and psychosocial theories have been described in the literature, however, very few of them have been researched in enough depth to either be supported or refuted (Craft & Perna, 2004). The neurobiological mechanisms represent potential ways in which exercise can influence physiological mediators of depression. The most widely researched of these hypotheses are as follows: the monoamine hypothesis, which suggests that exercise leads to an increase in the availability of brain neurotransmitters, such as serotonin, and dopamine, which are typically diminished with depression; the endorphin hypothesis, which proposes that exercise causes an increase in the release of ß-endorphins, commonly associated with positive mood; and the HPA axis hypothesis, which postulates that exercise training can lead to a reduction of the HPA-axis response to stress, which is generally marked by hyperactivity in depression (Brosse et al., 2002; Craft & Perna, 2004; O'Neal, Dunn, & Martinsen, 2000). Although all of these physiological mechanisms are plausible, further research involving less invasive procedures is required, to ascertain whether exercise leads to the neurochemical changes in the brain suggested by the various mechanisms (Craft & Perna, 2004).

In addition to the physiological hypotheses, there are a number of psychosocial theories that attempt to explain the antidepressant effects of exercise. The distraction hypothesis proposes that exercise may provide a distraction from daily worries and depressing thoughts (Craft & Perna, 2004). However, the research comparing exercise to other distracting activities, such as relaxation and social contact, has been inconclusive, with exercise being more effective than some activities, but equally as effective as others in reducing depression (North et al., 1990). The self-efficacy hypothesis suggests that exercise may promote self-efficacy and self-confidence. In mastering a task, such as exercise, particularly if the task was perceived as difficult, people are likely to gain a sense of achievement, which is likely to lead to an enhanced positive mood (Craft & Perna, 2004; North et al., 1990). Another theory that has been postulated is the social interaction hypothesis. Social group interaction or social reinforcement that exercises may receive could have a beneficial effect on reducing depression (Brosse et al., 2002; North et al., 1990). North et al. suggested that social interaction may be more important at the beginning of an exercise program because it is an external motivator, but that after some time, the social interaction effects decrease because rewards of exercise become internalised.

In all likelihood, a combination of biological, psychological, and social mechanisms are most probably involved in the exercise-depression relationship (North et al., 1990). Different mechanisms may also be more important at certain periods of time throughout the natural course of depression (Craft & Perna, 2004). Further research is required to test each of these theories, and to determine how accurately they can explain the antidepressant effects of exercise.

Effects on Depression (Cardiac Population)

There have been a number of studies showing positive effects of CR programs in reducing depression and negative affect in people with CHD (Lavie, Milani, Cassidy, & Gilliland, 1999; Lewin, Robertson, Cay, Irving, & Campbell, 1992; Milani & Lavie, 2007; Milani, Lavie, & Cassidy, 1996; Oldridge, Streiner, Hoffmann, & Guyatt, 1995). For example, after a 12-week CR program consisting of exercise sessions and education, Milani et al. (1996) found numerous physiological and psychological changes in their sample. In addition to many physiological improvements, both depression and anxiety were significantly reduced following the CR program, and a number of the quality of life measurements, such as energy, bodily pain, functional status, and well-being, had also improved. Similarly, Lavie et al., (1999) examined the effects of CR on depression levels in a population of older women with CHD. They also found that depression was significantly reduced after the CR program. Neither of these studies, however, included a control group, so it is difficult to know whether depression levels would have decreased over time, irrespective of any effects of the CR program.

In a more recent study, Milani and Lavie (2007) aimed to determine the impact of CR on depression and its associated mortality. Their sample consisted of 522 participants who completed CR, and 179 participants who did not. Following CR, prevalence of depressive symptoms fell 63%, from 17% to 6%. In addition, Milani and Lavie found that people with depression had an over four-fold higher mortality rate compared to non-depressed people. CR, however, appeared to act as a buffer against such high mortality rates, because people with depression who had attended CR had a 73% lower mortality rate compared to control depressed people who did not attend CR. A limitation of this study, however, was that the participants who did not complete CR (termed the “control” group) only completed the depression measure at baseline, and not again at the same point in time as the CR group (e.g., approximately 12 weeks after baseline). This obviously makes establishing cause and effect more difficult, and again leaves a major question unanswered about whether depression levels would have fallen over time, with or without CR.

To my knowledge, only one meta-analysis has been published in the last 15 years, which focuses on the effects of rehabilitation exercise programs on depression and anxiety in coronary patients. Kugler, Seelbach, and Krueskemper (1994) analysed 15 studies, and revealed a small to medium effect size ($d_{\text{mean}} = 0.46$) for depression. They concluded that, although exercise is beneficial as an additional treatment for depression, previous research has not demonstrated that it should be considered the only treatment. Although Kugler et al. focussed specifically on the effects of exercise on depression, they compared effect sizes from numerous studies that used a range of measures to detect depression. Kugler et al. stated that all questionnaires and interviews used to measure depression had been validated, however, it is most likely that not all of the measures had been well validated within the CHD population. Also, some of the measures were designed to detect mild to moderate depression, whereas others were more sensitive to severe depression. In addition, this meta-analysis was conducted 15 years ago. It would, therefore, be interesting to determine the effect sizes of more recent studies investigating the effects of exercise and depression in people with CHD.

The specific effects of exercise, as compared to CR programs, in reducing depressive symptomatology and negative affect in CHD population have also been investigated. Beniamini et al. (1997) assigned 38 participants to a 12-week program of either high-intensity strength training or flexibility training. After the program, participants in the strength group had greater improvements in their Profile of Mood States (POMS) depression scores, as well as self-efficacy, mood, and well-being scores than did the flexibility group.

In a larger study with a longer follow-up period, Dugmore et al. (1999) recruited 124 people with a clinical diagnosis of MI. Sixty-two participants were randomly assigned to a regular weekly aerobic training program, and 62 individuals acted as matched controls, who did not receive any formal exercise training. The exercise program was conducted for 12 months, and all participants completed a five-year follow-up questionnaire, investigating vocational status and lifestyle change. Amongst other measures, depression scores were obtained throughout the one-year program using the Toronto Attitude Scale (TAS; adapted from the MMPI), used to record and detect depression). The results indicated that the exercise group had significant improvements in their depression scores, when compared with their matched controls, although the difference in the two groups did not become evident until 12-months of exercise training had been completed. Dugmore et al. did not collect information on the participants' depression levels at the five-year follow up, nor did they examine whether participants had continued to engage in the exercise program, after the official program had finished. This information would have been useful in determining any long-term effects of exercise on reducing depression levels in people with CHD.

The studies by Beniamini et al. (1997) and Dugmore et al. (1999) provide preliminary support for the positive effects that exercise can have in reducing depressive symptoms and negative affect in people with CHD. Both of these studies, in addition to numerous others (e.g., Denollet & Brutsaert, 2001; Ewart, 1989; Oldridge et al., 1995), however, used measures of depression that were not highly specific (e.g., POMS), and focussed more on quality of life and general well-being, than specifically on depression. It appears from the early research conducted in the 1990s, that further research was necessary to investigate the specific effect of exercise and PA on depression in people with CHD. Randomised controlled studies, using appropriate and validated measures to detect specific levels of depression in people with CHD, were required.

In the past few years, Blumenthal and colleagues have been working on numerous studies to investigate the effects of exercise on depression in people with CHD (Blumenthal et al., 2004; Blumenthal et al., 2005; Blumenthal et al., 2007). One recent study, conducted by Blumenthal et al. (2005) employed a RCT and specifically measured depression using the validated BDI. Blumenthal et al. (2005) found that after a 16-week trial of usual care alone, or usual care plus supervised exercise or stress management, the groups receiving the exercise or stress management training showed greater reductions in depression compared with the usual care controls. In another study, Blumenthal et al. (2004) found that people involved in the ENRICHD study (i.e., having experienced an MI, and being depressed and/or socially isolated), who reported regular exercise, had lower baseline BDI scores, and had larger decreases from baseline to 6 months on BDI, compared to those who reported no regular exercise. As previously mentioned, one problem with this study was that a single, self-reported item was used to ascertain PA. Despite this shortcoming, these recent studies are certainly adding evidence to support the notion that exercise can have positive effects on depression in cardiac populations. In addition, another RCT titled “Understanding Prognostic Benefits of Exercise and Antidepressant Therapy” (UPBEAT), is currently being conducted (Blumenthal et al., 2007), to compare the effects of exercise and antidepressant medication in treating depression for people with heart disease. This will be the first study of its kind, and the findings are much anticipated.

In summary, the evidence suggesting the importance of exercise for people with CHD is growing. Not only is exercise associated with lower all-cause and cardiac-related mortality, cardiac morbidity, and physiological markers of cardiac risk factors, but the evidence is also mounting for the positive effects of exercise in reducing depression and depressive symptoms in people with CHD. Despite these benefits, only half of the adult population in Australia are exercising at a level that is required for maintaining good health. In the next section, I explain the problem of adherence to PA and CR, highlighting the common reasons why people with CHD or depression are unable or able to maintain PA. In particular, the effect of depression on adherence to both CR and PA is discussed.

Adherence to Cardiac Rehabilitation and Physical Activity

Adherence to Cardiac Rehabilitation

Despite the documented evidence of the varied benefits of CR programs, participation rates are low. In a study of outpatient CR programs in Victoria, Australia, Bunker, McBurney, Cox, and Jelinek (1999) reported participation rates, of at least one CR session, to be one third of eligible people with CHD. These rates ranged from as low as 10% for people who had undergone an angioplasty, up to 53% for those who had coronary artery bypass graft (CABG) surgery. In a study conducted in Queensland, Australia, Scott, Lindsay, and Harden (2003) reported that 59% of people who were referred to CR attended at least one session, however, fewer than one-third of participants actually completed the program. Similar rates have also been reported in the USA, with only 11-38% of eligible people typically participating in CR programs (Wenger et al., 1995).

Factors that have consistently been associated with non-participation in CR (i.e., failing to *begin* a CR program) include lack of referral by physicians (Ades, Waldmann, McCann, & Weaver, 1992; Daly et al., 2002), psychosocial factors, including a history of depression (Ades et al., 1992), associated chronic illnesses (Ades et al., 1992; Daly et al., 2002; Scott et al., 2003), specific cardiac diagnosis (Daly et al., 2002), a lack of perceived benefits of CR programs (Daly et al., 2002; Scott et al., 2003), low self-efficacy (Maddison & Prapavessis, 2004), and participants returning to work (Scott et al., 2003).

Researchers of numerous quantitative studies have found that the most common factors associated with a lack of adherence (i.e., not maintaining) to CR programs include, but are not limited to, female gender (Daly et al., 2002; Jackson, Leclerc, Erskine, & Linden, 2005), increasing age (Cooper et al., 2002; Daly et al., 2002), people denying the severity of their illness (Cooper et al., 2002), lower perception of the benefits of CR programs (Cooper et al., 2002; Daly et al., 2002; Johnson & Heller, 1998), barriers, such as physical environment and time (Johnson & Heller, 1998), lower level of PA prior to the cardiac episode (Lane, Carroll, Ring, Beevers, & Lip, 2001), and depression (Dorn et al., 2001; Glazer et al., 2002; Lane et al., 2001; Sanderson & Bittner, 2005; Turner, Bethell, Evans, Goddard, & Mullee, 2002; Ziegelstein et al., 2000).

The majority of studies within the areas of CHD and adherence to PA/CR have been conducted using a quantitative approach. Although many high quality studies have been conducted using such techniques, Faulkner and Biddle (2004) suggested that “qualitative studies with a focus on change at the individual level might permit greater insight and understanding of person-level changes than are possible through a randomised controlled trial” (p. 4). Qualitative methods facilitate the study of issues in-depth, because they are not constrained by predetermined categories (Patton, 2002). Mutrie (1997) proposed that the effect of exercise on quality of life should be studied using qualitative research techniques, because of the rich, in-depth information that can be obtained through these methods. Qualitative research can be particularly relevant for learning about people's experiences, as it is usually characterised by extensive description and narrative (Faulkner & Biddle, 2004).

Although smaller in number compared to the quantitative studies, a few studies have used qualitative techniques to investigate the reasons why people do, or do not, attend CR programs (e.g., Cooper, Jackson, Weinman, & Horne, 2005; East & Brown, 2004; Jones, Jolly, Raftery, Lip, & Greenfield, 2007; McSweeney, Crane, & Bach, 2001). For example, East and Brown conducted semi-structured interviews with MI survivors about their experiences of CR and recovery after their cardiac event. They reported the major barriers for not attending CR were people feeling too ill, or people believing that the issues to be explored in the CR classes were already understood. On the other hand, people who did attend the programs felt they had the opportunity to meet other people in similar situations, and they had received useful support (East & Brown, 2004). McSweeney et al. found the reasons women gave for not attending CR programs were caretaking responsibilities, transport or location problems, and the lack of a perceived need to attend CR. For women who did attend, similar barriers were identified, however, alternatives were devised for overcoming these barriers, often with the support of CR staff. Factors that influenced women to continue attending the CR programs included positive psychological appraisals, program components, including feeling safe and comfortable in the CR environment, identifying benefits of the program, and positive support offered by CR staff (McSweeney et al., 2001).

In summary, a range of factors can influence attendance at CR programs; some of which are external to the individual, and largely uncontrollable, such as support and recommendation given by medical professionals, components of the actual program, and transport arrangement; others are a result of the health of the individual, such as severity and diagnosis of the cardiac disease and other chronic illnesses; and some are more internally-based, such as an individual's perception of the need to attend CR, perception of the CR environment, knowledge of the benefits of CR, and depression.

Adherence to Physical Activity

Adherence or compliance to exercise programs for people with CHD is also problematic. In a longitudinal (36 month) exercise trial conducted in the USA, Dorn et al. (2001), reported a decrease from 80% compliance two months after commencement of the exercise trial, to 55% compliance six months after the start of the trial, in people with CHD. In this study, compliance was defined as the percentage of sessions attended by the individual. Dorn et al. noted that, although the most dramatic change in compliance was observed six months into the trial, compliance continued to decrease steadily at each six-month interval in the trial. By the end of the exercise trial, at 36 months, compliance rates had dropped to 13% (Dorn et al., 2001).

Similarly, Reid et al. (2006) were interested in determining exercise levels of people with CHD. In their study, however, participants were not involved in a specific exercise trial; rather their everyday levels were measured and recorded by the researchers. Reid et al. recruited 782 participants, while they were hospitalised for a CHD-related event, and measured PA levels at 2, 6, and 12 months post-hospitalisation. They found that the proportion of people with CHD reporting optimal levels of exercise dropped from 59% to 50% to 46%, 2, 6, and 12 months after a CHD-related hospitalisation. Women were found to be less active than men, as were people with diabetes. Using the same sample as Reid et al. (2006), Reid et al. (2007) found that people with CHD who decreased their PA levels over a 6-month period identified more barriers to exercise, believed they were more susceptible to future CHD-events, had fewer intentions to exercise, and reported lower self-efficacy, compared to people who increased PA levels.

It is not known exactly what happens to exercise levels of CR participants once the formal CR program has concluded, because there have been very few longitudinal studies that have followed-up with this population. The small amount of research that has been conducted has produced mixed findings. For example, in Japan, Iwaza et al. (2004) noted that 83% of participants continued exercising for at least 6 months after a CR program, whereas, in a study with women from the US, Moore, Ruland, Pashkow, and Blackburn (1998) found that adherence dropped from 83% one month after the conclusion of CR to 50% three months after CR. Both of these studies used both objective and subjective measures of PA. In a sample of cardiac patients from Canada, Reid et al. (2006) found that self-report PA declined over time (from 2 months post-event to 12 months post-event), regardless of whether an individual attended CR. It is possible that the discrepancies in adherence rates reported in the Japanese study, compared to the Canadian and US studies could be associated with cultural factors. Japan is a more hierarchical and authoritarian culture in which people with chronic health conditions are more likely to follow instructions given by high status professionals, like doctors than people from Western countries. Further research is required to determine long-term adherence rates to PA for cardiac patients, particularly in the first year after the conclusion of CR. Cultural differences should also be explored further.

With regard to reasons why people do or do not adhere to PA, there have been a number of studies, particularly in recent years, that have used qualitative techniques, including interviews and focus groups, to explore factors that influence participation in PA for older people (Resnick & Spellbring, 2000; Schneider, Eveker, Bronder, Meiner, & Binder, 2003), people from minority groups (Belza et al., 2004; Lawton, Ahmad, Hanna, Douglas, & Hallowell, 2006; Nies, Vollman, & Cook, 1999), people with physical disabilities (Levins, Redenbach, & Dyck, 2004; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004; Wahman, 2006), and people participating in CR programs (Cooper et al., 2002; McSweeney et al., 2001).

In these studies, researchers have found that a range of factors act as barriers and facilitators to being physically active, some that are common to the majority of participants (e.g., psychological and physical health benefits, and social support being facilitators, and unpleasant associations with exercise and competing responsibilities being barriers), and others that are specific to the different populations (e.g., child care being an important issue for African American women, chronic illnesses affecting older peoples' participation, and specific program components being important for people participating in CR).

Fewer studies have investigated people's experience with PA, in particular what helps and hinders PA participation after the conclusion of the formal CR program. Moore and colleagues (Moore, Dolansky, Ruland, Pashkow, & Blackburn, 2003; Moore et al., 1998) used quantitative methods to determine predictors of adherence to PA after CR, for women with CHD. They found that those women who were more likely to continue adhering to PA were receiving more instrumental social support, had less comorbidity, were older, had higher levels of self-efficacay, and perceived less barriers and more benefits. Yates et al. (2003) also utilised quantitative methods to determine common barriers to, and facilitators of, PA for people with heart disease. They reported symptom distress and negative well-being to be common barriers, while higher levels of self-efficacy were shown to be a facilitator.

Qualitative studies on PA experiences of people with CHD who have continued to engage in regular long-term exercise are scarce. Two studies have examined the reasons that people continue to adhere to a “graduate CR program” (i.e., a formal exercise class offered to people with heart disease that occurs after the traditional Phase 2 CR program). Hudson, Symons, Bates, and Stacey (1998) highlighted the importance of both social support from family and other participants in the exercise class, and gaining the psychological and psychosocial benefits from exercise, in helping to maintain adherence to exercise and other lifestyle changes. On a similar positive note, Mitchell, Muggli, and Sato (1999) found that individuals who consistently participated in the cardiac exercise program did not feel as though they needed to overcome barriers. Rather, they felt that they would do whatever was required to avoid another heart attack, and they used strategies, such as time management and financial budgeting to ensure their participation in the program.

In extensive literature searching, I uncovered only one study that used qualitative techniques to investigate perceived barriers to staying involved in self-initiated PA after CR. Fleury, Lee, Matteson, and Belyea (2004) recruited 160 participants who had recently finished the CR program. Six months after “graduating” from the CR program, participants completed an open-ended questionnaire to determine common barriers they experienced in maintaining PA. They found the most common barriers to maintaining PA after CR were intrapersonal barriers, such as physical condition, competing demands and lack of time, work responsibilities, and lack of motivation. Other common barriers reported were social or family obligations and inclement weather. Fleury et al. did not, however, examine the facilitators that helped people maintain PA. In addition, although Fleury et al. claimed that they used qualitative techniques, the participants did not complete an in-depth interview on their experiences with PA, rather they filled out an open-ended questionnaire, which only allowed them to list up to three barriers. Further research is clearly required that investigates the in-depth experiences of people with CHD, with reference to their ability to maintain regular PA, particularly after the conclusion of CR programs.

Effect of Depression on Adherence to Cardiac Rehabilitation and Physical Activity

Depression has been found to be a risk factor for non-adherence to general medical treatment (DiMatteo et al., 2000), cardiac-specific medical treatment (Carney, Freedland, Eisen, Rich, & Jaffe, 1995; Romanelli, Fauerbach, Bush, & Ziegelstein, 2002), CR programs (Glazer et al., 2002; Grace et al., 2005; Lane et al., 2001; Turner et al., 2002; Ziegelstein et al., 2000), and exercise programs (Castro, Wilcox, O'Sullivan, Baumann, & King, 2002; Dorn et al., 2001; Oliver & Cronan, 2002). In a meta-analysis of the effects of depression on patient adherence to various general medical treatments, DiMatteo et al. (2000) reported that, compared with non-depressed people, those with depressed mood were three times more likely to be non-adherent to medical treatment recommendations. In the CHD population, Carney et al. (1995) and Romanelli et al. (2002) found that depressed people were significantly less likely to adhere to specific cardiac treatment, such as taking aspirin and following a particular diet, than were those who were not depressed.

In a sample of 1,902 British CR participants, Turner et al. (2002) assessed predictors of defaulting from the CR program. Over a period of 6 years and 7 months, participants joined the community-based, hospital-linked CR program for a 2-6 month exercise and education course. Turner et al. used the HADS to measure depression levels before and after the program. Participants were considered to be non-compliant if they did not complete the CR program. Results indicated that one of the main predictors of non-compliance with the CR program was the presence of depression at the start of the program. Those individuals with borderline depression (a score of 8-10 on the HADS) or clinical depression (a score of 11 or more on the HADS) were twice as likely to default from the program as those who were not depressed.

Depression has also been found to predict non-adherence to exercise programs, in non-cardiac, clinical, and cardiac populations. For example, Castro et al. (2002), randomly assigned 100 sedentary women, who were caregivers for relatives with dementia, to an exercise program or an attention control condition. After a 12-month follow-up period, Castro et al. reported that the caregivers with lower baseline depression levels showed greater exercise adherence than those with higher baseline depression levels. Similarly, Oliver and Cronan (2002) found that, amongst other demographic and psychosocial variables, depression level was a predictor of continued engagement in exercise behaviour in a sample of people with fibromyalgia syndrome. In their research, Oliver and Cronan and Castro et al. acknowledged the physical and psychological importance of exercise for their respective populations, as well as highlighting the effect of depression on adherence to exercise.

Individuals with clinical depression or depressive symptoms are typically more likely to experience problems with adhering to PA, than people without depression (Seime & Vickers, 2006). Seime and Vickers proposed that people with depression often focus primarily on the barriers to exercise, leaving them feeling overwhelmed, and with a decreased sense of self-efficacy. Consequently, depressed individuals are more likely to relapse or give up after attempts at exercise. Wing et al. (2002) proposed a number of possible explanations why depressed individuals are less likely than non-depressed individuals to adhere to various forms of treatment. For example, they suggested that social isolation, cognitive impairment, feelings of hopelessness (thus, not expecting treatment to be effective), and a lack of energy, are all likely to negatively influence adherence, and of which factors are common in people with depression (Wing et al., 2002).

In reviewing the literature, I found that there have been very few qualitative studies investigating the perceptions of barriers and facilitators to PA, among people specifically with depression. Faulkner and Biddle (2004) provided a rare insight into the in-depth experiences of three individuals with clinical depression, regarding their PA habits over a period of one year. Faulkner and Biddle found that the benefits of exercise were seen as being an important coping strategy in their recovery from depression, rather than in the treatment of the depression. They also identified that, although the prominent initial motives for staying involved in the exercise programs were centred around distraction techniques and providing structure to the day, after some time, the motives became very individualised for each participant (e.g., social interaction, health concerns, improving body image). The three individuals in the study reported barriers to PA that are common to people without mental health problems, such as a lack of time, boredom, and social anxiety, however, the symptom of lethargy acted as a barrier for all three participants, at some point during the study.

Although not specifically investigating the effects of depression on exercise adherence, McDevitt, Snyder, Miller, and Wilbur (2006) examined barriers and benefits of PA for outpatients in psychiatric rehabilitation. McDevitt et al. used focus groups to collect their data and found that the key barriers affecting participation in

PA were mental illness symptoms, being medicated, gaining weight from medications, fear of discrimination, and safety concerns. Participants did, however, view PA positively, and they linked being active to improved mental health.

Research examining the relationship between adherence to PA or exercise programs and depression in people with CHD is relatively scarce. In an early study conducted in the USA, Blumenthal, Williams, Wallace, Williams, and Needles (1982) recruited 35 individuals, who had recently experienced a MI, to participate in a one-year exercise program. Before commencing the exercise program, participants' depression levels were measured using the MMPI. Participants were considered to be compliant with the exercise program if they attended 75% or more of all scheduled sessions. Blumenthal et al. found that those individuals who were considered to be non-compliant had higher levels of depression than those who participated for the prescribed duration of the program. Moreover, this relationship between depression and adherence to the exercise program was independent of physical status, such as left ventricular ejection fraction. Although this study did not include a RCT with a large sample size, it did offer important preliminary support for the relationship between adherence to exercise and depression in people with CHD.

More recently, Dorn et al. (2001) conducted a large (*N* = 651), randomised clinical trial designed to measure correlates of long-term exercise compliance in male MI survivors. They found that depressed mood, as measured by the Katz Depression Score, was one predictor that adversely affected compliance with the exercise program. Dorn et al. concluded that those participants, who were already at a high risk for experiencing further cardiac events due to elevated risk factors, including depression, were most likely to have low compliance.

The majority of literature on the relationship between depression and adherence to PA and CR that has been presented in this section of the chapter, used self-report PA tools to determine PA levels, or attendance at CR to determine adherence to CR, respectively. In extensive literature searches, I could not find any research that has investigated whether there is a relationship between depression levels and how active individuals *perceive* themselves to be (i.e., between depression and exercise SOC). A small number of studies have examined the relationship between depression and readiness to change other health behaviours, such as smoking (Prochaska et al., 2004; Tsoh & Hall, 2004) and excessive alcohol intake (Barnett et al., 2002; Blume, Schmaling, & Marlat, 2001), however, the findings in those studies have been equivocal in demonstrating a relationship. Interestingly, some studies have shown that higher depression levels may be linked to higher perceptions of readiness to change behaviours (e.g., Blume et al., 2001), whereas others do not show a clear relationship (e.g., Prochaska et al., 2004). Given the literature suggesting the positive effects of PA on depression, and the negative effects of depression on adherence to PA, it would be interesting to learn more about the relationship between depression and perceptions of exercise behaviour in a cardiac population.

Previous research, therefore, suggests that depression can adversely affect compliance with exercise programs in various populations, including clinical and cardiac populations. The negative influence of depression on adherence to PA has been clearly identified. I found no qualitative studies that have examined the personal experiences of people with *both* depression and CHD in terms of PA. Little, if anything, is known about what may hinder and facilitate participation in PA, particularly following the conclusion of hospital-based CR, among people with CHD who are depressed; similarly, means by which they attempt to overcome these barriers and enhance the facilitators are also unknown. The literature that does exist on PA experiences of people with CHD *or* depression has indicated that there are some factors influencing their participation in PA, which are seemingly specific to their condition. Currently, there is nothing to suggest whether the important factors that influence PA adherence for people with *both* CHD and depression, would be more similar to those expressed by people with either CHD or depression, or whether they would be specific to the group of people with both illnesses.

Researchers and practitioners would also benefit from learning more about the effect that mood can have on adherence to PA, and the effect of PA on mood for people with depression and CHD. Considering the benefits of exercise programs in reducing depression, and enhancing CHD and depression outcomes, gaining information on these PA experiences might give researchers an insight into how it may be possible to increase adherence to PA, which could have the potential to reduce depression levels. With this knowledge, interventions designed to increase adherence to PA, which are specific and effective for people with CHD and depression could be developed and implemented.

A topic within the area of exercise adherence and depression in people with CHD that has not been researched, and might be considered a “missed opportunity”, is an investigation of the relationship between depression and either self-reported PA or perceived exercise SOC, over time after a cardiac event. A number of studies have employed a longitudinal design to measure either PA (self-reported (e.g., Moore et al., 1998; Reid et al., 2006) or exercise SOC (Reid et al., 2007)), or depression (Grace et al., 2005) over time in a cardiac population, however, none have examined the relationship between PA and depression over time. Research has demonstrated that depression following a cardiac event can be a major problem for many people for months or years, and that PA may be effective in reducing depression. It would, therefore, be interesting to investigate in further detail how the relationship between actual, or perceived, PA and depression changes over time. It may be that depression is more problematic in affecting people's ability to be physically active immediately after a cardiac event, compared to following some time after a cardiac episode. In addition, it is possible that PA can have a greater effect on depression levels for people who have recently, compared to less recently, experienced a cardiac event. This would be important information, particularly in terms of knowing when it might be most appropriate and effective to implement an intervention to increase PA and decrease depression in people with CHD.

Interventions to Increase Adherence to Physical Activity

As previously mentioned, researchers have highlighted the risks of depression for both the development of CHD and poor prognoses for people with CHD. Researchers have also suggested there are a range of psychological and physiological benefits of adhering to PA following a cardiac event (e.g., Beniamini et al., 1997; Dugmore et al., 1999). The negative impact of depression on adherence to PA has also been demonstrated (e.g., Blumenthal et al., 1982; Dorn et al., 2001). Often these results are interpreted as implying depression causes poor adherence (Wing et al., 2002). Wing et al. suggested an alternative model, indicating that the behaviour (poor adherence to PA) may precede and influence the mood state (depression). They proposed that it may be more effective to directly focus on increasing the behaviour, in this case, PA, and that this increase in a desired behaviour will positively affect both depression and health outcome. According to Wing et al., therefore, interventions are required to increase compliance with PA, which, it is anticipated, may lead to a decrease in depression in people with CHD, in addition to numerous other benefits for health and quality of life.

In the following section, therefore, I examine various interventions designed to increase adherence to PA. Firstly, I address the issue of whether traditional, structured exercise interventions, or accumulated lifestyle PA interventions, utilising psychological strategies to enhance adherence, are more effective in helping people maintain PA. Then, I discuss the PA interventions and various strategies that have been conducted and utilised with people with chronic illnesses, such as CHD and depression. Finally, one particular type of exercise adherence intervention, known as exercise or PA consultation, is addressed in terms of implementation and effectiveness.

Exercise Prescription Versus Exercise Psychology

Structured PA interventions tend to refer to interventions that utilise the principles and guidelines of exercise prescription (Dunn et al., 1999). The specific exercise guidelines that are recommended by the American College of Sports Medicine follow the “FITT” principle: frequency (days per week), intensity (% of maximum capacity), time (duration on a given day), type (mode of exercise). The guidelines for cardiovascular/aerobic exercise suggest that people should engage in exercise on 3-5 days per week, at 50 to 85% of maximal heart rate, for 20 to 60 minutes (American College of Sports Medicine, 2006). Exercise prescription-type interventions focus on these guidelines, and are, therefore, usually quite structured in their approach to exercise.

Structured PA interventions appear to be successful in increasing PA, at least in the short-term. Dishman and Buckworth (1996) conducted a quantitative synthesis of the PA intervention literature published between 1965 and 1995. They concluded that interventions for increasing PA had a moderately large effect, equivalent to improving success from the typical rate of 50% without intervention, to about 80% with intervention. Dishman and Buckworth found that effect sizes, reported as *r* values (Pearson correlation coefficient), were larger for interventions that utilised behaviour modification approaches ($r = 0.92$), compared to any other intervention type, in particular, exercise prescription ($r = 0.21$). Effect sizes also differed according to the mode of PA. Effects for interventions focussing on active leisure time (no mode of activity was specified, but the goal involved increasing active leisure time), were larger compared with exercise programs that prescribed specific aerobic or strength-based exercise. In addition, Dishman and Buckworth reported larger effect sizes for studies in which PA was carried out at a lower intensity, compared with high-intensity exercise. Effect sizes did not, however, differ according to frequency. These results, therefore, suggest that structured or prescribed exercise interventions, that incorporate higher intensity exercise, may be less effective in encouraging PA, compared to unstructured interventions that focus on increasing lower intensity, active-leisure type exercise.

Structured exercise programs have been found to report drop-out rates of approximately 45% (Marcus et al., 2006). In their study with male cardiac patients, Dorn et al. (2001) reported a decrease from 80% adherence two months after commencement of an exercise trial, to 55% adherence six months after the start of the trial. The recommendations from a recent review by Marcus et al., support those of Dishman and Buckworth (1996), in suggesting that, although structured exercise programs may be appropriate for certain populations and settings, exercise professionals should consider broadening their recommendations to include exercise that focuses more on moderate intensity activities of daily living.

The current PA guidelines for the Australian (Australian Government Department of Health and Ageing, 2005) and US (Nelson et al., 2007) populations, recommend the accumulation of 30 minutes of moderate intensity PA on most, preferably all, days of the week. Both sets of guidelines specifically mention that the 30 minutes can be accumulated in 10-15 minute blocks, accumulated throughout the day. Taking these guidelines into consideration encouraged some researchers to conduct PA interventions based on lifestyle PA, rather than structured exercise interventions. Lifestyle PA refers to the incorporation of short bouts of moderate intensity PA into the daily routine, such as increasing walking and engaging in more vigorous tasks inside and outside the home (Blair, Kohl, & Gordon, 1992). Unlike structured exercise programs that often involve the activity being done at a specific time and place, lifestyle PA can be done throughout the day, without the need for specialised facilities or equipment (Richardson et al., 2005).

In two well-conducted RCTs with long follow-up periods, researchers have shown that a lifestyle approach to PA among previously sedentary adults may provide an effective and desired alternative to the traditional structured approach to PA promotion. Dunn et al. (1999) conducted a 2-year randomised trial that compared the effects of a lifestyle PA program, with a traditional structured exercise program on improving PA, cardiorespiratory fitness, and cardiovascular risk factors. They recruited sedentary men and women (*N* = 235) to take part in 6 months of intensive intervention, and 18 months of maintenance intervention in either a lifestyle PA (i.e., accumulating PA throughout the day, using various psychological tools to increase adherence), or structured (i.e., following basic exercise prescription guidelines) exercise program. Dunn et al. found that both the lifestyle and structured intervention groups had improvements in PA, cardiorespiratory fitness, and blood pressure at the conclusion of the 2-year study.

Andersen et al. (1999) examined short- and long-term changes in weight, body composition, and cardiovascular risk profiles in 40 sedentary, obese women. Similar to Dunn et al. (1999), participants were randomised, for 16 weeks, to either a structured aerobic exercise intervention, consisting of step aerobics classes, or a moderate-intensity lifestyle activity, where the women were taught and encouraged to incorporate short bouts of PA into their daily routines. All participants also took part in a cognitive behavioural weight loss program. The women were followed up for an additional year at the conclusion of the interventions, and encouraged to maintain the diet and activity program to which they had been randomised. Andersen et al. also found there were no differences in weight loss, cardiovascular profiles, and participation in PA for the two groups. Both intervention groups displayed improvements in all of these outcomes. Given that many sedentary men and women report common barriers to maintaining regular PA, such as lack of time, dislike of vigorous exercise, or lack of access to facilities, the results of Dunn et al. and Andersen et al. suggest that lifestyle approaches to PA may be equally as effective as structured exercise programs in achieving positive physiological outcomes, and in encouraging sustained PA in sedentary individuals.

In addition to adopting a lifestyle approach to encouraging regular PA, a number of researchers now are utilising various psychological strategies that are specifically designed to increase adherence to PA (e.g., Bock, Marcus, Pinto, & Forsyth, 2001; Brawley, Rejeski, & Lutes, 2000; Hughes et al., 2007). Dishman and Buckworth (1996), Marcus et al. (2006), and King, Rejeski, and Buchner (1998) have highlighted the importance of incorporating behaviour modification techniques into interventions to increase the likelihood of adherence. Such techniques include, but are not limited to, goal setting, self-monitoring, relapse prevention training, feedback, and follow-up telephone contact (King et al., 1998; van der Bij, Laurant, & Wensing, 2002). Studies and strategies of this kind are discussed in further detail in the coming sections of this chapter.

One particular theoretical perspective that is often incorporated into PA interventions is the transtheoretical model (TTM), known also as the stages of change (SOC) model. As previously mentioned, this model helps determine individuals' particular level of readiness to change a behaviour, such as exercise. The model suggests that people pass through specific stages as they attempt to change their behaviour. Marcus and colleagues have used the SOC model to develop and test the effectiveness of self-instruction PA interventions in the general community population (Bock et al., 2001; Marcus, Bock et al., 1998; Marshall et al., 2003) and in the workplace (Marcus, Emmons et al., 1998). These studies tend to compare the effectiveness of two types of print-based intervention formats: either individualised, motivationally-tailored materials that specifically match to the individuals SOC, or standard exercise promotion materials. The findings from these studies indicate that, for the general population, interventions tailored to the individual's specific SOC tend to be more effective in promoting PA, than those interventions, which are not stage-specific. Similar results have been reported in studies that employ stage-specific telephone counselling (Castro & King, 2002). As well as being effective in promoting PA in various populations, telephone counselling is also accessible and cost-effective (Castro & King, 2002).

Several researchers have also commented on the benefits of incorporating the SOC model, and its associated strategies, into interventions designed to enhance exercise adherence in people with CHD and other chronic illnesses (e.g., Bock et al., 1997; Guillot, Kilpatrick, Hebert, & Hollander, 2004; Hellman, 1997). For example, Bock et al. (1997) proposed that interventions need to be tailored for individuals in different stages of readiness for behaviour change. Some individuals beginning CR might be highly motivated and ready to exercise, whereas others may be inactive and have little interest in changing their current habits. It is unlikely that the same intervention will be effective in achieving the desired goals and outcomes of CR for individuals at these different stages of readiness (Bock et al., 1997). Guillot et al. suggested that interventions to increase adherence to rehabilitation programs should focus on building self-efficacy and promoting the development of the cognitive processes of change, through effective goal setting and education. Hellman advised that interventions should address the significant predictors of exercise adherence, particularly the modifiable variables, such as perceived self-efficacy, perceived benefits of, and barriers to, exercise, and interpersonal support for exercise. The use of the SOC/TTM model in PA interventions is discussed in more detail in the *Exercise Consultation* section.

In the following sections, I describe PA interventions that have been designed for people with CHD or depression. This discussion does not include the more structured exercise program interventions, but focuses on those that measure lifestyle PA, or that utilise specific psychological strategies, designed to increase adherence to exercise and PA.

Interventions to Increase Physical Activity in People with Coronary Heart Disease

Previous research has highlighted the problems associated with adherence to PA and CR for people with CHD. A number of studies have focussed on the factors associated with a lack of adherence, so researchers and health professionals alike are beginning to understand why people may not participate or adhere. Although there were a small number of RCTs in the 1980s (e.g., Daltroy, 1985; DeBusk, Haskell, Miller, Berra, & Taylor, 1985; Oldridge & Jones, 1983), Beswick et al. (2005) commented that, in the published literature prior to the year 2000, there were very few RCTs, or well designed studies, that investigated interventions or strategies designed to increase adherence to CR and PA. There have been some major advances in the PA intervention literature, however, in recent years. Particularly between 2003 and 2008, there have been a number of RCTs, investigating various interventions designed to enhance adherence to PA for people with CHD. The results of these studies have begun to provide interesting and important findings about programs and strategies that may be effective in helping people with CHD maintain regular exercise. The interventions focussing on increasing adherence to PA, rather than CR, are described in detail in this section.

Self-management techniques may be effective in improving adherence to exercise rehabilitation programs in people with CHD (Arrigo, Brunner-LaRocca, Lefkovits, Pfisterer, & Hoffmann, 2008; Oldridge & Jones, 1983; Sniehotta et al., 2005). Arrigo et al. randomised participants who had recently completed CR programs ($N = 261$), into either an intervention group or a usual care group. The aim of the study was to determine any effects of the intervention on adherence to PA at the 1-year follow-up. The intervention group were instructed on using a diary to record PA, and they also attended a physician-supervised group exercise session, every 3 months for 12 months. The usual care group were asked to return after 1 year for re-evaluation, without any on-going contact. At the 1-year follow-up, Arrigo et al. concluded that significantly more participants from the intervention group had adhered to regular PA, compared to the usual care group. Arrigo et al., however, gave very little information about exactly how PA adherence was measured, and whether the effect of increased adherence for the intervention group was the result of the diary activity or the follow-up contact provided by the group sessions.

Similar types of interventions have recently been conducted in Germany, in which psychological interventions, designed to increase adherence to PA, have focussed on developing cardiac patients' self-regulatory skills. Sniehotta et al. (2005) randomly assigned 240 participants, to one of two psychological interventions ("planning only" intervention or "planning plus diary" intervention), or a standard care control group. All participants were taking part in the standard care CR program at the time of recruitment. Both of the intervention groups participated in an individual planning session, towards the end of their CR program, which included both action planning (i.e., outlining when, where, and how they planned to be physically active), and coping planning (i.e., identifying potential barriers to their plans, and solutions to overcome these barriers). One of the intervention groups (planning plus diary) also received, by mail, 6 weekly diaries after discharge from the CR program, which they were required to complete and return to the researchers. Each diary included the individual plan of the participant, along with questions regarding their PA over the week, and their confidence in adhering to their plan over the next week. The plan could be updated at any stage. The control group continued with standard cardiac care. Participants were required to complete a series of questionnaires at baseline, and 2 and 4 months later.

Sniehotta et al. (2005) found that participants in the intervention groups engaged in more PA at follow-up, and had better adherence to recommended levels of exercise intensity than standard care patients. In addition, self-regulatory skills, including planning and action control, were significantly higher in the two treatment groups, compared to the control group. Particular improvements were noticed in action control, in the participants from the planning plus diary condition. Participants in this condition had very high behavioural intentions to exercise throughout the course of the study, and these intentions remained strong even at the 4-month point, at which time intentions of participants from the planning only and control conditions, decreased markedly. Sniehotta et al. concluded that interventions designed to improve self-regulatory skills can facilitate intended lifestyle changes, such as PA, in people with cardiac disease.

Scholz et al. (2006) further developed their previous study (Sniehotta et al., 2005), by measuring the effects of a self-management intervention on depressive symptoms, in addition to PA adherence, and included a longer follow-up period. Scholz et al. randomly assigned 198 CR participants into either an intervention condition, or a usual care control condition. The intervention was the same as the "planning plus diary" intervention used by Sniehotta et al. Therefore, both action planning and coping planning strategies were implemented, and diaries were completed by these participants. Participants in both the intervention and control condition completed a package of questionnaires, including the CES-D to measure depression, and a measure of goal attainment, at baseline, and 4 and 12 months later.

Scholz et al. (2006) found that participation in the intervention led to a significant increase in PA at both follow-up time points, and a decrease in depressive symptoms after 12 months. Surprisingly, they also found that perceived attainment of exercise goals, and not PA itself, was the mediator between the intervention and reduction of depression. Despite these unexpected results, Scholz et al. demonstrated that achieving personal goals during health behaviour change may be of particular importance for lowering depressive symptoms. Further research should investigate the use of goal attainment as part of PA adherence interventions for people with CHD and depression.

Testing the effectiveness of a lifestyle modification program for increasing adherence to exercise in the year following CR, Moore et al. (2006) randomly assigned 250 participants to either an intervention group, termed “CHANGE” (Change Habits by Applying New Goals and Experiences), or the usual care only group intervention. The CHANGE intervention, which also included usual care, consisted of five small group cognitive behavioural change counselling sessions, three of which were delivered over the final few weeks of the CR program, and the final two, over the first two weeks after CR had concluded. The sessions addressed issues surrounding exercise maintenance, such as self-efficacy enhancement, problem solving, relapse prevention, peer modelling, goal setting, and self-assessment. Exercise frequency, intensity, and duration were measured via a portable wristwatch heart-rate monitor, in addition to exercise maintenance, which consisted of the number of months in which participants continued exercising after the conclusion of the CR program. Moore et al. found that the participants in the usual care group were 76% more likely than those in the CHANGE intervention to stop exercising in the year after CR. Moore et al. did still find, however, that all participants had less than recommended levels of exercise. Moore et al. concluded that the CHANGE intervention had been effective in reducing the likelihood of participants stopping exercise in the year after completing a CR program, but the intervention needed some improvements to ensure maintenance of exercise did not decrease over time.

In another study, Carlson, Johnson, Franklin, and VanderLaan (2000) designed a reduced-cost, modified protocol (MP) for CR, and compared it to the traditional CR protocol (TP), in terms of, amongst other things, exercise adherence.

Participants were randomly assigned to the MP or the traditional protocol (TP), after completing the first 4 weeks of the standard CR program. The MP was developed to promote independent exercise and increase self-efficacy, and involved a predominantly off-site exercise regimen, educational support meetings, and telephone follow-up. The TP included three on-site exercise classes per week for 6 months, yet did not have a strong focus on education or encouraging off-site independent exercise. The results indicated that the MP participants had significantly higher rates of exercise adherence, and were more likely to continue participating in the program than were those in the TP. Physiological outcomes were comparable in both groups, and the MP cost significantly less than the TP. Carlson et al. attributed the findings of increased exercise adherence and participation in the MP to greater flexibility in programming and the emphasis on promoting independent exercise.

In the study conducted by Carlson et al. (2000), although there were not exact details of how long the weekly support and education meetings in the MP continued for (i.e., whether they continued from Week 6 through to the conclusion of the intervention at 6 months), this form of follow-up may have positively influenced exercise adherence. Very few of the studies that have conducted psychological interventions designed to increase exercise adherence in people with CHD, have implemented a long-term continuation of the intervention (i.e., longer than approximately 6 weeks), whether it be face-to-face or over the telephone, despite being recommended as being an important factor in successful PA interventions (Simons-Morton, Calfas, Oldenburg, & Burton, 1998). This is clearly an area of research that should be investigated in further interventions.

Several studies have provided researchers and clinicians with information on the factors that are associated with low participation and adherence to CR and PA, as well as suggestions for how interventions to increase adherence should be designed and conducted (Bock et al., 1997; Guillot et al., 2004; Hellman, 1997; Woodard & Berry, 2001). A small number of psychological interventions, designed to increase adherence to PA in people with CHD, have been conducted (e.g., Carlson et al., 2000; Moore et al., 2006; Scholz et al., 2006; Sniehotta et al., 2005), with some positive findings emerging for the particular psychological strategies employed. Despite these recent advances in knowledge, there are still very few psychological interventions that have been conducted with people with CHD, and many strategies and techniques that may be effective in increasing adherence to PA, have received little or no research attention. The scope for further research into the effectiveness of PA adherence interventions for this population is extensive and such research is necessary. Knowing the importance of PA for this population should be a focus of cardiac research in the coming years.

Interventions to Increase Physical Activity in People with Depression

As I have previously highlighted, although PA can be highly beneficial for people with depression, often people with this mental health problem can have difficulties adhering to regular PA. In recent years, structured and supervised exercise intervention studies have been conducted with people with depression, often resulting in positive results of increased PA (Stathopoulou et al., 2006). Very few studies, however, have examined the effects of PA adherence interventions, which utilise psychosocial strategies and techniques specifically designed for people with depression, and that measure lifestyle PA, rather than adherence to structured exercise programs. The intervention studies that do exist, however, are discussed in this section.

