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Phase two exercise rehabilitation
following a cardiac event:
The effects of group and individual
exercise on psychological well-being,
physical status and quality of life

A thesis presented in partial fulfilment of the requirements

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Abstract

A cardiac event has serious consequences for physical and emotional health. The aim of this research was to determine the effects of a 16 week exercise-based cardiac rehabilitation programme for improving physical status, psychological well-being and quality of life. It also aimed to examine whether group based exercise with social interaction is more beneficial for improving psychological status and quality of life among people undergoing cardiac rehabilitation compared to exercising alone. A pilot study was conducted in 2009 with six participants, all of whom took part in the 16 week programme. Based on this pilot work, a number of modifications were made to the study design, assessments and questionnaires. The main study involved 11 cardiac patients who had all experienced a cardiac event, and were recruited from Wellington Hospital or through word of mouth. The study employed a randomized crossover design, with participants acting as their own controls. The 16 week period was divided into 4x4 week blocks. All participants initially completed a four week baseline condition in the Massey Cardiac Rehabilitation Clinic (standard group exercise activities). Half of the participants then completed one of two intervention conditions, either increased social interaction within group exercise, or individual exercise and minimal social interaction. Following the intervention, participants undertook the 4-week baseline again (to washout intervention effects), and then crossed over to the alternative intervention. On commencing the study and at the end of each 4-week condition, participants completed physical outcome measures (blood sugar and cholesterol levels, performance on the 10m cardiac shuttle test) as well as psychological measures (modified Hospital Anxiety and Depression Scale and SF-36 quality of life questionnaire). Data were analysed using within participant ANOVAs and pre-planned t-tests. There were few significant changes across the course of the study. Non-significant trends occurred in the predicted direction for HADS anxiety and depression and for health-related quality of life in terms of vitality, social functioning, role physical, bodily pain and general health. There was a significant reduction in total cholesterol across the course of the study, while non-significant changes occurred in the predicted direction for diastolic blood pressure (but not for systolic blood pressure or heart rate). As predicted, blood sugar levels decreased over time and improvements on the SWT approached significance ($p=.07$). Unexpectedly, HDL cholesterol significantly increased and TC/HDL cholesterol decreased across the 16 weeks. Changes in anxiety, depression, and health related quality of life across the two interventions (group/individual) were inconsistent and non-significant, although trends showed improvement in anxiety and depression after the social exercise intervention. Results are discussed in terms of small sample sizes and difficulties in conducting research with cardiac populations. Suggestions for future research are provided, including exploring patients' perceptions, previous exercise history, support and preference for individual or group-based exercise programmes.

Statement from Supervisor

Venessa Green began her Masters of Health Science (Sport and Exercise) thesis research at the beginning of 2009 in the Institute of Food, Nutrition and Human Health (IFNHH). Her primary supervisor was Dr Alan Walmsley, and I was her second supervisor (in the School of Psychology), along with Wilma Tielemans (in IFNHH). At the beginning of 2010, Dr Walmsley left Massey University and I took over the role of primary supervisor, and Dr Steve Humphries (School of Psychology) joined the supervision team to assist with statistical analyses and advice. Later in 2010 Wilma Tielemans also left Massey University.

Venessa suddenly and tragically died on June 29th, 2011, leaving everyone in much shock and grief. She had been employed in the School of Psychology in a part-time administrator role in 2011, as well as in a part-time research assistant role throughout 2010. Venessa had just begun a new position as a lecturer at Weltec, and she was very close to submitting the penultimate draft of her thesis to her supervisors. Given how close Venessa was to completing and submitting her thesis, we were all (her friends, family, colleagues and supervisors) very keen for this still to occur. She had analysed all of her results for both her pilot and main studies; written all of her draft thesis chapters which I had provided her with feedback on previously; and she had re-worked these chapters in light of feedback from both of her supervisors. However, she had not written her discussion chapter, which she was working on and planned to give to me in draft form when I returned from overseas leave in July, 2011.

This statement is to outline my contribution to Venessa's thesis. I wrote most of the abstract (modified from an earlier version which Venessa had written prior to having her results in). I also generally tidied up some sentences, paragraphs, headings, and tables, in the same manner as I would do for any other student thesis. My main contribution was to Venessa's draft discussion chapter. Venessa had 18 pages of notes for her discussion, which were primarily her ideas about why she had obtained the results she had in the main study, possibly reasons for these (mostly null) results, and what other people had found in previous research with cardiac rehabilitation patients. However only the first two these pages were written in formal language using structured paragraphs. The remaining pages were in note and bullet point form, although they did have references and ideas about which papers and findings were relevant and why. I wrote these ideas into a structured discussion with headings. Therefore, while the discussion chapter of this thesis is my own writing, all of the ideas were Venessa's, and I have

not added anything that she had not already made notes about. I used as many of her own sentences or partial sentences as I could. I did not go beyond the literature that she had mentioned in her draft notes, nor did I read these papers myself – I merely used what she had written about them in writing up this chapter.

Other people have also had input into this thesis. Dr Steve Humphries, Venessa's second supervisor, restructured some of the pilot and main chapters to ensure there was less repetitiveness across the thesis, and that the reporting of results was clear, as he does for all his supervision students. Charlotte Stephens, Venessa's close friend, was present throughout Venessa's Masters journey, and has therefore written the acknowledgments page on behalf of Venessa. Ella Kahu worked on ensuring the accuracy of the referencing and formatted the thesis to prepare it for printing and binding. My thanks to all of you for your help in enabling us to have this thesis produced and examined.

Antonia Lyons

Associate Professor in Health and Social Psychology

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Venessa Green sadly passed away on 29 June 2011 following a tragic accident two months before she was due to complete and submit this Master of Health Science thesis. Venessa was a close friend of mine over the last 16 years and I know how passionate she was about rehabilitation and other's well-being. On her behalf, and on behalf of her parents, Marlene and Alan Green, and her brother Aaron and his wife Jenn, I would like to thank the following people for their support to Venessa over the last four years. We are so grateful to Massey University for allowing the completion and submission of this thesis posthumously. This has meant much to her friends and family, as we know Venessa was dedicated to completing her degree while holding down multiple part-time jobs and an active social life. To Antonia, Venessa's supervisor. Antonia, without you Venessa's thesis would not have been completed, which would have been a double tragedy. Without your wonderful mentoring and assistance especially during times of difficulty for Venessa, she would have found it that much harder to keep going. To Venessa's other supervisors at Massey, Alan Walmsley, Wilma Tielemans, and Steve Humphries, thank you for all of your input and assistance. To the students of Massey University who shared an office with Venessa and those who have assisted Antonia with completing the thesis. You helped keep Venessa sane, helped her focus, and no doubt helped her with the trickier parts of data analysis. To Anne Hare and the rest of the Scottish Harriers running club. You helped Venessa keep her life in balance and gave the friendship she needed. To the subjects of her research. Thank you for getting up so early in the morning to head to a gym. No mean feat, especially when you have cardiac issues! To all those I don't know who have helped Venessa in some way. Thank you. Venessa, I and the rest of your friends and family were all there to give you the encouragement to keep going. We are so proud that this thesis is complete and will celebrate the day you graduate for you.

Charlotte Stephens

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Chapter One: Cardiac Disease

Cardiovascular (CV) disease can be defined as disease of the heart and circulatory system. In 2004 CV disease was responsible for 29% of all deaths worldwide (World Health Organisation, 2011). With an increasing aging population, global rates of CV disease are predicted to increase, from 17.1 million in 2004 to 23.4 million in 2030 (World Health Organisation, 2008). In New Zealand, it is the leading cause of death and accounts for up to 40% of all deaths. A majority of these deaths (30%) are caused by coronary artery disease and other diseases of the heart (Hay, 2004). This equates to one death every 90 minutes, or 16 deaths a day in New Zealand (National Heart Foundation of New Zealand, 2011b). Many of these deaths are “premature and preventable” (National Heart Foundation of New Zealand, 2011b) as many of the risk factors associated with heart disease are modifiable and avoidable.

Even with the rising global death rates from CV disease, more people are surviving this chronic illness, due to better primary management of heart disease and secondary prevention strategies. As a result, patients are having to face and deal with the emotional consequences of their event for a long time after (Pleiver et al., 2001) which can cause ‘significant disability’ (Worcester & Le Grande, 2008). Such emotional problems can also still exist despite a good physical outcome (Worcester & Le Grande, 2008).

This research seeks to investigate the importance of group-based exercise in a socially interactive environment for improving psychological well-being after a cardiac event. Secondly this research will determine whether a phase two exercise programme, designed specifically for cardiac patients, will be effective over a 16 week period for improving psychological well-being, quality of life and physical status. Chapter 1 will briefly describe the various types of heart disease as well as define cardiac event, explain the risk factors for heart disease and outline ‘healthy’ ranges for certain physiological components (e.g. ideal ranges for blood pressure and blood cholesterol levels). It will also cover the emotional consequences of a cardiac event and the impact it can have on psychological well-being and quality of life. These two constructs will be defined, followed by a discussion of the literature findings in this area. In Chapter 2 cardiac rehabilitation and its phases will be introduced and defined (according to the National Heart Foundation of New Zealand) and research on the benefits of cardiac rehabilitation in terms of physical status, psychological well-being and quality of life will be reviewed. The importance of exercise training will be emphasized and how exercise in general

(outside the realm of cardiac rehabilitation) is beneficial for improving mental well-being. In the latter aspects of this chapter the concept of socially interactive, group exercise training will be introduced and proposed as an important intervention for phase two cardiac rehabilitation programmes. This will be discussed in terms of the social benefits derived from group based exercise and its benefits for accelerating the recovery of an individual's mental health status and quality of life following a cardiac event. There are currently only a small number of phase two group based exercise programmes being offered in New Zealand, and this research may suggest the need to establish a greater number of similar programmes throughout the country.

Coronary heart disease and coronary artery disease

Coronary artery disease (CAD) is the most common type of heart disease and accounts for up to 99% of all coronary heart disease (CHD) (Camic & Knight, 2004). It is also the most common cause of mortality in the western world (Ashley & Niebauer, 2004). The other 1% of CHD includes congenital abnormalities, endocarditis of the aortic valve, and cocaine related spasm (Camic & Knight, 2004). Coronary artery disease is characterised by arteriosclerosis or narrowing of the coronary arteries, caused by fatty, hardened deposits on the inner lining of the arteries (Burke, 1992). This results in a restricted blood supply to the heart, and if left untreated, over time may lead to chronic heart failure (Europe & Tyni-Lenne, 2004), ischaemia (lack of oxygen supply to the heart tissue), unstable angina, a myocardial infarction (MI, or heart attack) or sudden death (Burke, 1992; Camic & Knight, 2004).

Other diseases of the heart and circulation

Congestive heart failure (CHF) is the most common type of heart failure and is caused by damage to the heart and is characterised by the inability of the heart to pump efficiently. Instead of blood being returned to the heart, it ends up being backed up in the lungs and veins, causing breathlessness on exertion, oedema and the inability to lie down (Camic & Knight, 2004). The other type of heart failure is cardiomyopathy which encompasses a range of disorders affecting the heart muscles. Cardiomyopathy can be caused by ischaemic heart disease, MI, congenital defects, hypertension, valvular disease, chronic alcohol use, or pulmonary hypertension (Camic & Knight, 2004). Of these conditions, valvular disease refers to damage to the heart valves which can arise from rheumatic fever or congenital disorders of the heart valves. It may also require surgical interventions to replace the valve/s or to reconstruct the valve/s structure (Camic & Knight, 2004). Other diseases affecting the heart and circulation include arrhythmias, pericardial disease, endocarditis, aortic aneurysms and stroke.

A cardiac event can be defined as an acute incident of the heart such as an MI or unstable angina, also termed acute coronary syndrome (New Zealand Guidelines Group, 2002); a cardiac arrest, where the heart suddenly stops beating; or angina, which if left untreated can increase the risk for future acute events (Camic & Knight, 2004). A cardiac event may also include interventions such as coronary artery bypass graft (CABG), valve replacements, angioplasty and/or stent replacement, or other cardiac surgery (Aude, Hill, & Anderson, 2006).

Risk factors for cardiovascular disease and heart disease

A risk factor can be defined as “any characteristic that occurs with greater frequency in people with heart disease than in people free from that disease” (Brannon & Feist, 2007, p. 24). It does not specify the underlying physiology in the development of heart disease or allow for a “precise prediction of who will be affected and who will remain healthy” (Brannon & Feist, 2007, p. 228). Most of the risk factors associated with heart disease are modifiable risk factors and relate to behavioural factors such as physical inactivity, an unhealthy diet and tobacco use. These factors can be responsible for up to around 80% of coronary heart disease (World Health Organisation, 2011), and over time can manifest into ‘intermediate risk factors’ such as high blood pressure, raised cholesterol levels, high blood glucose (which can lead to diabetes) and obesity (World Health Organisation, 2011). The main risk factors for heart disease will be described briefly below, with a focus on behavioural and intermediate factors.

Three behavioural risk factors have received the most attention in the literature. These are physical inactivity, diet and tobacco use. Physical inactivity is one of the most well-established and understood risk factors for the development of heart disease and applies to the ‘entire lifespan’ (Brannon & Feist, 2007). Research has identified the importance of physical activity in the protection against the development of ‘metabolic syndrome’, a cluster of CV factors often presented in heart disease such as disturbed insulin and glucose metabolism, hypertension, obesity, elevated triglycerides and an increase in HDL cholesterol (Ekelund et al., 2005). Even in children, research has shown that a sedentary lifestyle and physical inactivity can, over time, lead to increased risk for obesity and cardiovascular disease (Brannon & Feist, 2007; Wang, 2003). In comparison, research has shown that women over the age of 65 years who regularly exercised (walking) exhibited better health and a lower risk for CV disease (Simonsick, Guralnik, Volpato, Balfour, & Fried, 2005).

In terms of dietary consumption, the choices of food we make can have a significant impact on developing an increased risk for CV disease. Foods that are high in saturated fats such as red meat, butter, fat, whole milk and gravy are associated with an increased risk, whereas diets

high in fruit and vegetables result in a lower risk for developing heart disease (Brannon & Feist, 2007). With regards to smoking and tobacco use, there has been substantial evidence over the last 35 years to demonstrate the link between smoking and heart disease. Specifically, exposure to tobacco smoke can increase the risk of dying from heart disease by 15% (Brannon & Feist, 2007; Kaur, Cohen, Dolor, Coffman, & Bastian, 2004).

As discussed earlier, intermediate risk factors often arise due to the neglect of behavioural risk factors. Of these, hypertension or high blood pressure has been regarded as “the single most important risk factor in cardiovascular disease” (Brannon & Feist, 2007, p. 232). Research has shown a direct correlation between high blood pressure and an increase in cardiovascular problems, including heart attack and heart failure (Brannon & Feist, 2007). Many people with high blood pressure are unaware however of the potential implications, and it commonly does not present with any symptoms or signals (Brannon & Feist, 2007). The ideal blood pressure is below 140/85, but for individuals who have had a heart attack or stroke, or with a diagnosis of coronary heart disease or diabetes, blood pressure should be below 130/85 (National Heart Foundation of New Zealand, 2011c).

Serum or blood cholesterol refers to the cholesterol circulating in our blood. It is related to the amount of cholesterol in our diet (also known as dietary cholesterol). While cholesterol is important for the production of cell membranes, too much dietary cholesterol (found in animal fats and oils) leads to increased risk for CV disease. Cholesterol circulates in the blood in many forms, of which low-density lipoprotein (LDL) is positively related to CV disease and high density lipoprotein is negatively related. Hence LDL is often referred to as the ‘bad cholesterol’, while HDL is the ‘good cholesterol’ (Brannon & Feist, 2007). Total cholesterol is composed of HDL, LDL and 20% of VLDL (or very low density lipoprotein), with a low ratio of total cholesterol to HDL being more desirable (Brannon & Feist, 2007). Ideal ranges for blood cholesterol levels are as follows: LDL: less than 2.0mmol/L, HDL: greater than 1.0mmol/L, TC/HDL ratio: less than 4.0 and triglycerides: less than 1.7mmol/L (National Heart Foundation of New Zealand, 2011c). Research demonstrates that exercise is closely associated with increasing HDL levels, and this relationship has been identified in terms of exercise duration rather than intensity (Kodama et al., 2007).

Type 2 diabetes is a further risk factor for heart disease (National Heart Foundation of New Zealand, 2011a), and can also lead to elevations in blood pressure and blood cholesterol. This condition arises either because the body cannot metabolise insulin properly or because there is insufficient amounts of insulin in the body. Type 2 diabetes can be prevented through eating

a healthy diet, exercising, losing weight and refraining from smoking. It is detected by elevations in blood glucose, with a fasting glucose test of between 4-6mmol/L being the recommended range. Levels over 7.0mmol/L are indicative of diabetes (Diabetes New Zealand, 2011).

The other types of risk factors for heart disease include inherent factors such as advancing age, genetics or family history of heart disease, gender and ethnic background. Unlike the behavioural factors, these factors cannot be readily modified. The other category of risk factors encompasses 'psychosocial factors' such as educational level and income, social support and marriage, stress, anxiety, depression, cynical hostility and anger (Brannon & Feist, 2007).

The impact of a cardiac event on psychological well-being

A cardiac event will have a major impact on an individual's psychological well-being and overall quality of life (Gardner & Worwood, 1997; Joeke, van Elderen, & Schreurs, 2007; Lesperance, Frasere-Smith, Juneau, & Theroux, 2000; Worcester & Le Grande, 2008). In the initial stages following an event, a person may experience a "period of turmoil and confusion as they adjust to the fact that their health has changed and work out how their illness will impact on their daily life and future plans" (New Zealand Guidelines Group, 2002, p. 45). It is likely that the patient will experience a range of emotions including "anxiety, depression, ambiguity, uncertainty, fear of recurrence, deterioration in health, boredom and inertia, with a struggle to integrate changes in lifestyle" (Daly et al., 2000, p. 62). Research has also shown that there may be no improvement in an individual's emotional functioning five years after having experienced a cardiac event, particularly in terms of 'anxiety', 'depression', 'well-being' or 'displeasure' (Pleiver et al., 2001). Gardner and Worwood (1997) identified large variations in depressed mood in some cardiac patients following surgery, which is sometimes severe and may persist for a long time. The New Zealand Guidelines Group (2002) also acknowledge how, in some depressed patients, there may be no improvement in emotional status a year after their event.

Psychological well-being

Psychological well-being is a multidimensional construct and researchers have strived for many years to define it. Earlier research focuses on the importance of happiness as an ideal balance between the affective dimensions of positive and negative affect (Ryff, 1989) and was later considered an 'important outcome' in research (Ryff, 1989). The second prominent conception views 'life satisfaction' as a 'key indicator of psychological well-being' (Ryff & Keyes, 1995)

while other definitions have been proposed “through Maslow’s (1968) conception of self-actualization, Allport’s (1961) formulation of maturity, Roger’s (1961) depiction of the fully functioning person, and Jung’s (1933) account of individualisation” (Ryff & Keyes, 1995, p. 720). Levin and Chatters (1998) further acknowledge the multidimensional nature of psychological well-being and define it, based on literature by George (1981), as “an umbrella construct comprising various cognitive and affective dimensions such as positive and negative affect, happiness, life satisfaction, congruence between expected and achieved life goals, psychosomatic symptoms and mood” (p. 505). They also propose that psychological well-being makes up the ‘metaconstruct’ of subjective well-being, along with the constructs of self-esteem, self-efficacy, and personal control or mastery.