Vickers et al. (in press) conducted a pilot study to test the feasibility of an exercise counselling intervention for depressed women smokers. Vickers et al. randomly assigned 60 female smokers into either the exercise counselling intervention (*n* = 30) or the health education contact control condition (*n* = 30). Participants in both conditions received 10 weeks of individually-tailored sessions, in addition to nicotine patch therapy and brief behavioural counselling for smoking cessation. The exercise counselling incorporated cognitive behavioural exercise intervention strategies, such as discussing personal benefits of exercise, problem solving around barriers to exercise, goal-setting, and dealing with lapses in activity. The health education condition included a variety of health topics, such as sleep hygiene and nutrition. Participants completed assessments at the end of the intervention (Week 10) and follow-up (Week 24), and included measurements of depression, smoking status, PA levels, and exercise SOC.

Overall the exercise adherence intervention in Vickers et al. (in press) was found to be feasible for depressed female smokers. Exercise counselling participants attended an average of 7.6 sessions (out of 10), during the intervention phase, and these participants had significantly increased their PA at Weeks 10 and 24 compared to baseline. In addition, significantly more exercise counselling participants were in the action SOC compared to health education participants, however, health education participants had a significantly greater reduction in depression scores at Week 10 than did those participants in the exercise counselling condition. Although attrition rates from the intervention were approximately 35% and almost 50% by follow-up, Vickers et al. noted the promising finding that 65% of participants did complete the intervention, and given that all participants were depressed, these were satisfactory rates. The authors also noted that future studies should include a larger sample size and consider recruiting women with milder depression, for which this type of intervention may be more effective.

Richardson et al. (2005) also acknowledged the importance of, yet also lack of, lifestyle PA interventions for people with mental illness. In an attempt to determine if such a program could be feasible for people with depression and other serious mental illness, Richardson et al. recruited 39 individuals with depression or other mental illness, such as bipolar disorder or schizophrenia, to take part in an 18-week lifestyle modification program which focussed on promoting PA and healthy eating. The intervention consisted of nine, 1-hour group sessions. The first 6 sessions were delivered weekly during the intensive phase of the intervention, while the final three sessions were delivered monthly, during the maintenance phase. Sessions included educational discussion on topics related to exercise and healthy eating, behavioural activities, such as goal setting and discussions about overcoming barriers, and a group walk for 20 minutes. Participants recorded their daily step count using pedometers.

In the study by Richardson et al. (2005), the main outcome measures were participation and dropout rates, participant satisfaction, and barriers to implementation. Although Richardson et al. did experience high drop-out rates (fewer than one-third of participants attended the final follow-up session at 18 weeks), they concluded that people with mental health problems can participate in a lifestyle intervention program. Decreases in depression were reported, in addition to satisfaction from the participants with the intervention, however, these results must be interpreted with caution, due to the high dropout rates, and small final number of participants. Total step counts were relatively high during the intensive phase of the intervention, and although there was a trend towards a decrease in step counts by the session in the 18th week, this trend did not reach significance.

Richardson et al. (2005) acknowledged that the adherence rate was disappointing, and that certain characteristics of the intervention may have had an impact on these low adherence rates, such as the longitudinal design, and infrequent monthly meetings during the maintenance phase of the intervention. People who did continue to attend the program until its conclusion, however, reported great satisfaction with the intervention, and many continued with a walking group after the program had finished. As previously mentioned, people with depression can experience greater problems with adhering to regular PA, compared to people without depression (Seime & Vickers, 2006). Conducting longitudinal PA interventions with people with depression, therefore, can be very challenging, particularly in terms of retention of participants. Despite these difficulties, more studies similar to the one completed by Richardson et al. and Vickers et al. (in press), need to be conducted with large samples and incorporating a control condition, to test the efficacy of psychosocial PA interventions for people with depression.

Although there are very few PA adherence intervention studies that have specifically been designed and tested with depressed individuals, some researchers and clinicians have highlighted important factors to consider, and techniques that may be implemented when encouraging exercise adherence with depressed people. For example, Applegate, Rohan, and Dubbert (1999) suggested using strategies, such as providing objective feedback regarding progress, setting short- and long-term exercise goals, and ensuring that exercise programs are enjoyable, rewarding, and individually tailored. From a psychotherapist's perspective, Pollock (2001) highlighted the importance of the relationship between the professional and the person with depression. He argued that developing an exercise initiation and maintenance plan, which should be based on an analysis and assessment of the relevant barriers and facilitators to exercise for the individual, is essential. Pollock also suggested that, for professionals working with people with depression, the individual with depression should drive the assessment, and eventual addressing, of barriers and facilitators. This should ensure the exercise plan is unique to the individual, and is likely to increase the chances of adherence to the exercise (Pollock, 2001).

Similar to the suggestions of Pollock (2001) and Applegate et al. (1999), Seime and Vickers (2006) recommended that interventions to increase adherence to PA among depressed individuals should be individualised, rather than taking an exercise prescription approach of “one-size-fits-all”. Seime and Vickers also stressed the importance of addressing many aspects of PA with depressed individuals, such as the benefits of PA that are particularly salient to them, the types of PA they enjoy, past and current PA behaviour, the pros and cons of increasing PA, the perceived barriers to PA, and strategies they believe will help overcome these barriers. Other strategies recommended by Seime and Vickers, include discussing how PA can be incorporated into the daily routine, setting realistic short and long-term goals, highlighting the importance of social support, and the need to offer follow-up contact, such as a brief telephone call.

In summary, strategies have been proposed that may be effective in increasing adherence to PA for people with depression. Very few of the strategies, however, have actually been analysed in terms of efficacy in RCTs. The task of conducting a longitudinal, controlled, PA adherence intervention study with depressed individuals is likely to present many challenges, particularly in terms of retention of participants. It is very important, however, that researchers now apply the information that is known about the benefits of PA, taking into account the problems of adherence for people with depression, and design and implement effective and appropriate intervention studies.

Exercise Consultation to Increase Adherence to Physical Activity

Background and Guidelines

Exercise consultation interventions have recently emerged as an alternative to structured exercise programs. Also referred to as PA consultations or PA counselling, exercise consultations aim to promote and maintain PA behaviour change (Kirk et al., 2007). These interventions generally focus on the PA recommendations, which advise the accumulation of 30 minutes of moderate-intensity PA on most days of the week, making them accessible and achievable for the whole population, especially for those individuals who are sedentary or have a chronic illness. Loughlan & Mutrie (1995) published guidelines for conducting an exercise consultation, in which they focussed on the use and benefits of this type of intervention for increasing adherence to PA in the general population. Since then, Mutrie and colleagues have been pivotal in continuing the research on general population (e.g., Fitzsimons et al., 2008; Lowther, Mutrie, & Scott, 2002), and also in adapting the exercise consultation for use in chronic illness populations (Kirk et al., 2007), particularly diabetes (e.g., Jackson, Asimakopoulou, & Scammell, 2007; Kirk, Mutrie, MacIntyre, & Fisher, 2003; Kirk, Mutrie, MacIntyre, & Fisher, 2004a), and CHD (Hughes et al., 2002; Hughes et al., 2007). The promising findings of these studies will be discussed in the next section.

The TTM is the underlying theory of behaviour change for exercise consultation interventions (Kirk et al., 2007; Loughlan & Mutrie, 1995). As previously mentioned, the TTM suggests that individuals move through five stages when changing behaviour. These stages are labelled precontemplation, contemplation, preparation, action and maintenance (Prochaska & Marcus, 1994). Movement through these stages is not always linear, however, and individuals can relapse back one or more stages at any time (Kirk et al., 2007). The fundamental element of the exercise consultation is that the advice and strategies given to the participant are directly tailored to their individual SOC and particular needs, and they are designed to help individuals progress through to the next stage. Exercise consultations tend to be most effective for people wanting to become more active (i.e., those in the contemplation and preparation stages), and less so for people in the precontemplation stage, who require additional strategies to move them closer to being in a stage of readiness to change behaviour (Loughlan & Mutrie, 1995). People within the action and maintenance stages can also benefit from exercise consultation, because of the strategies that can be applied to avoid relapsing back into an earlier stage (Kirk et al., 2007).

An advantage to exercise consultations, over some other psychological interventions, is that they can be delivered by any health professional, such as fitness professionals or any member of a health care team, requiring only minimal training in the delivery of cognitive behavioural interventions and PA knowledge (Kirk et al., 2007). Exercise consultations tend to be brief (approximately 30 minutes), one-to-one, patient-centred, and utilise a semi-structured approach. The content, strategies, and format of an exercise consultation are largely determined by the person’s motivational status, SOC, and personal needs, however, general guidelines as to how to conduct an exercise consultation have been proposed (Kirk et al., 2007; Loughlan & Mutrie, 1995).

Kirk et al. (2007) and Loughlan and Mutrie (1995), have suggested that when conducting exercise consultations with people in the contemplation or preparation stages, the focus should be on enhancing motivation, overcoming barriers, and developing an appropriate activity plan. Once the relevant SOC for the individual has been determined, the health professional conducting the consultation could begin by asking the participant about their past and current PA, to discover likes and dislikes. Next, a decision balance sheet (i.e., writing down the pros and cons of increasing PA levels) (Wankel, 1984) can be completed. The aim of the decision balance sheet is that the participant perceives that the pros of increasing PA levels outweigh the cons. The consultation should then involve a discussion of the participant's perceived barriers to becoming more active, and then develop strategies to overcome these barriers. The strategies need to be individualised and directly related to the barriers identified by the participant. For example, if the participant has identified lack of time as a barrier, then time-management strategies should be the focus.

The final section of the consultation involves developing realistic, specific, and measurable goals with the participant. Goals should be divided into short-term (1 month), intermediate (3 months), and long-term (6 months). To enhance motivation, the participant should be encouraged to take responsibility for the development of their PA goals (Kirk et al., 2007; Loughlan & Mutrie, 1995). Two other factors that have been shown to improve adherence to PA, and should, therefore, be explored in the exercise consultation are self-efficacy (Kirk et al., 2007) and social support (Loughlan & Mutrie, 1995). Strategies designed to enhance self-efficacy and increase supportive social support can be implemented at any stage throughout the process of the exercise consultation.

Kirk et al. (2007) suggested that, for people who are in the action or maintenance stages of exercise behaviour change, the focus of the consultation should be on relapse prevention and ensuring long-term maintenance of a physically active lifestyle. Strategies that can be used to prevent relapse, include identifying situations that may have a negative impact on PA maintenance (e.g., busy work schedule), and developing ways to prevent relapse during these high-risk situations (e.g., time-management). In addition, successful attempts and benefits of PA can be re-emphasised, and any barriers, addressed accordingly.

Evidence for Effectiveness of Exercise Consultation Interventions

Over the past 10 years, the effectiveness of exercise consultation interventions in increasing adherence to PA have been tested in general populations (e.g., Fitzsimons et al., 2008; Lowther et al., 2002), and in people with chronic illness (e.g., Hughes et al., 2007; Jackson et al., 2007; Kirk et al., 2004b). Promising findings have been demonstrated in these studies, with exercise consultation resulting in better adherence rates to PA, compared to other more structured intervention types (Lowther et al., 2002) or control conditions (Kirk et al., 2004b). Lowther et al. found that, compared to a fitness assessment intervention, participants from the general population, who took part in an exercise consultation, had significantly better long-term adherence to PA. In addition, the exercise consultation intervention, rather than the fitness assessment intervention, was the preferred intervention choice for participants who were not regularly active, which confirmed the prediction of Lowther et al. about the suitability of this intervention type for sedentary individuals.

The appropriateness of exercise consultations for increasing PA in people with chronic illnesses, such as Type 2 diabetes and CHD, has also been demonstrated. Kirk et al. (2001) conducted one of the first studies, which applied the guidelines for conducting an exercise consultation proposed by Loughlan and Mutrie (1995), to people with Type 2 diabetes. Kirk et al. conducted a pilot study with 26 sedentary individuals with Type 2 diabetes, to test the effectiveness of an exercise consultation for promotion of PA. Even with a small sample size, and short (5-week) follow-up period, Kirk et al. demonstrated significant effects of the intervention on advancing exercise SOC, and increasing PA levels, compared to a control condition.

With a larger sample size than their original pilot study (Kirk et al., 2001), Kirk et al. (2004b) randomised 70 sedentary individuals with Type 2 diabetes, to either an experimental condition (*n* = 35), or control condition (*n* = 35). The experimental condition consisted of an exercise consultation intervention, according to Loughlan and Mutrie's (1995) guidelines, with face-to-face consultations at baseline and 6 months, and phone call consultations at 1, 3, 7, and 9 months. Participants in the control condition received a standard exercise leaflet at baseline and 6 months, and follow-up phone calls at the same times as the consultation group, discussing matters unrelated to exercise. PA was measured subjectively (self-report) and objectively (accelerometers) at baseline, 6 months, and 12 months. Results from Kirk et al. (2004b) demonstrated that self-reported PA had significantly increased for the intervention condition, but not for the control condition, and accelerometer PA had significantly decreased for the control, but no change was recorded for the intervention. Also, at 12 months, a significantly larger number of participants from the intervention condition were in the active SOC, compared to the control condition. The particular strengths of this study were the use of both objective and subjective measures of PA, as well as the long-term intervention delivery, and long follow-up period.

Two studies (Hughes et al., 2002; Hughes et al., 2007) have applied the exercise consultation intervention to a CHD-population. Similar to the pilot study conducted by Kirk et al. (2001), Hughes et al. (2002) tested the effectiveness of an exercise consultation intervention with participants from the maintenance phase of CR with CHD. Thirty-one participants were randomly assigned to either an exercise consultation intervention (*n* = 16) or control condition (*n* = 15). After baseline measures of PA levels and stage of exercise behaviour change were taken, both groups received a standard exercise leaflet. The intervention group also received a 30-minute, individualised exercise consultation, as outlined by Loughlan and Mutrie (1995), utilising strategies to promote PA, based on the SOC of the participant. Both groups were measured again in terms of PA levels 4 weeks after baseline. Hughes et al. (2002) found that exercise consultation significantly improved participants' short-term (i.e., four weeks) adherence to exercise during Phase IV of CR.

Again, following a similar design to Kirk et al. (2004a, 2004b), Hughes et al. (2007) built on their earlier study (Hughes et al., 2002), by conducting a more detailed intervention, with a longer follow-up and larger sample size. Seventy cardiac patients were randomised into either an exercise consultation intervention (*n* = 35), which involved participants receiving a standard exercise leaflet, plus face-to-face exercise consultations at baseline and 6 months, and phone consultations at 3 and 9 months, or a control condition (*n* = 35), in which participants received a standard exercise leaflet, and phone calls discussing non-exercise matters, at the same time as the intervention group. Amongst other variables, PA was measured at baseline, 6 months and 12 months. Hughes et al. (2007) found that total PA increased slightly in the intervention group, but significantly decreased in the control group from baseline to 12 months. Depression was also measured using the HADS, at all three time points. Depression levels were found to be low at baseline and did not change significantly in either group over time. These low levels of depression are somewhat contradictory to previous research, which has shown depression levels in cardiac patients to be quite high. However, the intervention was not specifically intended to reduce depression, so recruitment of participants was not based on depression levels. In addition, the sample in Hughes et al. (2007) may have had slightly lower levels of depression compared to those found in previous studies because all of the participants in the study had just participated in a CR program, and had agreed to take part in an intervention study. This study provides further evidence for the efficacy of the exercise consultation process in maintaining PA, and demonstrates the specific positive effects for people with CHD.

To date, exercise consultation, as described in this section, has not specifically been applied to a depressed population. Seime and Vickers (2006) highlighted that depressed people may require additional support to initiate and maintain PA, due to the barriers they may experience, and consequently that interventions to increase adherence to PA among this population need to be individualised. In addition, Seime and Vickers and Applegate et al. (1999) identified a range of strategies to help depressed people maintain PA, and many of these are very closely matched with those in an exercise consultation. For example, Seime and Vickers stressed the importance of addressing the benefits of PA that are particularly salient to each individual, the types of PA people enjoy, past and current PA behaviour, the pros and cons of increasing PA, the perceived barriers to PA, and strategies they believe will help overcome these barriers. In addition, goal setting, social support, and follow-up contact are all strategies that can help depressed individuals maintain PA (Seime & Vickers, 2006). There is every reason to believe, therefore, that an exercise consultation would be well suited for use among people with depression. It can also be assumed that, due to the success of the exercise consultation intervention among people with chronic illnesses, such as diabetes and CHD, and the suggestion that this type of intervention would be suitable for people with depression, exercise consultations could be effective in increasing adherence to PA in people with both CHD *and* depression. RCTs, similar to those by Kirk et al. (2004b) and Hughes et al. (2007), should be conducted with people with depression alone, and depression and CHD, to determine the effectiveness of this type of intervention in promoting and maintaining PA within these populations.

Summary of Literature

Research has demonstrated a relationship between depression and the development and poor prognosis of CHD. Depression is common in people with CHD, even up to 12 months after the cardiac event. PA has been shown to be effective in reducing cardiac-related mortality and morbidity, and in improving psychological health, including depression, for individuals with CHD. Despite the known benefits of PA, however, many people with CHD are not engaging in sufficient levels to reap its many positive effects. Research suggests that depression is likely to be a risk factor for non-adherence to PA and CR. Fortunately, interventions designed to increase adherence to PA can be effective for people with CHD or depression.

Although some of these topics have been well researched, there are others within the area of CHD, PA, and depression that have either been partly or fully ignored. I propose that one of the key topics requiring further research is investigating the change *over time* in the relationship between depression and PA, in people with CHD. A number of studies have demonstrated patterns of depression after a cardiac event, and to a lesser extent, patterns of PA, however, the way in which the two are related and the changes that may occur in their relationship over time have not been explored in any detail. In addition, more in-depth, qualitative information is required on the PA experiences of people with CHD *and* depression. Finally, despite having a greater understanding of both the positive effects of PA for reducing depression, and the negative influence of depression on PA for people with CHD, there have been very few interventions designed specifically for people with depression and CHD, aimed at increasing PA adherence, and possibly decreasing depression.

Purpose of the Present Thesis

The overall aim of this thesis is to examine the relationship between PA and depression in people with CHD. As discussed in the literature review, there are a number of topics within the area of CHD, PA, and depression that remain unexamined. This thesis aims to address some of these issues. In Study 1, I use quantitative techniques to investigate depression and PA levels of people with CHD. I examine the changes in these two variables from baseline to approximately 6 to 9 months later, in addition to ascertaining the nature of their relationship at both time points. Exercise SOC and its relationship to depression is also explored. The second study is a qualitative investigation of the PA experiences of people with both CHD and depression. Specifically, I am interested in learning about the factors that affect participation in PA for people who had recently completed the hospital-based CR program. I use the information gained in Study 2, in addition to the relevant literature, to help guide the design and implementation of the intervention program presented in Study 3. The intervention consists of specific techniques to help increase adherence to PA. Changes in PA, depression, and exercise SOC are recorded over the 6-month follow-up period.

CHAPTER 3: AN INVESTIGATION OF DEPRESSION, PHYSICAL ACTIVITY, AND EXERCISE STAGE OF CHANGE OVER TIME IN PEOPLE WITH CORONARY HEART DISEASE

Introduction

Depression is common among people with CHD, with at least mild depression being reported in almost half of all people recovering from a cardiac event (Schleifer et al., 1989). Twelve months after a cardiac event, a high prevalence of depression is still evident (Grace et al., 2005). PA has been shown, through a small number of studies (e.g., Blumenthal et al., 2005), to reduce depression levels in people with CHD, in addition to having numerous other psychological, physical, and quality of life benefits. Despite this, many people with CHD, particularly those who are also experiencing depression, do not engage in sufficient PA to reap its many positive effects (Dorn et al., 2001). In addition, adherence to PA has been shown to decrease over time in cardiac populations (Reid et al., 2006). There is evidence to suggest that depression has an adverse effect on adherence to PA for people with CHD (Dorn et al., 2001). Very little research has specifically focussed on the relationships between depression and PA, either self-reported PA or perceived PA (exercise SOC). Further, no study has investigated how these relationships change over time, particularly in the first 12-18 months after experiencing a cardiac event.

Having identified these gaps in the literature and on assessing the importance of this topic, the overall aim of the current study was to investigate the relationship between depression and PA in people with CHD. Within this overall aim, I was interested in examining the changes over time since the cardiac event in depression and PA, the differences related to level of depression on PA, and the relationships between exercise SOC, depression, and PA. To examine the changes over time since the cardiac event in depression and PA, I measured the variables at both baseline and follow-up (approximately 6-9 months after baseline). In addition, at baseline, participants were categorised as having experienced their event between 1-6 months previously (termed “1-6 month” participants) or 7-12 months previously (termed “7-12 month” participants). The term “all participants” was used when analyses consisted of both the 1-6 and 7-12 month participants. Depression was presented as a total score and also categorised as “no depression”, “minor depression”, or “major depression” (according to scores on the CDS). Exercise SOC was expressed in terms of the five stages of change, and categorised as “inactive” or “active”. PA was reported as total minutes per week spent in leisure-based PA, and also divided into four subscales: “walking”, “sport”, “manual labour”, and “active housework”. In line with the analyses of the data, the specific aims of this study were as follows:

At baseline:

1. To identify baseline levels of depression, leisure-based PA (subscales and total), and perceived exercise SOC for: (a) all participants; (b) 1-6 month participants; (c) 7-12 month participants.
2. To investigate the difference in depression levels for the 1-6 month participants compared to the 7-12 month participants.
3. To determine the differences in leisure-based PA (subscales and total) for the 1-6 month participants compared to the 7-12 month participants.
4. To examine the relationship between depression and leisure-based PA (subscales and total) for: (a) all participants; (b) 1-6 month participants; (c) 7-12 month participants.
5. To assess the differences in PA levels for people with no depression, minor depression, or major depression.

6. To analyse the difference in leisure-based PA levels for people who were active compared to inactive, according to classifications on the exercise SOC model, for: (a) all participants; (b) 1-6 month participants; (c) 7-12 month participants.
7. To determine the differences in depression levels for people who were active compared to inactive, according to classifications on the exercise SOC model, for: (a) all participants; (b) 1-6 month participants; (c) 7-12 month participants.

At follow-up:

8. To ascertain whether there were any changes in depression, leisure-based PA (subscales and total), and perceived exercise SOC, at follow-up (T2) compared to baseline (T1).
9. To explore any changes in the relationship between depression and leisure-based PA (subscales and total) over time (T2 compared to T1).
10. To examine any differences in depression levels for people who were active compared to inactive, according to classifications on the exercise SOC model for T1 and T2.
11. To analyse any differences in changes in depression levels for people who were inactive at T1 and T2, inactive at T1 but active at T2, active at T1 and T2, active at T1 but inactive at T2.

Method

Participants

I recruited 102 participants (72 males and 30 females) with a mean age of 66.6 years (range 39 – 89 years) in this study. All participants had experienced a cardiac event within the 12 months prior to recruitment and had been referred to a CR program at the Western, Sunshine, or Williamstown Hospital, in the western suburbs of Melbourne, Victoria. PA had been considered safe and appropriate for each participant. There were 53 and 43 participants respectively who had experienced their cardiac event between 1-6 months and 7–12 months prior to completing the questionnaires. Six participants did not indicate when they had experienced their cardiac event. All participants were English speaking.

Measures

Demographics

I obtained demographic details of participants via a questionnaire, including age, gender, occupation, type of CHD, date of first diagnosis, time since last cardiac episode, attendance at hospital or community-based CR, smoking status, physical co-morbidities (e.g., diabetes, high blood pressure), and past or current mental illness. See Appendix A for the demographic questionnaire.

Cardiac Depression Scale

The Cardiac Depression Scale (CDS) (Hare & Davis, 1996) consists of 26 items, and measures depressed mood in people who have experienced a cardiac episode (see Appendix B). Items are rated on a 7-point Likert Scale from 1 (*strongly disagree)* to 7 (*strongly agree)*. The CDS consists of 7 subscales, as follows: (1) the sleep subscale (2) the anhedonia subscale; (3) the uncertainty subscale; (4) the mood subscale; (5) the cognition subscale; (6) the hopelessness subscale; (7) the inactivity subscale. Some examples of items from the CDS include “My sleep is restless and disturbed”, “My problems are not over yet”, “I feel frustrated”, “Dying is the best solution for me”, and “I can’t be bothered doing anything much”. Subscale scores are calculated by summing the item scores that comprise each subscale (Hare & Davis, 1996), and a total CDS score is the sum of all subscale scores. Total scores range from

26 to 182. Shi, Stewart and Hare (2008) found that a score of 80-100 on the CDS indicates minor depression. Shi et al. validated the CDS against the DSM-IV and reported a sensitivity of 94% and specificity of 77%. Similarly, in another study (Di Benedetto, Lindner, Hare, & Kent, 2006), a score of over 80 indicated depressive symptomatology. A score of 100 or more on the CDS indicates major depression (validated against the DSM-IV), with a sensitivity of 95% and specificity of 92% (Shi et al., 2008). Wise, Harris, and Carter (2006) also found that a score over 100 on the CDS was considered to be “more severe” depression. The internal reliability of the CDS (Cronbach’s alpha = 0.90) is high (Birks et al., 2004; Hare & Davis, 1996), and concurrent validation against the Beck Depression Inventory ($r = 0.79$) and the Hospital Anxiety and Depression Scale ($r = 0.77$) show strong correlations (Birks et al., 2004).

Scottish Physical Activity Questionnaire

The Scottish Physical Activity Questionnaire (SPAQ) (Lowther, Mutrie, Loughlan, & McFarlane, 1999) consists of five questions to assess participants’ current stage of exercise behaviour change and the time spent in occupational and leisure PA over one week (see Appendix C). The exercise SOC question requires participants to indicate their current SOC by ticking one of five boxes (pre-contemplation, contemplation, preparation, action, or maintenance). Time spent in occupational and leisure PA is recorded, in minutes, in a diary format for the previous week. Participants also indicate whether the recorded previous week was a typical week in terms of PA. If it was not, the participant specifies the amount of time spent in their usual activities for a typical week. PA at work is also assessed. The occupational PA subscale consists of walking at work and manual labour at work. The leisure PA subscale includes walking, sport, manual labour at home, and active housework. Test-retest reliability of the SPAQ is strong with a correlation coefficient of 0.998 (Lowther et al., 1999). I chose the SPAQ as a measure of PA in the present sample because of its successful use in another study of exercise adherence in CR participants (Hughes et al., 2002), and also because of the straight-forward nature of the questionnaire. Minimising participant burden was a high priority in the present study.

Procedure

I gained approval from Victoria University Human Research Ethics Committee and Melbourne Health's Mental Health Research and Ethics Committee and then recruited participants through CR referrals, according to the criteria cited in the *Participants* section. I mailed participants a package that comprised an invitation letter explaining the research project (Appendix D), a plain language statement / participant information form (Appendix E), the demographic questionnaire, the CDS, the SPAQ, a form indicating the participant's consent for me to contact them about further research (Appendix F), and a reply paid envelope.

I invited participants to take part in the research by completing the coded questionnaires and returning them in the reply paid envelope. I coded questionnaires in order to match up each participant's responses in the follow-up aspects of the research and to ensure anonymity. I employed a separate form to identify interested and appropriate participants for Study 2. Return of the questionnaire package indicated consent to participate. If participants were interested in taking part in further research, they returned the form with their contact details listed. On receipt of completed questionnaire packages, I separated the identifying forms from the questionnaires, to ensure confidentiality of participants' responses. Follow-up letters were sent to all participants (Appendix G), thanking them for their involvement and encouraging those who had not completed their questionnaires, to do so at their earliest convenience. A total of 562 questionnaire packages were sent out to potential participants (excluding 22 questionnaires that were either returned to sender, the participant was deceased or too ill to complete the questionnaires, or the participant did not speak English). The overall return rate was 18% (*N* = 102).

Approximately 6 months after the initial questionnaires were completed, I sent out an invitation letter (Appendix H), participant information form (Appendix I), and follow-up questionnaires to those participants who had expressed an interest in further research (*n* = 67, 66% of total sample). The questionnaires were the same as those sent out at baseline (i.e., the CDS and the SPAQ), but the demographic form was not sent again. Similar to the baseline data collection phase, I also sent out follow-up letters (Appendix G) approximately 3 weeks after mailing the questionnaires, thanking participants for taking part. The response rate for the follow-up study was 70% of those participants who indicated their interest in further research and provided us with their contact details. This represented 45% (*n* = 46) of the overall baseline sample.

At both the baseline and follow-up time points, I classified participants, by exercise SOC on the SPAQ, as either inactive (pre-contemplation, contemplation, or preparation stages) or active (action or maintenance stages), using these classifications in an attempt to distinguish differences between participants who thought they were regularly physically active compared to those who did not.

Analysis

I summarised and statistically described the questionnaire data using the computer-based statistical package, Statistical Package for the Social Sciences (SPSS) Version 15, analysing data in two main sections: baseline (initial testing period) and follow-up (6-9 months later). Within the baseline section, I used statistics, such as means (or medians), standard deviations (or interquartile ranges (IQR), and frequencies, to describe the variables (e.g., demographic information, depression, PA (leisure-based subscales and total), exercise SOC) for all participants and the subgroups of 1-6 and 7-12 month participants. Prior to carrying out inferential statistics, I checked all data for normality and skewness. Following the advice of Tabachnick and Fidell (2001) and McDougall and Rayner (2004), any data that was heavily skewed according to the skewness value and standard error of skewness calculated from SPSS (i.e., a skewness value of 2 or more standard errors of skewness was considered to be skewed to a significant degree), was analysed using medians, IQR, and an appropriate non-parametric test.

To determine any differences in total depression scores between the 1-6 and 7-12 month participants, I used an independent samples t-test. For the PA data, I used the non-parametric test, Mann-Whitney U, to ascertain whether there were any differences in total and subscale scores of leisure-based PA for the 1-6 and 7-12 month participants. This test was used because all of the PA data was heavily skewed to the right (e.g., the skewness value determined through SPSS for baseline leisure-based PA was 1.6) indicating more people were involved in lower levels of PA, compared to higher levels and, therefore, violated the assumptions of normality necessary for the independent t-test. Due to the small number (n = 21, 21%) of participants in this study who were employed on either a full- or part-time basis, and because of the problems acknowledged by the authors of the SPAQ (Lowther et al., 1999) with the measurement of occupational PA, particularly with reference to excessive reporting of walking in the workplace, I decided to exclude occupational PA from the analysis, so I only included the leisure PA measurements.

To determine any relationship between depression and PA (subscales and total) in the baseline data (for all participants, and subgroups of 1-6 and 7-12 months), I conducted correlation analyses (Pearson's *r*). According to Gravetter & Wallnau (2009), Pearson's *r* was an appropriate correlation analysis to use because the depression and PA data were both measured on an interval scale and a linear relationship was expected.

For any of the statistically significant correlations, I employed a univariate analysis of variance (ANOVA) to compare PA levels of individuals with no depression, minor depression, and major depression, according to the CDS. To investigate whether there were any differences in (a) PA levels (as measured by the SPAQ); (b) depression scores, for people who were active (action or maintenance stage of change classifications), or inactive (precontemplation, contemplation, or preparation stage of change classifications), for all participants, and the subgroups of 1-6 and 7-12 months, I used independent samples t-tests.

For the follow-up data, I used a paired t-test to analyse change over time in total depression scores. Once again, due to problems associated with skewness for the total and subscale PA data (e.g., skewness value for follow-up leisure-based PA was 1.5), the non-parametric test, Wilcoxon, was used to investigate change over time in PA. Similar to the baseline analyses, I conducted Pearson's r correlations to test the relationship between depression and PA (subscales and total) for follow-up participants at T1 and T2. I also used independent sample t-tests to analyse differences in depression levels for the different SOC (inactive and active) for T1 and T2. To determine differences in changes in depression levels for people who were active at T1 and T2, active at T1 but not at T2, not active at T1 or T2, or not active at

T1 but active at T2, change scores for depression were calculated, and a univariate ANOVA was employed.

Where appropriate, I interpreted the strength of the differences in means between variables using effect sizes (Cohen's d). Cohen (1988) defined effect size as "the degree to which the phenomenon exists" (p. 4). Effect size is calculated by dividing the difference between two means by the pooled standard deviation of those means. According to Cohen, a small, medium, and large effect size exists with a Cohen's d score of 0.2, 0.5, and 0.8, respectively. For r-values, however, small, medium and large effect sizes are equal to 0.1, 0.3, and 0.5, respectively (Cohen, 1988).

Results

I have divided results for this study into sections termed "baseline" (between 1 and 12 months post cardiac event) and "follow-up" (approximately 6 months later). For the baseline section, I present characteristics of the sample, depression and leisure-based PA data, results demonstrating the relationship between depression and PA, and exercise SOC data. The follow-up section consists of similar sections to those for the baseline data, demonstrating changes that occurred over the 6-9 month time period from baseline to follow-up testing for the 46 individuals who participated at follow-up.

Baseline

Characteristics of Sample

Participant characteristics are presented in Table 3.1. There were 53 and 43 participants, who had experienced their cardiac event between 1-6 months and 7-12 months prior to taking part in this study, respectively. Six participants did not indicate when they had experienced their cardiac event. There were notably more males than females in the study, particularly in the 1-6 month time period, and more employed individuals in the 1-6 month time period, compared to the 7-12 period. More of the 7-12 month individuals had attended CR, which is most likely due to some of the participants in the 1-6 month group not having begun their CR at the time of taking part in this study. For all participants, 35% had a heart attack, 25% had a stent(s) inserted, 18% had bypass surgery, 13% were admitted for unstable angina, 8% had a valve repaired or replaced, and 1% had a pacemaker inserted. For 61% of the sample, the recent cardiac event was their first experience with CHD, and for 39% it was a pre-existing condition. The most common co-morbidities were diabetes (32%), arthritis (25%), high blood pressure (13%), high cholesterol (4%), and cancer (6%). Over one third of participants with diabetes also had arthritis. Depression was the most common mental health problem reported (10%). Three individuals reported having being diagnosed with post-traumatic stress disorder, and two people with agoraphobia.

Table 3.1

Baseline Characteristics of Sample for all Participants, and Subgroups of 1-6 Months and 7-12 Months Post Cardiac Event.

	Age Mean (*SD*)	Male Gender (%)	Employed (%)	Current smokers (%)	Past smokers (%)	Cardiac rehabilitation attendance (%)
All participants	66.6 (10.4)	71	21	11	57	68
1-6 months post event	65.0 (9.9)	77	26	9	59	58
7-12 months post event	67.7 (10.9)	67	16	9	56	70

Depression

Mean depression scores on the CDS are shown in Table 3.2 for all participants, and the subgroups of 1-6 months and 7-12 months post cardiac event. On average, participants scored in the "minor" depression category (*M* = 87.9). Although there was no statistically significant difference in depression scores for the 1-6 and 7-12 month participants, and only a small effect size (*d* = 0.28), the 1-6 month participants did score marginally higher on the CDS (*M* = 90.1), compared to the 7-12 month participants (*M* = 81.7), indicating slightly higher levels of depression.

Table 3.2

Mean Baseline Cardiac Depression Scale Scores, and Number and Percentage of Participants Classified as Having No Depression, Minor Depression, and Major Depression for all Participants, and Subgroups of 1-6 Months and 7-12 Months Post Cardiac Event.

	N	CDS scores Mean (*SD*)	CDS scores <80 *n* (%) No dep.	CDS scores 80-99 *n* (%) "Minor" dep.	CDS scores 100+ *n* (%) "Major" dep.
All participants	102	87.9 (30.7)	39 (38)	26 (26)	37 (36)
1-6 months post event	53[#]	90.1 (29.7)	17 (32)	16 (30)	20 (38)
7-12 months post event	43[#]	81.7 (29.9)	21 (49)	10 (23)	12 (28)

Note. CDS = Cardiac Depression Scale; categorisation of depression scores based on Shi et al. (2008); Dep. = Depression.

[#] A total of six participants did not indicate when they had experienced their cardiac event, and therefore could not be included in the 1-6 or 7-12 month subgroups.

Independent samples t-test not significant, $p > .05$.

The different levels and distribution of depression in the two subgroups, however, are worth noting. For the 1-6 month participants, over two thirds (68%) were experiencing at least minor depression, compared to half (51%) of the 7-12 month participants. Therefore, approximately half of the participants in the 7-12 month time period were not depressed, compared to only 32% of the 1-6 month participants. In addition, there were 10% more of the 1-6 month participants who were experiencing major depression compared to the 7-12 month participants. A chi square analysis was performed, however, no significant differences were found between depression levels in the 1-6 and 7-12 months subgroups, χ^2 (2) = 2.9, $p > .05$.

Physical Activity

Table 3.3 shows the medians and interquartile ranges for total leisure-based PA and the leisure-based PA subscales of the SPAQ for all participants, and the subgroups of 1-6 and 7-12 months post event. The Mann-Whitney U test indicated there were no statistically significant differences in overall leisure-based PA between the 1-6 and 7-12 month participants, with a negligible effect size, $U = 1025$, $p > .05$, $d = 0.02$. Compared to the 1-6 month participants, the 7-12 month participants, however, did report higher levels of PA on the walking, active housework, and manual labour subscales, whereas the 1-6 month participants were engaging in higher levels of sport. Although there were no statistically significant differences, people who had attended CR engaged in slightly higher levels of PA, compared to those people who had not.

Table 3.3

Medians and Interquartile Ranges for Total Leisure-Based Physical Activity and Subscales (in Minutes per Week) for all Participants, and Subgroups of 1-6 Months and 7-12 Months Post Cardiac Event.

	N	Leisure-based PA Median (*IQR*)	Walking Median (*IQR*)	Sport Median (*IQR*)	Manual labour Median (*IQR*)	Active housework Median (*IQR*)
All participants	101*	360 (475)	150 (247)	0 (60)	0 (127)	45 (127)
1-6 months post event	52#	372 (670)	145 (279)	30 (60)	0 (180)	0 (120)
7-12 months post event	43#	380 (420)	195 (190)	0 (60)	30 (120)	60 (145)

Note. PA = physical activity; IQR = interquartile range.

*One participant did not complete the physical activity questionnaire.

#A total of six participants did not indicate when they had experienced their cardiac event, and therefore could not be included in the 1-6 or 7-12 month subgroups.

Mann-Whitney U tests not significant, $p > .05$.

Relationship between Depression and Physical Activity

Pearson product-moment correlations between depression scores on the CDS and total and subscale leisure-based PA were, on average, small but negative (excluding the active housework subscale; Table 3.4). For the whole sample, the 1-6 month, and 7-12 month participants, the only statistically significant relationship ($p < .01$) was a negative correlation between depression and the walking subscale, for all participants.

Table 3.4

Correlations (r) for Depression and Physical Activity for all Participants, and Subgroups of 1-6 Months and 7-12 Months Post Cardiac Event.

	N	CDS and leisure-based PA	CDS and walking	CDS and sport	CDS and manual labour	CDS and active housework
All participants	98*	-.19	-.27**	-.17	-.07	.01
1-6 months post event	51#	-.13	-.21	-.19	-.06	.11
7-12 months post event	41#	-.17	-.26	-.14	-.06	.06

Note. PA = physical activity.

*One participant did not complete the physical activity questionnaire. Three participants were excluded from this analysis due to having exceptionally high physical activity levels.

#A total of six participants did not indicate when they had experienced their cardiac event, and therefore could not be included in the 1-6 or 7-12 month subgroups.

**Correlation significant at $p < .01$

A univariate ANOVA revealed that there was a statistically significant difference in the amount of walking undertaken by participants with no depression, minor depression, and major depression, $F(2,98) = 4.56$, $p < .05$. Table 3.5 shows the average amount of walking, in minutes per week, undertaken by participants in the three depression categories. A parametric test (ANOVA), and means and standard deviations are presented here, rather than a non-parametric test and medians and interquartile range, because the walking subscale was not highly skewed. Scheffe post-hoc tests demonstrated there was a statistically significant difference ($p < .05$) in mean walking levels for those people with no depression compared to major depression. Those people who were not depressed engaged in 100 minutes more of walking per week compared to those with major depression. The mean difference in walking levels for people with no depression compared to minor depression approached statistical significance.

Table 3.5

Mean Walking Levels (in Minutes per Week), According to Categories of Depression for all Participants.

		Walking subscale
Level of depression	*N*	Mean (*SD*)
Not depressed	39	242.8 (166.1) *
Minor Depression	26	149.4 (170.0)
Major Depression	36	142.1 (140.6) *

Note. Not depressed = score < 80 on the Cardiac Depression Scale (CDS). Minor depression = score 80 - 99 on the CDS. Major depression = score > 100 on the CDS; categorisation of depression scores based on Shi et al. (2008).

* Mean difference significant at $p < .05$ level.

Exercise Stage of Change

I classified individuals who perceived themselves as being in precontemplation, contemplation, or preparation (according to the TTM), as being inactive, and I considered those in action and maintenance to be active. Although both are subjective measures, an independent samples t-test confirmed that there were statistically significant differences in reported weekly PA on the SPAQ for the active ($M = 663$, $SD = 476$) and inactive ($M = 364$, $SD = 445$) participants according to exercise SOC, $t(97) = 3.27$, $p < .001$, $d = -0.66$. Table 3.6 shows the breakdown of individuals in each SOC. Although the overall figures show that approximately half of the 1-6 month participants and the 7-12 month participants were inactive (and half were active), the number of individuals in the precontemplation and contemplation stages for each time period were essentially reversed. That is, the majority of the 1-6 month participants who were inactive were in the contemplation classification, compared to the 7-12 month participants, who were mostly in the precontemplation category.

Table 3.6

Number of Individuals in Each Category of Exercise Stage of Change for all Participants, and Subgroups of 1-6 Months and 7-12 Months Post Cardiac Event.

		Inactive			Active	
	N	Precontemplation *n* (%)	Contemplation *n* (%)	Preparation *n* (%)	Action *n* (%)	Maintenance *n* (%)
All participants	100*	11 (11)	12 (12)	31 (31)	7 (7)	39 (39)
1-6 months post event	$51^{\#}$	2 (4)	10 (20)	16 (31)	4 (8)	19 (37)
7-12 months post event	$43^{\#}$	8 (19)	1 (2)	12 (28)	3 (7)	19 (44)

Note. *Two participants did not complete the stage of change measure.

$^{\#}$ A total of six participants did not indicate when they had experienced their cardiac event, and therefore could not be included in the 1-6 or 7-12 month subgroups.

I present mean depression levels for all participants and the subgroups of 1-6 and 7-12 months post-cardiac event, according to exercise SOC, in Table 3.7. Independent t-tests revealed statistically significant differences in depression levels, according to exercise SOC. For all participants, and for the 1-6 and 7-12 month participants, active individuals were significantly less depressed than inactive individuals. Mean depression levels for inactive individuals among the 1-6 month (*M* = 98.2) and 7-12 month (*M* = 95.4) participants were in the major depression category. In comparison, for active individuals who had experienced their cardiac event between 1-6 and 7-12 months previously, mean depression levels were in the "no depression" (*M* = 77.4 and *M* = 68.6 respectively) category. It is also interesting to note that for all participants (i.e., active and inactive) whose heart event occurred 7-12 months earlier, depression levels were slightly lower than the participants whose event was in the previous 1-6 months. There were, however, no statistically significant differences in depression levels for the active 1-6 month, compared to 7-12 month participants, or the non-active 1-6 month, compared to 7-12 month participants.

Table 3.7

Differences in Mean Depression Levels According to Level of Activity for all Participants, and Subgroups of 1-6 and 7-12 Months Post Cardiac Event.

	Level of activity	*N*	CDS scores Mean (*SD*)	t-value (*t*)	*p*-value (*p*)	Effect size (*d*)
All participants	Inactive	54	99.4 (29.1)	4.80	<.0001	0.96
	Active	46	72.8 (25.9)			
1-6 months post event	Inactive	28	98.2 (27.1)	2.66	<.01	0.75
	Active	23	77.4 (28.7)			
7-12 months post event	Inactive	21	95.4 (30.6)	3.27	<.01	1.0
	Active	22	68.6 (22.9)			

Note. CDS = Cardiac Depression Scale; Inactive = precontemplation, contemplation, and preparation stages of change. Active = action and maintenance stages of change.

Follow-up

Characteristics of Sample

Forty-six participants (33 males; 13 females) with a mean age of 65.4 years took part in the follow-up phase of this study (45% of baseline sample; 70% of contactable and interested participants). Participants who took part in the follow-up phase were significantly more active (M = 620 minutes per week, SD = 490) than participants who did not take part (M = 409 minutes per week, SD = 449; $t(99) = 2.26$, $p < .05$, $d = 0.45$). Participants who took part were also less depressed (M = 84.4, SD = 30.6) than those who did not (M = 90.8, SD = 30.8), although the results were not statistically significant.

In this section, I present depression scores, PA levels, and exercise SOC information for the follow-up group in the following sections. I refer to baseline data as Time 1 (T1) and follow-up data as Time 2 (T2).

Depression

Scores on the CDS for the 46 participants are presented in Table 3.8. There were no significant differences in depression scores over time, $t(44) = 0.09$, $p > .05$, $d = -0.02$, with CDS scores being almost identical for T1 and T2. Mean depression levels at both time points were in the lower end of the minor depression category.

In examining individual CDS scores, the results indicated that at T2, 18 people were more depressed than at T1, 21 people were less depressed, and six people scored approximately the same (within 2 CDS points). Out of the 18 individuals whose CDS scores increased over time, five people still stayed within the no depression and minor depression categories, three people moved from no depression to major depression, three people moved from no depression to minor depression, and seven people showed increased scores within the major depression category.

Table 3.8

Cardiac Depression Scale Scores for Time 1 and Time 2.

	N	CDS scores Mean (*SD*)	CDS scores < 80 *n* (%) No dep.	CDS scores 80 – 99 *n* (%) Minor dep.	CDS scores 100+ *n* (%) Major dep.
Time 1	45*	84.1 (30.9)	21 (46)	9 (20)	15 (34)
Time 2	45*	83.8 (34.2)	21 (47)	9 (20)	15 (33)

Note. CDS = Cardiac Depression Scale; categorisation of depression scores based on Shi et al. (2008); Dep. = depression.

*One participant did not complete the Cardiac Depression Scale at Time 1 and one participant did not complete the Cardiac Depression Scale at Time 2.

Paired t-test not significant, $p > .05$.

For the 21 people who were less depressed at T2, nine of them were not depressed at T1, five moved from minor to no depression, three people moved from major to minor depression, one person moved from major to no depression, and three people decreased depression, but still stayed in the major depression category. Overall, out of 45 individuals at T2, over half reported at least minor depression, and 15 people (33%) still reported major depression at the time of follow-up.

Physical Activity

Table 3.9 shows the medians and IQR for the total leisure-based PA and the leisure-based PA subscales of the SPAQ at T1 and T2. Non-parametric Wilcoxon tests revealed no statistically significant differences over time for total PA or any of the subscales of PA. The active housework subscale, however, did approach statistical significance, and a medium effect size was found.

Table 3.9

Medians and Interquartile Ranges for Total Leisure-Based Physical Activity and Subscales (in Minutes per Week) for Time 1 and Time 2.

	N	Leisure-based PA Median (*IQR*)	Walking Median (*IQR*)	Sport Median (*IQR*)	Manual labour Median (*IQR*)	Active housework Median (*IQR*)
Time 1	46	455 (570)	210 (261)	0 (60)	68 (212)	60 (146)
Time 2	45*	460 (607)	225 (377)	0 (120)	60 (180)	120 (197)

Note. PA = physical activity; IQR = interquartile range.