In their critique of the research in this area, Ryff and Keyes (1989; 1995) argue that too much emphasis has been placed on the negative consequences of psychological well-being, such as human suffering and unhappiness, rather than the causes and consequences of positive functioning. In this framework, well-being is considered the ‘absence of illness, disease or disorder’ (Huppert & Whittington, 2003; Ryff, 1989), and highlights the “presence or absence of psychological symptoms such as anxiety, depression or low self-esteem” (Huppert & Whittington, 2003, p. 108). Within the realm of human illness and disease however, it can be of considerable value to focus on the prevalence of mental disorders such as anxiety and depression. As well as being used to “increase the detection rates of psychological problems” (Pouwer, Snoek, van der Ploeg, Ader, & Heine, 2001, p. 1929) the identification and monitoring of psychological distress can be used to determine progress over time in response to a particular intervention, for example cardiac rehabilitation (Herrmann et al., 1997; Steptoe, Mohabir, Mahon, & McKenna, 2000; Yoshida et al., 1999). Research by Pouwer et al. (2001), for example, identified that the monitoring, detection and discussion of psychological problems with patients, in addition to identifying those who would benefit from treatment, also improved the mood status of patients. Furthermore, the detection of psychological problems such as anxiety and depression is important because these can lead to significant impairments in quality of life (Pouwer, Snoek, Van Der Ploeg, Ader, & Heine, 2000), and can also determine who may be at risk for mortality and morbidity, as discussed below.

Anxiety and depression

Anxiety and depression are very common in cardiac patients (Child, Sanders, Tipson, Sigel, & Hunter, 2010; Lavie & Milani, 2004; Worcester & Le Grande, 2008). The New Zealand Guidelines Group (2002) confirm that up to 25% of patients will experience a “disabling level of anxiety or depression following a myocardial infarction” (p. 15), and that “mood disorders such

as anxiety and depression will lead to a patient perceiving what are actually small barriers, as insurmountable” (p. 25). Research by Ziegelstein (2001) confirmed that one in six patients following an acute MI will experience major depression, and that up to twice as many may experience significant levels of depression shortly after their event. High incidences of ‘generalised anxiety’ have been identified in patients following a cardiac event as well as moderate to severe anxiety symptoms (Lavie & Milani, 2004), and this is not just confined to MI patients. For example, high incidences of anxiety and depression have been identified in patients following CABG surgery (Gardner & Worwood, 1997), with unstable angina (Lesperance et al., 2000), with congestive heart failure (Joeke et al., 2007), and coronary heart disease (Todaro, Shen, Raffa, Tilkemeier, & Niaura, 2007). Specifically, Krannich et al. (2007) investigated the presence of depression in 142 patients undergoing CABG, and found that 25.8% were clinically depressed before their surgery, and 17.5% afterwards. Additionally, Gardner and Worwood (1997) investigated the cognitive, psychiatric and psychological changes associated with CHF and CABG surgery in the UK and confirmed this “has a significant impact on the mental health of patients and that the symptoms are independent of the severity of the disease” (p. 248). In Canada, Lesperance et al. (2000) confirmed that 41% of patients who were hospitalized for unstable angina were depressed. Todaro et al. (2007) investigated the presence of anxiety disorders in 150 CHF patients and found that up to 36% were able to be diagnosed with a current anxiety disorder.

Increasing evidence is also showing a link between anxiety and depression, with mortality and morbidity for cardiac patients (Blumenthal, Newman, Babyak, Lett, & Mark, 2003; Gardner & Worwood, 1997; Worcester & Le Grande, 2008; Ziegelstein, 2001). Lesperance et al. (2000) reported higher death rates in Canadian patients with unstable angina following persistent or severe depression. They further acknowledged how depression led to significant increases in mortality or further MIs. Furthermore, depression increased the risk of death by up to 25% (Lesperance et al., 2000). The New Zealand Guidelines Group (2002) acknowledge how depression is linked to a five-fold increase in mortality after six months and at 12 months, an overall three-fold increase in cardiac mortality. In the Netherlands, anxiety has also been found to be a predictor of cardiac events (Strik, Denollet, Lousberg, & Honig, 2003) including further MIs and death (Shibeshi, Young-Xu, & Blatt, 2007). Shibeshi et al. (2007) conducted a US-based study over a period of 3.4 years, and identified the presence of 44 nonfatal MIs and 19 deaths in 516 patients with CAD, and found that high anxiety was associated with an increased rate of MI or death. In their review of the literature, Gardner and Worwood (1997) acknowledge how,

following cardiac surgery, numerous studies have demonstrated the detrimental effects of anxiety on recovery, and how it is often linked to elevated levels of depression.

Anxiety and depression have also been strongly associated with a diminished quality of life (Lane, Ring, Lip, & Carroll, 2000; Ziegelstein, 2001). Research by Lane et al. (2000) showed that following a cardiac event, both anxiety and depression can predict an individual's quality of life. They further confirmed that depression has the biggest impact on quality of life, along with other factors such as previous exercise behaviour, gender, partner and living status (Lane et al., 2000; Sakai et al., 2011).

Health-related quality of life

Health-Related Quality of Life (HRQoL) has received a lot of attention from health researchers in the last three decades (Lyons & Chamberlain, 2006) and is considered important in illness research, particularly in response to increasing levels of mortality and morbidity (Lyons & Chamberlain, 2006; Sakai et al., 2011). Health-related quality of life is focussed on the impact of health and disease on one's abilities and daily functioning (Efficace et al., 2003; Olschewski, Schulgen, Schumacher, & Altman, 1994), mental and physical well-being, as well as the value of various treatment options (Jorngarden, Wettergen, & von Essen, 2006). Like psychological well-being, health-related quality of life is a general concept (Lyons & Chamberlain, 2006), is complex (Aude et al., 2006) and multidimensional with variable definitions. Most researchers seem to have an 'intuitive understanding' of this concept and its components (Fayers & Machin, 2000), however there is considerable variability in terms of what aspects are assessed. Olschewski et al. (1994) stated that health-related quality of life consists of domains such as emotional well-being, social functioning, physical well-being and other functional areas of life. Fayers and Machin (2000) however, in their review of this area, acknowledge how the domains assessed may "vary from study to study but may include any or all of general health, physical functioning, physical symptoms and toxicity, emotional functioning, cognitive functioning, role functioning, social well-being and functioning, sexual functioning, and existential issues" (p. 3). Health-related quality of life is also said to be subjective in nature and non-static, constantly changing over one's life time (Aude et al., 2006; Jorngarden et al., 2006; Olschewski et al., 1994).

With such wide variability within the construct dimensions, understandably the utilization of a wide variety of tools for measuring health-related quality of life has led to problems (Lyons & Chamberlain, 2006). For example, often the domains assessed are not directly related to the specific illness being considered (Lyons & Chamberlain, 2006). Specifically, research by Arnold

et al. (2004) compared quality of life across eight different conditions (e.g. diabetes mellitus, back problems, heart conditions) with a group of healthy participants, in terms of physical, psychological and social functioning, and analysed the contribution of these domains to overall quality of life. The findings were consistent in terms of psychological functioning, in that this domain predicted quality of life across all conditions. In terms of physical and social functioning, however, the results were inconsistent; for some disorders physical or social functioning contributed to overall quality of life, but not for others. Such results highlight the importance of considering the specific illness or condition and the domain of quality of life assessed (Lyons & Chamberlain, 2006).

In cardiac patients one of the most widely utilized tools for assessing health-related quality of life is the SF-36 questionnaire (Aude et al., 2006; Pashkow et al., 1995), which is well recognized in clinical trials and research (Sakai et al., 2011). The SF-36 questionnaire comprises of eight quality of life domains: physical functioning, role emotional, role physical, bodily pain, general health, vitality, social functioning and mental health. A number of research studies which have employed this measure in research with cardiac patients will be described later in this chapter.

Cardiac disease and health-related quality of life

Impairments in quality of life are very common in cardiac patients and will “contribute to the burden of disease long after the initial incident, eventually leading to ‘chronic disability’” (Pleiver et al., 2001, p. 131). In an investigation by Europe and Tyni-Lenne in New York (2004), interviews were conducted with 20 male participants who had been diagnosed with moderate to severe CHF, in order to find out about their experiences of living with CHF. Their findings highlighted the major impact this illness can have on an individual’s health status and quality of life. In terms of limitations in physical functioning, their participants reported symptoms of increased tiredness, general fatigue, increased heart rate, difficulty lying down, decreased physical capacity including muscular weakness, the inability to carry out activities with the same intensity or duration, variations in levels of fitness and restrictions in daily life. Emotional consequences included increased feelings of nervousness and fear, anxiety and depression, and feelings about death. Reported impairments in social functioning included feelings that friends had been lost and feelings of being unreliable, difficulties with spousal relationships including the outcome of a divorce, and effects on vocational status including being unable to work as before or return to work. Other issues reported were sexual impairments and cognitive consequences such as decreased memory function and concentration. There were also other things to consider such as having to adjust to their illness, changes in lifestyle, the

introduction of medication, and for some, developing cognitive strategies in order to manage their illness more effectively such as introducing positive thinking strategies, trying to feel calm and being grateful (Europe & Tyni-Lenne, 2004).

Additionally, in the Netherlands Joeke et al. (2007) identify how MI or CHF patients can experience 'perceived overprotection' by their spouse (especially male patients) which can further result in perceived impairments in quality of life as well as depression. A cardiac event can also put strain on marital relationships, in addition to having to face major changes to their lifestyle (Moser, Dracup, & Marsden, 1993), including the likelihood of further cardiac events. Returning to work is a major goal in the recovery process for cardiac patients (Yonezawa et al., 2009), and individuals can experience a loss of social status as well as economic instability when this does not occur (Williams, 2003; Yonezawa et al., 2009).

In Japan, Sakai et al. (2011) assessed patients on the SF-36 HRQoL questionnaire following discharge for an acute myocardial infarction (AMI) at 1, 6 and 12 months, in order to determine quality of life status following their event. Results showed that at one month following discharge, depressive symptoms were significantly related to poor recovery in terms of HRQoL. At six months, patients reported impairments in every domain and a lower quality of life compared to the general population on the domains of physical function, role-physical, general health, social function, and role-emotional. At the 12 month mark, these impairments were still evident in 71% of participants. Such results highlight the ongoing difficulties that are experienced by cardiac patients, even 12 months after their event.

Stephoe and colleagues (2000) also reported similar results against the SF-36 domains for patients in the UK. In this study, postal questionnaires were sent out to patients who had attended a cardiomyopathy clinic. Questionnaires were sent out over a 12 month period and included the SF-36 health scale and the Hospital Anxiety and Depression Scale (HADS), in order to measure anxiety and depression levels. In this instance patients reported major impairments on all dimensions of the SF-36 except for the bodily pain scale, and lower quality of life compared to the general population. Reported anxiety and depression levels were also higher than the general population. These researchers also compared their findings to those of two other similar studies, with patients with hypertrophic cardiomyopathy and those with 'severe cardiac conditions' (e.g. survivors of an MI, severe congestive heart failure patients). Their results revealed differences between the dilated cardiomyopathy patients and hypertrophic patients in that lower social functioning was reported for the dilated cardiomyopathic patients, however the hypertrophic patients reported higher levels of bodily

pain. Compared to the patients with severe cardiac conditions, there were no differences except that the dilated cardiomyopathic patients reported lower social functioning and poorer mental health, while those with severe cardiac conditions reported higher bodily pain. Such findings highlight the extent of emotional issues experienced by cardiac patients, and therefore emphasize the need for effective cardiac rehabilitation interventions to facilitate improved quality of life for this population.

Chapter Two: Cardiac Rehabilitation

Definition and goals of cardiac rehabilitation

Cardiac rehabilitation (CR) is a multidisciplinary intervention and has variable definitions. The New Zealand Guidelines Group (2002) defines cardiac rehabilitation as “the sum of activities required to ensure cardiac patients the best possible physical, psychological and social conditions so that patients with chronic or post-acute cardiovascular disease may, by their own efforts, preserve or resume optimal functioning in society and, through improved health behaviours, slow or reverse progression of disease” (New Zealand Guidelines Group, 2002, p. 5). Ultimately, the main aims of CR are to help people recover as quickly and completely as possible (Bethell, Lewin, & Dalal, 2009), by improving functional capacity, emotional state, and overall sense of well-being (Aude et al., 2006) as well as exercise capacity, the control of risk factors, and improving psychological status and quality of life (Turner, Evans, Bethell, & Goddard, 2003), with the primary goal of cardiac rehabilitation being the reduction of mortality (Yohannes, Doherty, Bundy, & Yalfani, 2010).

Cardiac rehabilitation originated in the early 1940s, initially being set up in the USA (Goble & Worcester, 1999; Worcester & Le Grande, 2008). In New Zealand, a range of cardiac rehabilitation programmes have been set up and promoted in the past 20-30 years (New Zealand Guidelines Group, 2002). With better primary prevention and improved disease management in the current age, the age standardised death rate from coronary heart disease has halved, however with an increasing aging population there is more emphasis on the need for secondary prevention strategies (New Zealand Guidelines Group, 2002). The importance of cardiac rehabilitation for the secondary prevention of heart disease and advancement of disease is shown in the literature (Tielemans, 2010) and is therefore critical (Goble & Worcester, 1999).

Types of cardiac rehabilitation programmes

In terms of the type of programmes that are offered, the specific content of CR can vary between countries and between programmes within the same country (Worcester & Le Grande, 2008). In the USA there is more emphasis on exercise based programmes (Wenger, Froelicher, & Smith, 1995; Worcester & Le Grande, 2008), whereas in Australia education and counselling are considered just as important in promoting recovery and as a secondary prevention strategy (Goble & Worcester, 1999; Worcester & Le Grande, 2008). In the UK,

exercise is considered the 'centrepiece' of programmes which are supplemented by education, relaxation and stress management, risk factor correction and monitoring (Bethell et al., 2009). In New Zealand, CR encompasses a comprehensive approach. Nationwide there are 41 centres offering phase one and two CR (see below for details). Within these programmes there is variability in terms of the facilities offered, format of the service, number of sessions, and programme duration (New Zealand Guidelines Group, 2002). Within the hospital based programmes, educational seminars are offered on aspects such as nutrition for heart disease, medication and lifestyle changes (Tielemans, 2010). The New Zealand Guidelines Group (2002), in their evidence based best practice guidelines, recommend the following components as an integral part of a comprehensive CR programme: Empowering patients to make lifelong changes, exercise programmes, nutrition and weight management, smoking cessation, managing psychosocial aspects of life, pharmacotherapy and ongoing personal follow up and support. In the UK and most European countries, CR is divided into four phases (see details below). In the USA and some other countries including New Zealand, CR is divided into three phases. It is important to recognize the possible combination of CR phases, in order to avoid confusion in the literature (Bethell et al., 2009). The three phases of cardiac rehabilitation as they apply in New Zealand and as described by the New Zealand Guidelines Group (2002) are as follows:

Phase I - Inpatient rehabilitation

This phase occurs during the patient's hospital stay, and is focussed on early mobilisation and education for the patient, spouse, partner, whānau/family, in order to help them understand heart disease and associated risk factors. It also involves providing reassurance, information, risk factor assessments, education, and consideration of psychological stress and responses. When patients are discharged they should be provided with a minimum of information on guidelines about physical activity and a smoking cessation plan, an angina action plan, medication, information about feelings, relationships, resumption of work, driving, nutrition and alcohol.

Phase II - Outpatient rehabilitation

Phase II rehabilitation consists of a supervised programme of six to twelve weeks duration, beginning shortly following discharge from hospital. This phase usually involves an exercise component, education sessions on topics such as modifiable and non-modifiable risk factors, understanding the disease process, physical activity and exercise, stress management, psychological support, support from the spouse, partner, whānau/family, returning to work, resumption of sexual and daily activity and resuscitation. These are either conducted within

group settings or with an individual or family. In terms of the exercise component, it is recommended that patients exercise at a moderate intensity of 60-75% heart rate maximum (HRmax), or 40-60% heart rate reserve maximum (HRRmax; Thow, 2006) . Exercise should be tailored to the individual depending on their risk stratification (Thow, 2006) and previous exercise history. It should also involve main muscle groups and include activities such as walking, cycling and swimming, and needs to be maintained long term in order for the benefits to be maintained. Circuit and resistance training is also recommended for cardiac patients, as resistance training significantly improves weight carrying tolerance and muscular strength, and results in “lower peak heart rate, rate-pressure product, and oxygen consumption than symptom limited aerobic exercise and is less likely to cause arrhythmias, angina or ST segment depression” (New Zealand Guidelines Group, 2002, p. 31). It has also been recommended that resistance training should be included in addition to aerobic training, and that it should not replace it. When conducted, resistance training should be of low to moderate intensity, in order to avoid elevations in blood pressure that can occur in conjunction with the valsalva manoeuvre (Baldi & Resnick, 2003).

Phase III - Long-term maintenance

This phase is designed to instil long term the behaviour and skills learned within Phase I and II. Within this phase of rehabilitation, exercise and positive lifestyle changes are maintained either independently or in a minimally supervised environment (New Zealand Guidelines Group, 2002) . In New Zealand, this phase is normally conducted by ‘community cardiac clubs’ of which there are more than 50 established around the country (New Zealand Guidelines Group, 2002).

In each consecutive phase in CR there is less supervision and monitoring, in order for the patient to become empowered and make the lifestyle changes necessary to lead an active and full lifestyle (Tielemans, 2010). In the UK and most European countries where cardiac rehabilitation is divided into four phases, phase 2 includes a period of convalescence at home, before moving onto phase three which takes the approach described in phase two above (Bethell et al., 2009).

The benefits of cardiac rehabilitation

There is an abundance of evidence to demonstrate the many benefits derived from CR programmes, including a reduction in mortality and morbidity, and improvement in quality of life (Bethell et al., 2009; New Zealand Guidelines Group, 2002; Thompson & Clark, 2009; Yohannes et al., 2010; Yoshida et al., 1999). Cardiac rehabilitation is also regarded as “one of

the most beneficial and cost effective treatments available to patients with coronary heart disease” (Bethell et al., 2009, p. 271). Such benefits are said to exist from a combination of exercise training, educational and behavioural interventions and support (Goble & Worcester, 1999). The benefits identified in the literature will be further described, with a particular emphasis on exercise training in CR.

The physical and physiological benefits derived from exercise training in CR “have clearly been amply demonstrated” (Worcester & Le Grande, 2008, p. 272). In addition to being effective for reducing long term mortality and morbidity, exercise is important for reducing recurrent events (Baldi & Resnick, 2003) and hospital readmissions (Goble & Worcester, 1999), improving functional capacity (New Zealand Guidelines Group, 2002), exercise tolerance (Aude et al., 2006; Thompson & Clark, 2009) and strength (Baldi & Resnick, 2003), physical fitness (Bethell et al., 2009; Thompson & Clark, 2009) as well as a good prognosis after a MI (New Zealand Guidelines Group, 2002). Exercise training is also effective for addressing other modifiable risk factors of heart disease, for example improving blood lipid profiles and blood pressure (Bethell et al., 2009; Thompson & Clark, 2009), as well as coronary risk factors (Aude et al., 2006) including reduced angina (Bethell et al., 2009; New Zealand Guidelines Group, 2002), enhanced coronary blood flow (Bethell et al., 2009), improvement in cardiac output and peripheral extraction of oxygen in older patients (Tielemans, 2010), and is effective for reducing arrhythmias (Bethell et al., 2009) and the frequency and severity of ischaemic symptoms (Baldi & Resnick, 2003).

To provide some examples of the research on CR, some specific studies will be discussed. In Japan, Yoshida et al. (1999) conducted an investigation to determine the effects of a comprehensive four week CR programme including a combination of exercise, education and counselling interventions. In this study, 29 patients were recruited as the rehabilitation group, and 34 patients opted not to participate in the programme and acted as a control group. Both physiological and psychological outcomes were assessed, at baseline, just after completion of the study and at six months. Physical outcomes assessed included serum lipid profiles, perceived exercise frequency, VO₂ peak and anaerobic threshold (AT). During the exercise component of the study, participants were required to exercise at 80-100% of heart rate, at anaerobic threshold (AT). The exercise consisted of 30-40 minutes of aerobic activity on a cycle ergometer and 20-30 minutes walking, twice a day, seven days a week. After participation in the programme, exercise tolerance and lipid profiles had improved for patients in the rehabilitation group and these results were significant after six months. Regular physical activity was also continued for 74% of participants in the rehabilitation group, after six months

of being on the programme. Such results support the benefits of exercise for improving physiological status and modifiable risk factors. In terms of the psychological outcomes, conflicting results were obtained. These findings will be discussed in detail in a later section. Furthermore, in research conducted by Hevey et al. (2003), MI and CABG patients were allocated to either a four week or ten week comprehensive CR programme, and were tested before, immediately after and six months following the programme on parameters measuring exercise capacity, heart rate, anxiety, depression and quality of life. Their results also showed significant improvements in exercise capacity and heart rate both immediately following the programme and six months later, and this was evident for both groups. There were mixed responses in terms of changes in psychological well-being and quality of life, and these are discussed in detail in a later section.