*One participant did not complete the physical activity questionnaire at Time 2.

Wilcoxon tests not significant, $p > .05$

Relationship between Depression and Physical Activity

I present correlations between leisure-based PA and depression in Table 3.10. At T1, for the majority of PA subscales (excluding active housework), there was a small, negative relationship with depression (i.e., higher depression levels associated with lower levels of PA). At T2, although not statistically significant, the PA subscale that demonstrated a slightly larger negative correlation with depression was the walking subscale. The sport and manual labour subscales had a small, negative relationship with depression. There was a small, but positive, relationship between the active housework subscale and depression, indicating that higher depression scores were associated with higher levels of housework. Although not a statistically significant change, over time there was a small but noticeable increase in the negative correlation between depression and the walking subscale.

Table 3.10

Correlations for Depression and Physical Activity for Time 1 and Time 2.

	CDS and leisure-based PA	CDS and walking	CDS and sport	CDS and manual labour	CDS and active housework
Time 1	-.18	-.11	-.15	-.16	.11
Time 2	-.16	-.27	-.10	-.19	.10

Note. CDS = Cardiac Depression Scale; PA = physical activity.

Exercise Stage of Change

Similar to the baseline exercise SOC data, participants were classified as inactive or active according to their selection of SOC on the SPAQ. Table 3.11 shows the breakdown of individuals in each SOC for the follow-up analysis.

Table 3.11

Number of Individuals (%) in Each Category of Exercise Stage of Change (Follow-up).

		Inactive			Active	
	N	Precon-templation *n* (%)	Con-templation *n* (%)	Prepar-ation *n* (%)	Action *n* (%)	Mainten-ance *n* (%)
Time 1	45*	3 (7)	6 (13)	13 (29)	4 (9)	19 (42)
Time 2	44*	3 (7)	2 (4)	11 (24)	5 (11)	23 (51)

Note *One participant did not complete the stage of change measure at Time 1 and two participants did not complete the stage of change measure at Time 2.

Exercise SOC classifications in Table 3.11 show that, at T1, 22 people (49%) were classified as not regularly active and 23 (51%) as active. At T2, 16 (36%) and 28 people (64%) were classified as being inactive and active respectively. From T1 to T2, 16 people moved up at least one stage (i.e., one stage closer to maintenance), six people moved back at least one stage (i.e., one stage closer to precontemplation), and 22 people stayed within the same stage. Of the 16 people who moved up a stage, six people increased depression levels and 10 decreased. Of the six individuals who moved back a stage, four people increased depression levels and two decreased their levels.

The results in Table 3.12 indicated that at T1, inactive participants were significantly more depressed than those who were active, with a medium to large effect size, $t(43) = 2.23$, $p < .05$, $d = 0.66$. Similar to T1, at T2, inactive participants were significantly more depressed than those who were active and the effect size was very large, $t(42) = 3.65$, $p < .001$, $d = 1.15$.

Table 3.12

Differences in Mean Depression Levels According to Level of Activity for Follow-Up Participants at T1 and T2.

	Level of activity	*N*	CDS scores Mean (*SD*)	t-value *(t)*	*p*-value (*p*)	Effect size (*d*)
Time 1	Inactive	22	92.3 (28.8)	2.23	<.05	0.66
	Active	23	72.8 (30.0)			
Time 2	Inactive	16	106.6 (21.2)	3.65	<.001	1.15
	Active	28	72.5 (33.6)			

Note. CDS = Cardiac Depression Scale; Inactive = precontemplation, contemplation, and preparation stages of change. Active = action and maintenance stages of change.

It is interesting to note in Table 3.12, the very high depression levels of those individuals who classified themselves as inactive; at T1, scores were on average, well within the minor depression category, and at T2, scores were well within the major depression category. By comparison, at both T1 and T2, active participants were in the no depression category.

In determining whether there were any differences in depression levels for participants who were (i) inactive at T1 and T2 (ii) inactive at T1 but active at T2 (iii) active at T1 and T2, or (iv) active at T1 but inactive at T2, depression change scores (T2 minus T1) were calculated and a univariate ANOVA was conducted. Table 3.13 demonstrates the mean depression change scores of participants, according to their classification into one of the abovementioned four groups.

Table 3.13

Mean Depression Change Scores for the Classifications of Physical Activity Patterns.

Physical activity pattern over time	N	Mean depression change score (Time 2 – Time 1)
Inactive, inactive	11	9.09
Inactive, active	9	-7.56
Active, active	19	-1.84
Active, inactive	4	6.00

Note. Univariate ANOVA not significant, $p > .05$.

The univariate ANOVA revealed there were no statistically significant differences in the depression change scores of participants according to their PA patterns over time, $F(3,39) = 1.25$, $p > .05$. Despite the lack of significant differences, it is important to note which of the four groups had lower, and which had higher, depression scores at T2 compared to T1. Those individuals who were inactive at T1 but active at T2 had the greatest decrease in depression levels over time, and those who were active at both time points had a slight decrease in depression. On the other hand, individuals who were either active at T1 but inactive at T2, or inactive at both T1 and T2, on average, had increased depression levels over time.

Discussion

In this study, I examined the patterns of, and relationship between, depression and PA in people with CHD. I also investigated changes that occurred in depression and PA, and in their relationship over time. In addition, I determined whether there was a difference in depression levels for people who were classified as active compared to inactive, as identified by their self-rated exercise SOC. An analysis of the results showed that, in general, there were no statistically significant changes in either PA or depression levels over time, although there were some interesting findings within this data. Also, on average, I found small, negative correlations between PA subscales and depression. Depression levels were high both at the initial and follow-up testing periods, with over 50% of participants continuing to experience at least minor depression at follow-up. I also found that participants who were regularly active were significantly less depressed than those who were not regularly active at baseline and follow-up.

Depression

The results indicated that depression scores did not change significantly over time, although there were some interesting findings when depression scores were examined more closely. The observation that there were no statistically significant changes in depression levels over time (i.e., from T1 to T2) is meaningful because this indicates that, on average, participants had minor depression within the first year of having their cardiac event, and this depression was still evident six months later. In fact, according to the CDS classification of levels of depression (Shi et al., 2008; Wise et al., 2006), prevalence of minor and major depression were almost identical at both T1 and T2. Approximately half of the participants involved in the follow-up study had no depression at both time points, 20% had minor depression, and just over

30% were experiencing major depression at follow-up. The results also indicated that most of those participants who had major depression at T1 were still experiencing these high levels of depression six months later. It is also important to note that the individuals involved in the follow-up study were, on average, less depressed than those who were only involved in the baseline study. The depression data presented in the follow-up aspect of the current study may, therefore, be an underestimate of the true prevalence rates of depression for people with CHD.

On a similar note, there was no statistically significant difference in depression levels for the 1-6 and 7-12 month groups. Participants whose heart event was within the 1-6 months prior to the study did, however, have higher mean depression levels compared to participants whose event was 7-12 months earlier. There were also small differences in the levels of depression for the two categories of participants. There were almost 20% more people with at least minor depression among the 1-6 month participants, compared to the 7-12 month participants, and approximately double the number of people who had major depression. Depression levels and rates of severity for the 7-12 month participants were very similar to those reported by participants at T2.

As reported in Chapter 2 of this thesis, prevalence rates of depression in people with CHD can vary, depending on the tool used to measure depression and the level of depression being measured (i.e., minor or major depression). Major depression (as measured by the DSM-IV) is commonly reported to affect approximately 15-20% of people who have had a cardiac event (Lichtman et al., 2008), and minor depression can affect another 20-30% of this population (Lesperance & Frasure-Smith, 2000; Schleifer et al., 1989).

Using the CDS to measure major and minor depression in a CR population, Wise et al. (2006) found prevalence rates of 22% and 17% respectively. The prevalence of minor depression in the present study closely matches that of the previous research, however, with approximately one third of participants experiencing major depression in the present study, I found substantially higher levels of major depression than Wise et al. This is possibly because, in the Wise et al. study, all participants were attending the CR program and completed the CDS during their initial assessment, whereas in the present study, only 68% of participants had attended CR, and participants completed the questionnaire outside the hospital setting. Research has demonstrated that those individuals with higher levels of depression are less likely to attend CR (e.g., Turner et al., 2002). It is possible, therefore, that the present sample had a higher prevalence of major depression because this study included people who had, and had not, attended CR. These findings are very important for health professionals and researchers because they add support to the body of evidence that suggests major depression is highly prevalent in people with CHD, and possibly even more so in people who are not accessing services, such as CR.

The results of the present study also support previous research findings (e.g., Grace et al., 2005; Hance et al., 1996; Lane et al., 2002; Schleifer et al., 1989), that depression levels do not reduce significantly over time. Similar to the findings of the present study, Lesperance et al. (1996) and Lane et al. (2002) found that a number of their participants became more depressed over the 6-12 months following their cardiac event. This is a concern because, usually, in Australia, additional support services, such as hospital-based CR programs, conclude 3-6 months after a cardiac event (Goble & Worcester, 1999), and support for individuals after 6 months may not be as high as it was in the initial months after the cardiac event. In order to address the problem of high, and often persisting, levels of depression in people with CHD, it appears that this population may need to be monitored and offered follow-up support, for *at least* six months after their cardiac event.

Overall, these results suggest that minor and major depression in people with CHD is common. In addition, for people who experience high levels of depression soon after a cardiac event, the likelihood of their depression levels decreasing over time is quite low. This is a very important issue, particularly because previous research has consistently shown that post-event depression is associated with an increase in all-cause and cardiac-related mortality (Carney et al., 2008; Frasure-Smith et al., 1993), morbidity (Borowicz et al., 2002; Carney et al., 1988), functional disability (Egede, 2007), and lower quality of life (Parashar et al., 2006). It is imperative, therefore, that further research is conducted into the processes and implementation of assessment, referral, management, and treatment of depression in people with CHD, to ensure they have the best possible overall health prognosis.

Physical Activity and Exercise Stage of Change

Total leisure-based PA levels did not change significantly over time, although, in general, I recorded higher levels of PA in the follow up study (T2). At both T2 and in the 7-12 month group, participants reported higher levels of walking and housework, however, at T2, slightly lower levels of manual labour were reported, compared to T1. It is likely that the higher level of sport reported by people in the 1-6 month group was a result of the CR program being classified as “sport” in the SPAQ, and, typically in Australia, CR occurs during the first 6 months after a heart event (Goble & Worcester, 1999).

Active housework was the one subscale of PA that approached a statistically significant difference over time, and for which a medium effect size was found. Participants in the follow-up phase reported higher levels of housework than they did at the baseline time period. This may be associated with an uncertainty about how much participants believed they could do with reference to vigorous housework soon after experiencing a cardiac event, or following advice to limit the amount of heavy housework that is undertaken in the early weeks or months following a cardiac event. In general, the Australian CR guidelines (Goble & Worcester, 1999), suggest that people should use the level of perceived exertion during CR exercise sessions as a guide for appropriate levels of activity at home, and that they can resume most activities when they feel confident to do so and if they have no symptoms. The guidelines also suggest that CR programs should include more formal aspects of exercise, such as walking, stationary bike riding, and weight training (Goble & Worcester, 1999), so people actually get to “test out” these activities in a safe environment. In most cases, simulations of housework activities would not be incorporated into the CR program. Less housework soon after a heart event may also be the result of a spouse, other family member, or a carer taking over the role of doing the housework, while the person recovers from their heart event.

In addition to active housework, participants tended to engage in higher levels of walking at T2 compared to T1, although the difference did not reach statistical significance. The general increase in PA over time is a positive finding, however, it is somewhat surprising given that other studies have shown that PA levels of cardiac populations decrease over time. For example, Dorn et al. (2001) found that adherence to exercise decreased over their randomised exercise trial, with the largest decrease in adherence observed between 8 weeks, at which time adherence rates were 80%, and 6 months when adherence had dropped to 55%. Similarly, Reid et al. (2006) found that the proportion of patients reporting optimal levels of PA decreased, from 59% to 46%, over a 12-month period following a cardiac-related event. In the present study, it is possible that PA levels on average, increased over time because the majority of subscales on the SPAQ measure more unstructured, lifestyle exercise, rather than purely structured exercise sessions, as was examined in the study by Dorn et al. Lifestyle PA (i.e., accumulating short bouts of moderate intensity PA into the daily routine, such as increasing walking, and engaging in more vigorous tasks inside and outside the home) has been shown to be maintainable, and effective in influencing positive physiological changes in sedentary men and women (Andersen et al., 1999; Dunn et al., 1999). On the other hand, research has shown that adherence to formal exercise programs often declines over the first 6 months (e.g., Dorn et al., 2001). The findings of the present study add support to the notion that increasing lifestyle or unstructured types of PA, such as walking and active housework, may be easier to maintain over time than structured exercise programs, particularly for previously more sedentary individuals, or individuals with a chronic illness, such as CHD.

The one PA subscale that showed a decrease (albeit it, a small decrease) over time was the manual labour subscale. This subscale includes activities, such as gardening, painting, and washing the car. Participants reported lower levels of manual labour at T2, compared to T1. It is difficult to know why this type of PA decreased over time when most other PA subscales increased. Perhaps people had decided to take up different types of exercise (such as walking or more active housework) over time, compared to the manual labour activities. Investigating how and why people with CHD engage in different activities over time could prove interesting and valuable research.

Overall, on average, PA levels at all times of testing (e.g., baseline for both 1-6 months and 7-12 months, and T1 and T2) were relatively high. In this study, the average amount of PA undertaken was approximately 460 minutes per week for baseline data (including all participants), and over 600 minutes per week for the participants taking part in the follow-up phase as well as the baseline. The discrepancy between the PA levels of participants taking part in only the baseline and both baseline and follow-up will be addressed in the *Methodological Issues and Future Research* section of this chapter. These amounts of PA could be interpreted as being quite high. If this figure was presented on a "per day" basis, it would be approximately 65-85 minutes. The Australian government, through the National Physical Activity Guidelines (2005), suggested that all Australians should be involved in at least 30 minutes of moderate intensity exercise on most, if not all, days of the week. Similarly, the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) recommended a minimum of 30 minutes of moderate intensity exercise on 5 days per week (Nelson et al., 2007). With these recommendations in mind, it appears that the majority of the participants in this study were not only satisfying the criteria to be considered regularly physically active, but were doubling these recommendations, according to their self-reported activities. This is unlikely to be the case, with the National Health Survey of 2004-05 reporting that over 60% of Australian adults do not achieve the amount of PA recommended in the guidelines (Australian Bureau of Statistics, 2006b).

Instead it is possible that the large amounts of PA reported in the present study may be associated with the tool I used to measure PA. There are many tools that are currently being used to measure PA levels of people with cardiac disease in research studies (Le Grande et al., 2008). The tool I used (i.e., the SPAQ), allowed participants to record even low to moderate intensity exercise, such as light housework and gardening. The entire spectrum of PA, therefore, was being measured and counted towards total exercise levels. In other studies in which the SPAQ is used, similarly high levels of PA are reported. For example, in the study conducted by Hughes et al. (2002), the average amount of PA reported by their participants was in excess of 400 minutes per week. Similarly, using an adapted version of the SPAQ, Jackson et al. (2007) found average PA levels of approximately 400 minutes per week. Jackson et al. also found that for their more active participants (i.e., those in the action and maintenance stages of change), PA levels were over 600 minutes per week.

On the other hand, Hughes et al. (2007), and Reid et al. (2006), investigated PA levels of cardiac patients using the 7-day Physical Activity Recall (PAR), which measures moderate, hard, and very hard PA in minutes per week. Hughes et al. found participants reported PA levels of approximately 150 minutes per week, which matches closely to the ACSM and AHA physical activity guidelines. The PAR, however, does not allow participants to record activities of less than 10 accumulated minutes, nor low intensity PA, both of which are very relevant for people with cardiac disease (Le Grande et al., 2008).

The results of the present study, therefore, do not necessarily suggest that the participants involved in this research were more highly physically active than the average cardiac population. Rather, the more likely interpretation of these results is that the sample in this study was able to record all levels of PA on the SPAQ, even those of a low – moderate intensity, and therefore presented somewhat inflated PA levels, compared to participants in other studies. These findings highlight the importance of checking the particular measure of PA used in studies, and exercising caution when comparing the actual amount of PA recorded by participants in various research studies. The issue of choosing an appropriate measure of PA will be addressed in more detail in the *Methodological Issues and Future Research* sections of this chapter.

Exercise SOC classification, as recorded in the SPAQ, was based on the Exercise Motivational Stage measure (Marcus, Rossi et al., 1992). After some updates, Lowther et al. (1999) developed their own definitions of the exercise stages of change. For example, by their classifications, an individual is in the preparation stage when they do some PA, but not enough for it to be considered regular PA. The maintenance stage includes anyone who has been maintaining regular exercise for at least 6 months. Regular PA was defined according to the ACSM (Pate et al., 1995) recommendations, as 2-3 times per week of vigorous exercise for at least 20 minutes, or accumulating 30 minutes of moderate intensity activity on 4-5 days per week.

The exercise SOC results in the present study showed that the majority of people, both at baseline and follow-up (T1 and T2), were in either the preparation or maintenance stages. Likewise, Reid et al. (2007) who had a similar sample to that in the present study, also found that soon after a cardiac event, the preparation and maintenance stages were the most widely reported. Over the course of their 6-month study, however, people tended to move from the contemplation and preparation stages into the action stage, and the majority of people who had been in the maintenance stage at baseline were still in this stage after 6 months.

The present study resulted in a similar, yet not identical, finding to that of Reid et al. (2007). In the present study, I noted that not only did fewer participants report being in the contemplation stage at the time of follow-up, but when compared to the 1-6 month group, participants in the 7-12 month group (or equivalent, i.e., approximately a further 6 months since their cardiac events) were less likely to report being at the contemplation stage. Reid et al. found that this was reflective of participants progressing up a stage (e.g., to the preparation or action stages), and this is a possible explanation in the present study for the participants involved in both baseline and follow-up. However, it is unclear why many more participants in the 1-6 month group were in the contemplation stage than in the precontemplation stage, yet for the 7-12 month group, these observations were reversed (i.e., more people in the precontemplation compared to contemplation stage). In addition to the earlier findings regarding PA levels, these results suggest that people who successfully reach the preparation stage are becoming even more physically active over time. A number of people who were previously intending to become more physically active (hence, being in the contemplation stage) over time, however, do not have these same intentions.

At T1, half the participants were regularly active, and half were not regularly active. In contrast, at T2, two thirds were classified as active. As previously mentioned, although these results are somewhat surprising given the current literature, they do consistently suggest that many people with CHD are able to maintain their PA levels in the first year after experiencing a cardiac event.

No other study has investigated how exercise SOC can shift in cardiac populations over time, so it is difficult to know why the discrepancies regarding exercise SOC might have occurred. It may, however, be because, initially after a cardiac event (e.g., 1 - 6 months after), people who are not already regularly physically active are likely to be considering taking up exercise (hence, being in the contemplation stage). This could be due to a range of factors including the perceived need to exercise, or encouragement and support provided by family, friends, and health professionals to increase PA levels. It is also during this time that many participants are attending CR. After 6 months, however, it is possible that those people who have not taken up regular exercise (and moved into at least the action stage) may have lost the incentive to exercise and are, therefore, no longer intending to exercise. This issue clearly requires further research to ascertain common patterns of exercise stage transitions over time for cardiac populations.

Physical Activity, Exercise Stage of Change, Depression, and Time

The correlations between PA and depression were shown to be small, and, for most of the subscales, negative, indicating that as depression levels increased, PA decreased. At baseline, there was a statistically significant negative relationship between walking and depression, and at both baseline (for the 1-6 and 7-12 month groups) and follow-up, those individuals who were experiencing major depression were engaging in significantly less walking, compared to those people who were not depressed. From these findings, it is unclear whether depression was contributing to the low levels of walking, or whether the low levels of walking were contributing to depression. The likelihood is that both of these relationships were occurring in people with CHD, and that there is a reciprocal relationship between depression and walking. Through numerous literature searches, I have been unable to find any past research that has investigated this reciprocal relationship between depression and walking in a cardiac population. Previous research does, however, demonstrate the negative relationship between depression and CR adherence (Lane et al., 2001), and depression and exercise program compliance (Dorn et al., 2001) in cardiac populations. The finding of a negative relationship between walking, as opposed to any other PA, and depression in the present study, and previous research that has demonstrated the importance of walking in terms of improving depression in cardiac populations (Evangelista et al., 2006; Gary & Lee, 2007), suggest that further research into the negative effects of depression on walking, and low levels of walking on depression, is important and warranted.

The findings of the present study showed that the relationship between depression and PA did not change significantly over time. There was, however, a slight increase in the strength of the negative relationship between the walking subscale and depression for the 7-12 month group compared to the 1-6 month group, and a noticeable increase in the same relationship for the follow-up compared to baseline groups. These results suggest that, for people who experienced their cardiac event more than 6-months ago, the relationship between higher depression and lower levels of walking became more prominent. No other studies have investigated *changes* in the relationship between depression and PA over time, so it is difficult to know exactly why these findings were observed in the present study. It is possible that people were able to increase their daily activities, such as walking, as time went by, and that the increased walking resulted in lower depression levels. On the other hand, those people who became more depressed over time may have been less likely to increase activities, such as walking. As mentioned previously, the relationship between depression and the specific exercise of walking requires further investigation, and it would be particularly interesting to continue research into changes in this relationship over time.

The results also demonstrated that individuals who were active at T2 (i.e., people who were either active at T2 but not T1, or active at both T1 and T2), had decreases in depression levels over time. Increases in depression levels were noticed for people who were inactive at T2 (i.e., people who were either active at T1 but inactive at T2, or inactive at both T1 and T2). Although these results were not statistically significant, they do lend support to the numerous studies that have found a positive effect of PA on reducing depression levels. In particular, a positive effect over time is suggested by the current findings. Further longitudinal research could investigate the extent of the relationship between depression and PA over time, and also whether there is an "optimal" time for encouraging increases in PA levels, in terms of possibly decreasing depression (e.g., immediately after experiencing a cardiac event or after a given period of time).

An interesting finding in the present study was the positive correlation between active housework and depression. Although the correlation was small, in all of the analyses (baseline for both 1-6 and 7-12 months, and in the follow-up data), the relationship was of a positive nature, indicating that as depression increased, so too did active housework (or vice versa). This was the only PA subscale to demonstrate a positive relationship with depression. Previous research has shown that, especially for women, when housework increases to a level beyond that which is considered desirable by the individual, depression levels often increase (Asztalos et al., 2009; Glass & Fujimoto, 1994). Although actual amount of household labour has an impact on depression levels, an even greater effect is produced by inequality in division of household labour (Bird, 1999; Glass & Fujimoto, 1994). Therefore, when people believe that the housework is not divided equally among members of their household, they are likely to feel more depressed. This perception was not specifically tested in the present study, and it would prove interesting to investigate the positive relationship between depression and housework in more detail. It may be worthwhile for CR co-ordinators to consider these findings, and possibly incorporate, into their CR program, a discussion of the importance of division of household activities with their cardiac patients.

Asztalos et al. (2009) suggest that because housework is seldom an activity chosen by people for enjoyment, rather it is considered as an activity that “must be done”, women in particular can become overwhelmed by these type of duties. Another possible explanation for the positive correlation between depression and housework could be that in the CHD population, if people stop working full-time and spend more time around the home, they might involve themselves in more household chores, which could have a direct effect on depression levels. However, the increased depression may be a result of the lifestyle changes prompted by the CHD (e.g., loss of employment, more time spent at home), which may also account for higher levels of housework.

Probably the most noteworthy finding of the current study was that participants who were classified as regularly physically active, according to their stage of change self-rating, were significantly less depressed than those who were not physically active. The different classification of depression for the two groups is also meaningful. The average depression level for active participants was classified as “no depression”, whereas for inactive people, depression levels were, on average, considered well within the minor depression category. These findings suggest that there may be a relationship between people’s self-perception about PA levels (based on self-rated SOC) and their depression levels. It is not clear from the present study whether depression levels affected exercise SOC, whether exercise SOC influenced depression, or whether some other variable(s), such as having CHD, affected both depression and exercise SOC. The likelihood is that all three of these relationships were occurring, with exercise SOC, depression, CHD, and other possible variables, all affecting each other.

To my knowledge, the relationship between exercise SOC and depression has not been investigated previously. A small number of studies have examined the relationship between depression and readiness to change other health behaviours, such as smoking (Prochaska et al., 2004; Tsoh & Hall, 2004) and excessive alcohol intake (Barnett et al., 2002; Blume et al., 2001), however, the findings have been equivocal in demonstrating a relationship. The relationship between depression and changing negative health behaviours, such as smoking and excessive alcohol intake, however, may be very different to the relationship between depression and changing exercise habits in people with CHD. For people with CHD, the depression experienced could be due to a complex interaction between the CHD itself, as a consequence of the CHD (e.g., altered lifestyle, more health problems, or ceased employment), exercise SOC, or other factors. In addition, depression may be affecting all of those factors, causing further physical and emotional complications.

The topic of depression and readiness to change PA behaviours is one that requires more attention in the future. Of particular relevance to the findings in the present study, and the previous literature suggesting the negative relationship between depression and exercise in people with CHD, and the benefits associated with exercise for this population, it would be useful and important to explore the reciprocal effect of depression on exercise SOC and exercise SOC on depression, and the possible influences of other variables on both exercise SOC and depression, in people with CHD.

In examining individual changes in depression levels over time, according to exercise SOC, the results showed that the majority of individuals who moved up at least one stage from T1 to T2 (i.e., closer to maintenance), were less depressed than those who moved down at least one stage over the same time period (i.e., closer to precontemplation). The results in the present study, therefore, suggest that an individual's perception of their PA level, may be associated with their depression level. No other research has investigated what happens to peoples' depression levels over time, according to how active they perceive themselves to be, in any population. Further research into changes that may occur in depression levels over time according to exercise SOC will be discussed in more detail in the *Methodological Issues and Future Research* section of this chapter.

The results of the present study have implications for health professionals and researchers working in the area of CR and exercise for people with CHD. As I have highlighted earlier in this chapter, and will address in the following section, numerous tools are being used in the research and clinical settings to measure PA in cardiac populations. Many of these measures are not particularly suitable for people with cardiac disease (Le Grande et al., 2008) for various reasons. The exercise SOC measure contained in the SPAQ, in addition to asking people to reflect on the more structured exercise they undertake, also refers to accumulating PA through general activities, such as walking and gardening, which would be very appropriate for the cardiac population. Although exercise SOC does not measure actual amounts of PA undertaken, it has been shown in the current study to be closely related to self-reported PA, and to depression. It may be possible, therefore, to use exercise SOC as a simple indicator to determine readiness to engage in PA, and according to the findings in the present study, exercise SOC may have the potential to highlight people who could be at higher risk of depression (i.e., those people in the earlier stages of change, such as precontemplation and contemplation). With this knowledge, CR co-ordinators can also be aware of how physically active cardiac patients believe themselves to be, and they can help appropriately guide individuals in their PA program.

Methodological Issues and Future Research

The findings of the present study provide an enlightening analysis of PA, depression, and exercise SOC in people with CHD, and the course of these relationships over time. There is, however, the possibility that when researchers are recruiting participants into PA and exercise studies, particularly when these terms are mentioned in the title of a study, people with slightly higher levels of PA compared to average or below average levels, may be attracted to participate. As the results demonstrated, those people in the current study who were more depressed were less likely to be physically active at both baseline and follow-up, and less likely to take part in the follow-up phase. Based on these findings, it is probable in the present study, slightly more active and less depressed individuals were recruited, than is actually represented in the general cardiac population. If this is the case, then the high prevalence rates and severity of depression demonstrated in this study could actually be an underestimate of the real figures.

The results also demonstrated that participants who were involved in both the baseline and follow-up phase of the current study had higher average levels of PA compared to those people only involved in the baseline phase. This is not entirely surprising, given the likelihood that people who were more interested and involved in PA would want to participate in further research on PA. To minimise the chances of attracting people with higher than average levels of PA into future studies, the study title could be worded in such a way that “activity” is mentioned, but that other aspects of the research project are also given more focus. Although the PA data may have been slightly elevated for the participants involved in the follow-up study, the main analyses focused on changes that occurred in PA, depression, and exercise SOC over time within this group of participants, rather than on comparing this group to the group that did not participate in the follow-up.

The small sample size of the current study was another limitation, particularly for the group who participated in the 6-month follow-up. In order to increase statistical power, it would be beneficial to conduct a similar study with a larger sample size. Approximately 100 participants would be required in a follow-up study to achieve a medium effect size with 80% power (Aron & Aron, 2003). Of particular interest would be a larger scale study, involving at least a one year follow-up period, and similar to the present study, measuring depression levels, PA, and exercise SOC. Currently, there is very limited research that tracks depression and PA in cardiac populations for a period of more than six months. As the present study and previous research have demonstrated, depression levels are still high for many cardiac patients up to one year following a cardiac event. PA did not change significantly over time in the current study, however, it would still be interesting to investigate any longer-term changes in depression, PA, or the relationship between depression and PA.

There were also two analytic limitations in the current study. First, confounding variables were not taken into consideration when examining the relationship between depression and PA. In particular, a measure of illness severity was not collected at the time of questionnaire completion. Having this information, in addition to any other possible confounding variables would have strengthened the analysis. Hence, future researchers in this area should ensure that information of this type is collected and considered in analyses of the relationship between depression and PA. Second, the analyses may have been statistically more powerful by modelling the months (or weeks) since the cardiac event as a continuum, rather than by creating artificial groups and dichotomising the variable into 1-6 months and 7-12 months since the cardiac event.

Choosing the most appropriate tools to measure variables in any research project is crucial, yet this can be challenging, particularly if there is not a specific tool designed to measure a variable with the specific target population of the research. In previous research, the SPAQ has been shown to be effective in measuring PA levels, and an easy instrument for participants to use. On the whole, in the present study, I believe that these same conclusions apply, however, as the authors of the SPAQ acknowledge, there are problems on the SPAQ with the occupational subscale of PA (Lowther et al., 1999). The SPAQ would be a much improved tool for measuring PA in various populations if it guided participants to accurately record occupational PA.

One of the strengths of the SPAQ (as mentioned previously) is that participants can record quite low intensity activities. On the other hand, however, this can also become a weakness of the measure. At times, participants reported very high levels of PA, particularly on the manual labour and housework subscales. Participants seemed to vary in their interpretations of what types and amounts of PA should have been reported. Without clarifying these amounts with participants, it was difficult to decipher whether these were accurate amounts of continuous PA, or whether these amounts included periods of inactivity as well. For example, two people may have both recorded four hours of gardening, however, one person may have worked continuously in the garden for the full four hours, yet the other may have included rest breaks and periods of inactivity during that time. Although the SPAQ does include a brief explanation of what to record as PA, the instructions might need to be clearer and more detailed if the questionnaire is being mailed to participants. The SPAQ may also be more effective when researchers administer it in a face-to-face or telephone interview mode.

Numerous tools have been used to measure PA in cardiac populations. It is, therefore, hard to compare PA levels across studies (Le Grande et al., 2008). Gaining an accurate account of how much PA people with CHD are taking part in is difficult, because PA instruments often measure different intensities and types of activity. Le Grande et al. outlined the importance of developing a suitable tool to measure PA in people with heart disease, which could then allow for a comparison of PA levels across numerous studies. A specific PA measure for cardiac populations needs to take into consideration, amongst other things, the intensity and duration of types of activities often undertaken by people with CHD. The instrument must also be very specific in explaining what sorts of PA need to be recorded, and it should be user-friendly and easy to complete for this population. In addition to using a self-report or interviewer-assisted questionnaire, researchers could use a more objective measure of PA, such as an accelerometer or pedometer. Accelerometers in particular have been shown to be useful devices in measuring PA in older adults (Grant, Dall, Mitchell, & Granat, 2008).

Another interesting area of future research would be to explore the effects of lifestyle verses structured exercise programs on PA adherence rates. The well-conducted, randomised controlled trials of Dunn et al. (1999) and Andersen et al. (1999) demonstrated the effectiveness of lifestyle PA in increasing adherence to PA, and these interventions were shown to have the same positive effects on cardio-respiratory fitness and body composition as structured exercise programs. Richardson et al. (2005) found that a lifestyle PA intervention program was appropriate and cost-effective for people with depression. To my knowledge, no research has been conducted on the effectiveness of lifestyle PA interventions, compared to structured exercise interventions, in maintaining regular PA over the longer term for people with CHD and depression. In addition, it would be particularly interesting to investigate differences in depression levels at the conclusion of the two types of interventions. Research of this type would assist researchers and health professionals to understand the most effective way to deliver exercise programs to cardiac patients with depression, and to provide information on the possible effects of the intervention types on adherence to PA and depression.

Further research on the relationship between exercise SOC and depression in people with CHD is warranted. No other research has been conducted to date on this topic, and based on the noteworthy findings of the present study, more information on the relationship between perceived exercise SOC and depression levels would be valuable and interesting. Qualitative research could be conducted in order to gain a rich, in-depth understanding of how the experience of depression affects individuals' capacity to be active. The barriers and facilitators to maintaining regular PA, that are pertinent to people with CHD and depression should also be established. With information of this type and depth, health professionals could more adequately assist people with CHD and depression to increase levels of PA, and researchers could develop effective and suitable interventions for people with depression and CHD that are designed to increase PA.

Summary

In summary, the present study highlights the prevalence and severity of depression, even up to 18 months after a cardiac event. It appears likely that if individuals are experiencing high levels of depression soon after their cardiac event, these levels of depression will still be present 6-12 months later. I also found a negative relationship between depression and PA, and depression and exercise SOC, indicating that those people with higher depression levels were less likely to engage in PA, and less likely to perceive themselves as active individuals. These findings are particularly relevant for CR co-ordinators working closely with many cardiac patients who, according to the present study, are highly likely to have at least minor depression and have trouble adhering to regular PA. Further research, which explores the in-depth experiences of people with CHD and depression in relation to their ability to adhere to PA, would provide great insight and knowledge into this important topic.

CHAPTER 4: FACTORS THAT AFFECT PHYSICAL ACTIVITY EXPERIENCES FOR PEOPLE WITH DEPRESSION AND CORONARY HEART DISEASE

Introduction

The findings from Study 1 (Chapter 3) provided an insight into the relationship between depression, PA, and exercise SOC. Further examination of the relationship between these variables, in particular, between depression and experiences with PA, is important and warranted. Similar to the methods used in Study 1, most of the research investigating the maintenance of PA in cardiac populations has employed quantitative approaches. Quantitative studies can be very informative, providing an overall analysis of how variables may be related, however, qualitative methods can be useful for gaining a richer, more in-depth understanding of people's specific experiences (Patton, 2002). Recently, a small number of qualitative studies have focussed on the reasons why people adhere to CR programs (e.g., Cooper et al., 2005; Jones et al., 2007), but very little qualitative research has explored PA experiences of people once they have completed CR. In addition, research typically suggests that individuals with depression and CHD are less likely to maintain an exercise program compared to their non-depressed counterparts (Dorn et al., 2001). It is possible that experiences of PA for people with depression *and* CHD may be different to those with CHD who are not depressed. A search of the literature did not reveal any qualitative studies that have investigated the PA experiences of people with *both* depression and CHD.

It is for these reasons that I conducted this second study. The aim of Study 2 was to explore, using qualitative methods, the experiences of people with depression and CHD, in relation to PA. Specifically, I was interested in learning about the factors that affected participation in PA for people who recently participated in the hospital-based CR program. The information gathered in the present study would then provide guidance for the design and implementation of the intervention program presented in Chapter 5.

Method

Participants

I recruited 15 participants (12 males; 3 females) with a mean age of 63.6 years (range 47 – 75 years) into this study. All participants had experienced a cardiac event within the past 9 months, and had attended a CR program at the Western, Sunshine, or Williamstown Hospital. Participants in the present study had all taken part in Study 1 of this thesis, at which time they indicated their willingness to be contacted about further research by providing me with their contact details. As part of the previous study, participants had completed the Cardiac Depression Scale (CDS; Hare & Davis, 1996). The inclusion criterion for the current study was that participants had scored between 95 and 125 on the CDS, which is considered to be indicative of "more severe" depression (Wise et al., 2006) or major depression (Shi et al., 2008). Another inclusion criterion was fluency in English, and two prospective participants were excluded on this basis. Most of the participants were from an Australian or European background, and many of them had low socio-economic status. Six participants were regularly physically active, and nine participants were not regularly physically active, according to the National Heart Foundation of Australia's recommendations for PA for people with cardiovascular disease (Briffa et al., 2006).

Measures

I used in-depth, semi-structured interviews. The interview began with some questions on education, occupation, family, and previous experience with physical activity. These early questions were designed to build rapport with participants and help them relax. I then focussed the interviews on exploring participants' experiences of PA since their cardiac event. In particular, I used open-ended questions to ascertain what participants believed to be the major factors that affected their participation in PA (see Appendix J for the interview guide). I also used elaboration and clarification probes (Patton, 2002) to explore issues in more depth. Interviews ranged in time from 60-120 minutes.

Procedure

After gaining approval from Victoria University Human Research Ethics Committee and Melbourne Health's Mental Health Research and Ethics Committee, I contacted participants by telephone and invited them to take part in an interview, if they satisfied the criteria mentioned in the *Participants* section. If potential participants were interested, I mailed them a Participant Information form (Appendix K), and advised that I would telephone again in approximately one week, to allow them time to consider the information and to decide if they would like to take part in the study. Interviews were held at a convenient location (either the participant's home or Victoria University) and time for each participant. At the interview, I answered any questions the participants had and, if they were happy to take part in the interview, I requested they sign the consent form (Appendix K). I audio-taped the interviews, with participants' prior permission, then transcribed the tapes verbatim. I asked participants at regular intervals if they were comfortable to continue with the interview, to minimise the risk of overtiring them. At the conclusion of the interview, I debriefed and thanked participants for their involvement. Immediately following each interview, I made field notes. I maintained confidentiality at all times when dealing with the transcripts to ensure participants could not be identified through quotations and descriptions.

Analysis

After transcription, I content analysed the interviews using procedures recommended by Patton (2002), Gould, Jackson, and Finch (1993), and Scanlan, Stein, and Ravizza (1989). I listened to interview tapes numerous times and read transcripts repeatedly to ensure accuracy and to include relevant information from field notes (e.g., pauses, laughter, overall mood of participants). I took 380 raw data statements directly from quotations of the participants in this study, and from this, I grouped together common raw data statements to form the raw data themes, producing a total of 97 raw data themes (see Appendix L for a list of the raw data themes, first- and second-order themes, and general dimensions). I used an inductive approach, which allowed the themes to emerge from the quotes (Patton, 2002). I inspected the raw data themes for overlap and commonalities, and, where appropriate, merged them together to form higher-level themes. General dimensions represented the highest-level, where no more themes could be uncovered. Finally, I used a peer review process to enhance trustworthiness of the interview data. Two researchers read the transcripts and reached consensus on assignment of the raw data and higher-level themes.

Results

I identified 13 second-order themes and two general dimensions. The general dimensions, termed barriers and facilitators, were based on inductive content analysis of the interview data. Figure 4.1 illustrates the first- and second-order themes, and general dimensions. Participants' names have been changed to ensure anonymity.

Barriers to Physical Activity

The "barriers" general dimension refers to the common factors that participants claimed hindered or prevented their participation in PA. This general dimension is made up of eight second-order themes, including negative perceptions of life changes resulting from heart disease, depression/low mood, lack of motivation, perceived and actual physical restrictions, negative perceptions and uncertainties of exercise, perceived external obstacles, lack of social support, and effects of past sedentary behaviour.

Negative Perceptions of Life Changes Resulting from Heart Disease

The most commonly expressed barriers to being physically active were associated with participants' negative perceptions of health and other life changes as a result of their heart disease. Coming to terms with getting older, having a sense of losing their relationship with good health, and dealing with the shock of developing the heart problem were difficult for some participants. In particular, participants reported that recognizing and acknowledging the need to slow down, the frustration associated with an increase in health-related problems, and no longer feeling invincible and confident in their health, were common issues associated with an inability to be active. The following quotes summarise these feelings:

> After you have a heart attack, you start to look at your various bodily functions and say "well you know I'm starting on the downward slide" (David).
>
> I think the whole thing about as you get older, we know you slow down or you know little things happen to you, but probably it was a bit of a shock to me when I had this heart attack. I really thought I was bullet-proof (Gavin).
>
> I resist this ageing thing. I'm not very good at it. I keep thinking that I'm twenty-five. Me…..grandchildren? (Jack).

First-order themes	Second-order themes	General dimensions
Fearful of engaging in exercise Uncertainty associated with exercise	Negative perceptions and uncertainties of exercise	BARRIERS TO PHYSICAL ACTIVITY
Perceived economic restrictions Perceived environmental conditions	Perceived external obstacles	
Effects of medications (perceived) Pain / restriction caused by heart Pain / restriction caused by other body parts (not heart)	Physical restrictions (perceived and actual)	
Lack of interest / desire to exercise No perceived change from exercise Lack of interest / desire to improve health	Lack of motivation	
Coming to terms with getting older Lost relationship with good health Shock of developing heart problems Work and financial changes	Negative perceptions of life changes resulting from heart disease	
Causes of depression / low mood Effects of depression / low mood	Depression / low mood	
Lack of family support No one to exercise with No support from others (e.g., family/doctors) to exercise	Lack of social support	
Lapsing back into old habits Not being an active person before heart event	Effects of past sedentary behaviours	

First-order themes	Second-order themes	General dimensions
Doing the exercise for someone (other than yourself) Wanting to improve their health Happy to be alive	Having a reason for exercising	FACILITATORS OF PHYSICAL ACTIVITY
Knowing you are physically improving health / body Feeling better psychologically by exercising	Experiencing the psychological and physical benefits of exercise	
Having someone to exercise with Support from family, friends, CR staff to exercise Social interactions from exercise Having a positive role model for exercise	The positive role of others	
Exercise needs to be fun and enjoyable	Enjoyment of exercise	
Goal setting Eliminating excuses Positive self-talk Using an exercise diary	Using psychological strategies	

Figure 4.1. First- and second-order themes, and general dimensions of physical activity experiences for people with depression and coronary heart disease.

> Never anything physically wrong with the body. It come a bit of a shock because I was working. I felt, I felt healthy (Kevin).

> I've always thought because I kept the body strong and my wife was always proud of that, you sort of feel a bit invulnerable…and I realized that it [heart problems] can happen any time (Nicholas).

Another major life change that affected three participants, in particular, was forced retirement. Retirement did not occur as these men had anticipated; that is, when they were fit and healthy and in a planned manner. In addition to causing emotional difficulties, the lack of work also added financial strain on their families. One participant commented, "That that's the biggest thing [not working]…if you know you're going to retire you can build up to it" (Eddie). Another said, "I was probably looking forward to sort of retiring fit and healthy" (Gavin). These perceived changes in one's life appeared to have a negative effect on physical activity levels.

Depression / Low Mood

Although all participants in this study had been identified as having moderate levels of depression, it was interesting that the majority of them independently acknowledged that depression was a major barrier to their PA. Some spoke about the causes of depression, which included an inability to work and be physically active, financial concerns, loneliness, and trouble sleeping. One participant described a number of these issues:

> Emotionally it can get pretty hard. It's frustrating not being able to do much. Money-wise its hard too `cause its putting a hell of a strain on the wife. And loneliness is a very big thing. (Eddie).

The effects of depression and low moods included feeling teary and emotional, lowered motivation and energy, feelings of uselessness, and a permanent or temporary decrease in PA, and increase in more sedentary behaviours. One participant claimed the depression and low mood is what stopped him from being active, saying "It's not the physical side that stopped me from getting up and walking around the block, it's more the mental side of things." (Kevin). Although depression was a higher-order theme, it was also connected to most of the other themes, such as physical restrictions, lack of motivation, negative perceptions of life changes, and lack of social support. Many participants were aware of the problems caused by the depression, but were unable to overcome this barrier to being physically active.

Lack of Motivation

A lack of interest or desire to exercise was a common barrier reported by participants. Some acknowledged laziness or boredom with exercise as the problem, yet others, while aware of the benefits, could see no obvious reason or necessity to be physically active. One participant, who was waiting for a bypass operation, described this lack of motivation as, "I have no incentive at the moment to get fit, really nothing" (Malcolm). Another participant could not perceive any benefit from exercise, and had no real desire to improve his health. He explained:

> I don't really feel rejuvenated or anything after the walk, so my mind says what benefit can I get out of it… who cares if I drop dead tomorrow (Harry).

Perceived and Actual Physical Restrictions

Three participants had developed other physical problems (leg, knee, and foot) since their heart event. All three claimed that these restrictions were the major barrier stopping them from being physically active, and the inactivity was very frustrating for them. One commented:

> It's been this vicious circle that I was in, that, while doing exercise, I suffered the plantar fasciitis and it was painful. It was more painful than a heart attack (Gavin).

For some, it seems there was a belief that exercise needed to be at a higher intensity than they thought they could manage, to be considered beneficial, as demonstrated by the following comment:

> The walking kills me because of the leg. I can walk very slowly for a fair distance, but that’s not much good. You’ve got to put a bit of effort into it and by putting an effort in, you just can’t go as far (Eddie).

Some participants commented that they felt restricted by their heart problem, but this did not seem to be the major barrier for any participant. Medications also affected perceived ability to be physically active. One participant, who felt severely restricted by her heart medication, explained, “When I was warfarin-free it was wonderful and it was exciting to feel the aerobic response of my heart, but I don’t feel that when I’m on warfarin” (Carolyn).

Negative Perceptions and Uncertainties of Exercise

For some participants, various negative perceptions of exercise stopped them from engaging in regular PA. Fears of causing more damage to the heart, damaging other body parts, or running out of energy were very real concerns, and these fears often resulted in participants being cautious or hesitant to engage in exercise. Two participants described this as follows:

> I was really frightened [when walking] because you don’t have the same stamina… you don’t have the same reserves and resources within your body. Your energies are all totally depleted after heart surgery (Carolyn)
>
> I’m not sure how this twisting and turning is going to affect me, so I’m a little bit cautious (Fred)

For other participants, uncertainty about the benefits of exercise, and the correct type and amount required for people with heart disease acted as a barrier. One participant described this as, “I just don’t really know how much I can do now, especially when I get a bit out of breath. But I am not sure if I get anything much from my walks if I don’t get out of breath” (Malcolm).

Perceived External Obstacles

A few participants identified external obstacles, or factors perceived to be outside one’s control, as being barriers to PA. A concern for some participants was that the exercise they enjoyed was too expensive (e.g., playing golf or using a gym regularly). Due to the extra financial strain often placed on families because of forced retirement or increased medical costs, participants removed non-essentials from the budget, often resulting in a decrease in physical and social activities. One participant knew that he would enjoy, and be physically able to exercise in a gym, but was restricted financially, as he explained:

> I can't afford the petrol to get to the gym, that's one of the other biggest killers since I stopped working. To go to a gym and do weights and things like that, that all costs money (Eddie)

Weather conditions were also a deterrent for PA involvement. In particular, cold and wet weather were perceived as being unpleasant to exercise in, in addition to a reduction of daylight hours in winter. One participant commented:

> Weather's a big thing, that's a real big thing 'cause if it's cold and wet no one wants to go out and be doing exercises (Jack)

Lack of Social Support

Some participants described family members' lack of support to be physically active, as a barrier to PA. Specifically, having no one with whom to exercise, and having no encouragement from their family and/or doctors, reduced their likelihood of being active. If their family was more active, or at least more supportive of their need for PA, participants reported they would be more likely to engage in higher levels of exercise, as demonstrated by the following comment.

> If my wife and my daughters and then my grandkids were more physically active, I'd probably do more physical things with them (Kevin).

Effects of Past Sedentary Behaviour

Effects of past sedentary behaviour and falling back into habits of inactivity contributed to current low activity levels for a small number of participants. One female participant noted, "As time goes on you slip back to the old way, you know.

But I've always been like that", and "I haven't really been a great exercise person. Where some people will go to the gym and that sort of thing, I've never been that sort person" (Anna).

Facilitators of Physical Activity

Figure 4.1 shows the five second-order themes for the general dimension of "facilitators". The facilitators general dimension refers to the common factors that participants claimed encouraged their participation in PA, including having a reason for exercising, experiencing the psychological and physical benefits of exercise, the positive role of others, enjoyment of exercise, and using psychological strategies.

Having a Reason for Exercising

This was the theme expressed by the largest number of participants and with the strongest emotion, as being a facilitator to PA. Most of our participants considered doing the exercise for someone other than themself was a major facilitator to PA. They spoke about having someone worth fighting for and owing it to someone else to take part in the necessary exercise and improve their health. One participant said "I owe it to my partner. That is important. You've got to get better for your partner" (Fred).

Wanting to improve their health was another driving force to maintaining PA. Participants spoke about the need to consider their health as the number one priority in their life, the importance of keeping positive and moving forward, wanting to do the exercise, and not being ready to die. The following accounts demonstrate how this helped motivate some participants to be more active:

> I'm not ready to go lay down and die… I want to watch these boys grow and such forth and watch them play footy and things like that and enjoy them growing up; my grandsons (Gavin).

> I know if I put it [exercise] higher on my priorities and, and convince myself more of how important it is to my health in the future, then that will motivate me (Jack).

> [By exercising] you're helping yourself to live a little bit longer (Linda).

Finally, a small number of participants mentioned that they were happy to be alive and felt content with their life, and that this alone motivated them to continue to be physically active.

Experiencing the Psychological and Physical Benefits of Exercise

Many participants spoke about experiencing the psychological and, to a lesser extent, the physical benefits of exercise, and how this aided in maintaining PA. Participants commonly continued to exercise because, psychologically it made them feel better, either by relaxing them, taking their mind off problems, such as pain or stresses, or by helping them feel good because they had achieved something important by exercising. One participant believed that exercise was like a therapy for his mind and body. He commented:

> The exercise to me is a vital thing… once I'm doing that [exercise], my mental attitude changes and you feel much better for it…There's no doubt in the wide world that the exercise after the operation is essential, both for your body and your mind (Ian).

Another participant spoke about how the exercise helped with his depression. He said "makes you feel good within yourself and gives you a mental uplift too, when you're doing physical things" (Kevin). Also, the chance to have some time to oneself through exercise was expressed by the following participant:

> Walking relaxes you, and it also gives you time to think. You get right away from the environment you're in and you can run things through your head (Owen).

Physical benefits, such as feeling the heart and body working well, achieving a healthy weight, and knowing you are doing something positive for your body, acted as motivators to keeping some people physically active.

The Positive Role of Others

Most participants mentioned the importance of the partner, family, and close friends in maintaining PA. Participants were highly motivated by support offered by significant others, either through encouragement to be active or by having an exercise companion. The following comments highlight this important facilitator:

> Without my wife's help there is no way I would've got to the level I am now. (Fred).
>
> What's helped is also the buddying system. My wife tends to come out 2 or 3 times per week, so she's been very supportive that way (Nicholas).

Support given by the CR staff was also very important to many of the participants. The ability of the staff to increase confidence, provide guidance and encouragement, and to monitor participants' health and progress during the CR program were important factors in participants' maintenance of PA. These ideas are reflected in the following quotes:

> The time I spent at the [cardiac] rehab was fabulous because we had the people there who were checking how we were feeling and our levels, and checking us as we went through the hour of exercise. They were very professional (Carolyn).
>
> I was always given encouragement to keep going, and I could have a chat to the girls at rehab if I needed to. They were really lovely people (Anna).

For some participants who did not have such a strong family or friend support base, exercise provided them with a chance to interact socially with other people. One participant said that through her Tai Chi class "you get to see other people and you're not by yourself all the time" (Linda). This encouraged her to attend class once a week. A few of the participants mentioned how important it was to have a positive role model for exercise. If they could see that someone else with similar characteristics and in a similar situation to themselves, had been successful at maintaining PA and achieving good health, they were much more likely to follow their exercise behaviours. One participant highlighted his feelings by saying:

> I met this guy at rehab who had not exercised much in the past, but had started, little by little, and now exercises every day and says how great it is. I thought, "if he can do it, surely I can too" (Jack).

Enjoyment of Exercise

Participants were more likely to engage in an activity if they enjoyed it. One participant said "I do something I want to do….it's got to be fun" (Bob), and another commented "some people just hate the monotony of it…by making it fun, I often find it just makes such a difference" (Nicholas). Although a number of people mentioned enjoyment as being a facilitator to PA, it wasn't spoken about with the same degree of emotion, or to the same extent as some of the other facilitators.

Using Psychological Strategies

Participants reported psychological strategies, such as goal setting, positive self-talk, eliminating excuses, and prioritising exercise by writing it in a diary, as being facilitators for PA. With regard to setting goals, two participants explained, "my view is that it's important to always have goals in front of you" (Jack), and "having goals which are meaningful to you and the family are worthwhile….goal setting is important because it gives you a target" (Nicholas). One female participant used another psychological skill, self-talk, to help her deal with the discomfort she sometimes felt while walking. An example of the self-talk she used is evidenced in this account:

> [I say] "come on, you can do this" you know, those sort of things. "You've only got one more to go" and "if you can get over there you'll be right" (Linda).

For some participants, eliminating the excuses that encourage inactivity was reported to be helpful in ensuring they participated in adequate levels of physical activity. One participant knew what effect making excuses would have on his PA program and said "Get rid of the excuses, I very quickly tore down those avenues that allowed me to take a route and not do it so often" (Nicholas). The three participants, who spoke in some detail about using psychological strategies, reported that this was a very effective way for them to remain motivated to exercise.

Discussion

Being diagnosed with CHD, or experiencing a myocardial infarction, was a major catalyst for changing the way participants perceived their lives, their health, their work situation, and their financial status. After their cardiac event, many participants reported feeling older, less healthy, and more vulnerable in relation to their health, than they did before their heart problem. A number of participants had to retire from their work, which in some cases, caused depressed mood, frustration, and a sense of guilt. Participants viewed these factors as negative and they commented that feeling this way hindered their efforts to continue to maintain PA. Only one other study has reported a similar finding, indicating that this may be a specific barrier to maintaining PA for people with CHD and depression. East and Brown (2004) found that CR participants experienced a sense of loss related to their inability to return to what they considered their "normal" life. East and Brown suggested that heart disease should be "viewed as a chronic illness with long-term consequences rather than an acute problem from which people quickly recover" (p. 208).

It is likely that, because the participants in the present study were also experiencing depression, the ability to deal with and accept the changes associated with their health and life situation caused by their CHD, would be even more difficult, compared to those people without depression. The changes that people with CHD experience in their perception of life and health-related issues should be considered valid and important in their overall recovery and rehabilitation, particularly with reference to how these altered perceptions may affect PA maintenance. This is clearly an area that requires further investigation.

Most participants reported that depression was a barrier to adhering to PA, indicating that they were less likely to be active when they were depressed. They also mentioned that when they were active, they noticed an improvement in their psychological well-being. In a qualitative study with psychiatric rehabilitation outpatients, McDevitt et al. (2006) found that symptoms of depression, provided many barriers to participants being physically active, whereas PA was associated with improved mental health. Researchers who conducted quantitative studies have also reported that depression can have a negative effect on exercise adherence for people with CHD (e.g., Ades et al., 1992; Lane et al., 2001; Yates et al., 2003).

Although not clinically assessed, depression in our participants appeared to be associated with a range of factors, including lowered perceived ability to engage in physical activities, such as exercise and work, loneliness associated with having fewer social opportunities since developing their heart problem, and coming to terms with the changes of living with CHD. Participants reported depression to be a barrier to PA in its own right and in addition, depression was highly associated with a number of the other barriers (e.g., negative perceptions of life changes, lack of motivation, and physical restrictions). These findings suggest that depression in CHD can negatively affect numerous aspects of life, including PA maintenance, and that there is a likely confounding and complex relationship between depression, CHD, and maintenance of PA, thus, further research in this area is required. There is also a great need for health professionals to assess, and if necessary, treat the depression and its underlying causes, in order to facilitate positive rehabilitation.

Overcoming the barrier to maintaining PA that was created by depression was, in general, found to be difficult by participants. Many of them commented that when they felt particularly depressed or sad, the idea of exercising was very difficult, or impossible, to contemplate. Instead, they took up more sedentary activities, such as sleeping, watching television, or just doing nothing. According to Seime and Vickers (2006), these types of sedentary behaviour, in addition to low motivation, low self-esteem, and pessimism are all common during periods of more severe depression. Faulkner and Biddle (2004) also found that, for their participants, when depressive symptoms worsened, PA was hard to maintain and enjoy. The challenge for researchers in this instance is to find out, firstly, whether it is possible for people to overcome these periods of sadness or depression and use exercise as a way of improving psychological well-being, and secondly, to determine the most effective ways of encouraging increased PA during these difficult times.

Participants also believed that lack of motivation acted as a barrier to PA maintenance. Although one might expect that experiencing a heart attack or being diagnosed with CHD would be enough of a reason to begin or continue to exercise, for a number of our participants, this was not the case. Most of the participants understood the benefits for their heart and overall health in keeping active, yet they believed lack of a reason, interest, or desire to exercise were the main contributors to their low motivation. Lack of motivation has been associated with non-adherence to PA across a number of studies of people with CHD (Fleury et al., 2004; McSweeney & Coon, 2004). This barrier may be more problematic to overcome because participants without the desire to recover may find PA motivation difficult to generate.

Another barrier to being physically active, reported with a great deal of emotion from a few of our participants, was physical limitations. Having an injury that restricted PA, particularly walking, seemed to cause the most frustration and disruption to exercise for these participants. In numerous studies, physical limitations have been found to affect PA levels in both cardiac (e.g., East & Brown, 2004; Fleury et al., 2004; Mitchell et al., 1999) and non-cardiac (e.g., Lawton et al., 2006; Schneider et al., 2003) populations. Due to the low mood and frustration that physical limitations imposed on our participants, it appears evident that health care professionals should identify and address (e.g., prescribing PA that doesn't aggravate existing physical conditions), not only physical restrictions of the heart, but also other physical injuries or complaints that are likely to affect PA levels. Although some participants were still a little fearful about doing further damage to their heart by exercising, surprisingly, people did not feel overly restricted by their heart. In fact, a small number of participants actually commented that their heart felt better than before the cardiac event.

The majority of barriers reported in this study were intrapersonal (e.g., lack of motivation, depression, physical restrictions, negative perceptions of life changes), which is a similar finding to the study by Fleury et al. (2004). Although there were a small number of participants in this study who reported financial concerns and weather conditions as being potential barriers, overall, environmental factors, such as safety and access to facilities, were not mentioned as being problematic for the present sample. Other studies (e.g., Belza et al., 2004; McSweeney & Coon, 2004; Nies et al., 1999) have identified an influencing effect of environmental barriers on

PA participation in their samples. These studies were, however, examining barriers for people from ethnic minority groups in the United States (Belza et al., 2004), and women (McSweeney & Coon, 2004; Nies et al., 1999), possibly indicating that these are specific barriers for those populations. Another major barrier to PA that has been noted in numerous studies, involving a variety of people with chronic illnesses, including CHD (e.g., Fleury et al., 2004; Johnson & Heller, 1998; Lawton et al., 2006), is a lack of time or competing commitments. Surprisingly, not one participant in the current study reported that they did not have time to exercise. Perhaps this could be due to the fact that most of the participants were no longer working full-time, and had more time to invest into exercise than working people.

On a more positive note, our participants reported that, when they were aware of, and noticed psychological changes associated with exercise, they were inspired to adhere to their PA program. Participants predominantly commented on their positive experiences of the psychological benefits of exercise, such as having time to oneself, clearing the mind, and achieving goals. This could have been due to the study title mentioning mood and PA, however, other PA studies with cardiac and psychiatric populations have also identified mental health benefits to be a major motivator (Hudson et al., 1998; McDevitt et al., 2006). It is possible that because the participants in the current study were experiencing depression, they may have been even more aware of any positive psychological changes resulting from exercise. Therefore, emphasising the psychological benefits of PA to people with CHD and depression may be particularly effective in encouraging maintenance to regular PA.

For many participants, one of the key facilitators mentioned with a great deal of emotion, and possibly one that is specific to people with CHD and depression, was the importance of having a reason for exercising. It did not seem to matter whether the reason was associated with something they thought would benefit themselves (e.g., improving their health, not wanting to die), or whether they were exercising for someone else (e.g., owing it to someone else to exercise and improve their health). Participants most highly motivated to exercise, reported they were doing the exercise and making other lifestyle changes because they owed it to a family member, usually a spouse. Surprisingly, few qualitative studies in either cardiac or non-cardiac populations have reported this as a facilitator. Mitchell et al. (1999) found that CR participants who consistently engaged in exercise programs used their desire to survive and improve their health as the driving force in their motivation to exercise. The present results indicate the importance of identifying the main reasons for exercising, and then focussing on those reasons whilst exercising to ensure PA maintenance. These strategies could prove very useful in PA interventions, particularly for people with depression, for whom having a definite focus and engaging in goal setting can be important in maintaining PA (Seime & Vickers, 2006).

Participants also highlighted the importance in PA maintenance of social support, provided by significant others, such as partners, family members, friends, or health care professionals. Support arose through verbal encouragement or physically participating in the exercise program with the individual. Having a positive and inspiring role model that an individual could identify with, provided some participants with a strong motivation to engage in PA. Some participants who did not have family or friendship support networks reported that belonging to a group exercise program enabled them to access social support and stay motivated. Most participants mentioned the importance of social support as a facilitator to PA, however, as a barrier, lack of social support was only mentioned by a small number of participants.

This may have been because more of the participants were receiving support to be physically active than were not, so they recognised its positive effects on motivation. For people with cardiac disease, there is mounting evidence that social support facilitates adherence to PA programs (e.g., Hudson et al., 1998; McSweeney & Coon, 2004).

Using psychological strategies was a technique that helped some participants in the present study to adhere to PA. This included goal setting, positive self-talk, keeping a diary to ensure exercise was considered a priority, and eliminating excuses. Psychological skills, such as goal setting and positive self-talk, have been shown to be effective in increasing adherence to PA for people undergoing sport-injury rehabilitation (Cupal & Brewer, 2001). In addition, Mitchell et al. (1999) and McSweeney and Coon (2004) found that different strategies were used by people with CHD to make lifestyle changes, including exercise adherence. These studies and the present research highlight the importance of applying the most appropriate strategy for the individual and the particular situation. It seems unlikely that "one size will fit all" when it comes to determining which strategy is the most effective (Seime & Vickers, 2006), indicating the importance of individualising strategies. The use of psychological strategies in intervention studies is discussed in more detail in the future research section of this discussion.

Methodological Issues and Future Research

The present study provides an in-depth analysis of previously unexplored experiences of PA for people with depression and CHD. With 15 participants, I attained saturation in data, because no new themes emerged from the final interviews. One limitation in this study was narrow cultural representation (most of the participants were white Australians and Europeans), but participants did come from varying socio-economic levels. Caution should be exercised when generalising these results to people with depression and CHD from other cultures.

With this limitation in mind, future research should address the specific barriers and facilitators to PA experienced by people of different cultural backgrounds. In particular, for populations that are experiencing a rise in prevalence and severity of CHD, such as people from Asian countries like India (Gupta, Joshi, Mohan, Reddy, & Yusuf, 2008), and in Australia, in the Aboriginal and Torres Strait Island population (Penm, 2008), it is important that more in-depth information is obtained about what helps and hinders their maintenance of regular PA, and the effect that depression has on their ability to be active.

Although the present study has begun to explore the effect of depression on exercise adherence in people with CHD, further qualitative research is required to delve deeper into the complex interactive effects of depression and CHD on PA maintenance. The present study suggests that CHD and depression affect each other in ways that impact negatively on PA. On one hand, the perceived implications of having a heart condition tend to make people feel more depressed and people who are more depressed tend to do less PA. On the other hand, being depressed seems to bias people to perceive that their heart condition restricts their lives in many ways, including making PA less manageable. For example, one major barrier identified by participants was negative perceptions of life changes resulting from heart disease. The negative perceptions of health and life in general experienced by the participants with CHD in this study could have been associated with increases in depression, which then reduced the motivation to undertake PA. In order to learn more about these complex interactions between CHD and depression, and to ascertain in more depth the role that depression and heart disease, both independently and together, play in influencing PA, further investigation is warranted.

From the present study, there were some specific barriers of, and facilitators to, PA that would be worthy of investigating in more detail. Using psychological strategies to enhance participation in PA was found to be helpful for a number of participants. There is very little research or description of the particular types of strategies that people with CHD and depression find most useful. Learning more about the strategies used and the success of these techniques in aiding PA maintenance would be valuable research. Interventions designed to increase PA adherence with this population could then include the most relevant and successful strategies.

Another approach that warrants further investigation is presenting positive role models, particularly those with similar characteristics and abilities to cardiac patients with depression. A few participants in the present study believed that this was very motivating for them, and helped increase their PA. A number of participants who were already active also commented that they would have been happy to talk to, and encourage, people who had just recently experienced heart problems and were struggling to make the necessary behaviour changes. According to Bandura's (1977) concept of self-efficacy, vicarious experience or social modelling is one way to increase self-efficacy, and high self-efficacy can impact positively on health behaviours. From the present study, I found that some participants experienced a fear of engaging in exercise, which may have been due to low self-efficacy and confidence to exercise. Research investigating the usefulness of employing a modelling strategy would be valuable. For example, a previous CR attendee, who had successfully maintained PA and other health behaviours, could attend a current CR program to provide encouragement and support to recent cardiac patients.

Participants in the present study identified the effects of past sedentary behaviour as being a barrier to their current PA maintenance. Previous research indicates that the likelihood of people with CHD and depression being inactive is high. The challenge for health professionals and researchers alike, therefore, is to minimise the negative effects of having an inactive past on current attempts to increase PA levels. Further research could explore, to what degree, the effect of having been inactive in the past affects current attempts to increase PA, and even more importantly, how to best prevent relapses to previous inactive behaviours.

The findings from the present study are unique in that they address in-depth, PA experiences of a population for which there is limited current knowledge. Past research has demonstrated both the importance of, and difficulties with, adhering to PA for people with CHD and depression. It is, therefore, imperative that the information gained through this research, and other literature on PA adherence in cardiac populations, is utilised in developing and implementing an intervention that encourages PA maintenance for people with CHD and depression.

Summary

Throughout this section of the chapter, I have identified numerous barriers that may need to be addressed and overcome, and facilitators that should be promoted in order to achieve successful maintenance of PA. In particular, the findings of the present study suggest interventions to increase adherence to PA should address barriers, such as depression, changes to the way people perceive their health and life after a cardiac event, lack of motivation, and physical restrictions, and encourage facilitators, such as having a reason for exercising, being aware of the psychological benefits of exercise, having positive social support, and using various psychological strategies to aid maintenance.

As previously mentioned, further in-depth qualitative research would help focus and guide intervention research. Researchers can then use this knowledge to help guide the design and implementation of PA adherence interventions that are specific to, and suitable for, people with CHD and depression. Intervention studies need to focus on the relevant and effective strategies to enhance participation in PA that have been identified in qualitative and quantitative research, to ensure the content of the interventions are applicable for people with CHD and depression. In addition, determining the most effective and sustainable delivery mode and structure of an intervention, would be valuable and necessary research.

The primary implication of the present study for health care professionals working with people with CHD, particularly those in hospital- and community-based CR programs, is that an understanding of the barriers and facilitators that influence PA levels of people with depression and CHD is of prime importance. The prevalence of depression in people with CHD, and the negative effect of the combination of CHD and depression on physical and psychological health together highlight the importance of the present research.

CHAPTER 5: STUDY OF AN INTERVENTION DESIGNED TO INCREASE ADHERENCE TO PHYSICAL ACTIVITY FOR PEOPLE WITH DEPRESSION AND CORONARY HEART DISEASE

Introduction

The findings from the qualitative study (Study 2, presented in Chapter 4) provided specific information on PA experiences of people with depression and CHD. To my knowledge, this was the first qualitative study to explore such experiences in this population. From this study, I was able to ascertain relevant barriers to, and facilitators of, PA for people with depression and CHD. Some of the barriers and facilitators mentioned by participants in Study 2 had not previously been reported in other qualitative studies with either cardiac or depressed participants, suggesting there may be some specific factors associated with PA adherence for people with *both* depression and CHD.

Past research has demonstrated the effectiveness of interventions to increase adherence to PA in the general population (e.g., Bock et al., 2001; Dunn et al., 1999), in people with cardiac disease (e.g., Scholz et al., 2006; Sniehotta et al., 2005), and in people with depression (Richardson et al., 2005; Vickers et al., in press). Despite having a greater understanding of the positive effects of PA in terms of reducing depression, yet the negative influence of depression on PA for people with CHD, to date, there have been no interventions designed specifically to increase adherence to PA for people with depression *and* CHD.

The purpose of the current study was, therefore, to utilise information from previous research, in addition to the results of Study 2, to specifically construct and implement a PA adherence intervention that would be suitable for people with both depression and CHD. In this study, PA was categorised as “overall PA”, which included all intensities of PA (i.e., light, moderate, and vigorous intensity), and "moderate PA", which included moderate and vigorous intensity PA. Depression levels were presented as a total score, and participants were categorised as having no depression at baseline (scoring < 80 on the CDS), or as having depression at baseline (scoring ≥ 80 on the CDS). The term "all participants" was used when analyses consisted of both the depressed and non-depressed participants. The measures were taken at three time points during the intervention: at baseline, Week 10 (just prior to the conclusion of the intervention), and at Week 24 (12 weeks after conclusion of the intervention). The specific aims of this study were as follows:

1. To identify whether there were any changes for all participants over the course of the study in (a) depression; (b) overall PA; (c) moderate PA; and (d) exercise stage of change (SOC).
2. To review the differences in terms of severity of depression, for people who were depressed at baseline, compared to those who were not depressed at baseline, at (a) baseline; (b) Week 10; and (c) Week 24.
3. To ascertain whether there were any differences in overall PA or moderate PA for people who were depressed at baseline, compared to those who were not depressed at baseline, at (a) baseline; (b) Week 10; and (c) Week 24.
4. To examine whether there were any differences in exercise SOC for people who were depressed at baseline, compared to those who were not depressed at baseline, at (a) baseline; (b) Week 10; and (c) Week 24.
5. To investigate whether there were any changes over time in depression for people who were depressed at baseline, from (a) baseline to Week 10; (b) baseline to Week 24; and (c) Week 10 to Week 24.

6. To analyse whether there were any changes over time in overall PA or moderate PA for people who were depressed at baseline, from (a) baseline to Week 10; (b) baseline to Week 24; and (c) Week 10 to Week 24.
7. To assess whether there were any changes over time in exercise SOC for people who were depressed at baseline, from (a) baseline to Week 10; (b) baseline to Week 24; and (c) Week 10 to Week 24.
8. To explore the personal experiences of participants taking part in the intervention. Specifically, I wanted to ascertain what aspects of the intervention participants perceived to be most/least useful, and to gather suggestions for how the intervention could be improved. Also, I wanted to find out whether participants perceived that the intervention had been effective, in terms of increasing PA, and improving physical and psychological well-being.

Method

Participants

In this study, I recruited 20 participants (14 males and 6 females) with a mean age of 64.4 (range 52 – 76 years). Originally, I was only going to include in this study people who were involved in the end stages of a Phase II (ambulatory outpatient) CR program and had scored at least 80 on the Cardiac Depression Scale (CDS; Hare & Davis, 1996), indicating at least minor depression (Shi et al., 2008). However, after many failed attempts to recruit people who fell into these categories, due most probably to the small number of participants with depression attending CR and difficulties encouraging people with depression to take part in PA research, I decided that in order to have even a small sample, I needed to broaden the inclusion criteria. The final sample of participants, therefore, consisted of 20 individuals who had experienced a cardiac event in the past few years, regardless of current CR participation and regardless of CDS score (depression status). All participants had, however, previously attended a CR program at the Western, Sunshine, or Williamstown Hospital, so physical activity was considered safe and appropriate for each participant. One participant chose to withdraw from the study during the intervention phase due to personal reasons, therefore, he did not complete the intervention, nor the measures at Week 10 or Week 24. It was, therefore, decided to exclude his baseline data from the study. Most of the participants were from an Australian or European background, and all spoke fluent English.

Measures

Demographics

I obtained demographic details of participants via a short questionnaire, including age, gender, birth country, occupation, marital status, and living arrangements (e.g., on own, with spouse, with children), type of CHD, date of first diagnosis, time since last cardiac episode, physical co-morbidities (e.g., diabetes, high blood pressure), and past or current mental illness. See Appendix M for the demographic questionnaire.

Cardiac Depression Scale (CDS)

A full description of the CDS (Appendix B) can be found in the *Measures* section of Chapter 3. The CDS that was sent out to participants at Weeks 10 and 24 included an extra question at the end, asking participants to report any significant life event that may have affected their mood and/or depression levels since they last completed the questionnaire.

Community Health Activities Model Program for Seniors (CHAMPS)

The CHAMPS physical activity questionnaire for older adults (Stewart, Mills et al., 2001) assesses the weekly frequency and duration of activities typically undertaken by older adults at light (e.g., leisurely walking, light gardening), moderate (e.g., heavy housework, dancing), and vigorous (e.g., jogging) intensities (see Appendix N). Participants complete the questionnaire focussing on a typical week in the past month. The questionnaire includes 40 items, with each item representing a particular activity. Participants indicate whether they did or did not take part in each activity. If they did participate in the activity, they also indicate how many times in the week (by inserting the relevant number), and how many hours in total over the entire week they spent involved in the activity. In estimating the total number of hours spent in each activity, participants can choose one of six categories, ranging from less than one hour to more than nine hours per week. To score the CHAMPS, each activity is assigned a metabolic equivalent (MET), based on the physical activity compendium values reported by Ainsworth, Haskell, and Whitt (2000). Scoring is based on caloric expenditure (measured in kcal/week) and frequency of activity per week, and is calculated for two categories: moderate-vigorous intensity activity, and all activities (light, moderate, and vigorous intensity activities). The CHAMPS physical activity measure has been shown to be reliable, valid, and sensitive to change over time in older adults from the United States of America (Harada, Chiu, King, & Stewart, 2001; Resnick, King, Riebe, & Ory, 2008; Stewart, Mills et al., 2001). This measure has also been shown to be reliable in a sample of older Australian adults (Brown et al., 2004; Cyarto, Marshall, Dickinson, & Brown, 2006).

The CHAMPS physical activity questionnaire, rather than the Scottish Physical Activity Questionnaire (SPAQ) which was used in Study 1 (Chapter 3), was chosen to measure physical activity in the current study for a number of reasons. First, as reported in Chapter 3, I had some problems with possible over-inflated PA scores with the SPAQ, and some participants' misinterpretations of how to complete the questionnaire. Second, I thought that a specific PA measure designed for older adults might be more appropriate for the present sample. Third, I was interested in determining the effects of both all intensity PA and moderate-intensity PA, a feature available with the CHAMPS but not the SPAQ. In addition, the CHAMPS has been validated with an Australian sample of older adults.

Exercise Motivational Stage Measure (Exercise Stage of Change)

Exercise SOC, based on the transtheoretical model (Prochaska & DiClemente, 1983), was assessed using the 5-item exercise motivational stage measure (Marcus, Rossi et al., 1992). Participants select the statement that relates most closely to their exercise behaviour. Each of the five items corresponds to a particular stage of change, i.e., “I currently do not exercise, and I do not intend to start exercising in the next 6 months” indicates “precontemplation” stage, “I currently do not exercise, but I am thinking about starting to exercise in the next 6 months” indicates “contemplation” stage, “I currently exercise some, but not regularly” indicates “preparation” stage, “I currently exercise regularly, but have only begun doing so within the last 6 months” indicates “action stage”, and “I currently exercise regularly, and have done so for longer than 6 months” indicates “maintenance”. This instrument has been shown to have adequate test-retest reliability (Marcus, Selby, Niaura, & Rossi, 1992) and concurrent validity with the standard 7-day Physical Activity Recall questionnaire (Marcus & Simkin, 1993). See Appendix O for the exercise motivational stage measure.

Open-Ended Intervention Questionnaire

I obtained information from participants about the intervention, including how they believed their PA levels had changed at Week 10 compared to at the beginning of the intervention, their experiences with the intervention, and any suggestions for how the intervention could be improved. This information was obtained via a questionnaire using open-ended questions (Appendix P).

Exercise Consultation Intervention

The intervention consisted of PA counselling, known as exercise consultation (Loughlan & Mutrie, 1995), delivered via an initial face-to-face consultation, and six follow up phone calls. I based the content of the intervention on the individual's exercise SOC, taking into account both the general principles of exercise consultation and the specific results found in Study 2, as reported in Chapter 4. As a basic guide, the content of the initial consultation included a brief discussion of exercise history, exercise likes and dislikes, advantages and disadvantages of behaviour change, overcoming individual barriers to PA, identifying and using available social support, increasing self-efficacy for exercise, goal setting, and relapse prevention.

One of the major strategies used during the face-to face and telephone consultations was goal setting. Participants were guided in setting long-term (i.e., 3-month) and short-term (i.e., 2-week) goals, following the recommendations of effective goal setting (i.e., specific, measurable, acceptable, and time-based goals), outlined by Kirk et al. (2007). Goals were constantly reassessed during the intervention, to ensure the participant felt they were able to achieve their goals, but to also provide some challenges where appropriate. An example of one participant's goal setting, included a short-term goal of walking around his immediate neighbourhood block (approximately 15 minutes) every morning. After 2 weeks, he would extend this to two blocks, and by 6 weeks, he aimed to be walking 3 blocks every morning, for approximately 45 minutes. As a long-term goal (after 10-12 weeks), this participant wanted to start playing tennis again, an activity he had enjoyed prior to his cardiac event.

Another strategy used during the exercise consultation was enhancing self-efficacy. Self-efficacy is a person's perceived ability to master specific tasks and demands successfully (Bandura, 1977). One of the techniques I used to aim to enhance self-efficacy was mastery experience. Participants were encouraged to reflect on times when they were successfully involved in regular PA, and to focus on the sense of accomplishment associated with those feelings. In addition, participants were asked if they knew of someone with similar characteristics to themselves (e.g., someone who had experienced a similar cardiac event) who had been successful at engaging in regular physical activity. If they did, I encouraged the participant that they too, could achieve these experiences.

Advantages and disadvantages to behaviour change were addressed using a decisional balance sheet (Wankel, 1984). In using this tool, participants identified what they believed were the major pros and cons to engaging in, or increasing, PA. The aim of this technique was for participants to perceive that the advantages of participating in PA outweighed the disadvantages.

Based on the findings reported in Chapter 4, specific factors that people with CHD and depression identified as helping them remain active included social support (i.e., having someone encourage their exercise habits, and also having a family member or friend with whom to exercise), having a reason for exercising, experiencing and understanding the psychological and physical benefits of exercise, and using psychological strategies, such as goal setting. The participant and I addressed these common facilitators in the intervention, in addition to other personal facilitators identified by the individual. For example, I asked participants whether they had someone to exercise with, and we discussed possibilities of including family members or friends in their exercise program. We discussed motivations and salient reasons the participant had for exercising, and we aimed to incorporate these into their goal setting. In addition, I ensured the participants had some knowledge of both the physical and psychological benefits of exercise, by way of discussion and a handout.

Common barriers to PA for people with depression and CHD that were reported in Study 2, included negative perceptions of life changes resulting from heart disease, depression/low mood, lack of motivation, perceived and actual physical restrictions, negative perceptions and uncertainties of exercise, perceived external obstacles, lack of social support, and effects of past sedentary behaviour. I asked participants about whether they believed these abovementioned barriers would interfere with their ability to be physically active. If they did feel hindered by any, we discussed ways to overcome the particular barrier. For example, if a participant believed their depression or lack of motivation was likely to prevent them from being physically active, we brainstormed ideas, such as encouraging a family member to exercise with them, or attempting to even take a short walk around the backyard when they felt unable to engage in their normal level of PA. The barrier of physical restrictions may have prevented other participants from being physically active. In this situation, we would discuss alternative forms of activity that may be more appropriate or comfortable for the participant to perform. The participant and I also discussed ways to overcome additional barriers to PA that were personally identified by each individual.

The intervention also included six follow-up phone calls in the three months after the initial consultation, at Week 2, 4, 6, 8, 10, and 12. The phone calls included a discussion of progress towards the individual's exercise goals, provided encouragement and support to the individual, addressed any barriers or relapses, and aimed to continue to build self-efficacy to exercise.

The exercise consultation intervention did not involve prescribing a specific program of PA to each individual. Rather, it aimed to inform and teach the participants about psychological techniques designed to increase adherence to PA, such as goal setting, relapse prevention, and increasing self-efficacy to exercise. Although similar strategies were discussed in the initial consultation with all participants, the way in which they were applied to the exercise program of each individual was personalised.

Procedure

I gained approval from the Human Research Ethics Committee at Victoria University and Melbourne Health's Mental Health Research and Ethics Committee. Due to the difficulties I encountered with recruitment, I had to employ two methods to attempt to increase participation. A small number of participants (n = 5) were recruited through the Phase II CR program at Sunshine and Williamstown Hospitals. In these cases, CR coordinators informed people who were participating in the CR program about the research and handed out invitation letters (Appendix Q) to anyone who was interested in learning more about the research. Potential participants then contacted me, at which time I explained the details of the study, sent out the Participant Information and Consent form (Appendix R), and advised them I would call in approximately one week to find out if they wanted to take part in the study. During the follow-up telephone call, I answered participants' questions and, if appropriate, arranged a time to conduct the initial consultation. The remaining 15 participants had all taken part in Study 1 (reported in chapter 3), and had consented to be contacted about any further research I was conducting. I mailed out an invitation letter (Appendix S) to approximately 50 people who took part in Study 1, for whom I had contact details. In addition to the letter, I included a reply-paid envelope and a form for the participant to return (asking for current phone numbers) if they were interested in learning more about the research. I then telephoned each person who returned the form within a couple of days of receiving the form from them, and gave them details of the study. Similar to the participants recruited through the CR program, participants were then given time to read the Participant Information and Consent form, and decide whether they wanted to take part in the study.

Originally, I planned to have two conditions in this study: an intervention condition, in which participants received the exercise adherence intervention, and a control condition, with participants receiving standard CR and medical care only. However, based on the small numbers of participants that I was able to recruit, it was not possible to have the two conditions, therefore, the study consisted of an intervention condition only.

All participants took part in an initial consultation held at their own home at a time that was suitable for them. Most of the initial consultations lasted approximately 60-90 minutes. At the beginning of the consultation, prior to the actual exercise consultation content, participants completed the demographic questionnaire, the CDS, the CHAMPS, and the exercise motivational stage measure. I assisted participants with the completion of the questionnaires if necessary, and ensured the questionnaires had been completed correctly. This was important because participants were required to complete the questionnaires on their own at two other time points over the following 6 months. Although the demographic questionnaire, the CDS, and the exercise SOC measure were straightforward, some participants had questions regarding the completion of the CHAMPS. This was not unexpected, as previous studies have demonstrated that participants may require some assistance to complete the CHAMPS correctly the first time they do it (Cyarto et al., 2006; Resnick et al., 2008).

In addition to the measures being completed at baseline during the initial consultation, I mailed out the same package of questionnaires (excluding the demographic questionnaire), and a reply-paid envelope to participants at Week 10, and Week 24 (i.e., 6 months after the initial consultation). In the questionnaire package sent at Week 10, I also included the open-ended intervention questionnaire. At both Week 10 and Week 24, participants were requested to complete the questionnaires, and return them to us at their earliest convenience.

All participants also received follow-up phone calls after the initial consultation at Week 2, 4, 6, 8, 10, and 12. At the end of the study, I debriefed and thanked all participants.

Analysis

The questionnaire data were summarised and statistically described using the computer-based statistical package SPSS, Version 15. Baseline data refers to the information collected at the beginning of the intervention, Week 10 refers to the testing done near to the end of the intervention, and Week 24 refers to the testing undertaken 24 weeks (approximately 6 months) after baseline. Post-testing was conducted at Week 10, rather than at the end of the intervention at Week 12, because previous research has shown that, at the end of an intervention, participants' responses to questions may be negatively affected by the anticipated end of the program (Petajan et al., 1996).

Participants were classified as "depressed" or "not depressed" according to their scores on the CDS. According to Shi et al. (2008) and Di Benedetto et al. (2006), a score of 80 or more on the CDS indicates at least minor depressive symptomatology. When scoring the CHAMPS PA questionnaire, I calculated each participant's score for overall PA expenditure (expressed in kcal/week), which included activities at a light, moderate, and vigorous intensity, and also for moderate intensity PA expenditure (also expressed in kcal/week), which included only those activities undertaken at a moderate or vigorous intensity. For the CHAMPS, a "frequency of overall and moderate intensity activity per week" score can also be calculated for each participant. In the current study, however, I decided to interpret the overall and moderate PA expenditure scores rather than the frequency scores. The reason this decision was made was because I believe the frequency score did not always accurately reflect the actual amount of PA undertaken. For example, one individual may have walked four times in the week for a duration of one and a half hours each time, compared to another who may have also walked four times but only for 10 minutes on each occasion. Both participants would have the same frequency score of four, however, the expenditure scores would have been different.

In all sections, I used statistics, such as means, standard deviations, and at times, frequencies, to describe the variables (i.e., demographic information, depression, PA (overall and moderate intensity), and exercise SOC). All of the data in the current study (i.e., depression, PA, and exercise SOC) were normally distributed, therefore, means, standard deviations, and parametric statistical tests were appropriate. To address the first aim, I used four repeated measures ANOVAs to determine any changes over the course of the intervention in depression, PA (overall and moderate in separate ANOVAs), and exercise SOC, for all participants.

To address aims 2, 3, and 4, I employed independent samples t-tests to examine each variable (i.e., depression, PA (overall and moderate), and exercise SOC), comparing those with depression to those without depression separately at baseline, Week 10, and Week 24. For aims 5, 6, and 7, I focused on those participants with baseline depression. The real interest in the current study was the effect of the intervention on people with depression. I used paired t-tests to analyse changes over time in depression scores, PA levels (overall and moderate), and exercise SOC in people with depression at the start of the study (baseline). I tested whether there were any changes from baseline to Week 10, from baseline to Week 24, and from Week 10 to Week 24 on depression, PA, and exercise SOC.

In addition to reporting significance levels ($p < .05$) for the inferential statistics, the interpretation of results also focuses on effect sizes in the form of Cohen's *d* (Cohen, 1988) for t-tests, or partial η^2 (Tabachnick & Fidell, 2001) for repeated measures ANOVA. Researchers have proposed that η^2 is a useful indicator of effect size, because it explains the strength of association between variables and represents the amount of variance in a variable accounted for by group membership (Tabachnick & Fidell, 2001). Cohen's *d* has been explained in detail in the *Analysis* section of Chapter 3.

Finally, I analysed the qualitative data that was collected via open-ended questions. I used thematic analysis to explore three main issues: participants' experiences with the exercise adherence intervention, perceptions of changes to their PA levels, and perceptions of changes to their physical and psychological well-being as a result of the intervention.

Results

In this results section, I address the aims of the current study in four sections. After I present characteristics of the sample, I report changes in depression, PA (overall and moderate), and exercise SOC over the course of the study, for all participants. Then, I analyse whether there were any differences in depression, PA (overall and moderate), and exercise SOC, at baseline, Week 10, and Week 24, for people who were depressed at baseline, compared to those who were not depressed at baseline. Next, I report changes in depression, PA (overall and moderate), and exercise SOC from baseline to Week 10, from baseline to Week 24, and from Week 10 to Week 24, for people who were depressed at baseline. Finally, I explore the personal experiences of participants who took part in the intervention.

Characteristics of Sample

Fourteen males and 6 females took part in this study. Participants had a mean age of 64.4 years (*SD* = 6.5). Fifteen (75%) were married/defacto, 2 were separated or divorced, 1 was widowed, and 2 were single. At baseline, 6 participants were employed on a part- or full-time basis, and 14 participants were not in paid employment. Most participants had undergone either a percutaneous transluminal coronary angioplasty (PTCA) with stenting (*n* = 9), or coronary artery bypass graft (CABG) surgery (*n* = 7). The remaining participants experienced a heart attack with no further intervention (*n* = 2) or repair of the mitral valve (*n* = 2). For 16 participants (80% of the sample), their most recent cardiac event had been their first experience with CHD, yet for 4 participants (20%), CHD had been an ongoing problem. In the present study, 5 participants had experienced their cardiac event within the 6 months prior to recruitment, 3 participants had experienced their event 2-3 years previously, 5 participants between 3-4 years, and 7 participants had experienced their event 4-5 years before recruitment into the study. All participants who had experienced their event in the 6 months prior to taking part in the study had been recruited through the CR program, whereas all other participants were recruited through the previous studies in this thesis.

Changes in Depression, Physical Activity, and Exercise Stage of Change over Time

Results were firstly analysed to determine if, for the whole sample of participants, there were any changes in depression, PA, and exercise SOC over the study. The mean depression scores were a little below the cut-off point for depression (i.e., CDS score of 80 or more indicating at least minor depression) (Table 5.1). Mean depression scores decreased slightly from baseline to the end of the intervention at Week 10, and then continued to decrease until the final measurement at Week 24, although this change over time was not statistically significant, $F(2,38) = 1.01$, $p > .05$. A medium effect size, however, was found, partial $\eta^2 = 0.05$.

Table 5.1

Means and Standard Deviations of Cardiac Depression Scale Scores at Baseline, Week 10, and Week 24.

		CDS scores
	N	Mean (*SD*)
Baseline	20	74.0 (31.1)
Week 10	20	72.6 (29.0)
Week 24	20	70.7 (27.3)

Note. CDS = Cardiac Depression Scale.

Repeated measures ANOVA not significant, $p > .05$.

Mean caloric expenditure for overall PA and moderate PA at baseline, Week 10 and Week 24 are displayed in Table 5.2. Overall PA increased slightly from baseline to intervention, but decreased from Week 10 to Week 24. As with the depression data, repeated measures ANOVA revealed no statistically significant changes in overall PA expenditure across the study, with only a small effect size found, $F(2,38) = 0.24$, $p > .05$, partial $\eta^2 = 0.01$. Similar results were found for the moderate intensity PA, where expenditure increased from baseline to Week 10, but then decreased from Week 10 to Week 24. Unlike overall PA expenditure, however, the mean moderate intensity expenditure at Week 24 was still above the baseline expenditure mean. Again, no statistically significant changes in moderate PA were found, with a small to medium effect size, $F(2,38) = 0.53$, $p > .05$, partial $\eta^2 = 0.03$. Standard deviations were reasonably large, indicating a wide range of overall and moderate PA expenditure.

Table 5.2

Means and Standard Deviations of Physical Activity Expenditure (Overall and Moderate) Expressed in Kcal/week at Baseline, Week 10 and Week 24.

		Overall PA expenditure	Moderate PA expenditure
	N	Mean (*SD*)	Mean (*SD*)
Baseline	20	4845 (2640)	2490 (1656)
Week 10	20	5084 (2807)	2939 (2023)
Week 24	20	4752 (3215)	2776 (2683)

Note. PA = physical activity.

Repeated measures ANOVA not significant, $p > .05$.

Table 5.3 shows the number of individuals in each SOC at baseline, Week 10, and Week 24. There were no participants in the precontemplation stage at any time point, and only two participants in contemplation at baseline and Week 24. All participants either stayed in the same SOC or progressed to a higher stage from baseline to Week 10. In addition, the two participants who were in contemplation at baseline, plus two others who were in preparation, moved into the action stage at Week 10, suggesting that the intervention affected exercise SOC. From Week 10 to Week 24, participants had either moved back a stage ($n = 4$), typically from action/maintenance to preparation, or action/preparation to contemplation, stayed in the same stage (*n* = 11), or progressed to a higher stage (*n* = 5), typically from action to maintenance.

Table 5.3

Number and Percentage of Participants in Each Stage of Change at Baseline, Week 10 and Week 24.

	Pre-contemplation *n* (%)	Contemplation *n* (%)	Preparation *n* (%)	Action *n* (%)	Maintenance *n* (%)
Baseline	0	2 (10)	7 (35)	2 (10)	9 (45)
Week 10	0	0	5 (25)	6 (30)	9 (45)
Week 24	0	2 (10)	4 (20)	2 (10)	12 (60)

Note. *N* = 20.

Mean scores on exercise stage of change, which were rated from 1 (*precontemplation*) to 5 (*maintenance*), are presented in Table 5.4. Exercise SOC scores increased from baseline to Week 10. Although there was a small decrease from Week 10 to Week 24, the score at Week 24 was still higher than that at baseline.

Table 5.4

Means and Standard Deviations of Exercise Stage of Change Scores at Baseline, Week 10 and Week 24.

	N	Exercise SOC scores Mean (*SD*)
Baseline	20	3.9 (1.1)
Week 10	20	4.2 (0.8)
Week 24	20	4.15 (1.1)

Note. SOC = stage of change.

Repeated measures ANOVA not significant, *p* > .05.

Although repeated measures ANOVA revealed that there were no statistically significant changes in SOC scores across the study, $F(2,38) = 1.31$, $p > .05$, there was a medium effect size (partial $\eta^2 = 0.07$).

Differences in Depression, Physical Activity, and Exercise Stage of Change between Depressed and Non-depressed People

Those participants who were depressed (i.e., scoring 80 or more on the CDS) compared to non-depressed (i.e., scoring less than 80 on the CDS) at baseline were analysed for differences in depression, PA (overall and moderate), and exercise SOC at each time point (i.e., baseline, Week 10, and Week 24). In examining differences in depression levels at each time point, the stand-out finding was that the average level of depression in the non-depressed participants was between 51 and 53, over the course of the study, compared to scores between 93 and 102 for the depressed participants (see Table 5.5 for means and standard deviations).