In Norway, Rognmo, Hetland, Helerud, Hoff and Slordahl (2004) were successful in demonstrating the effects of exercise training for improving functional capacity in cardiac patients. In their investigation, individuals were required to exercise at either 50-60% or 80-90% VO₂ peak, three times a week for ten weeks. After this time, there was a 7.9% improvement in aerobic capacity for those exercising at the moderate intensity, and a 17.9% increase for those in the higher intensity group. No significant changes were identified in terms of blood pressure, resting heart rate, or body mass following the study. Such results emphasize the importance of exercise training for increasing functional capacity and therefore survival in cardiac patients (Myers et al., 2002; Rognmo et al., 2004).

In terms of the benefits of exercise for decreasing mortality, the Cochrane Collaboration (Jolliffe et al., 2001) conducted a systematic review of randomised clinical trials conducted prior to December 1998, of both exercise only and comprehensive CR programmes. In this review they found a strong correlation between exercise and a reduction in mortality. The New Zealand Guidelines Group (2002) state that such findings show that exercise-based rehabilitation results in “a clinically important 20-30% reduction in cardiac death” (p. 30). Even with substantial evidence to support the benefits of exercise for reducing mortality, the actual mechanism for this is unknown but may occur due to regular exercise “raising the threshold for ventricular fibrillation and/or by increasing the ability to tolerate myocardial infarction by other known mechanisms” (New Zealand Guidelines Group, 2002, p. 31).

Psychological benefits of CR programmes

While there is compelling evidence to support the physical and physiological benefits from CR programmes, the evidence for improving psychological status is a lot more controversial

(Worcester & Le Grande, 2008). While many researchers acknowledge the importance of CR for improving psychological well-being, stress and health related quality of life (Goble & Worcester, 1999; Thompson & Clark, 2009), others such as Clark, Whelan, Barbour and MacIntyre (2005) highlight that there is 'considerable unexplained variation' in terms of the effectiveness of CR programmes.

In terms of exercise training in CR, some research demonstrates the benefits of exercise for improving psychological well-being, in particular anxiety and depression (Dugmore et al., 1999; Milani & Lavie, 2007; Worcester & Le Grande, 2008), and quality of life (Dugmore et al., 1999; Goble & Worcester, 1999). In their review of the literature in this area, Worcester and Le Grande (2008) found benefits have been shown in both randomised trials (Newton, Mutrie, & McArthur, 1991) and non-randomised trials (Milani, Lavie, & Cassidy, 1996), however they also point out that in some randomised trials, there are no changes in psychological status. This seems to depend on programme duration (Hevey et al., 2003) and exercise intensity (Worcester, Hare, Oliver, Reid, & Goble, 1993).

Worcester and Le Grande (2008) also discuss how exercise has been considered an essential component in CR for many years, and according to early 'pioneering work' of Hackett and Cassem in 1973, is "perhaps the most important aspect of convalescence" (p. 272). Furthermore, many of the psychological benefits are seen to be more pronounced in comprehensive programmes compared to those involving 'conventional care' (i.e. standard medical and nursing care; Oldridge et al., 1991). Additionally, and as demonstrated in Oldridge et al.'s (1991) research, once an individual is enrolled in a comprehensive CR programme, psychological recovery can be accelerated with improvements being noted as soon as four weeks into a group exercise programme (Hevey et al., 2003; Worcester & Le Grande, 2008).

In order to determine the psychological benefits arising from a CR programme, Milani and Lavie (2007) compared changes in depression levels between US patients who completed rehabilitation, and those who withdrew within two weeks of starting the programme. This research was conducted over a five year period and involved both groups completing questionnaires before rehabilitation, and again on programme completion for the rehabilitation group. The intervention involved 12 weeks of 36 sessions and included education and exercise components. During the exercise component the intensity of exercise was individually prescribed for participants, so it was completed at ten heart beats per minute below anaerobic threshold. The results of this research revealed significant reductions in depression that were directly correlated to improvements in VO₂ peak (or maximal oxygen

uptake, achieved from exercise training). Additionally, participants with no improvements in VO2 peak had no changes in their depression status. The benefits of this programme were also highlighted in terms of mortality rates: there was a 73% reduction in mortality for depressed patients in the rehabilitation group compared to those in the control group. These results provide substantial support for the benefits of exercise-based cardiac rehabilitation for reducing mortality rates.

In Yoshida and colleagues' (1999) study discussed earlier however, psychological outcomes were inconclusive. Psychological well-being was assessed by self-report scores on anxiety and depression scales. At the six month follow up period the rehabilitation group showed a significant improvement in depression, whereas the control group showed a non-significant trend towards increased depression. These findings support the benefits of a comprehensive programme for improving depression. In terms of anxiety however, the results were controversial in that there was a significant reduction for the rehabilitation group following completion of the programme, but no significant differences existed between the two groups at the six month follow up. These results suggest that it is possible anxiety may reduce over time, irrespective of whether an individual is involved in CR or not. The authors acknowledged the need for further research, as it was not a randomized study and it was possible that participants in the rehabilitation group may have been more highly motivated to improve at the time of the study.

In Hevey et al.'s (2003) study, also discussed earlier, findings with psychological outcomes were mixed. In this investigation, there were greater improvements in depression following participation in the shorter, four week programme, compared to the longer ten week schedule. In terms of anxiety, there were no significant changes between the two groups at the baseline, immediately following the programme or six months later. Quality of life also improved with both groups improving in energy, pain and general health immediately following CR, and six months later on the energy, emotional and social well-being dimensions of the SF-36 subscales.

A recent investigation by Yohannes et al. (2010) explored the benefits of a six week comprehensive CR programme (offering education, exercise and psychological support) on the long term effects (12 months following) of physical status, psychological well-being and quality of life in patients with coronary heart disease. Psychological well-being and quality of life was assessed by self-report scores on the Hospital Anxiety and Depression Scale (HADS) and the MacNew Heart Disease Health Related Quality of Life (MacNew), and physical activity was measured by a seven day recall activity self-administered questionnaire. The exercise

component of the study consisted of 12 sessions of a 50 minute aerobic circuit which was conducted twice a week. Participants were also provided with psychological support and attended an education session once a week for 45 minutes. The results led to the conclusion that a six week programme was effective in significantly improving physical status, psychological well-being and quality of life and that these benefits were significantly maintained at 12 months. Seventy one percent of participants were still maintaining exercise at the 12 month follow up period; however, the investigators were not convinced that it was the exercise component that was responsible for improving psychological status and quality of life. They stated “the correlation between depression and MacNew Health-Related Quality of life explained 79% of the variance at 12 months, yet the same correlations with energy expenditure only explained 5% of the variance” (p. 2810). They further concluded that changes in anxiety, depression and quality of life status could not be explained by changes in physical activity levels (Yohannes et al., 2010). Such findings are inconsistent with those found in the Milani and Lavie (2007) study discussed earlier, whereby improvements in depression were found to be significantly related to increases in exercise capacity or fitness. Unlike Milani and Lavie’s (2007) study however, in Yohannes et al.’s (2010) research, physical activity status was reliant on self-report measures taken from the participants and not from more objective measures such as VO2 peak. It is possible that the lack of consistency between these two studies could be explained by participants ‘misreporting’ their exercise status. There were some other inconclusive findings in Yohannes et al.’s (2010) research: Of the 147 participants who took part, at the 12 month follow up mark, some individuals showed no improvement in psychological well-being (29%), health related outcome scores (18%) and even had lower energy expenditure scores (14%) than recorded at baseline. The authors recognized the need to follow policy guidelines in this instance and the importance of continually evaluating and adapting in order to ‘optimise intervention outcome’. Surprisingly, and in reflection of previous findings in this area, they also recognized the “the importance of patients maintaining an active lifestyle in participating with regular exercise, e.g. walking” (p. 2811).

Psychological benefits from physical activity in general

While there is conflicting evidence concerning the benefits of exercise for improving psychological status in cardiac rehabilitation patients, for many years exercise outside the realm of CR has been advocated for improving psychological well-being. It has been well regarded as a suitable treatment option for a number of psychiatric conditions, particularly depression (Babyak et al., 2000; North, McCullagh, & Tran, 1990). In 1996 the U.S. Department of Health and Human Services produced the ‘long awaited’ Surgeons General Report on

Physical Activity and Health (Buckworth & Dishman, 2002). As well as identifying the benefits of physical activity for treating chronic diseases, this report also emphasized the importance of exercise for improving emotional status including anxiety and depression, in both 'clinical and non-clinical populations'. Additionally the report discussed sedentary lifestyles and how "persons who are inactive are twice as likely to have symptoms of depression than are more active persons" (p. 136). Furthermore, it acknowledged that many of the psychological benefits obtained from physical activity are derived from aerobic activity, and that other forms of activity such as strength training require further investigation. In terms of health-related quality of life, the Surgeons General Report acknowledged that the most beneficial effects are likely to be associated with improvements in psychological well-being, perceived physical function and physical well-being, and to a lesser extent, 'cognitive functioning' (U.S. Department of Health and Human Services, 1996).

Babyak et al. (2000) investigated the role of exercise for decreasing depression in patients with major depressive disorder (MDD). In their research, which was conducted in Durham, USA, individuals diagnosed with MDD received an intervention consisting of either exercise only, a combination of exercise and medication, or medication only. At a four month follow up, after which the formal intervention was discontinued, all groups showed a significant improvement in depression status. Participants were then educated about MDD and encouraged to continue with treatment on their own. At a further ten month follow up, participants who had been in the exercise group and had entered remission at the four month follow up (i.e. no longer met the criteria for MDD) had significantly lower depression relapse rates than participants in the medication group. Another finding was that participants who had been exercising in the six month follow up period after the formal intervention, independent of which treatment they had been initially assigned to, were seen to show less symptoms of depression. Another interesting finding at this follow up period was that the amount of exercise completed per week was directly related to depression status: As exercise time increased, depression levels decreased. Babyak et al. (2000) concluded that such findings provide "potential support for the value of exercise as a treatment for MDD" (p. 637).