Table 5.5

Means, Standard Deviations, and p-values of Cardiac Depression Scale Scores, According to Baseline Depression Status at Baseline, Week 10, and Week 24.

	Baseline depression status	*N*	CDS scores Mean (*SD*)	*p*-value (*p*)
Baseline	Not depressed	11	51.0 (18.3)	< .001
	Depressed	9	102.1 (16.3)	
Week 10	Not depressed	11	53.2 (18.1)	< .001
	Depressed	9	96.2 (21.1)	
Week 24	Not depressed	11	51.9 (20.2)	< .001
	Depressed	9	93.7 (13.6)	

Note. CDS = Cardiac Depression Scale; Not depressed = score < 80 on the Cardiac Depression Scale; Depressed = score ≥ 80 on the Cardiac Depression Scale; categorisation of depression scores based on Shi et al. (2008).

Independent groups t-tests indicated there were significantly higher depression levels and very large effect sizes (Cohen's *d*), at baseline, $t(18) = 6.53$, $p < .001$, $d = 2.92$, Week 10, $t(18) = 4.91$, $p < .001$, $d = 2.21$, and Week 24, $t(18) = 5.29$, $p < .001$, $d = 2.38$, for the depressed compared to non-depressed participants. These results may be unsurprising, given that I assigned participants to depressed and non-depressed categories on the basis of their baseline CDS scores. It is, however, particularly interesting that the results indicated that there were two very distinct groups: those who clearly *were not* depressed during the study, and those who clearly *were* depressed during the study.

When examining the differences in PA expenditure at each time point, for participants who were depressed compared to not depressed at baseline, I found some statistically significant differences. Table 5.6 shows the mean expenditure for both overall and moderate PA for those classified as depressed versus not depressed. Although the depressed individuals were engaging in less overall PA at each time point, there were no statistically significant differences in overall PA expenditure for those participants who were depressed or not depressed at any time point. There were, however, medium effect sizes at each time point. For the moderate PA, independent t-tests revealed that, at baseline, non-depressed participants were significantly more active, with a very large effect size, $t(18) = 2.76$, $p < .05$, $d = 1.24$, compared to those who were depressed. At Week 10, differences approached statistical significance at the .05 level, and there was still a large effect size, $t(18) = 1.85$, $p > .05$, $d = 0.83$, and although by Week 24, these differences were not statistically significant, a medium effect size was still apparent, $t(18) = 1.31$, $p > .05$, $d = 0.59$.

Table 5.6

Means, Standard Deviations, and p-values of Physical Activity Expenditure (Overall and Moderate), Expressed in kcal/week, According to Baseline Depression Status at Baseline, Week 10, and Week 24.

	Baseline depression status	*N*	Overall PA expenditure Mean (*SD*)*	Moderate PA expenditure Mean (*SD*)	*p*-values (*p*) (Moderate PA t-tests)
Baseline	Not depressed	11	5538 (2244)	3286 (1619)	< .05
	Depressed	9	3999 (2964)	1516 (1138)	
Week 10	Not depressed	11	5673 (2309)	3652 (1685)	> .05
	Depressed	9	4363 (3314)	2066 (2147)	
Week 24	Not depressed	11	5577 (3461)	3474 (3119)	> .05
	Depressed	9	3743 (2737)	1921 (1855)	

Note. Not depressed = score < 80 on the Cardiac Depression Scale; Depressed = score ≥ 80 on the Cardiac Depression Scale; categorisation of depression scores based on Shi et al. (2008); PA = physical activity.

*All overall PA independent samples t-tests not significant, $p > .05$

The difference in levels of moderate PA for depressed and non-depressed individuals at baseline was 1770 kcal/week, compared to 1586 kcal/week at Week 10, and 1554kcal/week at Week 24. These differences, and the decrease in effect sizes from baseline to Week 10 to Week 24, suggest that over time, the negative effect of depression had less of an impact on PA, which could be due to the intervention being more effective in increasing PA for depressed, compared to non-depressed individuals.

Table 5.7 displays the means and standard deviations of exercise SOC scores for the depressed and non-depressed participants at each time point. Depressed participants had significantly lower exercise SOC scores at baseline, with very large effect sizes, *t*(18) = 2.88, *p* < .01, *d* = 1.30, and at Week 10, *t*(18) = 3.13, *p* < .01, *d* = 1.40, compared to non-depressed participants. Differences approached statistical significance at Week 24, and there was a large effect size, *t*(18) = 1.92, *p* > .05, *d* = 0.87. This indicates that the depressed individuals were more likely to be in contemplation or preparation, whereas non-depressed individuals were more likely to be in action and maintenance, particularly at baseline and Week 10. Similar to the PA data, the results suggest that the effect of depression on exercise SOC was less pronounced at Week 24 than it was at baseline or Week 10.

Table 5.7

Means, Standard Deviations, and p-values of Exercise Stage of Change Scores, According to Baseline Depression Levels at Baseline, Week 10, and Week 24.

	Baseline depression status	*N*	Exercise SOC scores Mean (*SD*)	*p*-value (*p*)
Baseline	Not depressed	11	4.5 (1.0)	< .01
	Depressed	9	3.2 (0.8)	
Week 10	Not depressed	11	4.6 (0.7)	< .01
	Depressed	9	3.7 (0.7)	
Week 24	Not depressed	11	4.6 (1.0)	> .05
	Depressed	9	3.7 (1.0)	

Note. Not depressed = score < 80 on the Cardiac Depression Scale; Depressed = score ≥ 80 on the Cardiac Depression Scale; categorisation of depression scores based on Shi et al. (2008); SOC = stage of change.

Changes in Depression, Physical Activity, and Exercise Stage of Change for Participants with Depression at Baseline

It is likely that the results presented in the earlier section, on changes in depression, PA, and exercise SOC over time, were not statistically significant because the analysis included all participants and not just those who were depressed. Because the non-depressed individuals had virtually unchanged depression scores and PA levels over the course of the study, their inclusion may have diminished possible effects for those who were depressed. Although the inclusion of non-depressed participants allowed me to compare scores on depression, PA, and exercise SOC for the depressed participants, I was particularly interested in examining the changes in depression, PA, and exercise SOC for the depressed individuals. This is because there was little likelihood of increasing initially high baseline levels of PA (i.e., observing ceiling effects), or decreasing initially low levels of depression (i.e., observing floor effects), in the non-depressed individuals. The analyses presented in the current section, therefore, include only people with depression (i.e., CDS scores ≥ 80).

Examining raw data scores for individual patterns of changes in depression scores revealed that 8 out of 9 participants who were depressed at baseline experienced a reduction in depression levels from baseline to Week 10. In addition, depression scores for 6 out of 9 participants were lower at Week 24, than at baseline.

Mean depression scores at baseline, Week 10, and Week 24, for depressed participants are shown in Table 5.5. Depression scores decreased from baseline (M = 102.0) to Week 10 (M = 96.2) and then continued to decrease even after the active phase of the intervention had ended at Week 24 (M = 93.7). At baseline, the mean depression score was in the “major” depression category (i.e., a CDS score ≥ 100), but at Week 10 and Week 24 had decreased into the “minor” depression category (i.e., a

CDS score between 80 and 99), as defined by Shi et al. (2008). Paired t-tests showed that depression levels decreased significantly from baseline to Week 10, with a small to medium effect size, $t(8) = 2.61$, $p < .05$, $d = 0.32$, and approached statistical significance at the .05 level from baseline to Week 24, with a medium effect size, $t(8) = 2.11$, $p > .05$, $d = 0.56$. No statistically significant changes in depression levels were found from Week 10 to Week 24, $t(8) = 0.56$, $p > .05$, $d = 0.13$.

Mean overall and moderate levels of PA expenditure are presented in Table 5.6. Overall and moderate PA increased from baseline to Week 10, but then decreased by Week 24. However, unlike overall PA that decreased to a level lower than baseline at Week 24, moderate PA was still higher at Week 24 than it was at baseline. Although the results suggested that PA levels were increasing from baseline to Week 10, paired t-tests revealed no statistically significant differences and only small effect sizes, in overall PA, $t(8) = 0.67$, $p > .05$, $d = 0.12$, and moderate intensity PA, $t(8) = 0.86$, $p > .05$, $d = 0.32$. It is possible that the small sample size and reasonably large standard deviations reduced the significance levels. There were no statistically significant changes in overall or moderate PA from Week 10 to Week 24, or from baseline to Week 24.

Changes in mean exercise SOC scores over the course of the study are shown in Table 5.7. In depressed individuals, exercise SOC scores increased from baseline ($M = 3.22$) to Week 10 ($M = 3.67$). During the intervention, therefore, participants perceived themselves as being more active than they were at baseline. In fact, all participants who were depressed at baseline either progressed to a higher stage from baseline to Week 10 (most commonly from preparation to action), or stayed at least in the preparation stage. No participants regressed a stage from baseline to Week 10. Although a paired t-test indicated no statistically significant changes in exercise SOC scores from baseline to Week 10, a medium effect size was evident, $t(8) = 1.84$, $p > .05$, $d = 0.58$. Similar results were found when a paired t-test was used to analyse changes from baseline to Week 24. Changes in exercise SOC scores were not statistically significant, although there was a medium effect size, $t(8) = 1.51$, $p > .05$, $d = 0.49$. Exercise SOC scores did not change at all, however, from Week 10 to Week 24 ($M = 3.67$), indicating that, although they did not continue to increase, the depressed participants maintained the higher exercise SOC levels from the end of the intervention to Week 24.

Qualitative Analysis

In this section, I analyse the qualitative data, gathered via the open-ended intervention questionnaire, which was completed by each participant. I explore the patterns of participants' responses to the three main issues of interest. The first issue I was interested in learning more about was the experiences of participants with the exercise adherence intervention, and any suggestions for how the intervention could be improved. The second was the participants' perception of whether their physical and psychological well-being had changed as a result of the intervention. The final issue that I explored through the qualitative data was the participants' perception of how their PA levels had changed over the intervention period. Quotes will be used in each section to highlight some of the main issues. Participants' names have been changed to ensure anonymity.

Experiences with Exercise Adherence Intervention

Increases in motivation and provision of support. Overall, the participants were very happy with the exercise adherence intervention. For those participants who had not been active prior to the intervention, the motivation generated by the intervention was very important in initiating an increase in their PA levels. A number of participants commented that by participating in the intervention, they felt confident and motivated enough to begin an exercise program, and felt they understood the importance of exercise. These thoughts are highlighted in the following quotes:

> The intervention has given me the confidence to keep challenging myself, and to properly start exercising (Nola).
>
> Helped remind me of the importance of my health, and the fact that I needed to start exercising to help with my recovery [from heart disease] (Margaret).
>
> Having the opportunity to make a decision on my own has been highlighted for me in the intervention……it [the intervention] has really helped me with this (Julie).
>
> It was useful in helping me stay motivated, gave me an awareness of what can happen if we do the exercise and an awareness of the importance of the exercise (Bill).

For the participants who were already active prior to taking part in the intervention, the intervention provided them with the feedback or acknowledgement that they were engaging in adequate or high levels of PA. This in turn gave them motivation to keep going with their current levels of PA. A few comments summarise these feelings:

> Being involved [in the intervention] helped keep the motivation there. It helped me to continually be aware of my exercise levels, and the importance of the exercise (Joe).
>
> It was good to be able to see exactly what exercise I was doing, and at a high level. I also got positive feedback about what I was doing (Robert).
>
> It reminded me to continue activities at a high level (Simon).
>
> The encouragement to keep doing what I was doing, and some advice about other things I could do was helpful (Janice).

Another common theme expressed by both active and inactive participants was that they appreciated the support provided during the intervention. Those who were active to begin with felt that the intervention gave them the ongoing support to continue with their activities. One participant said “being able to talk about what I am doing with exercise with someone else was good, and also having someone looking over my shoulder and providing support when needed, helped keep me in line" (Robert). For those participants who were inactive at the beginning of the intervention, this support was very important. A common thought was that participants felt less alone whilst beginning an exercise program and that someone was showing an interest in their attempts to become more active. The following comments highlighted these feelings:

> It was certainly helpful to have some guidance and encouragement and to have someone interested in what I was doing and how I was managing (Cecil).
>
> I found the program was a real support. Someone was concerned with my condition and my situation……didn't feel on my own, had someone providing me with information and encouragement (Elizabeth).
>
> The program itself and the support given by the researcher was the most helpful thing in getting me to walk regularly (Nola).

A number of participants commented positively on the way the intervention was structured (i.e., an initial, face-to-face interview followed by phone calls). A couple of people commented that meeting the researcher in the first consultation helped with their motivation and interest because they could "put a face to the research" (Margaret). Then the follow-up phone calls were, as described by one participant "very convenient" (Janice). Other comments on the follow-up phone calls were as follows:

> The phone calls ensured I kept going with the exercise and didn't give up. The fact that you rang, but didn't push was a great help (Cecil).
>
> I was very motivated, and looked forward to the researcher's calls (Nola).

It seems that one of the strengths of the intervention was the follow-up support provided to participants. Many of the participants commented that the overall follow-up was very helpful to keep their motivation levels high.

One interesting factor mentioned by some participants as being a motivator to being physically active during the intervention, was a feeling of being accountable to someone (i.e., the researcher), and, therefore, needing to continue exercising for that reason. These feelings are reflected in the following quotes:

> Being accountable to someone else really helped me stay motivated (Fraser)
>
> I didn’t want to let her [the researcher] down (David).
>
> Being part of the intervention provided a bit of pressure for me to keep going with the exercise. I didn’t want to appear as though I wasn’t doing the right thing with my exercise (Bill).

Of course, these ideas do raise the issue of whether people can stay motivated once this support and accountability is no longer present. This issue will be addressed in the *Discussion* section of this chapter.

Alternative types of exercise. Some participants also reported that they felt the intervention provided them with alternative types of exercise they had not already considered. One participant, who had been active previously, said he was “provided with ideas for other exercises”. He said, “I can become bored with the same old exercise sometimes, but the intervention has helped me become more aware of the things around me that I can do to increase my exercise…..different activities I can do” (Joe). Another participant commented “I was given ideas of other exercises I could do when I had a sore foot. This was very helpful” (Russell).

Suggested changes to intervention. Although participants were happy with the exercise adherence intervention, they were asked to make any suggestions for changes that could be made to the intervention, to make it more effective in increasing PA levels. A number of participants commented that the intervention would have been most effective immediately after their cardiac event. They felt it was at this time when they particularly needed the support to change their behaviours and increase levels of PA. One participant felt strongly about this issue and commented:

> Initially, I felt quite isolated after the cardiac event. I needed emotional support and especially with exercise, I wanted to know how much I could do, so I could still get benefit, but not do further damage. A program such as this could have provided me with that support and knowledge at that time (Janice).

However, the majority of people who had recently had their cardiac event and were participating in the intervention found the intervention came at an appropriate time. One participant commented that it would have been very beneficial if the intervention could have continued on from the CR program, in which exercise, nutrition, and emotional recovery were all addressed. She felt that this would have been a very rounded program. Another issue with the timing of the intervention was raised with one participant commenting that the intervention would have been more effective if follow-up phone calls could have continued for another 3 months, with phone calls being reduced from two per month in the first 3 months, to one per month for the next 3 months.

Another interesting issue that was raised was how effective the intervention would be for people who had low levels of motivation, or for those who were struggling to come to terms with the psychological and physiological changes associated with CHD. Two participants made the following comments:

> The intervention would be particularly beneficial to people who needed one-on-one support and encouragement. To be able to share their experiences and ease their burdens, that could help a lot of people (Fraser).

> There are a lot of people who do not have a positive outlook and motivation, and for these people, this sort of program would be very helpful (Simon).

Given that the intervention was originally to be delivered to participants with CHD *and* depression *soon* after their cardiac event, it is interesting that participants identified that an intervention such as the one offered in this study, would be most beneficial for cardiac patients immediately after their cardiac event, and to people who had low levels of motivation or had some form of psychological distress.

Some participants made the suggestion that motivation levels may have been better maintained if there were some physiological evidence that the changes they were making to their exercise behaviours were having a positive effect on their physiological status, in terms of increasing fitness and improving heart health. For these participants, the extra incentive of noticing physiological improvements may have resulted in increased adherence.

The final suggestion made was the idea of incorporating the use of positive role models into the intervention to help increase adherence to PA. A number of participants who had experienced their cardiac event just prior to taking part in the study, felt it would have been helpful to have seen or heard about how other people with similar cardiac experiences to themselves, had managed to make the necessary changes to their lifestyle, and had experienced successful outcomes. Participants felt they could have benefited from some sort of “buddy system”, in which they were able to share their experiences with someone else who had been through the same processes, in addition to receiving the follow-up phone calls from the researcher.

Perception of Changes to Physical Activity Levels

Overall, 12 people thought they had increased their PA over the 12-week intervention period, five people felt they were still doing about the same amount of exercise (for all of these five participants, it was already at a high level), and three people believed they had done less PA over the intervention period, citing medical reasons in each case (e.g., a hand operation, a recurrence of the heart condition).

For those participants who believed they were doing more PA during the intervention compared to before, the most common exercise that people were engaging in at a higher level was walking. Some people had increased the amount of walking they were doing or had increased the intensity. Others had started doing some walking compared to not doing any walking prior to the intervention. Still others tried new activities, such as bike riding, swimming, or gardening. For some people, exercise patterns had become more structured. Others became more aware of exactly what they were doing and when they needed to do more. The following comments are just a sample of those that were made about perceptions of PA:

> I walk an hour a day now, but before being on this program, I would have been lucky to do 20 minutes every now and then (Margaret).
>
> I walk to the train station now instead of taking the car, so I save money and get fit! (Elizabeth).
>
> I am walking faster and longer now. I push myself a bit more (Janice).
>
> I joined up at the local gym, I always wanted to sign up for a gym membership, now just had the motivation to do it (Robert).

As mentioned, a couple of participants were unable to increase their levels of PA over the intervention period and, in fact, had decreased their levels. This frustrated these participants because, in both cases, medical issues had arisen suddenly which had interfered with the exercise. Both of these participants had been very keen to increase their exercise over the course of the intervention and had hoped they would have renewed motivation to continue. The lack of exercise had been disappointing for these participants. One commented that, “I started off really well with the exercise but just couldn’t continue with it. It was a real shame” (Guido).

Perception of Changes to Physical and Psychological Well-Being

It was interesting that in asking participants how they felt, psychologically and physically after the intervention compared to before, the main responses related to physical feelings. Several participants commented that they felt fitter and healthier. Some participants had noticed they had lost a few kilograms since being involved in the intervention, which they commented had helped with the motivation to continue to exercise. One participant said, “I have lost a bit of weight and feel I can move more easily, which helps with the exercise” (Simon).

A small number of participants felt more confident and motivated to exercise once having taken part in the intervention. Comments such as, “I feel more confident in what I can do with my exercise” (Julie), and “I feel much more inclined to make more of an effort to do physical activities” (Bill), highlight some of these feelings. One participant, who had developed foot problems during the intervention, commented, “I have improved my mental well-being, and can now accept my physical disabilities more readily” (Russell). Finally, one participant who had been unsure of whether she would be able to make the necessary behavioural changes to increase PA, said, “I look forward to getting out now on my walks. I used to have the attitude of “well, I’ll see how I go” in regards to whether I would walk or not, but now I just say “I’ll do it, because I want to” (Nola).

Discussion

In this study, I investigated the effects of a 12-week exercise adherence intervention on depression, PA, and exercise SOC. I analysed changes over time in these variables, firstly for all participants taking part in the intervention, and then for depressed participants only. I also determined whether there was a difference in depression, overall and moderate PA, and exercise SOC, at baseline, Week 10, and Week 24, for participants who were at least mildly depressed, compared to participants who were not depressed. I also captured participants’ experiences with the exercise adherence intervention through the use of qualitative methods.

The results of the current study revealed that depression levels decreased from baseline to Week 24, and PA levels and exercise SOC scores increased over the 12-

week intervention, although the results did not reach statistical significance. Results also suggested that the intervention may have been particularly effective for participants with depression at baseline, leading to decreases in depression levels and increases in PA and exercise SOC. Finally, results demonstrated that, compared to their non-depressed counterparts, people classified as depressed at baseline had lower PA levels and exercise SOC scores at all time points throughout the study. Of course, because the current study did not have a control condition, in which participants did not receive the intervention, I cannot attribute the improvements in depression, PA, and exercise SOC solely to the intervention. This is a limitation of the current study that is addressed in more detail throughout the *Discussion* section. However, the qualitative information collected in the current study revealed that participants were very satisfied with the intervention, and most felt that the intervention had been successful in helping them to increase their PA levels, or at least maintain high levels of PA.

An important point that needs to be mentioned is in regards to the inclusion of both depressed and non-depressed participants in the intervention. The original focus of the intervention was to be on the changes over time in depression, PA, and exercise SOC for participants *with* depression. Due to recruitment difficulties, however, the current study ended up including participants both with and without depression. Although this may not have been the ideal sample for the current study, there were advantages with including participants *without* depression in the intervention. First, the inclusion of people without depression provided me with a “group” to which I could compare depression, PA, and exercise SOC scores for the depressed individuals. Second, including participants without depression allowed me to confirm what otherwise would be only an assumption, that interventions like the one used in the current study would not significantly reduce depression or increase PA in people low on depression and high on PA.

Changes in Depression over Time

Mean depression levels for participants in the current study were very similar to other studies that have utilised the CDS in a cardiac population, such as Davidson et al. (2008) and Wise et al. (2006). When analyses included all 20 participants, mean CDS scores were just below the cut-off for depressive symptomatology at baseline. Depression levels decreased slightly from baseline to Week 10, and then continued to decrease to Week 24. Although the results were not statistically significant, there was a medium effect size, indicating that the intervention may have had some practical effect in decreasing depression levels. In their sample of cardiac patients, Hughes et al. (2007) also found depression levels were low at baseline and did not change significantly over time. It is possible that in the current study, and perhaps also in Hughes et al., depression levels did not change over time because all participants (i.e., those with and without depression) were included in the analysis. Including participants both with and without depression may have diluted the overall results, and decreased the chances of finding statistically significant changes. For participants without depression, whose scores on the CDS were low at the start of the study, it would have been unlikely for depression levels to fall over the course of the intervention and follow-up.

Because of the specific interest I had in the effects of the intervention for depressed participants, I went on to analyse changes in depression in those people who had been identified by the CDS as having depression at baseline. Although the sample size was small, I felt it was necessary to investigate these results in more detail. As reported in the *Results* section, the differences in depression scores for those individuals defined as depressed, compared to those classified as not depressed at baseline by the CDS, were very large. For the depressed participants, at baseline, the mean depression scores were slightly above the cut-off for major depression, according to the classifications of the CDS (Shi et al., 2008), whereas for the non-depressed participants, depression levels were very low. Exactly why these differences were so large is difficult to explain, but what is clear about the sample in the current study, is that there were two very distinct groups, those who were clearly depressed, and those who were clearly not depressed. These results supported my decision to investigate changes that occurred over time for the depressed participants only.

In the current study, those participants with depression at baseline experienced significant decreases in depression levels from baseline to Week 10, and continued to decrease from Week 10 to Week 24. In fact, 8 out of 9 participants who were depressed at baseline experienced a decrease in depression over the period of the intervention. Of course, these results need to be interpreted with caution given the small sample size and absence of a control group, however, they are pleasing preliminary findings for the effectiveness of an exercise adherence intervention, based on the principles of exercise consultation. The particularly promising result is that depression levels continued to decrease, even after the conclusion of the intervention. A small number of studies utilising exercise adherence interventions with depressed participants have also demonstrated positive results in which depression levels decreased over time (e.g., Richardson et al., 2005; Scholz et al., 2006). Similar to the current study, Richardson et al. had a small sample size and did not have a control condition, however, they found their intervention to be feasible, effective in decreasing depression, and well accepted by the participants.

An important factor that may have had some impact in “dampening down” the effects of the intervention on depression and also PA levels was major life events that occurred for the participants during the 6-month study. Given the average age of participants in the current study, it is inevitable that events, such as deaths within the family or close friends, or health issues arising for participants or their family, may have occurred during the study. During the current study, one participant experienced the death of his wife, while another’s brother passed away. For another six participants, health issues that were not present at the beginning of the intervention became apparent during the 6-month study. It is possible that these events may have had a negative effect on depression, or on PA, which could have masked the positive effects of the intervention for reducing depression or increasing PA.

It is impossible to determine exactly which aspects of the intervention may have been most beneficial for working with a depressed population, however, some ideas can be gained from examining previous research, and from the comments made by participants in the current study. In their intervention, Scholz et al. (2006) concluded that achieving personal goals during health behaviour change may be of particular importance for lowering depressive symptoms. Applegate et al. (1999) and Seime and Vickers (2006) also highlighted the importance of setting achievable long- and short-term goals when working with people with depression. In the current study, participants set long- and short-term exercise goals, and this seemed to be a worthwhile part of the intervention, with some participants commenting that having clear goals helped keep motivation levels high. Addressing barriers to and facilitators of PA in the intervention also may have been worthwhile strategies, particularly in the early stages of the intervention when some people were just beginning their exercise program. Pollock (2001) and Seime and Vickers stressed the importance of actively engaging individuals with depression in an assessment of the relevant PA barriers and facilitators. The follow-up aspect of the intervention also allowed for barriers and facilitators to be constantly readdressed if the individual’s situation changed.

Previous research has also demonstrated that interventions or programs designed for people with depression should be individually tailored to each participant’s specific situation. According to Seime and Vickers (2006) and Applegate et al. (1999), interventions that are specific to the needs of the individual with depression, and address relevant factors, such as likes and dislikes of PA, barriers and facilitators, pros and cons of PA, and salient benefits of PA, are more likely to be adhered to, than if they follow a “one-size-fits-all” approach. One of the major strengths of the exercise consultation intervention used in the current study was that it was individualised, and the one-on-one delivery enabled the intervention to be specific to the individual.

Another aspect of the intervention that was probably appropriate for use both with depressed individuals and with individuals who were not depressed was the follow-up contact and support provided through the fortnightly phone calls. The participants’ appreciation of the support received during the intervention, and also the interest shown in their well-being, was strongly expressed in the qualitative data. Participants felt as though they were not going through the process of behaviour change on their own, and enjoyed having someone to talk to about any issues associated with exercise. Seime and Vickers (2006) emphasised the importance of offering depressed individuals follow-up support, similar to what happens when individuals are involved in counselling or therapy for their depression. It is difficult to know whether the intervention as a whole, or just the support and follow-up contact, contributed to the reduction in depression levels over the course of the intervention.

Further research could address this issue by implementing three conditions in a study: an intervention condition in which participants receive the full exercise adherence intervention, including the follow-up support, another intervention condition in which participants receive support only, and a control condition in which participants receive usual medical care, but neither the intervention nor associated follow-up support. This could help ascertain the effects of both the intervention and follow-up support on reduction of depression levels. Either way, based on this and previous studies, follow-up support appears to be a crucial element of an intervention working to reduce depression levels and increase PA levels in people recovering from cardiac events.

Changes in Physical Activity over Time

Surprisingly, PA levels were found to be quite high among participants in the current study. Although self-report measures of PA can sometimes result in overestimating of PA and social desirability bias (Bauman & Merom, 2002), compared to other studies in which the CHAMPS was utilised, such as Stewart, Mills et al. (2001) and Stewart, Verbonocoeur et al. (2001), the overall PA levels reported in the current study were noticeably higher. Moderate PA levels were still in excess of those reported in previous research, however, not to the same degree. There could be a number of reasons for the high levels of overall PA reported in the current study. First, similar to the comments made in Chapter 3 about the high levels of PA found in Study 1, it is possible that a study of this type (i.e., conducting an exercise adherence intervention) may have attracted people who were already active or at least receptive to making exercise behaviour changes. Second, participants in the current study may have slightly overestimated the amount of time spent, particularly in low intensity exercise, resulting in higher levels of overall PA. It is possible that a social desirability effect might have occurred in the current study. Through the face-to-face, initial consultation, followed by 12 weeks of regular phone contact, I developed rapport with many participants. During the intervention, I sensed that some participants wanted to please me with adequate PA levels. However, this aspect of the intervention was one of its major strengths and may, in fact, have resulted in real increases in PA. Thus, it is difficult to ascertain whether the PA levels were slightly inflated, or whether they were accurate indications. Nonetheless, the main aim of the current study was to investigate changes in PA over time for the same participants, rather than comparing PA levels of participants in the current study to those reported in other studies.

Similar to the findings for depression, when all participants were included in the analyses, there were no statistically significant changes in either overall or moderate PA over time. Overall PA increased from baseline to Week 10, but then decreased to below baseline level by Week 24. For moderate PA, levels increased non-significantly from baseline to Week 10, and despite the small decrease from Week 10 to Week 24, the levels at Week 24 were still higher than at baseline. Reasonably large standard deviations were found, indicating a wide range of PA among participants.

One problem with analysing changes in PA levels for all participants is that cardiac patients with depression are less likely to engage in PA than patients without depression, as shown in previous research (Dorn et al., 2001). The results from the current study supported these findings. At baseline, Week 10, and Week 24, depressed participants were engaging in less overall and moderate intensity PA than their non-depressed counterparts. In addition, PA levels were very high for non-depressed individuals, indicating that it would be unlikely for the intervention to have any meaningful effects on PA levels of those people who were not depressed.

Analysing the differences in PA for depressed and non-depressed participants provided some interesting findings. Although the results did not reveal statistically significant differences in PA for depressed and non-depressed people, for overall PA, medium effect sizes were found at baseline, Week 10, and Week 24. The non-depressed participants were engaging in higher levels of PA at each time point. The results for moderate intensity PA were even more pronounced. At baseline, people with depression were engaging in significantly less moderate PA, compared to people without depression. These results, therefore, indicate that before the intervention had even begun, those people with depression were already at a distinct disadvantage with lower PA levels than their non-depressed counterparts. These findings support those of Dorn et al. (2001) and Blumenthal et al. (1982), who demonstrated that people with depression were less likely to be engaging in PA than people without depression.

One particularly promising finding in the current study was that the differences in moderate PA between depressed and non-depressed individuals became smaller over time. That is, at baseline, there were very large differences in PA levels between the depressed and non-depressed participants, whereas, by Week 24, these differences, and the effect size, were substantially less. It is possible, therefore, that depression may have had less of a negative impact on PA as time went by, or that the intervention was more successful at increasing PA levels for those people who were depressed. With a small sample size, quite large standard deviations, and the lack of a control condition, these results need to be interpreted with caution, however, they do highlight the possible positive effects of the intervention on increasing PA, particularly for people with depression. To my knowledge, there have not been any other studies conducted which have investigated differences in PA levels at numerous time points, for people with and without depression, therefore, it is difficult to interpret these findings with reference to previous research. In the absence of other research on this topic, the current study offers support for further research with larger samples to determine the effects of an exercise adherence intervention on PA levels, particularly for people with depression.

As previously mentioned, my particular interest, and the area in which I predicted that the intervention would probably have the largest effect, was on PA levels of depressed individuals. Unfortunately, I was unable to analyse this data with the sample size I was initially anticipating, but I was still able to investigate whether there were any changes over time in PA for depressed individuals.

Although the increases in overall and moderate intensity PA were not statistically significant, the results suggested that PA levels did increase from baseline to Week 10, and moderate intensity PA at Week 24 was still substantially higher than its baseline level. It is possible that participants might have "traded off" low intensity exercise for moderate intensity exercise. That is, rather than adding more moderate intensity exercise onto their current overall PA levels, participants with depression may have engaged in a moderate intensity activity instead of a low intensity one. Therefore, the intervention may have been successful in increasing moderate intensity exercise in depressed individuals. These findings are pleasing, given the physiological and psychological benefits associated with moderate intensity exercise (Australian Government Department of Health and Ageing, 2005), particularly for people with heart disease (Briffa et al., 2006). Given the small sample size, it would be very beneficial to conduct a similar intervention with a larger sample and a control condition, to ascertain whether there were any meaningful changes in PA over time for people with depression. This issue will also be addressed in further detail in the *Methodological Issues* and *Future Research* sections.

The qualitative information collected at the end of the intervention period revealed participants’ beliefs about whether they had changed their PA levels over the course of the intervention. Most of the participants believed they either increased their PA levels during the intervention, or continued to maintain already high levels of PA. In particular, qualitative comments from depressed individuals revealed that they believed their PA levels had improved substantially over the course of the intervention. Some people felt confident to try new activities, whereas others were given motivation to return to past exercise routines, which involved various activities. For some of the participants who were already exercising at a high level, often just becoming aware of how much exercise they actually were doing helped with motivation. As shown in the results of Chapter 3, and as I will demonstrate in the section on exercise SOC in the current chapter, the positive perceptions people have about their own level of PA have been found to be associated with lower levels of depression. The comments made by participants, that they believed they were engaging in more PA as a result of the intervention, were positive, and combined with the data showing trends towards increased PA over the course of the intervention, provide good preliminary evidence for an effective exercise adherence intervention.

Increases in PA following an exercise consultation intervention have been found in general populations (Lowther et al., 2002), and both cardiac (Hughes et al., 2002; Hughes et al., 2007) and diabetic (Kirk et al., 2004b) populations. Similar to the current study, Hughes et al. (2007) and Kirk et al. utilised exercise consultation interventions in their studies. The main differences between these studies and the current study were the length of the intervention, the inclusion of a control group, and the sample size. Hughes et al. (2007) and Kirk et al. both had a larger sample size than the current study, and included a non-treatment group control. The basic structure of the interventions in Hughes et al., Kirk et al., and the current study were similar, with all studies having face-to-face consultations at baseline and follow-up phone calls. In addition to the baseline consultation, Hughes et al. and Kirk et al. also had a second face-to-face consultation at 6 months, and follow-up phone calls occurring at 3 and 9 months for Hughes et al., and 1, 3, 7, and 9 months for Kirk et al. Although shorter in time, the current study had a more intense intervention phase, with the follow-up phone calls being made every 2 weeks for 12 weeks. In terms of increasing and maintaining PA, further research could examine the effectiveness of shorter, more intense interventions, such as that presented in the current study, compared to longer interventions as implemented by Hughes et al. and Kirk et al.

Participants commented that they enjoyed receiving the phone calls on a regular basis, and this aspect of the intervention helped keep them motivated to continue exercising. Based on the comments of participants, and the consistent pattern of increases in PA over the course of the intervention, I propose that the structure and design of the current study were suitable for cardiac patients, both with and without depression. Further research, using the same format intervention with a larger sample size and control group, could elicit results that demonstrate the effectiveness of an intervention of this type for increasing PA and decreasing depression in this population.

Changes in Exercise Stage of Change over Time

In the current study, there were no participants who were in the precontemplation exercise SOC, which is not surprising given the study topic. It would have been most unlikely to have someone volunteer to take part in an exercise adherence intervention if they had no intention of becoming more active (Jackson et al., 2007). Other studies that have utilised exercise consultation interventions have also reported this finding (e.g., Hughes et al., 2007; Jackson et al., 2007; Kirk et al., 2004b). Although exercise consultation could provide some assistance to people who are in the precontemplation stage of change in becoming more active, it is primarily designed for helping people in the contemplation, preparation, action, and maintenance stages of change (Kirk et al., 2007; Loughlan & Mutrie, 1995).

In the current study, exercise SOC showed signs of improvement, particularly during the 12-week intervention. All participants either progressed at least one stage or stayed in the same stage (i.e., preparation, action, or maintenance stages) from baseline to Week 10. Importantly, all participants who were in the contemplation stage and the majority of participants in the preparation stage, had all moved up at least one stage over the 12-week intervention. These results suggest that the intervention was effective in changing participants' perceptions about how active they believed they were. Although overall exercise SOC scores from Week 10 to Week 24 indicated that participants slightly regressed in their perceptions of how physically active they believed they were, in fact, the majority of participants either stayed in the same stage or moved into a higher stage over this time.

Other studies that have employed exercise consultation interventions have also reported on participants' successfully progressing into higher exercise stages of change (e.g., Jackson et al., 2007; Kirk et al., 2001; Kirk et al., 2004). Because the exercise consultation is specifically tailored to individuals' exercise SOC, a major aim of each study was to progress individuals through at least one stage. Kirk et al. (2001; 2004) and Jackson et al. found that participants receiving the exercise consultation intervention were significantly more likely to progress to a higher exercise SOC at follow-up than were people in the control condition. Jackson et al. demonstrated equivalent findings to the current study, with all individuals who participated in the exercise consultation intervention either progressing into a higher SOC or staying in the same stage, and all participants in the contemplation stage at baseline progressing into a higher SOC at follow-up. Helping people to progress even one stage higher on the stages of change model has been shown to double their chance of successful action on the behaviour under examination in the near future (DiClemente et al., 1991).

Although not conducted in the current study due to the small sample size, an interesting analysis that may be performed with a larger sample taking part in an exercise consultation, would be to investigate the relationship between baseline SOC and changes in PA levels. For those individuals in the inactive stages of change, such as precontemplation, contemplation, and preparation, a successful outcome after an intervention would be an increase in PA level, however, in the active stages (action and maintenance), the anticipated result may be a maintenance of PA. Future researchers could aim to recruit a sufficient number of participants in each SOC to allow for this type of analysis.

The results also revealed there were statistically significant differences in exercise SOC for people who were depressed compared to those who were not depressed at baseline. Those who were depressed at baseline were much more likely to be in a lower stage, such as contemplation or preparation, compared to action or maintenance for the non-depressed participants, at each time point during the study. The main difference between the preparation and action/maintenance stages, is that by the time people reach the action stage, their PA is regular, and once they progress to maintenance, they have been able to maintain regular PA for at least 6 months (Marcus, Rossi et al., 1992). As has been mentioned numerous times previously in this thesis, maintaining regular PA is very important for cardiac patients, particularly for those with depression. These results, however, suggest that individuals with depression perceived that they were in a less active SOC than people without depression.

The differences in exercise SOC for depressed and non-depressed individuals remained over the course of the study. Similar to the findings of differences in PA for people with varying levels of depression, however, the effect of depression on SOC became smaller over time and/or, the effect of the intervention on exercise SOC for people with depression compared to those without depression, became greater over time. All participants with depression perceived themselves as either being more active, or at least as active at Week 10, than they were at baseline, and this perception was maintained at Week 24. Participants without depression were mostly in the action and maintenance stages at baseline, and had virtually no change in exercise SOC across the course of the study. The results from the current study, therefore, suggest that the exercise consultation intervention may have been successful in increasing perceptions of exercise SOC in depressed participants and maintaining perceptions in non-depressed individuals.

The results also suggest that moving people from the preparation stage to the action or maintenance stages may be an important shift, given that the majority of depressed individuals were in the preparation stage at baseline, compared to the non-depressed individuals who were mostly in action/maintenance throughout the study. Progressing from preparation to action and maintenance is very important given that individuals go from not exercising regularly, to exercising regularly and maintaining regular exercise. In a cardiac sample, progression from the preparation stage to the action/maintenance stages has been shown to be associated with the perception of fewer barriers to exercise, and progression from, or continuation of, action/maintenance is associated with a perception of being less susceptible to future heart problems, having greater intentions to exercise, having higher task efficacy, and perceiving fewer barriers to exercise (Reid et al., 2007). Lowther, Mutrie, and Scott (2007) highlighted the need for interventions that are intended to progress people from preparation into action and maintenance, to focus on individuals' belief and commitment that they can be more physically active, and to encourage people to use the support of others whilst being physically active. There is a range of factors and strategies, therefore, that may need to be considered and addressed to ensure that people successfully progress from the preparation stage into the higher stages of exercise behaviour change.

These findings offer further support to the relationship between depression and exercise SOC as reported in Study 1 (Chapter 3). As previously mentioned, I could find no other studies that have investigated this relationship over time, either with or without the inclusion of an intervention. The results presented in Study 1 and in the current study, suggest that people with depression were less likely to perceive themselves as active individuals. It is not possible from these studies to determine whether depression influences people to perceive themselves as less active, or whether the perception of being less active elicits higher levels of depression. The findings in the current study, however, raise the issue of the likely relationship between exercise SOC and depression. The demonstration of positive changes in exercise SOC during the intervention of the current study for people with depression, suggests that exercise consultation may be effective in helping people progress to a higher exercise SOC, and might even be effective in decreasing depression levels for people with CHD. Further research is required to explore the relationship between exercise SOC and depression, and to determine the effectiveness of exercise adherence interventions for increasing SOC and decreasing depression.

Perceptions of the Exercise Adherence Intervention

Overall, participants reported they were very satisfied with the exercise adherence intervention. Participants who were active or inactive at the start of the intervention appeared to benefit from the program. For the active individuals, being involved in the program enabled them to become aware of exactly how much PA they were engaged in, and how much was required to maintain good health. In addition, they were able to explore other activities in which they could participate, in order to increase or maintain their levels of motivation. The inactive participants believed they had increased their confidence and motivation over the study period, and felt more prepared and ready to initiate PA programs. Previous research has indicated that exercise consultation interventions are particularly suitable for sedentary individuals (Lowther et al., 2002), however, because they are delivered at the individual level, and are stage specific, they are also appropriate for people in the higher stages of change (Kirk et al., 2007).

One of the major strengths of the intervention, according to participants, was the ongoing support provided to them during the intervention. This issue has already been addressed previously in the *Discussion* section of this chapter, more specifically on the benefits of follow-up support for people with depression. It seemed that both people with and without depression appreciated the support, because it provided them with increased motivation to begin, or continue with, their exercise program. Previous research has also highlighted the importance of ongoing support and follow-up for maintenance of PA (e.g., King et al., 1998; Muller-Riemenschneider, Reinhold, Nocon, & Willich, 2008). Interestingly, a number of the participants felt somewhat accountable to me as the researcher for keeping up their PA, and this provided them with added incentive to continue exercising. Having the initial face-to-face and then regular telephone contact with the participants, is likely to have assisted in developing rapport and trust. Although the exercise consultation can be delivered by any health care professional with minimal training in cognitive behavioural interventions and knowledge of PA for the specific population, it is crucial for the success of research interventions that researchers have excellent communication and listening skills, and that an environment of trust and support is developed (Loughlan & Mutrie, 1995).

Feelings of accountability to me as the researcher could have increased participants' motivation to be physically active, but it is difficult to know how this impacted on motivation levels once the intervention had concluded. When learning to change behaviour, such as exercise, individuals need to come to rely less on extrinsic sources of motivation, such as other people or rewards, and more on their own intrinsic motivational resources, such as enjoying the process and experience of exercise and wanting to change the behaviour for themselves (Berger, Pargman, & Weinberg, 2006). One of the aims of the intervention in the current study was to foster a sense of independence and confidence in participants, so that they would be able to maintain adequate levels of PA over the long-term. Although the qualitative and quantitative results suggest this beginning to be achieved, without following-up participants for another 6-12 months after the conclusion of the intervention, I cannot be sure whether these effects would have been maintained long-term. Future exercise adherence interventions must be designed and implemented with the aim of encouraging participants to develop intrinsic motivation, in order to ensure long-term adherence to PA.

An interesting observation was made by a number of the participants with regard to the timing of the intervention. Although participants were happy with the overall intervention, some felt that it would have been more beneficial if it were offered to them soon after their cardiac event, and possibly as a direct follow-up to their hospital-based CR program. It is particularly interesting that participants raised this issue because, based on the findings from Study 1 (presented in Chapter 3), the original target population for this study was cardiac patients involved in the hospital Phase II CR programs. Therefore, all participants would have recently experienced a cardiac event, and the intervention would likely have been very relevant to their situation. Due to major difficulties associated with recruiting participants who were involved in the CR programs for Study 3, I was unable to recruit enough participants who had recently experienced their cardiac event. The final sample, therefore, included a small number of people who had experienced their heart problems less than six months prior to recruitment, and the majority who had experienced heart problems more than six months before recruitment. Most other exercise adherence interventions for cardiac patients have been conducted soon after the cardiac event (e.g., Carlson et al., 2000; Hughes et al., 2007; Scholz et al., 2006; Sniehotta et al., 2005). Although future exercise adherence interventions should continue to address the specific needs of cardiac patients soon after their cardiac event, long-term adherence of PA is critical in maintaining good physical and psychological health. Therefore, I propose that interventions could be conducted soon after individuals' heart event, but with "top-up" sessions provided over time to ensure long-term adherence.

Another issue raised by participants, along the same lines as the timing of the intervention, was specifically about the length of the intervention. Participants thought the fortnightly follow-up phone calls over the first 3 months were very useful, but some participants thought that the phone calls could have continued at the rate of one per month for the following 3-6 months. The follow-up involved in exercise consultation has become an important aspect of these interventions, with more recent studies, such as those by Fitzsimons et al. (2008), Hughes et al. (2007), and Kirk et al. (2004b) opting for longer periods of telephone follow-up and more face-to-face contacts, compared to the earlier studies of Hughes et al. (2002) and Kirk et al. (2001). Due to time restraints, I was unable to extend the length of the intervention in the current study, but I believe that the intensive initial 3-month phase of follow-up telephone calls, plus a less-intensive following 3-12 months could be an effective way to provide enough follow-up to ensure greater success at long-term maintenance. This issue is addressed in more detail in the *Methodological Issues* and *Future Research* sections of this chapter.

A number of the participants also suggested that an intervention of this type would have been most effective for people who had low levels of motivation, or for those who were struggling to come to terms with the psychological and physiological changes associated with CHD. Similar to the comments made earlier about how effective the intervention would have been for people soon after their cardiac event, the original intervention had been designed specifically for people who had at least mild levels of depression. Due to major difficulties with recruiting participants with depression, only half of the final sample in the current study were depressed. Had I been able to recruit only participants with depression, it is probable that some of the trends of reduced depression and increased PA observed for the small number of depressed participants over time would have been statistically significant. The problems associated with recruiting and retaining participants with depression into any study, let alone an exercise intervention study, have been reported previously (e.g., Richardson et al., 2005). Again, this issue will be addressed in further detail in the *Methodological Issues and Future Research* section of this chapter. Although it was unfortunate that I was unable to recruit only participants with depression, it was promising that participants in the current study believed that an intervention of this type could be effective in encouraging increased adherence to PA for people with depression.

Methodological Issues and Future Research

In this section of the chapter, I discuss methodological issues of the current study. I refer to strengths of the study and I make suggestions for how the limitations could be overcome in future research. In addition, I present other research ideas that have arisen from the current study.

The main problems encountered in the current study centred on recruitment difficulties. As I have previously mentioned, originally the sample was to have consisted of approximately 40-50 participants with depression, who had recently experienced their cardiac event. The sample would have then been randomly assigned to either a standard care control or intervention condition. This would have resulted in a sufficiently powered study to detect clinically significant differences, with a relatively homogenous sample in terms of depression levels and time since cardiac event, and a randomised control trial design. The major limitations of the current study, therefore, were the small sample size, the variation in depression levels and time since the cardiac event, and the lack of a standard care control condition. I was particularly interested in conducting an intervention using a RCT design, however, the smaller than expected sample size made this impossible and impractical. Despite the obvious limitations of the current study, its results suggest overall trends for the effectiveness of the exercise consultation intervention in increasing PA, decreasing depression, and progressing exercise SOC, particularly for people with depression. Given these promising results, if future researchers of exercise consultation interventions consider and address the limitations of the current study, they may demonstrate even clearer and statistically significant changes in depression, PA, and exercise SOC.

Overcoming the difficulties associated with recruiting participants, such as those who were required for the current study, is not an easy task. Specifically, attempting to recruit people who have recently experienced a major life event, such as a cardiac event, *and* who are experiencing acute or chronic symptoms of depression, is especially difficult. Cardiac patients with depression find it more difficult to adhere to specific cardiac treatments (Romanelli et al., 2002), cardiac rehabilitation (Turner et al., 2002), and PA (Blumenthal et al., 1982), compared to people without depression. In addition, retaining people with depression throughout the course of a study, particularly one that involves a follow-up period, can also be difficult (Richardson et al., 2005; Vickers et al., in press).

While researchers need to be mindful of these potential problems, studies can be designed such that they are particularly appropriate and suitable for people with depression. When conducting exercise interventions with people with depression, researchers should aim to encourage participation by ensuring that the program is individually tailored to the specific needs and abilities of people, is rewarding and enjoyable (Seime & Vickers, 2006), and is largely participant-driven (Pollock, 2001). The current study had a very good retention rate, with only one participant withdrawing from the study (due to personal circumstances). I believe that the high retention rate was, at least in part, due to the individualised design of the intervention, which took the personal circumstances, needs, and abilities of each participant into consideration. Another strength of the current study was that the ongoing support provided to participants throughout the intervention was delivered by one researcher and, therefore, offered a continuity-of-care type program.

Despite the positive aspects of the current study, future research should be conducted to investigate the best ways to engage people with depression in PA, and to determine the most appropriate and effective types of interventions for people with depression. For example, although exercise consultation has been successfully utilised as an intervention to increase PA in people with other chronic illnesses, such as CHD (e.g., Hughes et al., 2007) or diabetes (e.g., Kirk et al., 2004b), apart from the current study, exercise consultation has not been examined in any depth with depressed participants. The results of the current study indicated that exercise consultation could be particularly effective in increasing PA in this population. There may also be other types of adherence interventions or psychological strategies that are effective for increasing PA in people with depression. For example, for people with moderate levels of depression, exercise consultation could be used in conjunction with psychotherapy to increase PA levels and improve patients' overall psychological well-being.

In addition to investigating the most effective types of interventions for people with depression, further research could examine the effects of different characteristics of interventions on PA adherence and depression levels. Specific research questions that could be addressed include whether people would benefit more, in terms of increasing PA and decreasing depression, if interventions were conducted in groups, rather than as individual programs, and whether the setting of an intervention (e.g., in the home, community, or a health care setting) influences the effectiveness of the intervention. In conducting future exercise adherence interventions, researchers may also need to consider allowing participants to choose an intervention type from two or three options that they believe will best suit their needs and specific circumstances, to allow for an individually tailored approach (e.g., an individual-based intervention conducted in the participant’s home, or a group-based intervention run by the local community health centre). Although there can be difficulties in conducting research with people with depression and CHD, I believe that it is crucial for researchers to continue investigating the best ways to engage participants with depression in regular PA, and to determine appropriate and effective ways in which to decrease depressive symptoms through PA.

By conducting large-scale exercise consultations, which utilise RCT designs and are specific for people with depression and CHD, researchers could overcome two of the major limitations of the current study. Oldridge (1988) highlighted the importance of randomised controlled designs to determine the full effects of interventions. Based on issues raised in the current study, it would be interesting if future research could be conducted to examine the effects of an exercise consultation intervention, which not only includes a standard care (control) condition receiving usual medical care only, but also a standard care plus support condition, which provides participants with an equal amount of support and time as those in the exercise consultation group, but without the actual content of the consultation. The results of studies employing this type of RCT design would provide useful information on the effect of specific exercise consultation techniques and the effect of the support only. From the comments made by participants in the current study, the most effective time for conducting exercise adherence interventions, such as those just mentioned, would likely be either towards the end stages of the Phase II CR program or just after the conclusion of the CR program. If possible, participants should be recruited directly through the CR programs, to encourage continuity of care, and to follow-on from the progress made during CR. Conducting interventions at this time, and recruiting participants in this manner, is likely to increase both the effectiveness of the PA adherence interventions, and the number of participants recruited into the program.

In the current study, the content for the exercise consultation was designed using the results from the qualitative study presented in Chapter 4 of this thesis, in addition to previous literature on exercise consultation. This was one of the major strengths of the current study, in that the design of the intervention was based on personal PA experiences of people with depression and CHD, as well as research on effectiveness of PA interventions for the general population, and other chronic illness populations. To my knowledge, however, this was the first exercise consultation study that had been conducted with people with both depression and CHD. It is difficult to determine, therefore, exactly which specific strategies and techniques were most or least successful for encouraging PA adherence in this population. For example, the goal setting activities or self-efficacy enhancing techniques may have been particularly useful, whereas participants may not have benefited greatly from the decisional balance activity. Or it is possible that participants benefited from having involved and included in the intervention, significant others or people who could provide social support. Further research into which strategies and techniques would be most effective and appropriate in PA interventions for people with depression and CHD would prove extremely useful in developing this area of research and practice.

In terms of effective PA measures to be used in exercise consultation interventions, future research could explore the value of including more objective tools that monitor the amount of PA performed, such as pedometers or accelerometers, in addition to self-report PA questionnaires. As well as providing a more objective measure of PA, pedometers have been shown to act as an effective technique to increase maintenance of PA (Croteau, Richeson, Farmer, & Jones, 2007). A number of the participants in the current study also commented that motivation could have been increased even more if the intervention had incorporated some physiological measures throughout the 6-month study, so that the participants could monitor any physiological improvements in their fitness or heart health. Further research could also explore the effects on motivation to adhere to PA of including physiological measures within the intervention.

Fitzsimons et al. (2008) described their study, for which data collection is still occurring, which incorporates psychological and physiological techniques and measures. They aim to determine the effectiveness of a pedometer-based walking program in combination with exercise consultation with inactive Scottish men and women. That project involves a long-term follow-up, with numerous physiological and environmental measures taken, in addition to the objective and subjective PA measures. Also, qualitative information from key stakeholders and participants is being collected via semi-structured interviews and focus groups in an early stage of the study. Finally, an economic evaluation of the intervention will also take place. The extensive results of the research by Fitzsimons et al. are eagerly anticipated in the coming years, as they may guide the design and implementation of future exercise adherence interventions.

If, in the future, researchers can explore in more detail the most appropriate strategies to incorporate into an exercise consultation, then it would also prove interesting to learn more about the most effective way to structure the intervention. In previous studies, researchers, such as Hughes et al. (2007) and Kirk et al. (2004b), found that exercise consultations and the associated telephone follow-ups conducted over a period of 9 months were successful at increasing PA. As previously described, Hughes et al. and Kirk et al. included an extra face-to-face consultation and follow-up phone calls which were delivered less often but over a longer period of time, compared to the current study. Participants in the current study were satisfied with the structure of the intervention, and, in particular, the ongoing support that was provided for 12 weeks after the initial face-to-face consultation.

Future research could investigate specific issues, such as the effects of face-to-face consultations and follow-up phone calls at various times during an intervention, and whether the structure of the consultations and phone calls should take the individual's specific situation into account, or whether the structure should be the same for all participants. For example, some participants may benefit more from a second face-to face consultation after 3 months, and some may require follow-up phone calls every 2 weeks for the first 12 weeks, but then monthly calls for the next 3 months. Other participants, however, may not need another consultation until 5 or 6 months, and may require less frequent follow-up phone calls, which are terminated earlier.

In future, researchers could also explore how long interventions should be in order to achieve the desired increase or maintenance of PA. Researchers have shown that exercise adherence for the general population (Lowther et al., 2007) and for cardiac patients (Dorn et al., 2001; Moore et al., 1998) can decrease markedly approximately 3 months after involvement in an intervention or CR program. In addition, researchers have suggested that the crucial period for long-term maintenance of PA is between 6 and 12 months (Jackson et al., 2007; Lowther et al., 2002;

Lowther et al., 2007). The design of the current study allowed for a 3-month intervention, followed by a 3-month follow-up period, although, due to time restraints, I was unable to further extend the length of either the intervention or follow-up. It would be interesting, therefore, to determine both the ideal length for exercise consultation interventions to ensure adequate long-term adherence, as well as an adequate length of time for follow-up to determine whether long-term adherence is achieved. Researchers who conduct exercise adherence interventions should also include detailed economic evaluations or cost-benefit analyses to determine the feasibility and possible benefits of the intervention (King et al., 1998; Roux et al., 2008).

In the current study, the results demonstrated a strong relationship between higher exercise SOC scores (i.e., either progressing to, or maintaining, a more active exercise SOC) and lower levels of depression. Only a limited amount of research has been conducted on the relationship between exercise SOC and depression, and also on the relevance of this relationship to actual PA adherence, however, the current findings provide evidence that further research into this topic is warranted. Having a better understanding of how individual's perception of their level of PA and depression are related, in addition to knowing whether this relationship has an impact on an individual's PA level, could be valuable information for researchers and health professionals alike. Similar to the relationship between PA and depression being reciprocal, it is likely that there is a reciprocal relationship between exercise SOC and depression. It would be interesting to determine the degree to which depression affects exercise SOC and exercise SOC affects depression.

Along the same lines, further research should continue to investigate the most effective way for people with depression and CHD to progress through to higher levels of exercise SOC. The particular strategies and techniques that are likely to be the most appropriate and effective at helping people with depression and CHD progress to a more active level, or to maintain an active level of exercise SOC, require further examination. For example, goal setting might be particularly relevant and helpful for people with depression to progress to a higher level of exercise SOC, or increasing self-efficacy for exercise may be essential in improving one's perceptions of their PA levels. This information could then help guide the development of new exercise adherence interventions designed specifically for people with depression and CHD.

Summary

In summary, the results of the present study suggested positive effects of an exercise adherence intervention on depression, PA, and exercise SOC in people with CHD. Although the results did not reach statistical significance, depression levels decreased from baseline to Week 24, and both self-reported PA levels and exercise SOC levels improved over the 12-week intervention. Results also indicated that people with depression at baseline were more likely to have lower PA levels and perceive themselves as being less active compared to people who were not depressed, at all time points throughout the study. The findings from the current study also suggested that the intervention may have been particularly effective for those participants with depression at baseline, in decreasing depression levels, increasing PA, and moving exercise SOC to more active levels. The qualitative data also highlighted the success of the intervention, particularly in increasing levels of PA. These findings are particularly relevant for researchers aiming to design effective and appropriate exercise adherence interventions for people with depression and CHD, and also health professionals who are aiming to increase PA levels and decrease depressive symptoms in people with CHD. The promising results of the current study highlight the great potential in conducting larger scale, RCT, exercise adherence interventions, which incorporate the principles of exercise consultation, for people with depression and CHD.

CHAPTER 6: GENERAL DISCUSSION

Summary of Overall Findings

The overall aim of the present thesis was to investigate the relationship between depression and PA in people with CHD. By conducting three linked studies, I aimed to explore some of the research issues that have, to date, been largely unexamined by researchers. The first study was a descriptive study which was designed to “set the scene” for the remaining two studies. I was particularly interested in determining whether there were any changes from baseline to follow-up (approximately 6 months later), in depression, PA, and exercise SOC, in addition to ascertaining the nature of the relationship between depression and PA, and depression and exercise SOC at both time points. The purpose of the second study was to explore the PA experiences of people with both depression and CHD using in-depth interviews. Specifically, I wanted to learn about the factors that affected participation in PA for people who had recently completed the hospital-based CR program. Finally, based on the findings from Studies 1 and 2 and the relevant literature, I designed and implemented an exercise adherence intervention and tested its suitability for people with CHD and depression.

The results from Study 1 demonstrated that, on average, depression levels were high, both soon after a cardiac event, and up to 18 months later. There were no statistically significant changes in depression from baseline to follow-up, indicating that if individuals were experiencing high levels of depression soon after their cardiac event, it was likely that these levels of depression would still be present 6-12 months later. Although participants reported higher average levels of PA on most of the subscales at follow-up, there were no statistically significant changes over time. I also found negative relationships between depression and most of the PA subscales, and depression and exercise SOC, indicating that those people with higher depression levels were less likely to engage in PA, and less likely to perceive themselves as active individuals. From Study 2, I learned about the factors that influence participation in PA for people with depression and CHD. Some of the common barriers reported by participants included depression, changes to the way people perceived their health and life after a cardiac event, and a lack of motivation, while the facilitators that helped with maintenance included having a reason for exercising, being aware of the psychological benefits of exercise, and having positive social support.

Having gained information that highlighted both the issues and problems associated with depression in terms of remaining physically active, but also some of the strategies used to help adherence to PA, I designed and conducted an exercise adherence intervention that was specific and appropriate for people with depression and CHD. The results from the 12-week intervention study (Study 3) revealed firstly, that people with depression were more likely to have lower PA levels and perceive themselves as being less active compared to people who were not depressed, at all time points throughout the study. Secondly, although not reaching statistical significance, the results showed that the exercise consultation intervention may have been effective at increasing PA, decreasing depression levels, and progressing people to more active levels of exercise SOC, particularly for people with depression.

In the remainder of this chapter, I address some of the major findings that have emerged from the present thesis. I discuss the importance and relevance of each finding to the previous research in the area of PA and depression in people with CHD, and identify potential future research directions. I also link the findings of the three studies together, and discuss how they influence and relate to each other. In addition, I address the implications of the findings of the present thesis for health professionals working with people with CHD and depression, such as CR coordinators, psychologists, and exercise professionals, as well as family members and friends of this population group.

The Prevalence and Severity of Depression in People with Coronary Heart Disease

One of the most noted findings from the current research was the prevalence and severity of depression in people with CHD. I found depression to be highly prevalent soon after a cardiac event, with approximately 25% of people experiencing minor depression and 35% experiencing major depression. The rate of minor depression I found in Study 1 was consistent with other studies, such as Schrader et al. (2004) and Schleiffer et al. (1989), however, the percentage of individuals experiencing major depression was higher in the current study, compared to previous research. In particular, compared to another Australian study conducted by Wise et al. (2006) that also used the CDS to measure depressive symptomatology, major depression was found to be more prevalent in the present study. One of the reasons for this discrepancy could be that, in the Wise et al. study, all participants who took part in the research were completing the CR program, whereas in the current study, approximately 30% of participants had not taken part in CR. In the current study, participants were recruited via *referrals* to CR, whereas the Wise et al. study, and many other studies that aim to determine prevalence rates of depression, have sampled from *attendees* at CR programs. Previous research has shown that people with depression are less likely to participate in CR, compared to those without depression (Turner et al., 2002), therefore, it is likely that the prevalence rates obtained in the current study were a more accurate reflection of the overall cardiac population, than were those found in Wise et al. However, even though the rates of depression, in particular major depression, were high in the current study, it is possible that they were still an underestimate of the true extent of depression in cardiac patients. Participants in the current study were required to complete and return the questionnaire to the researchers in their own time, and it is likely that the more severely depressed individuals did not take part in this process. Determining a way to recruit a truly representative sample is a critical issue. Thus, there is still a need to find other ways to accurately estimate the true levels of depression in people who recently had a CHD event.

The results from Study 1 also indicated that there was virtually no change in depression levels from baseline (within 1-12 months post-cardiac event) to follow-up (approximately 6 months later). These findings are noteworthy, given that, on average, depression scores were still in the “minor depression” category at follow-up, according to the CDS classification of Shi et al. (2008). One of the disturbing findings from the follow-up component of the study was that, even 6 months or more after the cardiac event, according to the CDS, almost half of all participants were experiencing at least minor depression, and one-third of participants were experiencing major depression. These results are worrying for two main reasons. First, it is a major concern that such a high number of people are still being affected by depression, and in many cases, major depression, between 6 and 18 months after a cardiac event. Second, the people who participated in the follow-up phase of the research were less depressed than those who did not. This latter observation suggests that the real number of people experiencing depression up to 18 months after their cardiac event may be even higher than the levels indicated by the present figures.

In Study 3, it is most likely that depression levels were, again, an underestimate of mean depression levels of cardiac patients, because all of these participants had agreed to take part in a longitudinal, exercise adherence intervention. Compared to Study 1, in which mean depression levels fell well within the Shi et al. (2008) category of minor depression, in Study 3, mean depression levels were categorised as “no depression”. Although *mean* depression levels were reasonably low in the intervention study, these results do not highlight the fact that nine out of 20 of the participants who did take part in the intervention study, were experiencing at least minor depression at the beginning of the 12-week intervention, and for five of these participants, their depression was considered major. Again, one of the concerning aspects of these findings, is that the majority of participants who were depressed at the beginning of the intervention had experienced their cardiac event approximately four years previously. The results presented in this thesis, therefore, highlight the potential longevity and severity of depression following a cardiac event.

The problematic nature of depression for people with CHD has been shown in previous research, which demonstrates that depression is a risk factor for poor outcomes following a cardiac event, such as increased cardiac-related morbidity (e.g., Borowicz et al., 2002), cardiac-related mortality (e.g., Barefoot et al., 1996), all-cause mortality (e.g., Carney et al., 2008), future cardiac events (e.g., Whooley et al., 2008), and decreased quality of life (e.g., Parashar et al., 2006). In addition, depression is also associated with non-adherence to cardiac-specific medical treatment (e.g., Romanelli et al., 2002), CR programs (e.g., Glazer et al., 2002), and exercise programs (e.g., Dorn et al., 2001). Blumenthal et al. (2003) specifically found that the risk of poor outcomes following a cardiac event was particularly high for people whose depression was still present 6 months after the event. Based on the previous research, therefore, it is likely that depression, particularly depression that persists for at least 6 months, may negatively impact on an individual's ability to effectively manage necessary lifestyle changes and recover from a cardiac event.

The current and previous research have shown high rates of continuing depression and potential problems associated with persistent depression in terms of recovery from a cardiac event, and longevity and quality of life. These issues raise questions about whether further, ongoing assessments of depression by healthcare professionals are required in the year or two following cardiac events. Further research should aim to determine the most effective and feasible ways to carry out such assessments. Issues that could be addressed include, how often assessments would be required, what assessment tools would be most effective to use with this population, given, for example, the setting in which assessments would be taking place and the resources available to the health professional, which health care professional would be most suitable to conduct the assessments, and how results of the assessment would be shared with other health professionals. Research should also investigate how the most severely depressed people can be reached, assessed, and treated. Health care professionals may also need more support and resources to carry out such assessments, and to be provided with information on what to do with the results of the assessments. This issue will be discussed in further detail in the *Implications for Practice* section of this chapter.

The Ongoing Negative Relationship between Depression and Physical Activity

One of the main findings to emerge from all three studies of the present thesis was the negative relationship between depression and PA in people with CHD. In Study 1, I found, albeit mostly small, negative correlations between depression and PA subscales. The negative association between depression and PA, however, was found to be consistent among people who had experienced their cardiac event between 1-6 and 7-12 months previously, in addition to when participants were followed-up approximately 6 months later. In addition, the walking subscale, which may be the most accurate indication of typical PA undertaken by this population, was significantly related to depression at baseline, and approached statistical significance at follow-up.

Participants in Study 2 also indicated that depression was a major barrier to them being able to maintain regular PA. They reported that when they felt depressed or were having an episode of depression, they were far less able to participate in their usual activities, such as exercise. For a number of the participants, the depression had been present for at least 6 months and was still negatively impacting on their ability to be physically active. As well as depression being considered an independent barrier in its own right, the results from Study 2 also revealed that depression was closely associated with a number of the other barriers to PA, such as coming to terms with changes in one's health and life as a result of the CHD, lack of motivation, and physical restrictions preventing the individual from exercising. It appeared that depression was having a negative effect on PA in numerous ways. On a more positive note, however, participants also commented that when they did engage in PA, they felt less depressed, less stressed, and more relaxed. These positive psychological experiences, in turn, acted as facilitators to help people continue their PA.

Similar to the results found in Studies 1 and 2, in conducting the intervention study, I found that depression and PA were negatively associated at each of the three time points. Those participants with depression at baseline were less likely to be physically active at baseline, at the end of the intervention, and 6 months later. However, one pleasing finding was that, over time, the negative effect of depression on PA became less pronounced, suggesting that the intervention may have been effective in decreasing depression and increasing PA in people with depression. Nonetheless, the negative and ongoing association between depression and PA was a consistent finding throughout the current thesis.

Previous research has demonstrated the negative relationship between depression and adherence to PA in cardiac populations (e.g., Blumenthal et al., 1982; Dorn et al., 2001). The negative impact of depression on adherence to PA is often interpreted in the literature as implying that depression causes poor adherence. Wing et al. (2002) suggested an alternative model, indicating that the poor adherence to PA may precede and influence depression. They proposed that it may be more effective to directly focus on increasing the behaviour, in this case, PA, to achieve a positive outcome on both depression and health indices. Cause and effect is unclear in the depression-PA relationship. One reason for this is that researchers typically start their studies at some point during the process. In fact, it is likely that the depression-PA relationship is reciprocal, that is, depression makes it harder for people to be physically active and low PA levels contribute to depression. Further research into the proposed model put forward by Wing et al. is warranted, particularly if this knowledge can help in the design of interventions to increase PA behaviour. Another topic for future research is to investigate the reciprocal relationship between PA and depression in people with CHD. This may be best investigated using a longitudinal, repeated measures design with the causal links between PA and depression, and depression and PA examined using structural equation modelling (Joreskog & Sorbom, 1993).

Another area of research that remains unexplored is how the relationship between depression and PA changes over time. Some studies have employed a longitudinal design to measure self-reported PA (e.g., Moore et al., 1998; Reid et al., 2006), or depression (Grace et al., 2005) over time in a cardiac population, however, none have examined the relationship between PA and depression over time. In Study 1, I found that the relationship remained negative over time, and that there was a small increase in the negative correlation between depression and the walking subscale over time. I was unable, however, to fully ascertain any change in the relationship, due in part to the small sample size. It would be interesting to know whether the association between higher depression levels and lower PA levels was more problematic soon after a cardiac event, compared to one or two years later. Information of this type should help identify at what stage or stages after a cardiac event, people might be at higher risk of being depressed and not adhering to PA. This would help to identify the most effective times to deliver interventions to increase PA. In addition, CR coordinators and other health professionals could use this information to help guide the design and delivery of hospital and maintenance CR and exercise programs.

The difficulties associated with conducting research of this type (i.e., studies of PA in people with CHD and depression), in terms of recruitment and retention, were addressed in detail in Chapter 5. Although I do not wish to repeat that discussion, I believe it is necessary to highlight, in the present chapter, the biggest challenge that I experienced in conducting research in this field. For numerous reasons outlined in this thesis, research investigating the relationship between PA and depression, reasons for adherence and non-adherence to PA, and solutions that may aid in enhancing adherence to PA, for people with CHD and depression, is vitally important. It can be very difficult, however, to recruit people, particularly with depression, into these studies. As mentioned in Chapter 5, future research into how to best recruit and retain participants with depression into studies involving PA interventions, or other PA topics, is warranted and important.

The Relationship between Perceived Levels of Physical Activity and Depression

Another consistent and important result to emerge from the present thesis, which is, to date, unexplored in the literature, was the strength of the relationship between exercise SOC and depression. More specifically, the finding that people who were categorised as inactive, according to the stages of change model (i.e., those who rated themselves as being in precontemplation, contemplation, preparation), were significantly more depressed than those in the active stages of change (action, maintenance). These findings were statistically significant in Study 1, at baseline and follow-up, and also in Study 3. The differences in magnitude of depression levels for the active and non-active individuals were very large. In Study 1, at baseline, depression scores for those not active, bordered on the major depression category, whereas for active people, depression levels were in the no depression category. In the follow-up phase of the study, these differences were even more pronounced. Depression levels for the active participants were in the no depression category, and for the non-active individuals, depression levels were well into the major depression category. Another interesting finding from the follow-up study was that those individuals who were not active at baseline, but were active at follow-up had the greatest decrease in depression levels over time. On the other hand, individuals who were either active at baseline but inactive at follow-up, or inactive at both baseline and follow-up, on average, had increased depression levels over time.

I reported similar findings in Study 3. Those participants who were depressed at baseline were significantly more likely to be in the more inactive stages, compared to those who were not depressed at baseline. These differences remained over the course of the intervention study, however, similar to the PA data, the effect of depression on exercise SOC appeared to become less pronounced over time. To my knowledge, research exploring the relationship between exercise SOC and depression has not been conducted previously. A small number of studies have examined the relationship between depression and readiness to change other health behaviours, such as smoking (Prochaska et al., 2004; Tsoh & Hall, 2004) and excessive alcohol intake (Barnett et al., 2002; Blume et al., 2001), however, the findings in those studies were equivocal in demonstrating a relationship. It is likely that the relationship between depression and changing exercise habits in people with CHD is very different to that between depression and changing negative health behaviours, such as smoking and excessive alcohol intake. For people with CHD, the relationship between depression and readiness to change exercise behaviours is likely to be complex. This relationship may include moderating effects from the CHD itself and the consequences of the CHD (e.g., more health problems, ceased employment), or actual PA undertaken.

Further research should focus on investigating the relationship between depression and exercise SOC in people with CHD. The current research has provided some interesting findings that suggest there is a strong, negative relationship between depression and exercise SOC, however, more research could address specific issues. For example, it would be interesting to learn more about the reciprocal relationship between depression and exercise SOC, and to know how much of an influence depression has on exercise SOC, and what impact exercise SOC has on depression. The effect of other variables on this possibly complex relationship could also be determined.

In addition, future research could examine how actual PA levels are related to exercise SOC, and how PA levels impact on the relationship between depression and exercise SOC. In Study 1, I found that individuals who perceived themselves as active, had significantly higher PA levels than those who perceived themselves as inactive. Further research that examined the correlation between actual PA, measured via self-report and also measured using more objective measures, such as accelerometers, could prove valuable. The measure to determine exercise SOC is simple and quick to complete. If it was found to correlate closely with actual PA levels and was shown to be highly related to depression, it may provide health professions with a tool that could quickly and easily assess people with CHD who may be at higher risk of not adhering to PA, and possibly be experiencing depression. I am not suggesting that the exercise SOC measure should be used instead of tools designed to determine actual amounts of PA undertaken. However, if, after further research, exercise SOC is shown to be a reliable and valid measure of PA habits, it might provide health care professionals, particularly those with limited time and resources, with an alternative to more cumbersome or expensive measures of PA. Also, if future research projects with substantial sample sizes uncover a relationship between exercise SOC and depression, as I did in the present thesis, the exercise SOC measure could also be useful, even as a first step, in identifying people who might be at a higher risk of experiencing depression.

“Light at the End of the Tunnel”: Effectiveness of Interventions

Most of the issues raised in this chapter, thus far, have focused on the problematic nature of depression for people with CHD, particularly in terms of adhering to PA. It is crucial that we have a solid understanding of how depression can impact upon recovery from a cardiac event. In the current thesis, the research conducted in all three studies, provided a clear picture of the negative relationship between depression and PA for people with CHD. The information gained, particularly in Study 1, assured me that I needed to learn more about the factors that influenced whether people with depression and CHD were able to be physically active. It was not enough to know that there was a problem. I needed to ascertain why there was a problem, and whether I could find some strategies to help solve the problem. Conducting Study 2 enabled me to talk with participants about their own personal experiences with PA, and to delve deeper into the issue of how I might be able to conduct an intervention to assist in enhancing the facilitators of, and eliminating the barriers to, PA. The insight I gained from Study 2 into experiences of people with CHD and depression, in terms of PA, was instrumental in helping me design the exercise consultation intervention conducted in Study 3.

Some of the key factors that were mentioned in Study 2 were incorporated into the intervention study. Participants in Study 2 identified a number of relevant barriers to, and facilitators of, PA. For example, depression, changes to one's lifestyle as a result of the CHD, physical restrictions, and lack of social support were identified as barriers to PA. On the other hand, common facilitators mentioned were having a reason for exercising, psychological and physical benefits of exercise, the positive role of others, and using psychological strategies. With these findings in mind, I either discussed some of these issues with participants in Study 3 to find out whether they might be relevant to their situation, or I incorporated the ideas into strategies or techniques within the Study 3 intervention. For example, in the exercise consultation session in Study 3, I encouraged participants to speak about whether they felt that depression, or physical restrictions, or a lack of social support hindered them in their attempts to be physically active. If these issues were relevant to the individual, the participant and I would address ways to possibly overcome these barriers. Similarly with the facilitators, if participants in Study 3 felt that knowing more about the psychological benefits of exercise or having a reason for exercising helped them to be active, we addressed these issues. I also encouraged participants who took part in the intervention to discuss their own relevant barriers and facilitators, as this was shown in Study 2 to be a very necessary aspect of an intervention.

As well as incorporating the findings from Study 2 into discussion topics in the intervention in Study 3, I also applied some of the techniques that Study 2 participants had successfully used to help with PA, into the intervention. For example, a number of the participants mentioned that they found it very helpful to have the involvement of a spouse, family member, friend, or local community or exercise group, in keeping them physically active. Others commented that they used goal setting, positive self-talk, or recording their exercise in a diary to help them adhere to their PA program. Of course, not all of these strategies were suitable for all participants in the intervention in Study 3, but the insights gained in Study 2 provided me with a "bag of tools" to use as appropriate in the exercise consultation intervention.

As mentioned, having direct input in Study 2 from people who had been through the difficulties associated with depression and CHD, in terms of adhering to PA, was extremely important in guiding the design and implementation of the exercise adherence intervention in Study 3. However, I also required a format or type of intervention that would be appropriate and sensitive to the needs of the cardiac population. The concepts, theories, and practicalities of exercise consultation appeared to fit in perfectly with my ideas of an effective intervention, in addition to what I had learned from cardiac patients. The collating of all these pieces of information and ideas lead to the development of the exercise consultation intervention conducted in Study 3.

Although only a small number of participants were included in the intervention study, and not all of the findings were statistically significant, some of the findings were very promising. For example, the fact that mean depression levels decreased from baseline to Week 24, and both self-reported PA levels and exercise SOC levels were improved over the 12-week intervention, indicated that the intervention had some effect on these variables. Possibly, the most encouraging finding was that the intervention may have been particularly effective for those participants with depression at baseline, in decreasing depression levels, increasing PA, and moving exercise SOC to more active levels. Therefore, although research suggests that the outlook for people with depression and CHD, in terms of recovery of health may appear troublesome, the current research has shown that there may be ways in which to improve adherence to PA and, therefore, to aid in long-term recovery.

Other studies have shown that increases in PA following an exercise adherence intervention can be achieved in cardiac populations (e.g., Carlson et al., 2000; Scholz et al., 2006; Sniehotta et al., 2005), and that exercise consultation interventions can be particularly effective (Hughes et al., 2002; Hughes et al., 2007). A very small number of studies utilising exercise adherence interventions with depressed participants have also demonstrated positive results in which depression levels decreased over time (e.g., Richardson et al., 2005; Scholz et al., 2006). As previously mentioned, to date, exercise consultation has not been conducted specifically with depressed individuals with CHD. Therefore, I am unable to draw any direct comparisons between findings of previous research and findings in the current intervention, however, both the previous and current research suggest that there are some promising intervention types for increasing PA and decreasing depression in people with CHD.

The information collected from the brief qualitative evaluations of the intervention indicated that participants enjoyed taking part in the exercise consultation and follow-up telephone calls, and that they believed the consultation and telephone discussions helped them stay physically active, at least during the 12-week intervention. The self-reported PA data indicated that participants increased both their overall and moderate intensity PA during the 12-week intervention. The findings are mixed, however, for changes in PA from the end of the intervention to the follow-up at Week 24. Although moderate intensity PA levels decreased only slightly during this time, overall PA levels decreased to levels below those at baseline. One of the challenges present for future researchers is in finding out how to encourage people to maintain all intensities of PA for the long-term. Interventions may need to be designed with some different features to the intervention used in the current thesis, possibly including more face-to-face consultations, or longer follow-up telephone discussions. Researchers could investigate the use of brief catch-up discussions over the longer term, after the conclusion of active interventions. Issues, such as determining the most effective frequency and content for these catch-up sessions in terms of achieving long-term PA adherence, as well as conducting cost-benefit analyses of these interventions, could be examined in the future. Long-term adherence to PA needs to be one of the main goals for researchers conducting future studies in this area.

There were a number of links between the qualitative evaluations of Study 3 and the qualitative interviews of Study 2. For example, one of the major facilitators to being physically active mentioned in Study 2, was experiencing the psychological benefits associated with PA. In the intervention study, some participants mentioned that the confidence, motivation, and positive attitude gained as a result of taking part in the intervention helped with their ability to maintain their activity. Also, in Study 2, low motivation associated with depression was identified as a barrier to PA, and in Study 3, participants mentioned how effective the intervention would be for encouraging people with low motivation and/or depression to become more active. The issue of the positive role of others was mentioned in both Studies 2 and 3. Participants in Study 2 identified social support as a crucial facilitator to PA, but stated that lack of social support acted as a major barrier. In Study 3, participants mentioned that the support of the researcher and family/friends was an important element in helping them continue to adhere to PA. Unfortunately, however, in both studies, physical restrictions (other than the heart) were identified as barriers to being physically active and caused participants a great deal of frustration and disappointment. In summary, therefore, a number of the key themes to emerge from Study 2, such as common factors that influenced participation in PA, were also reflected in the evaluation of the intervention, indicating these factors may need to be addressed in future interventions.

As discussed in Chapter 5, there are a large number of topics within the area of exercise interventions that warrant further investigation. Previous research and the current thesis highlight both the negative effects of depression on PA for people with CHD and also the positive effects of PA on improving overall health and recovery for the cardiac population. It is crucial that more is learned about effective strategies and interventions designed to encourage PA adherence, particularly for people with depression. In the *Discussion* section of Chapter 5, I highlighted the importance of intervention research, and discussed how interventions could be structured and conducted to possibly improve their effectiveness. In this section, I focus on specific strategies that may be worthy of further research, given the positive results of the current thesis and past research. Firstly, I emphasise the importance of employing qualitative research to learn about the strategies and techniques that cardiac patients themselves believe are likely to be effective in encouraging adherence to PA. The value of this type of research should not be underestimated.

In the current research, participants identified social support as being an important facilitator to PA. The positive role of others was mentioned by a number of participants in Study 2 as being a factor that helped them stay physically active. As a result, in the intervention study, participants were asked about available social support and, where possible and appropriate, this was emphasized as being important in their endeavours to increase PA, or remain physically active. The intervention, however, did not involve participants' social support network directly, although participants did mention that they believed the support provided by the researcher and significant others, helped in keeping them motivated to participate in PA. One area of future research in exercise interventions for people with CHD and depression should be to investigate the effects on PA and depression levels of interventions that directly involve both the participant and a supportive significant other. Other programs, such as CR, encourage the inclusion of partners, family members, or friends, for the benefit of both the participant and the significant other (Goble & Worcester, 1999).

For people who did not have a supportive significant other, a "buddy system" could be used, for example, in which participants are paired up to exercise together, possibly after completing CR, with another person who is in a similar situation and living in a nearby area. The use of buddy systems in community-based interventions, however, has demonstrated mixed findings in terms of effectiveness. For example, the

Task Force on Community Preventive Services (2001) conducted systematic reviews of community interventions to increase PA, and strongly recommended social support interventions, such as those that employ a buddy system, in community settings. The Task Force reported that social support interventions were effective in increasing minutes spent in PA and frequency of PA sessions, in addition to increasing aerobic capacity. Dunstan et al. (2006), however, found in one of their resistance training and Type II diabetes studies that establishing buddy groups was not effective because participants could not find mutually convenient times to exercise together. Dunstan et al., therefore, discarded this approach early in their intervention. The effectiveness of buddy systems in increasing PA, particularly for people with chronic illnesses, such as CHD, therefore, requires further investigation.

Hellman (1997) suggested that interventions to increase adherence to PA should focus on personal factors that can be modified, such as perceived self-efficacy. Luszczynska and Sutton (2006) highlighted the importance of self-efficacy in maintaining PA after the CR program, and Reid et al. (2007) found those who regressed in exercise SOC over time showed lower self-efficacy at follow-up. It seems particularly relevant, therefore, for interventions to incorporate strategies that focus on building individuals' self-efficacy for exercise, which may result in higher levels of PA, and, possibly, lower depression levels.

Another type of strategy that was found to be successful in the current and previous research was goal setting. In Study 2, some participants identified goal setting as being an important facilitator to PA, and the process of goal setting in the intervention appeared to be successful. In addition, Scholz et al. (2006) demonstrated that achieving personal goals during health behaviour change may be of particular importance for lowering depressive symptoms. Further research should, therefore, investigate the use of goal attainment as part of PA adherence interventions for people with CHD and depression.

While chronic illnesses, such as CHD and depression, continue to negatively impact on the health and well-being of so many people around the world, further research should focus on ways in which adherence to PA in people with CHD can be increased. With the additional knowledge gained through research of this type, it is anticipated that PA adherence may be increased in this population, resulting in numerous positive outcomes for people with CHD, including reduced depression levels, lower levels of morbidity and mortality caused by CHD, and enhanced rehabilitation. In the following section, I discuss how the results of the current thesis can be applied to the everyday lives of people working with, or caring for, someone with CHD and other chronic health issues, and depression.

Implications for Practice

This thesis highlights both the negative relationship between depression and PA in people with CHD and the positive findings of an intervention designed to increase PA and reduce depression in this population. The findings presented herein may have implications for people, who work with, or care for, an individual or group of people with CHD. In particular, CR staff, psychologists, exercise professionals, and partners, family members, and friends of people who have experienced a cardiac event, may find the results and discussion presented in this thesis, valuable and applicable to their everyday activities and lives.

The finding highlighting the prevalence of depression in people with CHD and the negative relationship between depression and PA, can have implications for all people who live with, or care for, an individual with CHD. It is very important for health professionals and the general public to understand that depression following a cardiac event is common, and in a substantial proportion of cases, can be serious and long-lasting. Being aware of the signs and symptoms of depression, may allow for early diagnosis and treatment, which may minimize the long-term negative effects of depression. Health professionals who may not have a high level of knowledge of psychological conditions, such as exercise professionals, may benefit from additional training in recognizing symptoms that may be indicative of depression, and in knowing the types of advice and support they should offer to their clients with depression. In addition, all health professionals should have updated information about different professionals to whom they can refer people with depression, if required. Discussions and education about depression and psychological well-being have been recommended in CR programs for some time (Goble & Worcester, 1999). Sessions of this type can be very beneficial for family members and patients, to help their understanding of some of the psychological experiences that may occur following a cardiac event, and to know when and how to seek further assistance and support.

The findings in the current study of a negative relationship between depression and PA for people with CHD could also have implications for people involved in caring for an individual with CHD. For anyone aiming to promote and encourage participation in PA, understanding that people with depression may find it difficult to adhere to PA, is important. These findings may be particularly relevant for exercise professionals, exercise psychologists, and CR coordinators. Professionals who are working with people with depression in exercise settings need to be aware of the negative impact that depression may have on individuals' ability to be active, so the professionals are supportive and encouraging at these times. This may also be an important time for health and exercise professionals to utilize some of the strategies found to be effective in the current study for helping to increase adherence to PA, such as goal setting and encouraging social support. In addition, the current study highlighted the importance of follow-up in ensuring people maintained PA to the best of their ability. This is an important consideration for professionals working with depressed clients and patients, particularly if they do miss an exercise session. A quick phone call to check in with the individual to see if they are okay, and to encourage them to return to the next session may help improve adherence to PA, and possibly also depression levels.

Another major finding of the current study, that could have implications for health professionals working with, and people caring for, people with CHD and depression, is the association between exercise SOC and depression. For those individuals who perceived themselves as less active, depression levels were likely to be significantly higher than for those who *perceived* themselves as active. These perceptions could be associated with confidence in one’s ability to be active. Thus, workers and carers could aim to increase the confidence of cardiac patients in their abilities to be active. Strategies, such as ensuring the exercise is achievable and realistic for the individual, thus promoting mastery, which enhances self-efficacy, may assist with increasing confidence for PA, and therefore, may increase actual levels of PA.

Chapter 4 highlighted the relevant barriers and facilitators to PA for people with CHD and depression. These barriers and facilitators are again, important for health professionals to be aware of when they are working with cardiac patients with depression. For example, physiotherapists should understand the negative effects that other physical problems and injuries can have on individuals’ ability to be physically active, so they prescribe alternative exercises that do not exacerbate the discomfort.

Social workers and psychologists should also be aware that perceptions about health and abilities in life can be altered after a cardiac event, and that this can affect PA of people who have experienced such an event. These kinds of issues may need to be discussed during therapy sessions. The facilitators of PA identified in the current thesis could also be encouraged and implemented into exercise programs by professionals, such as ensuring there is adequate social support and identifying the psychological benefits associated with regular PA.

Another direct implication of the current thesis for practice arises from the intervention study. Although exercise consultation has not previously been used to encourage PA adherence in people with CHD and depression and requires further research to test its effectiveness, the findings of the current research suggest that the techniques used as a part of the exercise consultation were particularly helpful for people with depression in increasing PA and decreasing depression. The type of one-on-one, individualised intervention used in the current thesis could be replicated by various health professionals with minimal resources. Alternatively, specific strategies from the intervention, such as providing continued follow-up and feedback or devising a plan of action for PA, could be applied to existing PA programs to encourage adherence for people with depression. Health professionals could test out various strategies or aspects of the intervention to suit their own needs and the needs of their patients and clients.

The findings presented in the current thesis, particularly those associated with the intervention research, may also be relevant to a wider proportion of the community than just people with CHD. In times of increasing physical inactivity and obesity, and rises in preventable chronic illnesses, such as type II diabetes and hypertension (AIHW, 2008), research that focuses on increasing adherence to PA is relevant to people with many different types of health issues. Previous research has highlighted the link between depression and other chronic health conditions, such as Type II diabetes (Knol et al., 2007), obesity (Cilli et al., 2003) and chronic obstructive pulmonary disease (Yohannes, Baldwin, & Connolly, 2003). In addition, PA has been shown to reduce symptoms of depression in individuals with chronic illnesses, such as multiple sclerosis (Sutherland, Andersen, & Stoove, 2001) and breast cancer (Mustian, Katula, & Gill, 2002; Segar et al., 1998). Due to evidence highlighted by previous research of the success of exercise consultation with Type II diabetic and cardiac populations, the intervention conducted in the current research may prove to be relevant for people with depression and other chronic health issues. This may result in higher PA levels and lower depression levels for these people, which could lead to improvements in physical, psychological, and quality of life parameters for numerous people, in many sectors of society. The present thesis, therefore, could provide people working with patients with various chronic illnesses, for which PA is deemed appropriate and necessary, with information and techniques that may be useful in encouraging increased PA.

Concluding Comments

The current research examined the important issue of PA and depression in people with CHD. The three studies I conducted provided information on the relationship between PA and depression at two time points, the PA experiences of people with depression and CHD, and the effectiveness of an exercise adherence intervention designed for people with depression and CHD. On a personal level, although there have been challenges and obstacles to overcome, the process of designing, conducting, analyzing, and writing up this research, has been an incredibly valuable experience, and I have developed and gained numerous skills whilst completing the thesis. On a professional and academic level, I believe that this thesis has made an important and original contribution to the field. More is known now in terms of the negative relationship between PA and depression, the facilitators that help, and barriers that hinder participation in PA, and about one type of exercise adherence intervention that could be particularly effective for increasing PA and decreasing depression in people with CHD. The material contained within this thesis is relevant for researchers who are investigating issues related to PA and depression for people with CHD, or practitioners who are working with people with depression and CHD, to encourage PA adherence. In addition, this research could be applicable to people with other chronic illnesses who are experiencing depression and are having difficulties with adhering to PA. I hope that the findings and discussion presented in the current thesis will stimulate other researchers to further investigate effective ways to encourage PA adherence, particularly for people with depression and chronic physical conditions.

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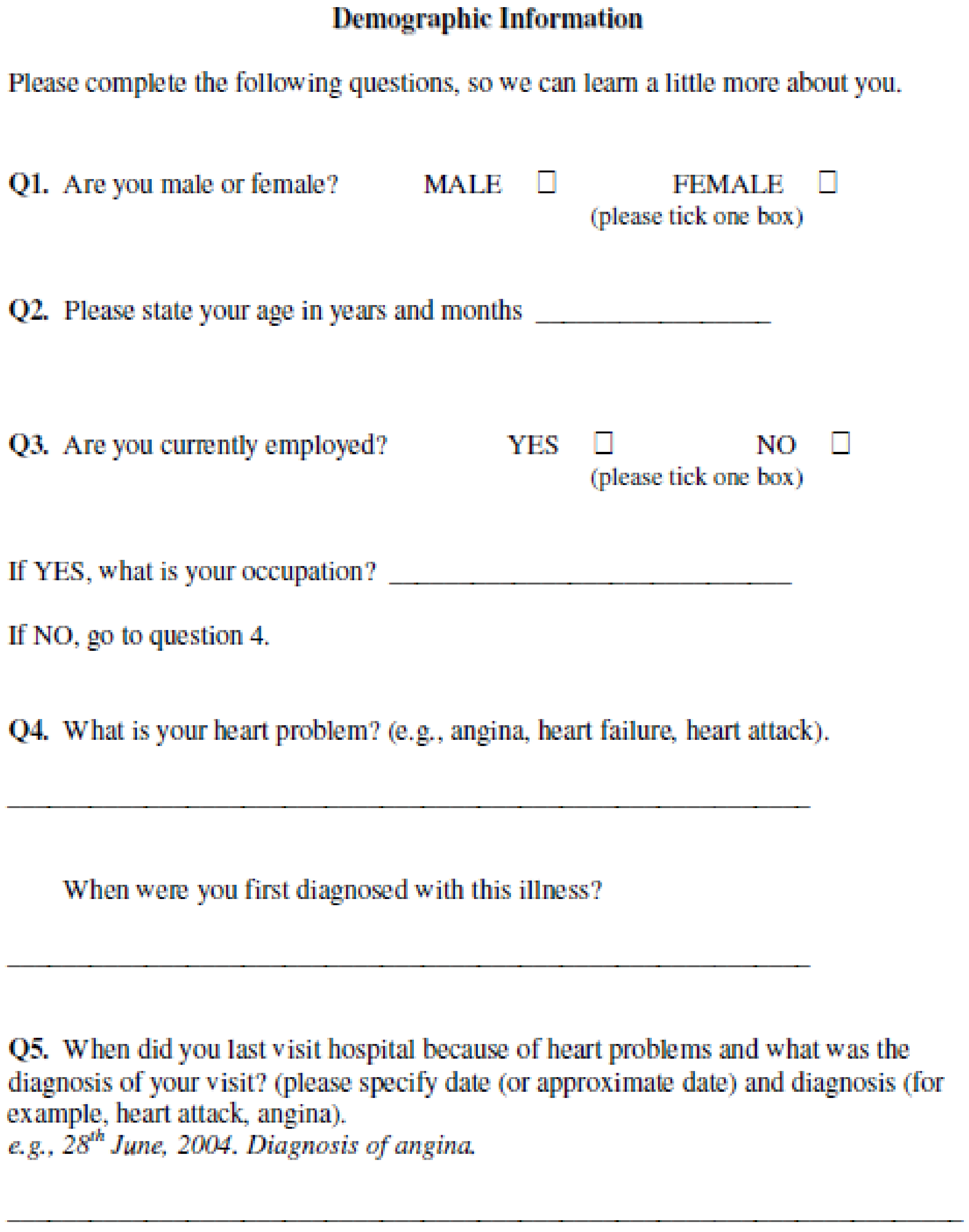
APPENDIX A – STUDY 1: DEMOGRAPHIC QUESTIONNAIRE



Demographic Information

Please complete the following questions, so we can learn a little more about you.