Psychological benefits from education, counselling and behavioural CR

In terms of research findings regarding the benefits of education, counselling and behavioural programmes for improving psychological well-being in cardiac patients, psychological benefits have been difficult to demonstrate, with many conflicting results (Worcester & Le Grande, 2008). Worcester and Le Grande (2008), for example, state: "statistically significant benefits in some psychological outcomes seem to have only been reported in studies favouring the

intervention group, or in subsets of patients in the intervention group” (p. 272). Goble and Worcester (1999) also acknowledge how “in some areas evidence is non-existent or scanty” (p. xxi). In a meta-analysis conducted by Dusseldorp, van Elderen, Maes, Meulman and Kraaij (1999) of 37 psychoeducational (health education and stress management) CR programmes, the following benefits were found: 34% reduction in cardiac mortality, 29% reduction in reoccurrence of MI, and positive effects on blood pressure, smoking behaviour, cholesterol, body weight and physical exercise. However no significant effects on psychological well-being such as anxiety or depression were identified.

For example, Oldenburg, Martin, Greenwood, Bernstein and Allan (1995) investigated the effects of a behavioural and educational intervention on patients following CABG surgery. Participants were randomly allocated to either the behavioural and educational intervention or to routine care. The intervention included components such as goal setting, skills training, modelling and reinforcement, with follow ups being conducted at baseline, four months, eight months and twelve months after surgery. Following the interventions, there were no significant changes between the two groups in terms of quality of life, smoking cessation, dietary behaviour and lipid profiles. The reason for such conflicting results following educational, behavioural and counselling interventions is proposed by Worcester and Le Grande (2008), and Dusseldorp et al. (1999) as being due to low participant numbers, poorly described interventions and/or poor quality research designs.

Which component of a comprehensive CR programme is responsible for improving psychological status?

Given the inconsistent research findings, it is difficult to determine exactly which component is responsible for improving psychological status within a comprehensive CR programme; that is, whether one component is primarily responsible or the sum of the components put together. This thesis has emphasized the benefits of exercise training for improving psychological well-being and quality of life. While such benefits are accelerated when exercise is incorporated into a comprehensive CR programme, it is difficult to determine how much exercise contributes to improvements in well-being. Some researchers did not advocate exercise as being responsible for improvements in mental health (Yohannes et al., 2010) whereas other investigators show that exercise is very beneficial (Milani & Lavie, 2007). Hence it is difficult to decipher the impact of exercise on psychological well-being in cardiac rehabilitation, as well as “determine what works for whom, when and why” (Thompson & Clark, 2009, p. 1898).

The importance of social interaction for CR and exercise

While it is difficult to determine which facet of a comprehensive CR is responsible for enhancing psychological well-being and how much exercise training will contribute to this, it is worth considering the actual nature of physical activity, specifically in terms of whether exercise is conducted in a group or individual setting. In group settings, there is the opportunity for social support and encouragement from other members of the group, and the chance to identify with others who are in the same situation. The New Zealand Guidelines Group (2002) acknowledge how marital status, emotional and social support and social networks are likely to have a protective effect and reduce the risk of future fatal and non-fatal events and total mortality. In Yohannes et al.'s (2010) study, baseline anxiety and depression predicted poorer quality of life and increased mortality at 12 months after an MI. In their discussion, the authors acknowledged that "patients may be more confident and cope better with their condition as a result of the 'peer support' gained during the rehabilitation period" (p. 2811). Goble and Worcester (1999), in their reference to the benefits of group exercise, state "it is likely that many of the psychosocial benefits of exercise training are attributable to group activities, peer support and access to professional advice rather than to the exercise itself" (p. 7). The New Zealand Guidelines Group (2002) state how group cohesion (derived from group activities) will enable participants to feel supported as they progress through challenging situations and lifestyle changes.

A qualitative study by Clark et al. (2005) used focus group interviews in order to understand patients' perspectives following participation in a 12 week group based CR programme. The programme included exercise, addressing smoking cessation, dietary change and psychological well-being. In general, the results showed that initially many participants thought it was disadvantageous to be involved in a group programme. Over time however, being part of a group setting came to be regarded a 'significant advantage', in that patients were able to relate to others in the group as having "similar fears, problems and needs as the self" (p. 365). Having people in close proximity throughout the programme also meant participants were able to achieve much higher levels of fitness than they had initially anticipated, and helped to instil greater levels of self-confidence regarding their thoughts about exercising. Increased levels of confidence were said to occur as a result of participants developing a realization of what levels of activity were realistic and safe, and through exercise becoming an integral part of their daily life. In their discussion, the authors emphasized the importance of group-based CR as "ongoing contact with other people is essential to ensuring positive effects are maintained over the long term" (p. 367).

Worcester and Le Grande (2008) acknowledge how group based exercise has a “positive effect on morale” and how the “social expectations of a group encourage participants to follow regimens” (p. 270). Group based exercise will also enable patients to gauge their activity at home from their performance in a group (Worcester & Le Grande, 2008) as well as create ‘supportive relationships’ (Hare, Fitzgerald, Darcy, Race, & Goble, 1995). In Milani and Lavie’s (2007) research discussed earlier, group exercise was also seen to be important for increasing patients’ confidence in their ability to recover. While the benefits of group exercise are documented, it should also be recognized that individuals will vary in their desire for a group exercise programme, and that some may prefer individual exercise; “thus it is essential to provide flexible programs to meet particular needs” (Goble & Worcester, 1999, p. 7).

Aims and hypotheses

The aim of the present research was to determine the effects of 16 weeks of participation in a phase two CR programme on physical status, psychological well-being and health-related quality of life following a cardiac event. The study also aimed to investigate the relative effects of undertaking an exercise-based CR programme within a group of people (involving social interaction) versus alone (individual exercise) on changes in psychological well-being (anxiety and depression in particular), physical status and quality of life. To date there has been minimal research conducted in New Zealand to investigate the effects of exercise training on changes in psychological well-being in cardiac patients. Additionally, there appears to be limited amount of research to investigate the benefits of group based exercise for improving psychological status in cardiac patients. Currently there are only a small number of formal CR rehabilitation clinics in New Zealand which offer group-based exercise therapy for cardiac patients, and where exercise is closely monitored. The findings of this research may have implications for the nature of CR programmes in New Zealand.

It was hypothesized that cardiac patients would show improvements in physical status, psychological well-being and quality of life following 16 weeks of participation in a phase two exercise CR programme. It was also expected that improvements in psychological well-being and quality of life would be more evident following socially interactive, group-based exercise compared to individual exercise. Specifically it was hypothesized that:

1. Cardiac patients will show improvements in anxiety and depression and quality of life from before to after taking part in a 16 week exercise-based phase two CR programme.

2. Cardiac patients will show improvements in cardiac function or fitness, and a reduction in blood glucose levels, cholesterol levels, blood pressure and heart rate from before to after taking part in a 16 week exercise-based phase two CR programme.
3. Cardiac patients will show greater improvements in psychological well-being (anxiety and depression) and quality of life following four weeks participation in a socially interactive, group based programme, compared to their participation in an individual exercise programme.

Chapter Three: Research Methodology

There were two studies completed in this research, a pilot study in 2009 and the main study in 2010. The study was approved by the New Zealand Central Regional Ethics Committee and assigned number CEN/09/04/018 in July 2009.

Participants

Criteria

All participants had to be patients who had been to hospital following some form of cardiac event (e.g. MI, CABG, stent insertion due to angina), and who had received medical approval from their cardiologist or GP to participate. Participants were recruited from one of two Wellington hospitals, Wakefield private hospital and Wellington public hospital. Participants had to have completed or partially completed their respective hospital's cardiac rehabilitation programme before starting the study (see below for details).

Recruitment of participants and procedure

Presentations were conducted at Wakefield and Wellington Hospitals' cardiac rehabilitation education seminars. These sessions provided details about the study including expectations of participants and the commitment involved. Information sheets (see Appendix 1) were left for interested participants as were contact details for the main researcher or her supervisors. When interested participants made contact with the researcher, an appointment was made for their baseline testing session, and they were sent a medical history questionnaire (see Appendix 2), consent form (see Appendix 3) and map of the Massey campus to assist them with finding the correct location. Participants were required to bring their completed forms and a referral letter from their GP or cardiologist to their baseline testing session if this had not been received prior.

During the majority of the study participants were required to attend the Wellington Massey Cardiac Rehabilitation Clinic. Standard procedure for joining this clinic required everyone to complete additional forms (see Appendix 4) and undergo an exercise stress test. An appointment was also made for participants to complete this test either before their baseline test or within the first week of joining the study.

Hospital cardiac rehabilitation programmes

The cardiac rehabilitation programmes differed between the two hospitals where participants were recruited from, as outlined below.

Wellington Hospital

Wellington Hospital offered 2 x one hour physical activity sessions and a one hour education session each week. The programme consisted of one hour exercise, one hour education on a Monday, and one hour exercise on a Wednesday. The exercise sessions included 10 minutes warm up activity (normally walking), 40 minutes of circuit activities followed by a 10 minute warm down and stretch. The circuit activities utilised one's own body weight and included activities that were transferable to the home. The education sessions included information on:

- exercise
- psychological outcomes of a cardiac event
- diet and label reading
- stress management
- risk factors for heart disease and
- medications utilised for management of risk factors and recent coronary event.

All participants also completed a brief psychological screening for anxiety and depression utilising the HADS scale at the beginning and at the completion of this programme. Waist circumference was also measured. This hospital has also recently introduced the York Cardiac Beliefs Questionnaire (YCBQ) into their programme in order to provide an indication of each person's perceptions and beliefs related to their cardiac event so any misconception/s can be addressed.