Q1. Are you male or female? MALE ☐ FEMALE ☐
(please tick one box)

Q2. Please state your age in years and months ________________

Q3. Are you currently employed? YES ☐ NO ☐
(please tick one box)

If YES, what is your occupation? ____________________________

If NO, go to question 4.

Q4. What is your heart problem? (e.g., angina, heart failure, heart attack).

____

When were you first diagnosed with this illness?

____

Q5. When did you last visit hospital because of heart problems and what was the diagnosis of your visit? (please specify date (or approximate date) and diagnosis (for example, heart attack, angina).
e.g., 28th June, 2004. Diagnosis of angina.

____

Q6. Are you currently attending a cardiac rehabilitation program?

YES ☐ NO ☐
(please tick one box and answer relevant question below)

If YES, please indicate which cardiac rehabilitation program you are currently attending and how long you have been attending that program (e.g., Sunshine Hospital cardiac rehabilitation program for 4 weeks)

If NO, have you ever attended a cardiac rehabilitation program?

YES ☐ NO ☐
(please tick one box)

If you have attended a cardiac rehabilitation program in the past, which program did you attend and for how long?

Q7. Do you currently smoke?

YES ☐ NO ☐
(please tick one box and answer relevant question below)

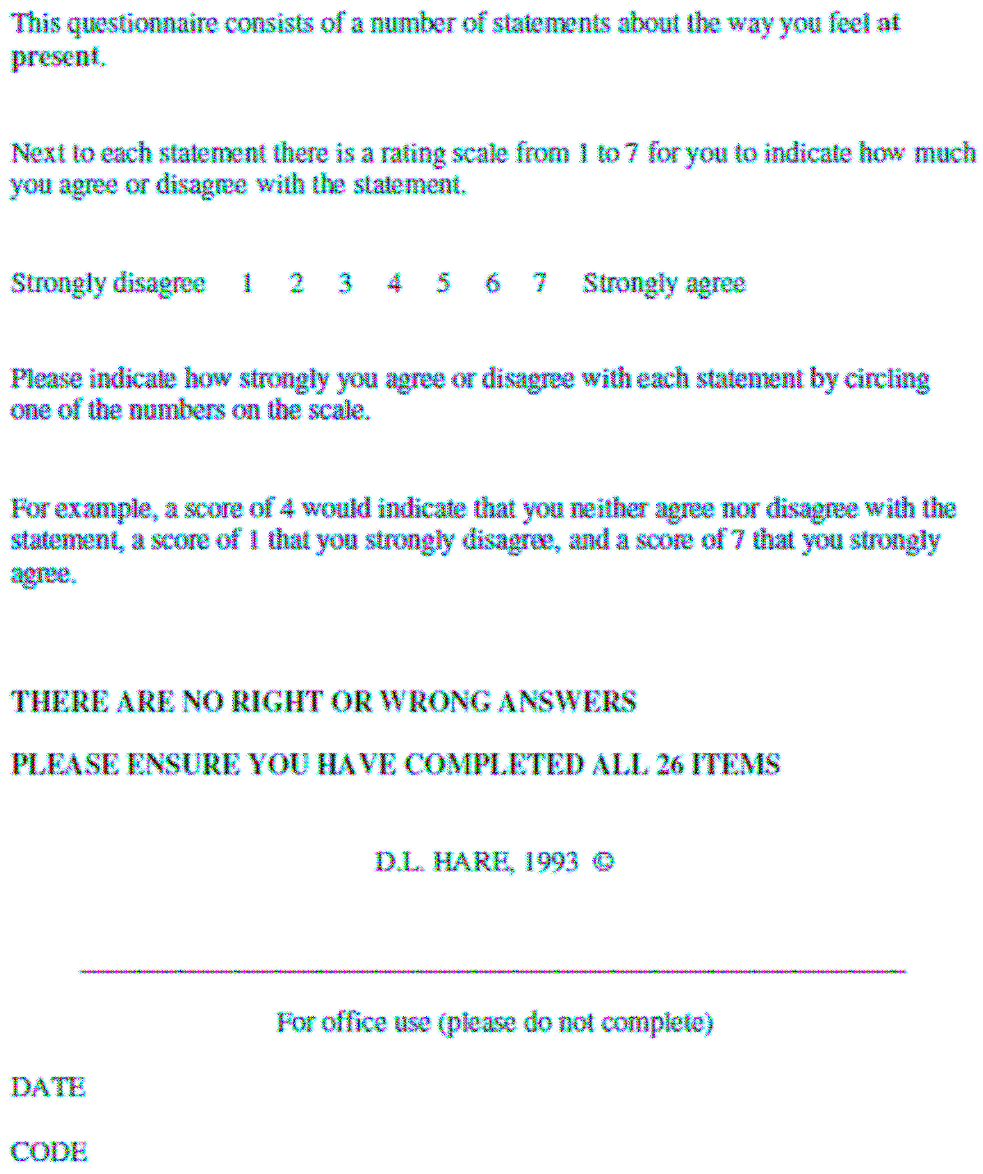
IF YES, please indicate for how many years you have smoked and how many cigarettes you smoke per day?

IF NO, did you smoke in the past? If so, how many cigarettes did you smoke and when did you quit smoking?

Q8. Can you please indicate if you have any other physical health problems? (e.g., diabetes, arthritis, chronic obstructive pulmonary disease (COPD) etc.)

Q9. Can you please indicate if you currently have, or have had in the past, mental illness(es)? Please specify the illness.

APPENDIX B – STUDY 1: CARDIAC DEPRESSION SCALE



This questionnaire consists of a number of statements about the way you feel at present.

Next to each statement there is a rating scale from 1 to 7 for you to indicate how much you agree or disagree with the statement.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Please indicate how strongly you agree or disagree with each statement by circling one of the numbers on the scale.

For example, a score of 4 would indicate that you neither agree nor disagree with the statement, a score of 1 that you strongly disagree, and a score of 7 that you strongly agree.

THERE ARE NO RIGHT OR WRONG ANSWERS

PLEASE ENSURE YOU HAVE COMPLETED ALL 26 ITEMS

D.L. HARE, 1993 ©

For office use (please do not complete)

DATE

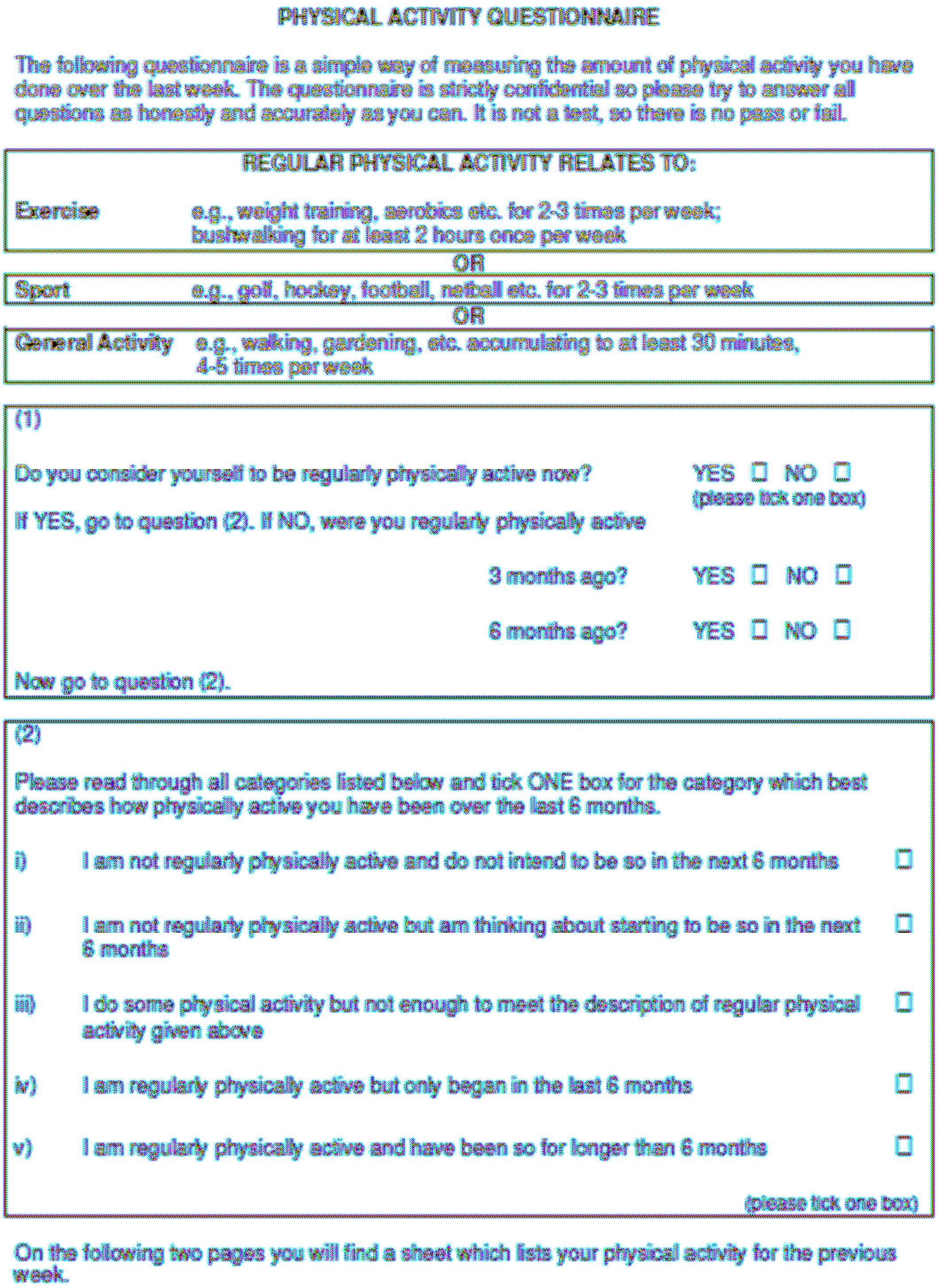
CODE

CHECK TO MAKE SURE YOU HAVE ANSWERED ALL QUESTIONS	**Strongly Disagree**						**Strongly Agree**
1. I have dropped many of my interests and activities…..	1 None dropped	2	3	4	5	6	7 All dropped
2. My concentration is as good as it ever was…..	1 Very poor concentration	2	3	4	5	6	7 Excellent concentration
3. I can't be bothered doing anything much…..	1 Keen to do things	2	3	4	5	6	7 Can't be bothered
4. I get pleasure from life at present…..	1 No pleasure	2	3	4	5	6	7 Great pleasure
5. I am concerned about the uncertainty of my health…..	1 Not concerned	2	3	4	5	6	7 Very concerned
6. I may not recover completely…..	1 Will recover completely	2	3	4	5	6	7 Will not recover
7. My sleep is restless and disturbed…..	1 Not restless	2	3	4	5	6	7 Very restless
8. I am not the person I used to be…..	1 Just the same	2	3	4	5	6	7 Completely different
9. I wake up in the early hours of the morning and cannot get back to sleep…..	1 Never wake	2	3	4	5	6	7 Always wake

CHECK TO MAKE SURE YOU HAVE ANSWERED ALL QUESTIONS	**Strongly Disagree** **Strongly Agree**
10. I feel like I'm living on borrowed time…..	1 2 3 4 5 6 7 Unlimited time Very much on borrowed time
11. Dying is the best solution for me…..	1 2 3 4 5 6 7 Not a solution Best solution
12. I feel in good spirits…..	1 2 3 4 5 6 7 Very poor spirits Excellent spirits
13. The possibility of sudden death worries me…..	1 2 3 4 5 6 7 Not at all Very worried
14. There is only misery in the future for me….	1 2 3 4 5 6 7 No misery Only misery
15. My mind is as fast and alert as always….	1 2 3 4 5 6 7 Slow and inattentive Very fast and alert
16. I get hardly anything done….	1 2 3 4 5 6 7 Everything done Nothing done
17. My problems are not yet over…..	1 2 3 4 5 6 7 All problems over Still major problems
18. Things which I regret about my life are bothering me…..	1 2 3 4 5 6 7 Absolutely no regrets Great regrets

CHECK TO MAKE SURE YOU HAVE ANSWERED ALL QUESTIONS	Strongly Disagree						Strongly Agree
19. I gain just as much pleasure from my leisure activities as I used to…..	1 No pleasure at all	2	3	4	5	6	7 Very great pleasure
20. My memory is as good as it always was…..	1 Very poor memory	2	3	4	5	6	7 Excellent memory
21. I become tearful more easily than before…..	1 Not at all tearful	2	3	4	5	6	7 Very easily tearful
22. I seem to get more easily irritated by others than before…..	1 Never irritated	2	3	4	5	6	7 Very easily irritated
23. I feel independent and in control of my life….	1 No independence	2	3	4	5	6	7 Completely independent
24. I lose my temper more easily nowadays….	1 Never lose temper	2	3	4	5	6	7 Lose it very easily
25. I feel frustrated….	1 Not at all frustrated	2	3	4	5	6	7 Extremely frustrated
26. I am concerned about my capacity for sexual activity…..	1 No concern at all	2	3	4	5	6	7 Grave concern

APPENDIX C – STUDY 1: SCOTTISH PHYSICAL ACTIVITY QUESTIONNAIRE



PHYSICAL ACTIVITY QUESTIONNAIRE

The following questionnaire is a simple way of measuring the amount of physical activity you have done over the last week. The questionnaire is strictly confidential so please try to answer all questions as honestly and accurately as you can. It is not a test, so there is no pass or fail.

REGULAR PHYSICAL ACTIVITY RELATES TO:

Exercise	e.g., weight training, aerobics etc. for 2-3 times per week; bushwalking for at least 2 hours once per week
OR	
Sport	e.g., golf, hockey, football, netball etc. for 2-3 times per week
OR	
General Activity	e.g., walking, gardening, etc. accumulating to at least 30 minutes, 4-5 times per week

(1)

Do you consider yourself to be regularly physically active now? YES ☐ NO ☐
(please tick one box)

If YES, go to question (2). If NO, were you regularly physically active

3 months ago? YES ☐ NO ☐

6 months ago? YES ☐ NO ☐

Now go to question (2).

(2)

Please read through all categories listed below and tick ONE box for the category which best describes how physically active you have been over the last 6 months.

i) I am not regularly physically active and do not intend to be so in the next 6 months ☐

ii) I am not regularly physically active but am thinking about starting to be so in the next 6 months ☐

iii) I do some physical activity but not enough to meet the description of regular physical activity given above ☐

iv) I am regularly physically active but only began in the last 6 months ☐

v) I am regularly physically active and have been so for longer than 6 months ☐

(please tick one box)

On the following two pages you will find a sheet which lists your physical activity for the previous week.

(3)

The following questions relate to your physical activity over the **previous week**. Please try to think carefully and be as accurate as possible with your answers. For example, you may have spent 4 hours at the National Park but actually only spent half the time walking. Additionally, be careful not to count the same activity twice. For example, if you have spent time in the last week bushwalking, be careful only to include this in either the walking or leisure section and not both.

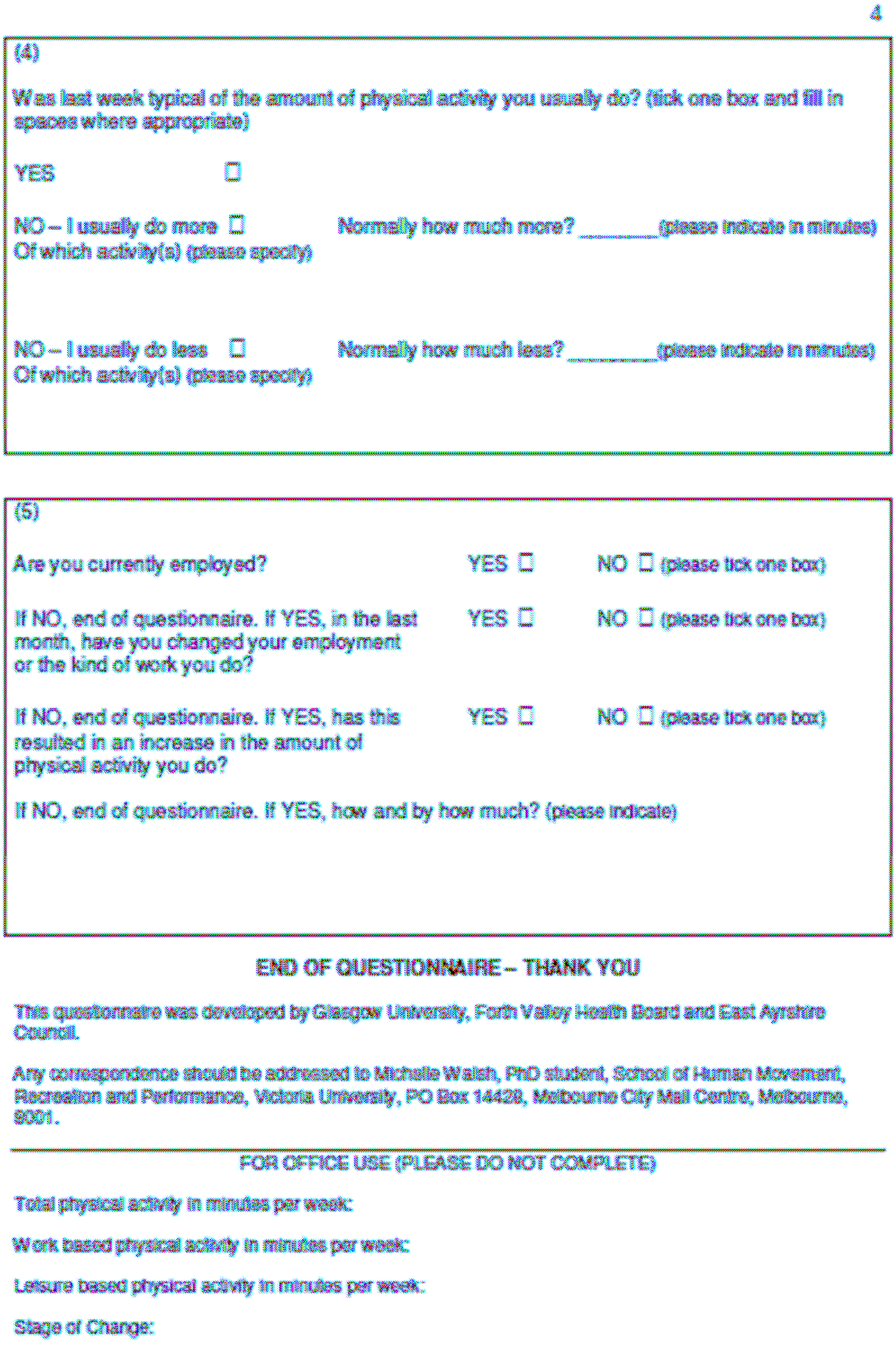
In the past week, how many minutes did you spend each day (please indicate in each square, the minutes spent in that activity on that day):

ACTIVITY	Monday	Tuesday	Wednes-day	Thursday	Friday	Saturday	Sunday	Total
Walking at work? e.g., walking up or down stairs, walking to and from your desk, "doing the rounds", etc.								
Walking outside work? e.g., walking to the shops, walking your dog, walking to work, bushwalking, walking for pleasure, etc.								
Manual labour at work? Do include e.g., lifting, stacking shelves, climbing ladders, building work, etc. Do not include e.g., sitting at desk, answering telephone, working on a check-out, etc.								
Manual labour outside work? Do include e.g., cutting grass, painting and decorating, washing car, digging, etc. Do not include e.g., weeding, planting, pruning, etc.								
Doing active housework? Do include e.g., vacuuming, scrubbing floors, bed making, hanging out washing, etc. Do not include e.g., sewing, dusting, washing dishes, preparing food, etc.								

Continued on next page

(3) cont.

ACTIVITY	Monday	Tuesday	Wednes-day	Thursday	Friday	Saturday	Sunday	Total
Dancing? e.g., line, country, ballroom, etc.								
Cycling for pleasure or to work?								
Participating in a sport, leisure activity or training? Do include e.g., lawn bowls, exercise classes, football, swimming, golf, jogging, athletics, etc. Do not include e.g., playing a musical instrument, fishing, darts, snooker/pool, etc.								
Other physical activity if not already covered (please write in)								



4

(4)

Was last week typical of the amount of physical activity you usually do? (tick one box and fill in spaces where appropriate)

YES ☐

NO – I usually do more ☐ Normally how much more? ________(please indicate in minutes)
Of which activity(s) (please specify)

NO – I usually do less ☐ Normally how much less? ________(please indicate in minutes)
Of which activity(s) (please specify)

(5)

Are you currently employed?	YES ☐	NO ☐ (please tick one box)
If NO, end of questionnaire. If YES, in the last month, have you changed your employment or the kind of work you do?	YES ☐	NO ☐ (please tick one box)
If NO, end of questionnaire. If YES, has this resulted in an increase in the amount of physical activity you do?	YES ☐	NO ☐ (please tick one box)

If NO, end of questionnaire. If YES, how and by how much? (please indicate)

END OF QUESTIONNAIRE – THANK YOU

This questionnaire was developed by Glasgow University, Forth Valley Health Board and East Ayrshire Council.

Any correspondence should be addressed to Michelle Walsh, PhD student, School of Human Movement, Recreation and Performance, Victoria University, PO Box 14428, Melbourne City Mail Centre, Melbourne, 8001.

FOR OFFICE USE (PLEASE DO NOT COMPLETE)

Total physical activity in minutes per week:

Work based physical activity in minutes per week:

Leisure based physical activity in minutes per week:

Stage of Change:

APPENDIX D – STUDY 1: INVITATION LETTER

Hello.

You are invited to be a part of a study, which aims to investigate the relationship between mood and physical activity in people with coronary heart disease. Also, we are investigating the effect of time since your cardiac event on this relationship. This study is being conducted by Victoria University in association with Western and Sunshine Hospitals.

The information you provide will help us understand more fully the link between mood and physical activity in people with coronary heart disease, and to learn about how this relationship changes over time. It will also be used as a basis for further research into the experiences of people with coronary heart disease.

If you would like to take part in this research, please read the sheet titled "Participant Information" and then complete the small package of questionnaires. We have included a reply paid envelope for you to return your questionnaire package to the researchers. If you have any questions, please do not hesitate to contact Michelle Walsh of the research team on 9384 1048 or 0413 xxx xxx.

Thank you for your assistance and time.

Professor Tony Morris (Principal Investigator)	Michelle Walsh (Student Researcher)

APPENDIX E – STUDY 1: PARTICIPANT INFORMATION FORM

VICTORIA UNIVERSITY

PARTICIPANT INFORMATION

Participant Information
Version 2 Dated 21 November 2004
Site: Victoria University and Western Health

Full Project Title: Physical activity and mood in people with coronary heart disease

Principal Researcher: Professor Tony Morris
Associate Researcher: Professor Stephen Bird
Student Researcher: Ms Michelle Walsh

This Participant Information Form is 3 pages long. Please make sure you have all the pages.

1. Your Consent

You are invited to take part in this research project, which explores the relationship between mood and physical activity in people with coronary heart disease.

This Participant Information contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project before you decide whether or not to take part in it.

Please read this Participant Information carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to complete the questionnaires included in this package. By completing and returning the questionnaires in the reply paid envelope provided, you indicate that you understand the information and that you give your consent to participate in the research project.

You will be given a copy of the Participant Information Form to keep as a record.

2. Purpose and Background

The purpose of this project is to gain an understanding of the relationship between physical activity and mood in people with coronary heart disease, and to learn about the effect of time since the cardiac event on this relationship. In Australia, there has been very little research conducted on this topic. As you have recently experienced a cardiac event, we would like to invite you to participate in this project. Your personal experiences will help us to identify the relationship between mood and physical activity. The information collected in this study will help us to understand more fully the relationship between physical activity and mood in people with coronary heart disease and will be used as a basis for further research.

The results of this research will be used to help researcher Ms Michelle Walsh obtain a PhD degree.

It is anticipated that a total of 180 people will participate in this project.

3. Procedures

Participation in this project will involve completion of three short questionnaires. The first questionnaire asks questions about your background (for example, your age, gender, occupation, date of first diagnosis of heart troubles, time since your last cardiac episode, whether you have in the past, or currently are, attending hospital or community-based cardiac rehabilitation, and if you have any other health problems). The second questionnaire asks you about your mood, and the third requests that you complete some information about your physical activity. We have included a reply paid envelope for you to put the completed questionnaires into, and then you just need to put this envelope in the post. Return of the questionnaires will imply consent to participate in this research. We have also included a consent form for you to complete if you might be interested in taking part in further related research conducted by the same researchers. On return to the researchers, these consent forms will be immediately separated from the questionnaires to ensure that you remain anonymous. The questionnaires should take approximately 30 minutes to complete.

4. Possible Benefits

Possible benefits include the chance to share information about your experiences of mood and physical activity and to be involved in further research with the same researchers (sharing your experiences in an interview setting).

5. Possible Risks

There is the possibility that some participants may feel distressed when revealing sensitive issues surrounding their mood and physical activity. Participants may feel uncomfortable about disclosing their experiences. If you feel upset or uncomfortable during or after filling in the questionnaires, please contact the researchers on the phone numbers mentioned and if necessary, we can arrange some counselling through Western Health or if you would rather, through your own GP. Alternatively, you may contact Mark Andersen, a Psychologist at Victoria University, on (03) 9919 5413.

6. Privacy, Confidentiality and Disclosure of Information

Information you give us will be strictly confidential and used only for the purpose of this study. Your confidentiality will be protected through the use of a code. No identifying material of you or health care professionals will be used in the study. All research materials will be kept under lock and key. Access to research materials will be limited to the research team (the principal investigators and the student researcher). On completion of the study, the results will be stored securely for seven years at Victoria University and then destroyed.

In any publication or presentation of findings, information will be provided in such a way that you cannot be identified.

7. Results of Project

The research team will inform you of the results when the research project is finished.

8. Further Information or Any Problems

If you require further information or if you have any problems concerning this project (for example, any side effects), you can contact the principal researcher Professor Tony Morris, the associate researcher Professor Stephen Bird, or the student researcher, Ms Michelle Walsh.

The researchers responsible for this project are:
Professor Tony Morris, contact number: 9688 5353
Professor Steve Bird, contact number: 8345 1196
Ms Michelle Walsh, contact number: 9384 1048 or 0413 xxx xxx

9. Other Issues

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact

Name: Dr Stacey Gabriel

Position: Coordinator, Mental Health Research and Ethics Committee

Telephone: (03) 9342 7098. You will need to tell Dr Stacey Gabriel the name of one of the researchers given in section 8 above.

10. Participation is Voluntary

Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine treatment, your relationship with those treating you or your relationship with the Western Health Network

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project once you have submitted your questionnaires, please notify a member of the research team so that we can withdraw your information.

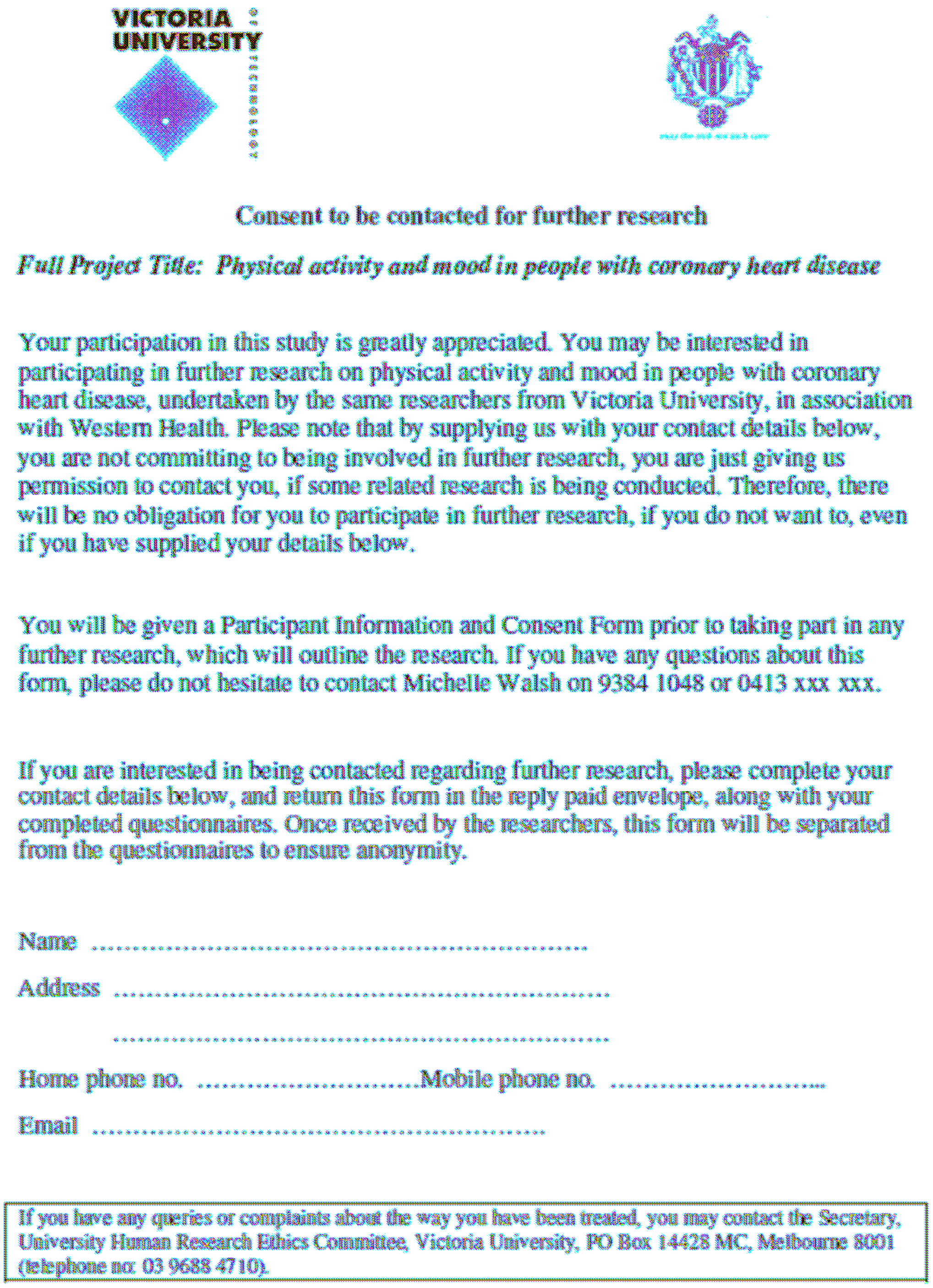
11. Ethical Guidelines

This project will be carried out according to the *National Statement on Ethical Conduct in Research Involving Humans* (June 1999) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Victoria University and the Melbourne Health Human Research Ethics Committee.

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9688 4710).

APPENDIX F – STUDY 1: CONSENT TO BE CONTACTED FOR FURTHER RESEARCH



Consent to be contacted for further research

Full Project Title: Physical activity and mood in people with coronary heart disease

Your participation in this study is greatly appreciated. You may be interested in participating in further research on physical activity and mood in people with coronary heart disease, undertaken by the same researchers from Victoria University, in association with Western Health. Please note that by supplying us with your contact details below, you are not committing to being involved in further research, you are just giving us permission to contact you, if some related research is being conducted. Therefore, there will be no obligation for you to participate in further research, if you do not want to, even if you have supplied your details below.

You will be given a Participant Information and Consent Form prior to taking part in any further research, which will outline the research. If you have any questions about this form, please do not hesitate to contact Michelle Walsh on 9384 1048 or 0413 xxx xxx.

If you are interested in being contacted regarding further research, please complete your contact details below, and return this form in the reply paid envelope, along with your completed questionnaires. Once received by the researchers, this form will be separated from the questionnaires to ensure anonymity.

Name ……………………………………………………………

Address ……………………………………………………………

……………………………………………………………

Home phone no. ……………………………Mobile phone no. …………………………

Email ……………………………………………………………

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9688 4710).

APPENDIX G – STUDY 1: FOLLOW-UP LETTER

VICTORIA
UNIVERSITY

Hello.

You may remember receiving an invitation a few weeks ago to be part of a research study conducted by Victoria University, in association with Western and Sunshine Hospitals, which is investigating the relationship between mood and physical activity in people with coronary heart disease. If you have returned the questionnaire package, thank you very much for your participation.

If you have not yet returned the package, but would still like to be part of this study, could you please return the questionnaires as soon as possible? If you no longer have a copy of the questionnaire package, but would like to take part in this research, please do not hesitate to contact Michelle Walsh of the research team on 9384 1048 or 0413 xxx xxx and another package will be sent out to you.

The information you provide will be used to help us understand more fully the link between mood and physical activity in people with coronary heart disease, and to learn about how this relationship changes over time. Also this information will be used as a basis for further research. Therefore, your experiences are very important and valid to this research.

Thank you for your assistance and time.

Professor Tony Morris
(Principal Investigator)

Michelle Walsh
(Student Researcher)

APPENDIX H – STUDY 1: INVITATION LETTER (FOLLOW-UP)

VICTORIA
UNIVERSITY

Dear

A number of months ago you kindly completed a small package of questionnaires for a research project on the relationship between physical activity and mood in people with coronary heart disease. You also indicated that you might be interested in taking part in further research conducted by the same researchers. Now we would like to invite you to participate in a follow-up study, in which we are investigating any changes that have occurred over time with respect to physical activity and mood. Once again, this study is being conducted by Victoria University in association with Western, Sunshine and Williamstown Hospitals.

The information you provide will help us understand more fully the link between mood and physical activity in people with coronary heart disease, and to learn about how this relationship changes over time. It will also be used as a basis for further research into the experiences of people with CHD.

If you would like to take part in this research, please read the sheet titled "Participant Information" and then complete the two short questionnaires that are enclosed in this package. We have also included a reply paid envelope for you to return your questionnaire package to the researchers. If you have any questions about the study, please do not hesitate to contact Michelle Walsh of the research team on 9919 4066 or 0413 xxx xxx.

Your assistance and time has been very valuable to us and we thank you for taking part to date, and hope that you will be able to complete these 2 short questionnaires to end this research study.

Thank you again for your assistance and time.

Professor Tony Morris	Michelle Walsh
(Principal Investigator)	(Student Researcher)

APPENDIX I – STUDY 1: PARTICIPANT INFORMATION FORM (FOLLOW-UP)

PARTICIPANT INFORMATION

Participant Information
Version 3 Dated 15 December 2005
Site: Victoria University and Western Health

Full Project Title: Physical activity and mood in people with coronary heart disease

Principal Researcher: Professor Tony Morris
Associate Researcher: Professor Stephen Bird
Student Researcher: Ms Michelle Walsh

This Participant Information Form is 3 pages long. Please make sure you have all the pages.

1. Your Consent

You are invited to take part in this research project, which explores the relationship between mood and physical activity in people with coronary heart disease.

This Participant Information contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project before you decide whether or not to take part in it.

Please read this Participant Information carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to complete the questionnaires included in this package. By completing and returning the questionnaires in the reply paid envelope provided, you indicate that you understand the information and that you give your consent to participate in the research project.

You will be given a copy of the Participant Information Form to keep as a record.

2. Purpose and Background

The purpose of this project is to gain an understanding of the relationship between physical activity and mood in people with coronary heart disease, and to learn about the effect of time since the cardiac event on this relationship. In Australia, there has been very little research conducted on this topic. As you have recently experienced a cardiac event, we would like to invite you to participate in this project. Your personal experiences will help us to identify the relationship between mood and physical activity. The information collected in this study will help us to understand more fully the relationship between physical activity and mood in people with coronary heart disease and will be used as a basis for further research.
The results of this research will be used to help researcher Ms Michelle Walsh obtain a PhD degree.

It is anticipated that a total of 60 people will participate in this project.

3. Procedures

Participation in this project will involve completion of two short questionnaires. The first questionnaire asks you about your mood, and the second requests that you complete some information about your physical activity. We have included a reply paid envelope for you to put the completed questionnaires into, and then you just need to put this envelope in the post. Return of the questionnaires will imply consent to participate in this research. The questionnaires should take approximately 20 minutes to complete.

4. Possible Benefits

Possible benefits include the chance to share information about your experiences of mood and physical activity and to be involved in further research with the same researchers.

5. Possible Risks

There is the possibility that some participants may feel distressed when revealing sensitive issues surrounding their mood and physical activity. Participants may feel uncomfortable about disclosing their experiences. If you feel upset or uncomfortable during or after filling in the questionnaires, please contact the researchers on the phone numbers mentioned and if necessary, we can arrange some counselling through Western Health or if you would rather, through your own GP. Alternatively, you may contact Mark Andersen, a Psychologist at Victoria University, on (03) 9919 5413.

6. Privacy, Confidentiality and Disclosure of Information

Information you give us will be strictly confidential and used only for the purpose of this study. Your confidentiality will be protected through the use of a code. No identifying material of you or health care professionals will be used in the study. All research materials will be kept under lock and key. Access to research materials will be limited to the research team (the principal investigators and the student researcher). On completion of the study, the results will be stored securely for seven years at Victoria University and then destroyed.

In any publication or presentation of findings, information will be provided in such a way that you cannot be identified.

7. Results of Project

The research team will inform you of the results when the research project is finished.

8. Further Information or Any Problems

If you require further information or if you have any problems concerning this project (for example, any side effects), you can contact the principal researcher Professor Tony Morris, the associate researcher Professor Stephen Bird, or the student researcher, Ms Michelle Walsh.

The researchers responsible for this project are:
Professor Tony Morris, contact number: 9919 5353
Professor Steve Bird, contact number: 8345 1196
Ms Michelle Walsh, contact number: 9919 4066 or 0413 491 005

9. Other Issues

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact

Name: Dr Stacey Gabriel

Position: Secretary, Mental Health Research and Ethics Committee

Telephone: (03) 9342 7098. You will need to tell Dr Stacey Gabriel the name of one of the researchers given in section 8 above.

10. Participation is Voluntary

Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine treatment, your relationship with those treating you or your relationship with the Western Health Network

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Complete the questionnaires only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project once you have submitted your questionnaires, please notify a member of the research team so that we can withdraw your information.

11. Ethical Guidelines

This project will be carried out according to the *National Statement on Ethical Conduct in Research Involving Humans* (June 1999) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Victoria University and the Mental Health Research and Ethics Committee at Melbourne Health.

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9919 4710).

APPENDIX J – STUDY 2: INTERVIEW GUIDE

Interview Guide

Thank participant for giving up their time for this interview.

Introduce myself

- Michelle Walsh, doing my PhD at Victoria University, conducting research with Western Health
- Looking at the links between physical activity and mood in people who have coronary heart disease, might remember some of the questionnaires you filled in a few months ago, this is the next study in the series.
- The experiences and responses you share in this interview are very valid and important and they will help us to help others with CHD.

Go over issues from Participant Information Form.

- The responses you give me will be kept confidential and you will be anonymous in any reports, publications or in the final PhD. This means I will not reveal your responses to anyone other than my supervisor and no-one else, including my supervisor, will know your identity.
- If you get tired during the interview and would like to take a break, please let me know.

Ask if they had any questions from the Participant Information form (address these), sign the consent form.

Ask if it is OK for me to record the interview.

- I would like to start by asking if you could tell me a bit about yourself (e.g., your family, your work, your interests).

- Can you tell me about your experiences with PA (from your past to the present)? What types of PA do you enjoy/not enjoy?

- What influences your participation or lack of participation in PA? (Keep open-ended to begin. Then ask, how do each of these things influence participation, expand on each point, what sort of influence does each point have on your participation?). Probe for further influences.

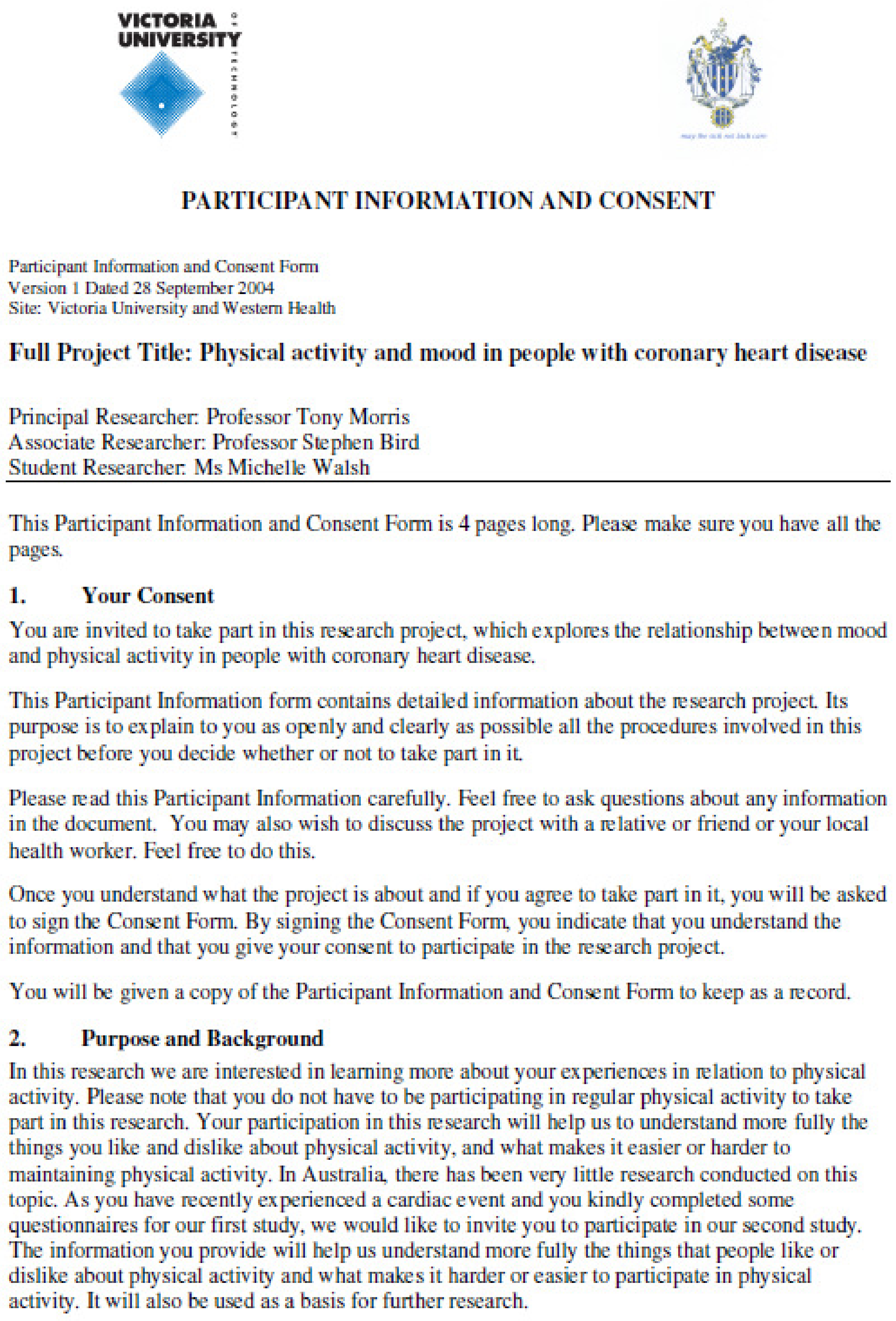
- What sorts of things might help you be more active or maintain your exercise? How do you try and overcome things that get in your way of exercise?)

- Can you think of a time when you did not exercise because you were feeling sad?

- Can you think of a time when your mood changed as a result of exercising?

Thank participant and close interview.

APPENDIX K – STUDY 2: PARTICIPANT INFORMATION AND CONSENT FORM



PARTICIPANT INFORMATION AND CONSENT

Participant Information and Consent Form
Version 1 Dated 28 September 2004
Site: Victoria University and Western Health

Full Project Title: Physical activity and mood in people with coronary heart disease

Principal Researcher: Professor Tony Morris
Associate Researcher: Professor Stephen Bird
Student Researcher: Ms Michelle Walsh

This Participant Information and Consent Form is 4 pages long. Please make sure you have all the pages.

1. Your Consent

You are invited to take part in this research project, which explores the relationship between mood and physical activity in people with coronary heart disease.

This Participant Information form contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project before you decide whether or not to take part in it.

Please read this Participant Information carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project.

You will be given a copy of the Participant Information and Consent Form to keep as a record.

2. Purpose and Background

In this research we are interested in learning more about your experiences in relation to physical activity. Please note that you do not have to be participating in regular physical activity to take part in this research. Your participation in this research will help us to understand more fully the things you like and dislike about physical activity, and what makes it easier or harder to maintaining physical activity. In Australia, there has been very little research conducted on this topic. As you have recently experienced a cardiac event and you kindly completed some questionnaires for our first study, we would like to invite you to participate in our second study. The information you provide will help us understand more fully the things that people like or dislike about physical activity and what makes it harder or easier to participate in physical activity. It will also be used as a basis for further research.

The results of this research will be used to help researcher Ms Michelle Walsh obtain a PhD degree.

It is anticipated that a total of 15 people will participate in this project.

3. Procedures

Participation in this project will involve a tape-recorded interview of about an hour, with the student researcher of the research team, Michelle Walsh. You may choose to have the interview conducted at your home, or at Victoria University, Footscray Campus at a time convenient to you. Before the interview commences, you will be asked to read and sign the consent form. The researcher will start the interview by asking you questions about your age, occupation, family and living arrangements. The interviewer will then ask you questions about what you like or dislike about physical activity, what you perceive the benefits to be of physical activity, what motivates you to maintain your physical activity or what you find hard about maintaining physical activity. If you become tired or upset during the interview, we will take a break, cease the interview or re-schedule the interview. If you feel that you would like to talk to someone about any issues that have arisen as a result of the interview, we can arrange some counselling through Western Health or if you would rather, through your own GP.

4. Possible Benefits

Possible benefits include the chance to share information about your experiences with physical activity which some participants might find helpful. By identifying those things that make physical activity easier or harder, you might learn something new about how you can increase or maintain your physical activity.

5. Possible Risks

There is the possibility that some participants may feel distressed when revealing sensitive issues about their background and their physical activity. Participants may feel uncomfortable about disclosing and discussing their experiences. If you feel upset or uncomfortable during or after the interview, please tell the researchers, either during the interview, or after the interview on the phone numbers mentioned, and if necessary, we can arrange some counselling through Western Health or if you would rather, through your own GP.

6. Privacy, Confidentiality and Disclosure of Information

Information will be strictly confidential and used only for the purpose of this study. Your confidentiality will be protected through the use of a code. No identifying material of you or health care professionals will be used in the study. All research materials will be kept under lock and key. Access to research materials will be limited to the research team (the principal investigators and the student researcher). On completion of the study, the results will be stored securely for seven years at Victoria University and then destroyed.

In any publication or presentation of findings, information will be provided in such a way that you cannot be identified.

7. Results of Project

The research team will inform you of the results when the research project is finished.

8. Further Information or Any Problems

If you require further information or if you have any problems concerning this project (for example, any side effects), you can contact the principal researcher Professor Tony Morris, associate researcher Professor Stephen Bird, or student researcher, Ms Michelle Walsh.

The researchers responsible for this project are:
Professor Tony Morris, contact number: 9688 5353
Professor Steve Bird, contact number: 8345 1196
Ms Michelle Walsh, contact number: 9384 1048 or 0413 xxx xxx

9. Other Issues

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact

Name: Dr Angela Watt

Position: Manager of the Melbourne Health Human Research Ethics Committee

Telephone: (03) 9342 8530

You will need to tell Dr Angela Watt the name of one of the researchers given in section 8 above.

10. Participation is Voluntary

Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine treatment, your relationship with those treating you or your relationship with the Western Health Network

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project, please notify a member of the research team before you withdraw.

11. Ethical Guidelines

This project will be carried out according to the *National Statement on Ethical Conduct in Research Involving Humans* (June 1999) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Victoria University and the Melbourne Health Human Research Ethics Committee.

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9688 4710).

CONSENT FORM

Consent Form
Version 1 Dated 28 September 2004
Site: Victoria University and Western Health

Full Project Title: Physical activity and mood in people with coronary heart disease

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I have read, or have had read to me, and I understand the Participant Information version 1 dated 28th September 2004

I freely agree to participate in this project according to the conditions in the Participant Information.

I will be given a copy of the Participant Information and Consent Form to keep.

The researcher has agreed not to reveal my identity and personal details if information about this project is published or presented in any public form.

Participant's Name (printed) ……………………………………………………

Signature Date

Name of Witness to Participant's Signature (printed) …………………………………

Signature Date

Researcher's Name (printed) ……………………………………………………

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9688 4710).

APPENDIX L – STUDY 2: RAW DATA THEMES

Raw data themes, first- and second-order themes, and general dimensions for Study 2 analysis

BARRIERS TO PHYSICAL ACTIVITY

Negative perceptions and uncertainties of exercise

Fearful of engaging in exercise

Fear of doing damage to heart
Fear of not having enough energy to exercise
Fear of damaging other body parts, causing further injury
Being hesitant or cautious with exercise
Evaluating every twinge / feeling in his heart

Uncertainty associated with exercise

Not knowing the full benefits of exercise
Not knowing what could / should do with regards to exercise

Perceived external obstacles

Perceived economic restrictions

Financial concerns - not enough money to attend gyms, play golf etc
No longer working – need to be careful with money spent

Perceived environmental conditions

Wintry/hot/wet weather conditions restricting exercise

Physical restrictions (perceived and actual)

Effects of medications (perceived)

Possible effects of medication restricting exercise (e.g., lower energy, weakness of muscles)
No aerobic response from exercise (due to medication)

Pain / restriction caused by heart

Can't do physical activities for as long, breathing more difficult, get some chest pain etc

Pain / restriction caused by other body parts (not heart)

Injury to body part other than heart stopping / restricting exercise
Pain from other injuries stopping / restricting exercise
Developed diabetes / other problems causing fatigue since heart condition

Lack of motivation

Lack of interest / desire to exercise

Laziness can hinder exercise
Gets bored easily with exercise
Don't have great will power to exercise
Need the desire to exercise
Not interested in exercise
No real reason to exercise
No / little motivation to exercise

No perceived change from exercise

Not feeling any different / better after exercise

Lack of interest / desire to improve health

Not having a real incentive to get better
No interest in getting better
Biding time before die

Negative perceptions of life changes resulting from heart disease

Coming to terms with getting older

Needing to take on new roles associated with an older person
Not ready for old age / retirement
Realise getting older, need to slow down
Feel aged much quicker rate since heart problems

Lost relationship with good health

Previously never taken medications
No other / limited other physical health problems previous to heart condition
Many more health problems since heart condition, since getting older
Feels starting on a downward slide with health
Miss doing physical things, feeling fit
Frustration associated with decrease in condition and health
Broken relationship with good health
Frustration at being caught in the middle (not being sick enough for bypass operation but still feeling unwell)

Shock of developing heart problems

Shock to the system having heart problems
Thought was bullet proof / invincible, but not after heart problems

Work and financial changes

Biggest change since heart problems is not working
Miss not working
Retirement didn't happen as planned
Wanted to retire fit and healthy

Not knowing how to be useful / to whom
Extra financial stress because of retirement
Feeling like they are not making a contribution to the family, no longer providing for family

Depression / low mood

Causes of depression / low mood

Frustration and boredom associated with not being able to exercise / work (due to physical limitation other than heart)
Frustration at not being able to do some physical things
Loneliness (associated with not working, interacting with people)
Depression / low mood very problematic soon after heart problem
Trouble sleeping gets her depressed

Effects of depression / low mood

Much more emotional since heart operation
Depression / low mood restricted / stopped them from exercising (either occasionally or permanently)
Depression stops him from working
Soon after heart attack, difficult to cope because had no structure / routine
Sometimes very little energy / motivation resulting in a depressed / low mood
Sense of uselessness

Lack of social support

Lack of family support
No one to exercise with
No support from others (e.g., family/doctors) to exercise

Effects of past sedentary behaviours

Lapsing back into old habits
Not being an active person before heart event

FACILITATORS OF PHYSICAL ACTIVITY

Having a reason for exercising

Doing the exercise for someone (other than yourself)

Having someone worth fighting for
Owing it to someone, needing to do exercise to get better for someone else

Wanting to improve health

Keeping positive and moving forwards
Need to want to do the exercise and want to get better
Considering health as number 1 priority
Not ready to die / wanting to live longer

Having a real reason to get better
Not wanting to go through operation again

Happy to be alive

Fortunate to be alive
Content with life

Experiencing the psychological and physical benefits of exercise

Knowing you are physically improving health / body

Knowing the benefits / importance of exercise for your health / body
Achieving a healthy weight
Doing something good for your body
Motivated to improve appearance
Feeling aerobic response of the heart
Enjoy feeling body / heart working well

Feeling better psychologically by exercising

Keeps your mind off pain, depression, heart problem etc
Exercise is a good therapy
Clears the head and keeps you relaxed
Gets you away from your stresses
Feel good within yourself when exercise
Achieving something you set out to do
Exercise to get self-respect

The positive role of others

Having someone to exercise with
Support from family, friends, CR staff to exercise
Social interactions from exercise
Having a positive role model for exercise

Enjoyment of exercise

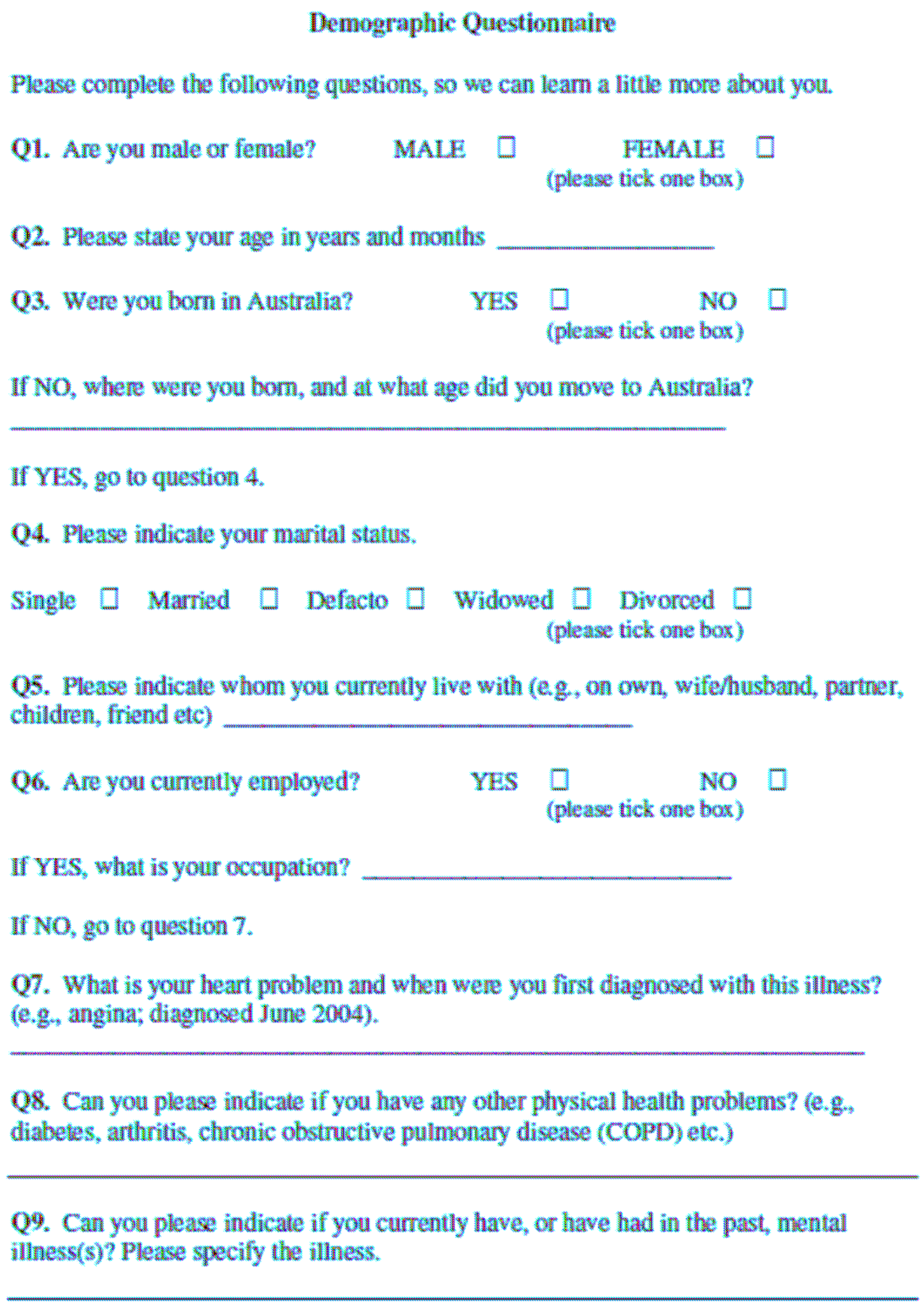
Exercise needs to be fun and enjoyable

Enjoyment a key motivator to exercise
Exercise must be fun

Using psychological strategies

Goal setting
Eliminating excuses
Positive self-talk
Using an exercise diary

APPENDIX M – STUDY 3: DEMOGRAPHIC QUESTIONNAIRE



Demographic Questionnaire

Please complete the following questions, so we can learn a little more about you.

Q1. Are you male or female? MALE ☐ FEMALE ☐
(please tick one box)

Q2. Please state your age in years and months ____________________

Q3. Were you born in Australia? YES ☐ NO ☐
(please tick one box)

If NO, where were you born, and at what age did you move to Australia?

____

If YES, go to question 4.

Q4. Please indicate your marital status.

Single ☐ Married ☐ Defacto ☐ Widowed ☐ Divorced ☐
(please tick one box)

Q5. Please indicate whom you currently live with (e.g., on own, wife/husband, partner, children, friend etc) ______________________________________

Q6. Are you currently employed? YES ☐ NO ☐
(please tick one box)

If YES, what is your occupation? __________________________________

If NO, go to question 7.

Q7. What is your heart problem and when were you first diagnosed with this illness? (e.g., angina; diagnosed June 2004).

____

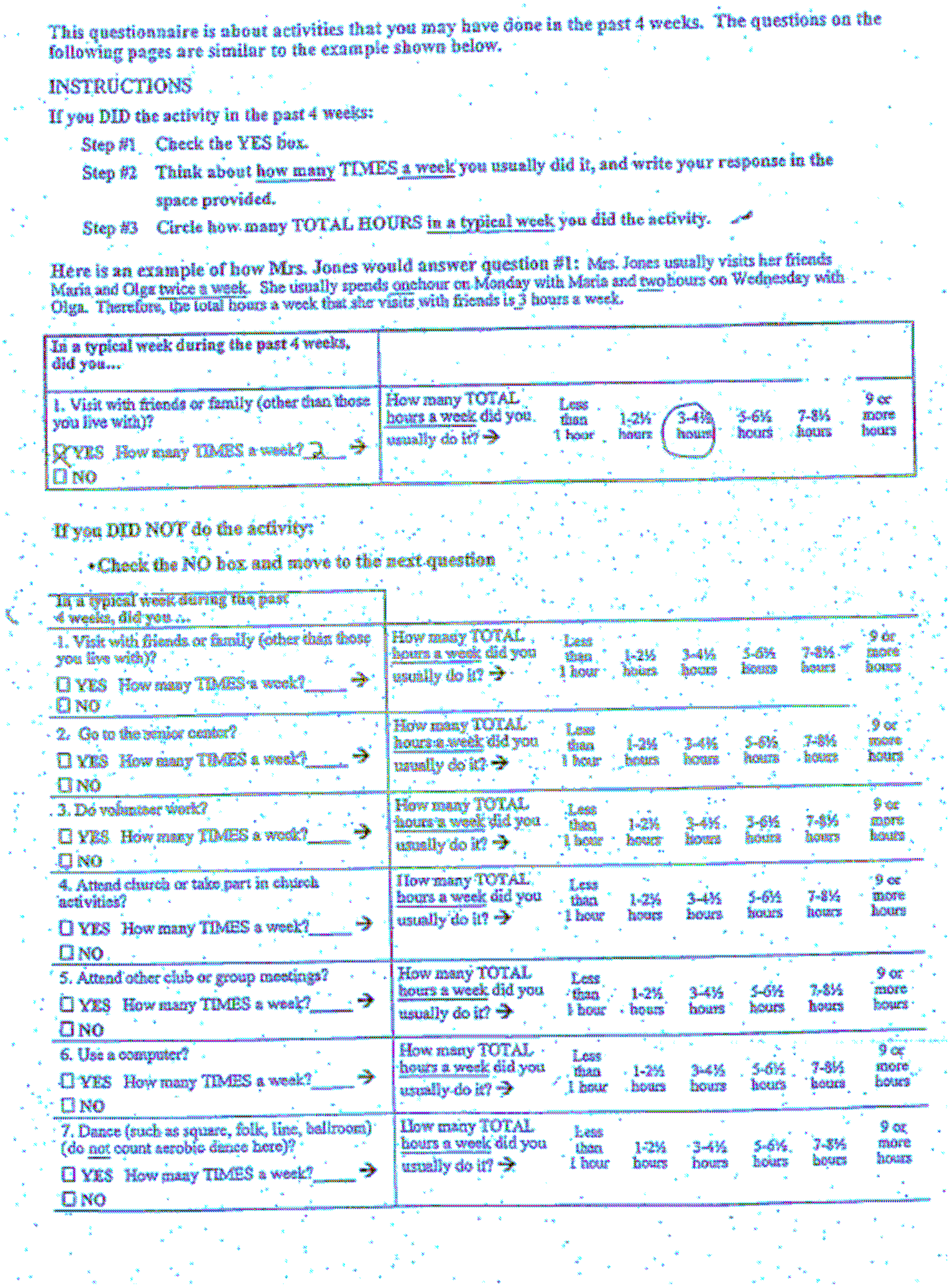
Q8. Can you please indicate if you have any other physical health problems? (e.g., diabetes, arthritis, chronic obstructive pulmonary disease (COPD) etc.)

____

Q9. Can you please indicate if you currently have, or have had in the past, mental illness(s)? Please specify the illness.

____

APPENDIX N – STUDY 3: CHAMPS PA QUESTIONNAIRE



This questionnaire is about activities that you may have done in the past 4 weeks. The questions on the following pages are similar to the example shown below.

INSTRUCTIONS

If you DID the activity in the past 4 weeks:

Step #1 Check the YES box.

Step #2 Think about how many TIMES a week you usually did it, and write your response in the space provided.

Step #3 Circle how many TOTAL HOURS in a typical week you did the activity.

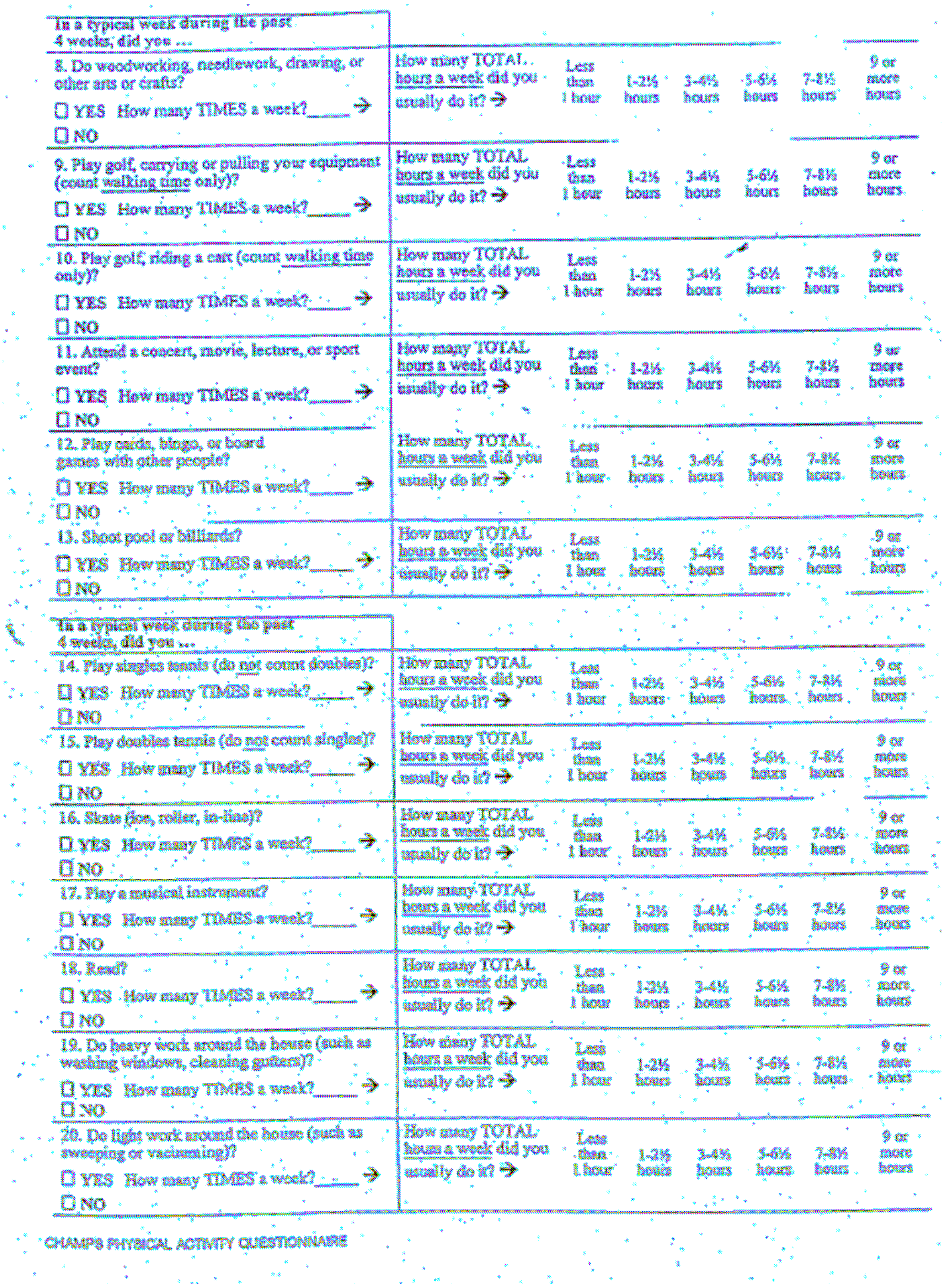
Here is an example of how Mrs. Jones would answer question #1: Mrs. Jones usually visits her friends Maria and Olga twice a week. She usually spends one hour on Monday with Maria and two hours on Wednesday with Olga. Therefore, the total hours a week that she visits with friends is 3 hours a week.

In a typical week during the past 4 weeks, did you...							
1. Visit with friends or family (other than those you live with)? ☒ YES How many TIMES a week? 2 → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	[✓ 3-4½ hours]	5-6½ hours	7-8½ hours	9 or more hours

If you DID NOT do the activity:

•Check the NO box and move to the next question

In a typical week during the past 4 weeks, did you ...							
1. Visit with friends or family (other than those you live with)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
2. Go to the senior center? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
3. Do volunteer work? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
4. Attend church or take part in church activities? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
5. Attend other club or group meetings? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
6. Use a computer? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
7. Dance (such as square, folk, line, ballroom) (do not count aerobic dance here)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours



In a typical week during the past 4 weeks, did you ...							
8. Do woodworking, needlework, drawing, or other arts or crafts? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
9. Play golf, carrying or pulling your equipment (count walking time only)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
10. Play golf, riding a cart (count walking time only)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
11. Attend a concert, movie, lecture, or sport event? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
12. Play cards, bingo, or board games with other people? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
13. Shoot pool or billiards? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
In a typical week during the past 4 weeks, did you ...							
14. Play singles tennis (do not count doubles)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
15. Play doubles tennis (do not count singles)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
16. Skate (ice, roller, in-line)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
17. Play a musical instrument? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
18. Read? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
19. Do heavy work around the house (such as washing windows, cleaning gutters)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
20. Do light work around the house (such as sweeping or vacuuming)? ☐ YES How many TIMES a week?______ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours

CHAMPS PHYSICAL ACTIVITY QUESTIONNAIRE

In a typical week during the past 4 weeks, did you …							
21. Do heavy gardening (such as spading, raking)? ☐ YES How many TIMES a week?___ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
22. Do light gardening (such as watering plants)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
23. Work on your car, truck, lawn mower, or other machinery? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
**Please note: For the following questions about running and walking, include use of a treadmill.							
24. Jog or run? ☐ YES How many TIMFS a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
25. Walk uphill or hike uphill (count only uphill part)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
26. Walk fast or briskly for exercise (do not count walking leisurely or uphill)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
In a typical week during the past 4 weeks, did you …							
27. Walk to do errands (such as to/from a store or to take children to school (count walk time only)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
28. Walk leisurely for exercise or pleasure? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
29. Ride a bicycle or stationary cycle? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
30. Do other aerobic machines such as rowing, or step machines (do not count treadmill or stationary cycle)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
31. Do water exercises (do not count other swimming)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
32. Swim moderately or fast? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
33. Swim gently? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours

In a typical week during the past 4 weeks, did you ...							
34. Do stretching or flexibility exercises (do not count yoga or Tai-chi)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
35. Do yoga or Tai-chi? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
36. Do aerobics or aerobic dancing? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
37. Do moderate to heavy strength training (such as hand-held weights of more than 5 lbs., weight machines, or push-ups)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
38. Do light strength training (such as hand-held weights of 5 lbs. or less or elastic bands)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
39. Do general conditioning exercises, such as light calisthenics or chair exercises (do not count strength training)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours

In a typical week during the past 4 weeks, did you ...							
40. Play basketball, soccer, or racquetball (do not count time on sidelines)? ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours
41. Do other types of physical activity not previously mentioned (please specify)? ____________________ ☐ YES How many TIMES a week?_____ → ☐ NO	How many TOTAL hours a week did you usually do it? →	Less than 1 hour	1-2½ hours	3-4½ hours	5-6½ hours	7-8½ hours	9 or more hours

Thank You

APPENDIX O – STUDY 3: EXERCISE MOTIVATIONAL STAGE MEASURE

Exercise Motivational Stage Measure

Please read through all categories listed below and tick ONE box for the category which best describes how physically active you have been over the last 6 months.

Please note, regular exercise = 3 or more times per week, for 20 mins or more each time.

i) I currently do not exercise, and I do not intend to start exercising in the next 6 months ☐

ii) I currently do not exercise, but I am thinking about starting to exercise in the next 6 months ☐

iii) I currently exercise some, but not regularly ☐

iv) I currently exercise regularly, but have only begun doing so within the last 6 months ☐

v) I currently exercise regularly, and have done so for longer than 6 months ☐

(please tick one box)

(Marcus, Rossi, Selby, Niaura, & Abrams, 1992)

APPENDIX P – STUDY 3: OPEN-ENDED QUESTIONS REGARDING INTERVENTION

Intervention questionnaire

Please answer these questions as honestly as you can. Your honesty will help us improve our intervention in the future.

If you would like your answers to this questionnaire to be anonymous, please return THIS questionnaire in the second reply paid envelope (that is, separate to the other questionnaire). Otherwise, please return both questionnaires in the one envelope.

Q1. Are you doing more, less or the same amount of exercise / physical activity NOW compared to 3 months ago? Please tick one of the following 3 options, and answer the relevant questions.

MORE ☐

If more, please explain what extra exercise you do now (e.g., walk for an extra 30 minutes per day, go for one swim per week):

Please explain what helped you to increase your exercise?

LESS ☐

If less, please explain what you don't do now that you used to do:

Why do you think your exercise level has decreased?

SAME ☐

If the same, did you maintain a moderate or high level of exercise during the intervention? Please explain:

OR

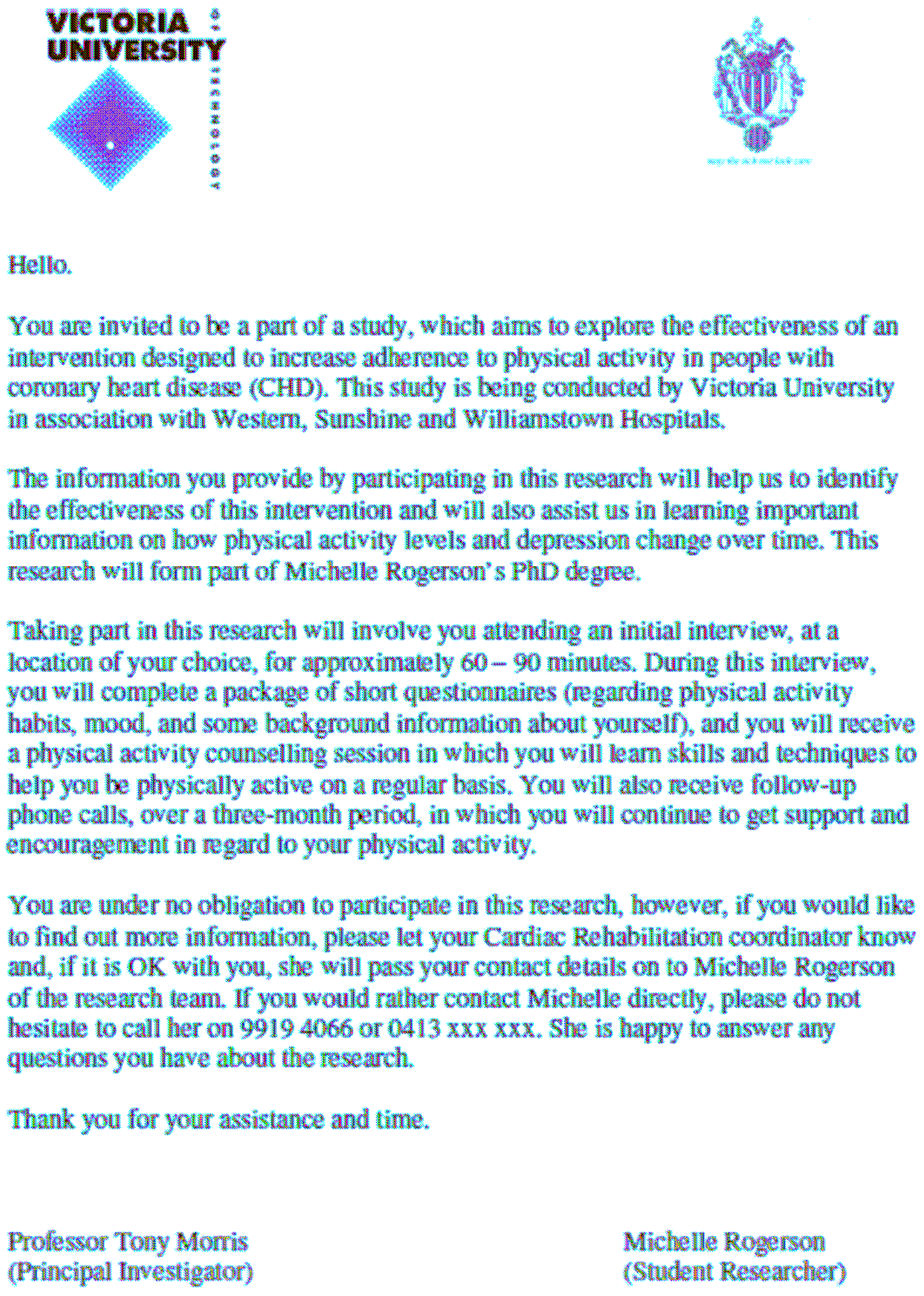
You were not previously exercising (or exercising very little) and your exercise level has not changed. Please explain:

Q2. Do you feel any differently (physically or psychologically) NOW compared to 3 months ago? Please explain.

Q3. Please make any comments about your involvement in our intervention study? Was it helpful / unhelpful? What did you find helpful/unhelpful?

Q4. What can we do differently to improve our intervention (e.g., what might have helped you more to increase or maintain your exercise?)

APPENDIX Q – STUDY 3: INVITATION LETTER FOR CR PARTICIPANTS



VICTORIA UNIVERSITY

Hello.

You are invited to be a part of a study, which aims to explore the effectiveness of an intervention designed to increase adherence to physical activity in people with coronary heart disease (CHD). This study is being conducted by Victoria University in association with Western, Sunshine and Williamstown Hospitals.

The information you provide by participating in this research will help us to identify the effectiveness of this intervention and will also assist us in learning important information on how physical activity levels and depression change over time. This research will form part of Michelle Rogerson's PhD degree.

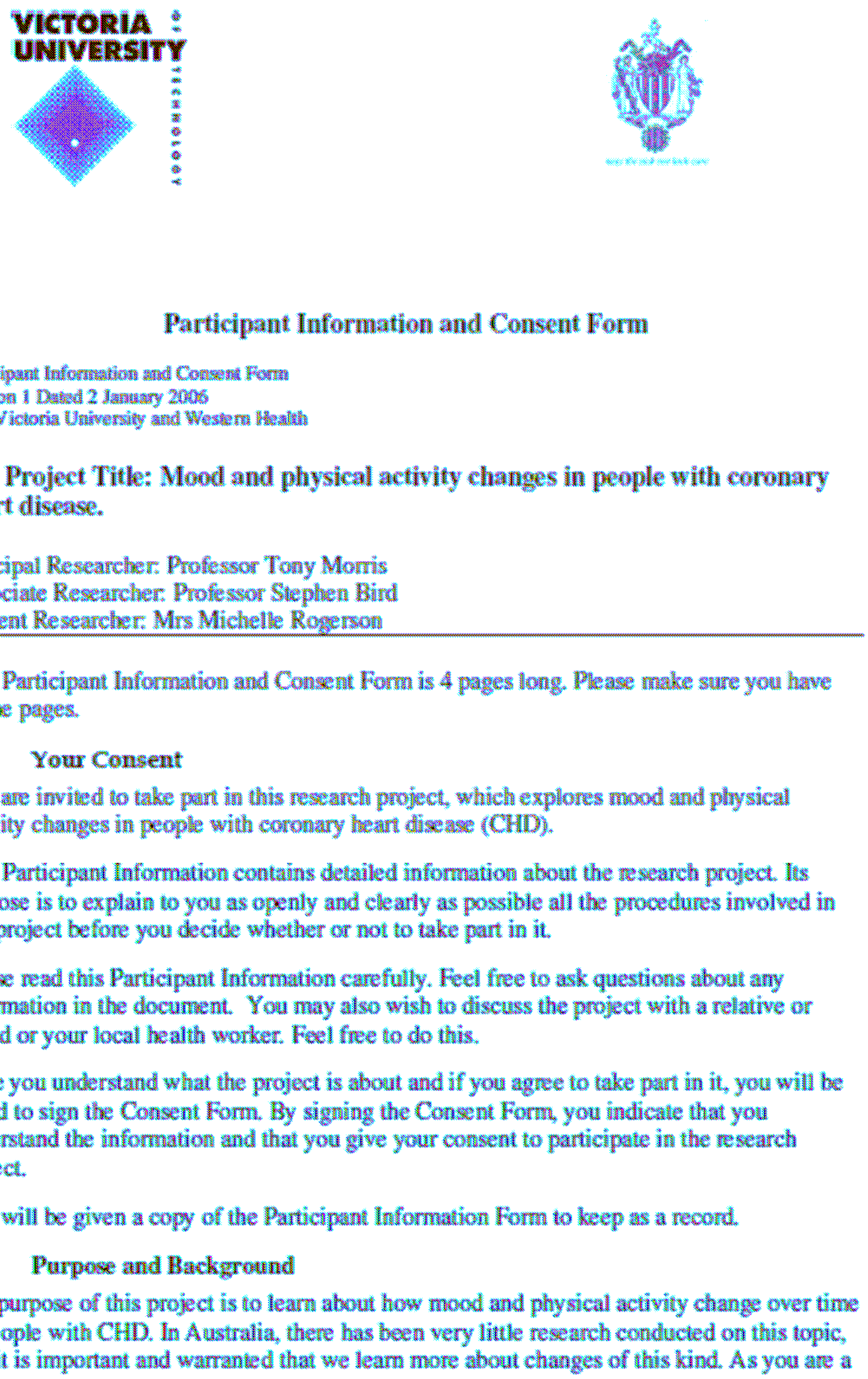
Taking part in this research will involve you attending an initial interview, at a location of your choice, for approximately 60 – 90 minutes. During this interview, you will complete a package of short questionnaires (regarding physical activity habits, mood, and some background information about yourself), and you will receive a physical activity counselling session in which you will learn skills and techniques to help you be physically active on a regular basis. You will also receive follow-up phone calls, over a three-month period, in which you will continue to get support and encouragement in regard to your physical activity.

You are under no obligation to participate in this research, however, if you would like to find out more information, please let your Cardiac Rehabilitation coordinator know and, if it is OK with you, she will pass your contact details on to Michelle Rogerson of the research team. If you would rather contact Michelle directly, please do not hesitate to call her on 9919 4066 or 0413 xxx xxx. She is happy to answer any questions you have about the research.

Thank you for your assistance and time.

Professor Tony Morris (Principal Investigator)	Michelle Rogerson (Student Researcher)

APPENDIX R – STUDY 3: PARTICIPANT INFORMATION AND CONSENT FORM



Participant Information and Consent Form

Participant Information and Consent Form
Version 1 Dated 2 January 2006
Site: Victoria University and Western Health

Full Project Title: Mood and physical activity changes in people with coronary heart disease.

Principal Researcher: Professor Tony Morris
Associate Researcher: Professor Stephen Bird
Student Researcher: Mrs Michelle Rogerson

This Participant Information and Consent Form is 4 pages long. Please make sure you have all the pages.

1. Your Consent

You are invited to take part in this research project, which explores mood and physical activity changes in people with coronary heart disease (CHD).

This Participant Information contains detailed information about the research project. Its purpose is to explain to you as openly and clearly as possible all the procedures involved in this project before you decide whether or not to take part in it.

Please read this Participant Information carefully. Feel free to ask questions about any information in the document. You may also wish to discuss the project with a relative or friend or your local health worker. Feel free to do this.

Once you understand what the project is about and if you agree to take part in it, you will be asked to sign the Consent Form. By signing the Consent Form, you indicate that you understand the information and that you give your consent to participate in the research project.

You will be given a copy of the Participant Information Form to keep as a record.

2. Purpose and Background

The purpose of this project is to learn about how mood and physical activity change over time in people with CHD. In Australia, there has been very little research conducted on this topic, and it is important and warranted that we learn more about changes of this kind. As you are a current (or past) participant of Phase II Cardiac Rehabilitation, we would like to invite you to participate in this project. Your participation in this research will help us to identify the effectiveness of an intervention designed to increase physical activity and improve mood, and will also provide us with important information on how physical activity levels and mood change over time.

The results of this research will form part of Michelle Rogerson's PhD degree.

It is anticipated that a total of 35 people will participate in this project.

3. Procedures

Participation in this project will involve taking part in an exercise consultation interview, follow-up phone calls, and the completion of questionnaires. During this interview, you will be required to complete a package of short questionnaires. These questionnaires ask about your background (e.g., age, gender, occupation, time since your last cardiac episode, and if you have any other health problems), physical activity levels and habits and mood. During the initial interview, we will also conduct the exercise consultation intervention which includes a discussion of your exercise history, advantages and disadvantages of changing physical activity behaviour, addressing any barriers to change, identifying available social support, goal setting, and relapse prevention. As a follow-up to the intervention, we will also arrange a suitable time to call you at Week 2, 4, 6, 8, 10, and 12. These phone calls will follow-up on the issues raised in the interview, and will provide you with additional support and encouragement. We will also send the same package of questionnaires to you after Week 10 of the intervention, and then finally at Week 24 (i.e., 6 months after the initial interview). You will just need to complete the questionnaires, put them into the reply paid envelope we send you, and post it back to us. The initial interview (including completing the questionnaires) will take 60 – 90 minutes, and the questionnaires we send you should take approximately 30 minutes to complete.

4. Possible Benefits

It is anticipated that an intervention of this type is likely to have numerous positive physical and psychological health benefits for people with CHD. Personalised exercise consultation has been shown to be beneficial in increasing adherence to physical activity, which is known to have positive effects on both physical and psychological health. It is also hoped that this intervention will have lasting positive effects on health status. The exercise consultations and follow-up phone calls will provide you with skills and techniques that help to increase and maintain healthy levels of physical activity, and to make you feel more confident and supported in performing physical activity.

5. Possible Risks

There is the possibility that some participants may feel distressed or uncomfortable when revealing sensitive issues and experiences surrounding their mood and physical activity. If you feel upset or uncomfortable during or after filling in the questionnaires or the interview, please contact the researchers on the phone numbers mentioned and, if necessary, we can arrange some counselling through Western Health or if you would rather, through your own GP.

6. Privacy, Confidentiality and Disclosure of Information

Information you give us will be strictly confidential and used only for the purpose of this study. Your confidentiality will be protected through the use of a code. No identifying material about you, your friends or family, or health care professionals will be used in the study. All research materials will be kept under lock and key. Access to research materials will be limited to the research team (the principal investigators and the student researcher).

On completion of the study, the results will be stored securely for seven years at Victoria University and then destroyed.

In any publication or presentation of findings, information will be provided in such a way that you cannot be identified.

7. Results of Project

The research team will inform you of the results when the research project is finished.

8. Further Information or Any Problems

If you require further information or if you have any problems concerning this project (for example, any side effects), you can contact the principal researcher Professor Tony Morris, the associate researcher, Professor Stephen Bird, or the student researcher, Mrs Michelle Rogerson.

The researchers responsible for this project are:
Professor Tony Morris, contact number: 9919 5353
Professor Steve Bird, contact number: 8345 1196
Mrs Michelle Rogerson, contact number: 9919 4066 or 0413 xxx xxx

9. Other Issues

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact

Name: Dr Stacey Gabriel

Position: Secretary, Mental Health Research and Ethics Committee

Telephone: (03) 9342 7098. You will need to tell Dr Stacey Gabriel the name of one of the researchers given in section 8 above.

10. Participation is Voluntary

Participation in any research project is voluntary. If you do not wish to take part you are not obliged to. If you decide to take part and later change your mind, you are free to withdraw from the project at any stage.

Your decision whether to take part or not to take part, or to take part and then withdraw, will not affect your routine treatment, your relationship with those treating you or your relationship with the Western Health Network

Before you make your decision, a member of the research team will be available to answer any questions you have about the research project. You can ask for any information you want. Sign the Consent Form only after you have had a chance to ask your questions and have received satisfactory answers.

If you decide to withdraw from this project once you have begun participation, please notify a member of the research team, so that we can withdraw your information.

11. Ethical Guidelines

This project will be carried out according to the *National Statement on Ethical Conduct in Research Involving Humans* (June 1999) produced by the National Health and Medical Research Council of Australia. This statement has been developed to protect the interests of people who agree to participate in human research studies.

The ethical aspects of this research project have been approved by the Human Research Ethics Committee of Victoria University and the Melbourne Health Human Research Ethics Committee.

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9919 4710).

Consent Form

Consent Form
Version 1 Dated 2 January 2006
Site: Victoria University and Western Health

Full Project Title: Mood and physical activity changes in people with coronary heart disease.

I have read, or have had read to me, and I understand the Participant Information Form version 1 dated 2nd January 2006.

I freely agree to participate in this project according to the conditions in the Participant Information, and I agree to take part in an exercise consultation interview, follow-up phone calls, and complete a package of questionnaires over a 6-month period. I will be given a copy of the Participant Information Form to keep.

The researcher has agreed not to reveal my identity and personal details if information about this project is published or presented in any public form.

Participant's Name (printed) ……………………………………………………

Signature Date

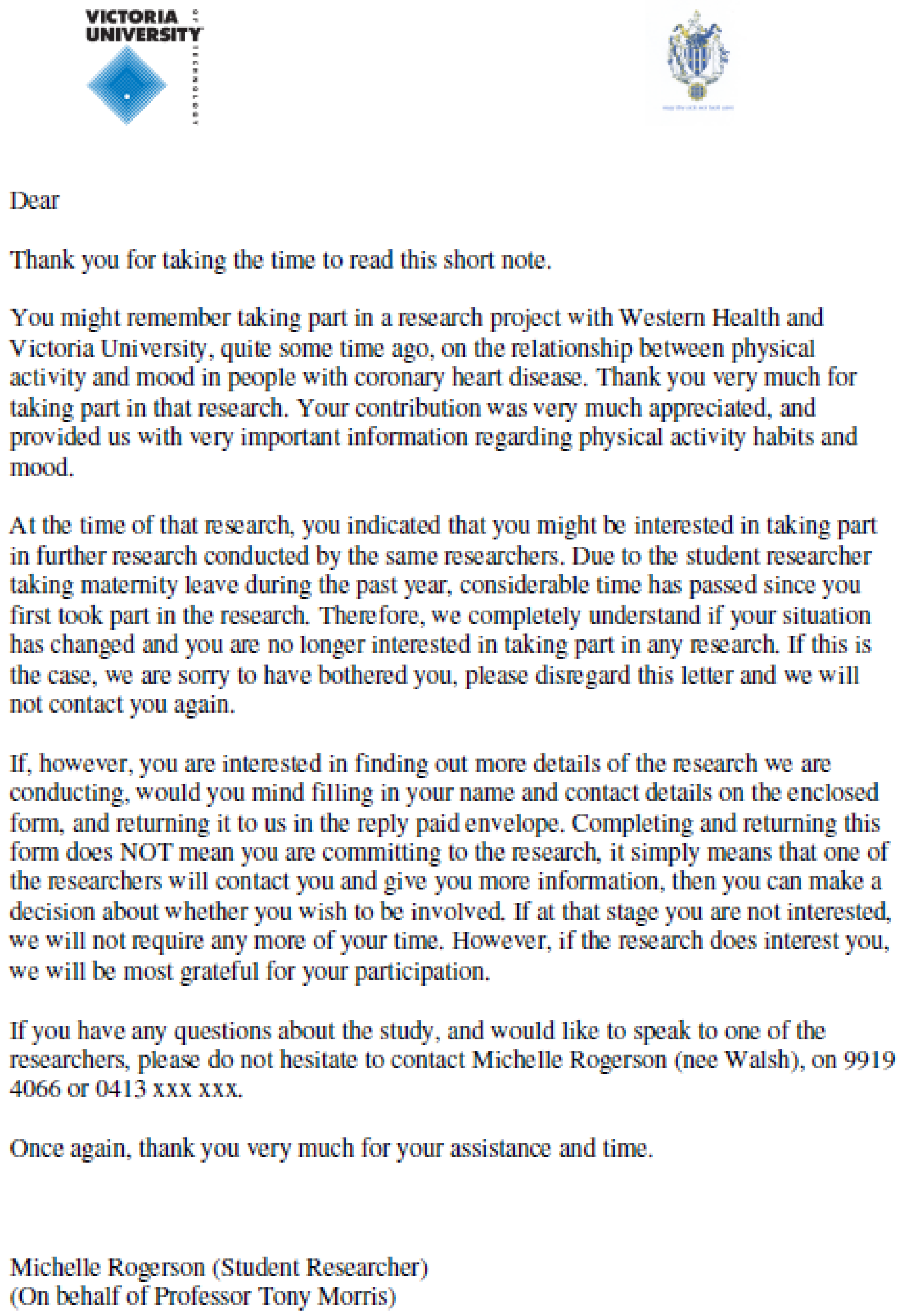
Name of Witness to Participant's Signature (printed) …………………………………

Signature Date

Researcher's Name (printed) ……………………………………………………

If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University, PO Box 14428 MC, Melbourne 8001 (telephone no: 03 9919 4710).

APPENDIX S – STUDY 3: INVITATION LETTER FOR PAST PARTICIPANTS



VICTORIA UNIVERSITY

Dear

Thank you for taking the time to read this short note.

You might remember taking part in a research project with Western Health and Victoria University, quite some time ago, on the relationship between physical activity and mood in people with coronary heart disease. Thank you very much for taking part in that research. Your contribution was very much appreciated, and provided us with very important information regarding physical activity habits and mood.

At the time of that research, you indicated that you might be interested in taking part in further research conducted by the same researchers. Due to the student researcher taking maternity leave during the past year, considerable time has passed since you first took part in the research. Therefore, we completely understand if your situation has changed and you are no longer interested in taking part in any research. If this is the case, we are sorry to have bothered you, please disregard this letter and we will not contact you again.

If, however, you are interested in finding out more details of the research we are conducting, would you mind filling in your name and contact details on the enclosed form, and returning it to us in the reply paid envelope. Completing and returning this form does NOT mean you are committing to the research, it simply means that one of the researchers will contact you and give you more information, then you can make a decision about whether you wish to be involved. If at that stage you are not interested, we will not require any more of your time. However, if the research does interest you, we will be most grateful for your participation.

If you have any questions about the study, and would like to speak to one of the researchers, please do not hesitate to contact Michelle Rogerson (nee Walsh), on 9919 4066 or 0413 xxx xxx.

Once again, thank you very much for your assistance and time.

Michelle Rogerson (Student Researcher)
(On behalf of Professor Tony Morris)