Wakefield Hospital

Since commencing this study, Wakefield Hospital had discontinued their cardiac rehabilitation programme education seminar series. In the meantime, all patients were being referred to Wellington Hospital for rehabilitation. When the programme was being offered by Wakefield, it consisted of a one hour education session each week, on the following topics:

- coronary artery disease
- nutrition and heart disease
- exercise and your heart
- management of coronary artery disease
- lifestyle and heart disease
- cardio-pulmonary resuscitation

Research design

A randomised, two treatment, two period, crossover experimental design was used in the present study, as shown in Figure 1. This repeated measures design had participants acting as their own controls. The research involved a total of 16 weeks participation and the two intervention exercise conditions were:

- Intervention A: Exercise and social interaction (group exercise)
- Intervention B: Exercise and minimal social interaction (individual exercise)

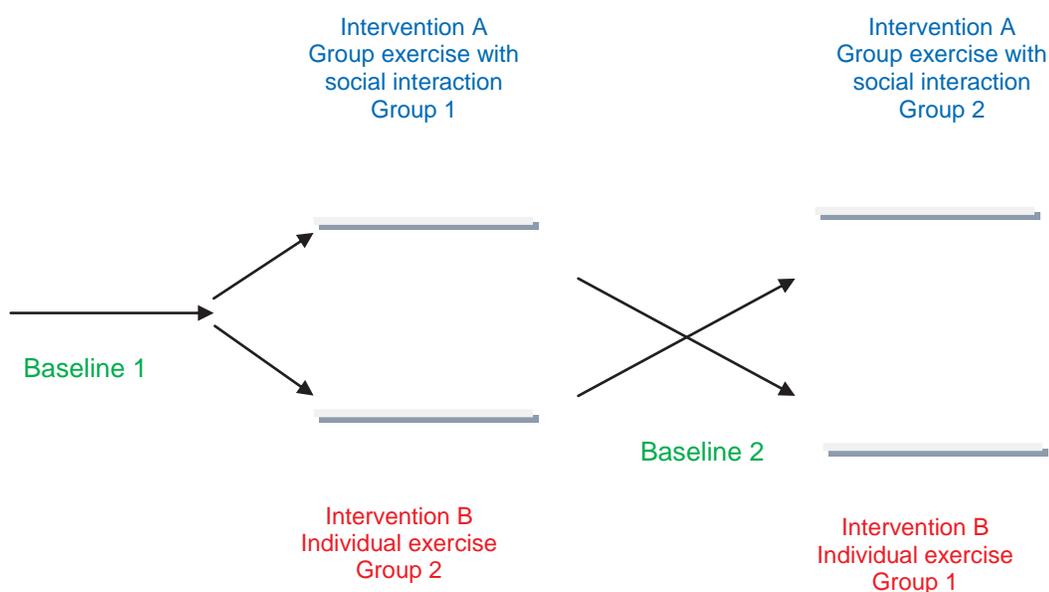


Figure 1. Pilot study design. Randomised two-treatment, two-period, crossover clinical trial

During the first four weeks of the study all participants completed four weeks of a baseline phase (Baseline1). Half of the participants then went on to complete one of the two intervention exercise conditions, while the other half completed the other intervention exercise condition (see Figure 1). Participants then went on to complete another four weeks of baseline (Baseline 2) and then went on to complete four weeks of the alternative intervention exercise condition. Each four week baseline or four week treatment phase consisted of 11 exercise sessions, with the 12th session being a testing session (see below for details).

Baseline

During the baseline phases participants attended the Massey University Wellington Cardiac Rehabilitation Clinic. Baseline 1 was designed to familiarise participants to the conditions of the cardiac clinic, the exercise and study protocol conditions. Baseline 2 was a 'washout' phase designed to minimise the effects from the first intervention phase carrying over into the second intervention phase.

Group exercise intervention condition

The group exercise intervention was also completed in the Massey University Cardiac Rehabilitation Clinic. In this exercise intervention, participants were encouraged to increase their social interaction, for example talk more with other clients and staff, if possible 'buddy up' with one of the other clinic clients and if they were able to, attend breakfast/coffee with the cardiac clients and staff afterwards.

Individual exercise intervention condition

During the individual exercise intervention, participants completed their exercise session on their own in a separate testing laboratory on the Massey University campus. They were supervised by either the main researcher, one of the research supervisors or a third year student. Participants' heart rates and blood pressures were monitored in an identical manner as in the 'group exercise' condition except social interaction was kept to a minimum, with talking only occurring if absolutely necessary.

Exercise protocol

The exercise sessions were three mornings a week of one hour duration, between 7-8am or 7.30-8.30am (time slot at the choice of the client). Sessions were on a Monday, Wednesday and Friday morning. The exercise regime consisted of 30 minutes cardiovascular activity on an exercise bike, followed by 30 minutes of floor work and resistance exercises. The exercise protocol was consistent for both the group and individual interventions in the main study (see below for differences in the 2009 pilot study).

During the cardiovascular activity, heart rate and blood pressure were measured at the following intervals: pre exercise, 5 minutes, 10 minutes, 15 minutes, 20 minutes and after 30 minutes of activity. Everyone was encouraged to keep their perceived exercise intensity at 60-70% maximum heart rate (or "6" or "7" out of "10"), except for those participants requiring a different heart rate range, as indicated by their medication or results of their ECG. The floor and resistance exercises included a range of different activities, including light resistance

weights designed for cardiac patients (e.g. unilateral exercises), exercises utilising their own bodyweight, stretches and core work. The sessions were led by one of the clinic's exercise physiologists or Massey University students, and were performed as a group activity in a circle so everyone could see and copy the demonstrator. The types of exercises varied from session to session in order to provide variety and as an overall body workout. On completion of this component everyone had their post exercise heart rate and blood pressure recorded (60mins).

Individual exercise intervention

2009 Pilot Study: During the individual exercise intervention, participants followed the same exercise protocol except during the 30 minutes of floor and resistance exercises they performed a specific set of exercises. These were shown to participants as a set of exercise cards (Appendix 5) and remained consistent for each session over the 4 week period. Participants completed one circuit of one set of each exercise and then repeated it for a second circuit. Participants normally took 2-3 sessions to become familiar with the exercises, which often required some feedback in terms of necessary adjustments that were needed (e.g. to correct posture etc). From then on the amount of social interaction occurring was minimal.

2010 Main Study: During the main study an attempt was made to make the floor exercise protocol identical to the type of exercises conducted in the cardiac clinic. Participants were shown and followed a DVD of an exercise session that been filmed in the cardiac clinic earlier in the year. Four DVDs had been developed so participants had the variety of four different exercise sessions.

Testing protocol

Participants were tested before commencing the study and after completing each four week block. Each four week block consisted of 11 sessions of exercise and the 12th session was a testing session.

Specifically, testing occurred at the following times:

- Before starting (week 0)
- End of baseline 1 (end of week 4)
- End of intervention 1 (end of week 8)
- End of baseline 2 (end of week 12)
- End of intervention 2 (end of week 16)

2009 Pilot Study: The following tests were conducted at each testing session:

1. Resting heart rate: Taken manually by palpating the radial pulse for a period of 60 seconds.
2. Resting blood pressure: Measured with a sphygmomanometer (Heine Gamma XXL LF, Heine Optotechnik, Herrsching, Germany) and stethoscope.
3. Cardiovascular function: The cardiovascular test involved participants performing the 10m shuttle walking beep test (Singh, Morgan, Scott, Walters, & Hardman, 2010). Orange road cones were used to mark out the 10m course and a Panasonic portable stereo CD system (RX-D29) was used to play the CD.
4. Blood analyses: Obtained by finger prick method with the sample being put on a lipid analyser strip (Lipid Panel test strips, Polymer Technology Systems, Indianapolis, US) and glucometer analyser strip (Medisense Optimal Blood Glucose Electrodes, Medisense Australia). Total cholesterol, high-density lipoprotein, and TC/HDL cholesterol were measured using a lipid analyser (CardioCheck PA Analyzer, Polymer Technology Systems, Indianapolis). Blood glucose was measured on a glucometer (Optimum Exceed, Medisense Australia).
5. Self report on the Hospital Anxiety and Depression scale (HADS).
6. Self report on the SF-36 Quality of Life questionnaire.

2010 Main Study: The same tests as the 2009 Pilot study were repeated in the main study with the following differences:

1. Blood pressures were measured using an electronic measuring device in order to ensure consistency in results over time (Omron automatic digital blood pressure monitor, model HEM-703CP).
2. A modified HADS scale was used in order to increase the precision and sensitivity of the scale (Appendix 6). This incorporated the same statements as the original HADS except each statement required participants to rate on a 0-100 scale how they felt (as opposed to a 0, 1, 2 or 3 Likert scale).
3. The original HADS was used only at the start and end of the research for clinical purposes, in order to identify any participant that was experiencing elevated levels of depression and anxiety. Any participant that was experiencing high levels of anxiety and/or depression was referred to their GP.

4. The following additional questionnaires were submitted to participants before commencing the study:
- The Auckland heart study questionnaire (Jackson, 1989; Appendix 7). This was used to provide an indication of participants' exercise history over the previous three months.
 - The abbreviated form of the revised Eysneck Personality Questionnaire (EPQR-A, Francis, Brown, & Philipchalk, 1992; Appendix 8). Participants' answers to the 'Lie' and 'Extraversion' subscales were recorded and were the ones the researcher was particularly interested in. The extraversion scores were expected to be related to desirability for exercising in a group, while the 'lie' subscale scores were an assessment of social desirability bias.

Equipment

Safety precautions

A cardiac crash trolley was present in one of the testing laboratories on the Massey campus and also in the cardiac clinic as a safety precaution, should another cardiac event arise. An emergency phone line was also available in one of the testing laboratories. Private cell phones were used for communicating between researchers when participants were exercising in two separate testing laboratories during their individual exercise intervention (at one stage there were four participants exercising individually) and also for communicating between the cardiac clinic and testing laboratories.

Aerobic activity

This was completed on either a Monark Ergonomic 828E exercise test cycle or a Cateye ergociser (EC-1200).

Equipment for floor exercises

This included 0.5kg, 1kg, 2kg and/or 4 kg dumbbell hand weights, an exercise mat, and Swiss balls when necessary (baseline and social exercise intervention). For the individual exercise intervention, during the 2009 pilot study, a Reebok step, Swiss ball and skipping rope were used for the floor exercises. During the 2010 main study, a laptop (Toshiba Tecra M2) was used for showing the floor exercise DVD sessions to participants. As one participant was visually impaired, the images needed to be magnified, and so a data projector (Toshiba TLP670CF LCD) and DVD player (Phillips 736K DW) was used to portray a larger version of the exercise session. The camera used during filming the DVDs was a Sony DVCR-TRV950E, and the tapes used were Sony Digital Video cassettes (Mini DVM60).

Chapter Four: Pilot Study

Introduction

A pilot study was conducted in order to assess the effectiveness of the research design and methodology in preparation for the main study. Specifically, to assess the exercise interventions, the assessment tools and the testing protocol, as well as any other practical issues arising. The pilot study also aimed to get 10 participants to identify any limitations in the study design and to calculate specific effect sizes and estimate statistical power. The identified limitations will be elaborated on in the discussion, as well as how they were addressed in the main study.

Method

Research design

The crossover experimental design as described in Chapter Three was used.

Recruitment

Participants were recruited as described in Chapter Three. All participants needed to have received medical approval from their cardiologist or GP to participate, and had experienced a cardiac event such as an MI, unstable angina and/or undergone a cardiac procedure at any time in their past.

Throughout the duration of the pilot study, the main researcher made contact on a regular basis with the cardiac nurses from both hospitals, in order to update them on the status of current participants in the study as well as to determine whether there were more participants who were interested in taking part in the study.

Hospital cardiac rehabilitation programmes

Both Wellington Hospital and the Wakefield Hospital offered a phase two rehabilitation programme, and these were completed for all participants prior to coming into the study. Both hospital programmes are conducted in a group format, so a moderate amount of social interaction occurs between cardiac patients and staff. This is particularly prevalent with the Wellington Hospital programme, in that patients are engaging with others during their exercise sessions. As this programme is conducted over an eight week period, there is an also opportunity for patients to get to know one another and for social support networks to be established.

Massey University Wellington Cardiac Rehabilitation Clinic

During the 12 weeks of the study, participants were required to attend the Massey University Wellington Cardiac Rehabilitation Clinic. The cardiac rehabilitation clinic has been running for over five years and offers a group based, phase two clinical exercise programme designed specifically for people undergoing cardiac rehabilitation. The exercise programme is closely monitored by qualified exercise physiologists, Massey University staff and students. The clinic receives regular referrals from general practitioners and cardiologists in the Wellington region. About 20 cardiac clients attend each of the morning sessions, with up to 60 people enrolled in the clinic. Standard procedure for joining the clinic involves completion of standard forms (see Appendix 4) and a modified Bruce test. The modified Bruce test involves a walking test on a treadmill for three consecutive three minute phases. Each phase is conducted at a higher intensity than the previous one. The intensity is increased by increasing the treadmill speed and incline. ECG activity, heart rate and blood pressure are recorded on the completion of each three minute phase. A recovery exercise phase is included for a further final three minutes when the intensity and incline is reduced back to a low level. The test is discontinued if the participants cannot complete the test or if their signs and symptoms indicate the test should be stopped.

Participants

Eleven participants indicated an interest in taking part in the study, and of these, one participant completed baseline tests but decided not to start the study. This participant showed very elevated levels of anxiety and depression in the baseline tests and was anxious about attending the cardiac clinic. He decided in the day following his tests that he did not wish to start the study and was referred to his GP as per the ethical procedure for elevated anxiety and depression. Another interested participant decided that she was not ready to take part in the study at that point in time due to personal reasons, but indicated she would like to be involved at a later stage if the study was still in progress. The other three interested participants were unable to commit to the 16 weeks of the study. These participants were offered the opportunity to become a member of the cardiac rehabilitation clinic. The final sample consisted of six participants, three males and three females. Ages ranged between 49 and 72 (mean age 62 years). All had received prior approval from their GP or cardiologist before starting the study. For participant demographic and medical details, see Table 1 below.

Table 1

Participant Demographic and Medical Details

Participant pseudonym	Gender	Age	Hospital recruited	Cardiac event	Occupation	Attendance (out of 11 exercise sessions)	
						Social exercise Intervention	Individual exercise intervention
Melissa	F	72	Wakefield	Stent insertion following angina	Retired	11	8
Rebecca	F	60	Wellington	Valve replacement	Retired	11	10
Bruce	M	66	Wellington	Stent insertion following MI	Retired	9	9
Ian	M	49	Wakefield	Double triple coronary artery bypass graft	Manager	9	11
Tina	F	60	Wakefield	Stent insertion following angina	Office Manager	9	11
Paul	M	64	Wakefield	Coronary artery bypass graft	GP	11	10

Administrative requirements

When coming in for their first testing session, participants were asked to submit their signed consent form, completed medical questionnaire and forms for joining the cardiac clinic. They were also required to submit a written referral from their GP or cardiologist if this had not been received prior. They were then informed about the testing procedure and what it would involve. They were also asked if they could maintain the same 'routine' on the morning of each test for consistency purposes, and to maintain the same exercise habits outside of the study for the 16 week period (for example, if they normally cycled twice a week they were encouraged to maintain this for the duration of the study. This was to avoid any interference from changes in external variables). An appointment was also organised for every participant to complete their modified Bruce test if this had not been conducted prior to the first testing session. Participants were then asked (as for every testing session thereafter) whether they had fasted from midnight the night before, prior to taking blood samples. If participants had forgotten and had eaten or had something to drink other than water on the morning of their test, they were asked to come in on the following Monday to repeat blood sample testing (tests were always conducted on a Friday). This occurred on two occasions. For every test following the first testing session, participants were asked if any changes had been made to their medication or to their outside exercise habits during the last four weeks. They were also asked how many exercise sessions they had attended since the last testing session (in order to record attendance rates).

Exercise protocol

The exercise protocol was as described in Chapter Three. Everyone was encouraged to keep their perceived exercise intensity at 60-70% maximum heart rate, except for those participants needing to maintain it at a lower intensity as indicated by their medication or modified Bruce test results. For example, if a participant exhibited ischemia during the modified Bruce test, they were monitored and advised to keep their exercise intensity lower than the intensity at which the ischemia presented during their test. The exercises were specific to cardiac patients, for example a number of the exercises were unilateral in order to avoid elevations in blood pressure. On completion of this component and at the end of the workout session, everyone had their post exercise heart rate and blood pressure taken.

Baseline phases and exercise interventions

The exercise protocol was consistent for all conditions apart from the floor work routine during the individual exercise intervention (see details below). During baseline phases and the

social exercise intervention the exercise sessions were completed in the Wellington Massey Cardiac Rehabilitation Clinic. In the clinic, the floor exercise routines are led by an exercise physiologist or Massey University final year health science student. The exercises are performed as a group activity in a circle so everyone can see and copy the demonstrator. The types of exercises vary from session to session in order to provide variety and an overall body workout. Within the clinic, there is some social interaction in that clinic members, staff, students and study participants are conversing and interacting with one another.

In terms of the baseline phases, Baseline 1 was designed to 'familiarise' participants to the conditions of the cardiac clinic, the exercise and study protocol conditions. Baseline 2 was designed as a 'washout' phase from the effects of the first intervention, and to re-familiarise participants with the conditions of clinic if they had just completed their individual exercise intervention. During the social exercise intervention an attempt was made to increase the amount of social interaction compared to both the individual intervention and baseline phases. Specifically, participants were encouraged to talk more with other clients, study participants and staff in the clinic, as well as attend breakfast/coffee with the cardiac clients and staff following the session.

During the individual exercise intervention, participants completed their exercise sessions individually in a separate testing laboratory on the Massey University campus. They were supervised by either the main researcher, one of the research supervisors or a final year health science student. In this intervention an attempt was made to keep social interaction to a minimum, with talking only occurring between the supervisor and participant if the participant needed help with their technique during the floor routine. In this intervention, the floor routine and resistance exercises differed from the baseline phases and social exercise intervention in that participants followed a set of specific exercises. These exercises were held consistent over the four week intervention. The exercises were shown to participants on a set of exercise cards (Appendix 5). Participants completed one set of 10-15 repetitions for each exercise and then repeated each exercise for the same number of repetitions. The final five minutes of the session was spent doing some stretches (Appendix 5).

Equipment for exercise protocol

Aerobic activity

During the exercise component of the study, aerobic activity was completed on either a Monark Ergonomic 828E Exercise test cycle or Cateye ergociser (EC-1200). Unless participants had been instructed to maintain a lower exercise intensity, cardio activity was completed at

60-70% of HR max or, according to participants' 'perceived level of exertion', a '6' or '7' out of '10'. A range of ideal heart rates for each participant was recorded in their personal 'cardiac clinic' file so when they were being supervised, their exercise intensity could be monitored.

Floor exercises

For the baseline phases and social exercise intervention, participants were offered the choice of 0.5kg, 1kg, 2kg and 4kg dumbbell hand weights, and were provided with an exercise mat and Swiss ball if required (dependent on the nature of the floor routine). For the individual exercise intervention, participants were provided with the same choice of hand weights as well as a Reebok step, skipping rope and Swiss ball. They were also provided with the set of exercise cards (nine in total). These showed a picture of the exercise in colour along with some instructions (Appendix 5).

Testing protocol

Participants were tested before commencing the study and after completion of each baseline phase and intervention (i.e. 11 exercise sessions). Specifically, testing occurred at the following:

- before starting (week 0) – Baseline testing session or Test 1
- end of baseline 1 (end of week 4) – Test 2
- end of intervention 1 (end of week 8) – Test 3
- end of baseline 2 (end of week 12) – Test 4
- end of intervention 2 and study completion (end of week 16) – Test 5

The following measures were taken at each testing session:

- self report on the Hospital Anxiety and Depression Scale (HADS)
- self report on the Medical Outcomes Study Short Form Quality of life questionnaire, version 2 (SF-36v2)
- resting heart rate
- resting blood pressure
- blood analyses including cholesterol tests (total cholesterol, HDL, and TC/HDL) and blood sugars
- performance on the 10m shuttle walking test (SWT)

Testing procedure and equipment

Self-report questionnaires

Hospital Anxiety and Depression Scale (HADS): Anxiety and depression were assessed by the HADS, which is a reliable and valid self report instrument (Bjelland, Dahl, Haug, & Neckelmann, 2002; Zigmond & Snaith, 1983) and is widely used to assess emotional distress and psychological well-being in clinical populations and in cardiac patients (e.g. Turner et al., 2003; Yohannes et al., 2010). It is also the most commonly used questionnaire for assessing anxiety and depression in cardiac patients in New Zealand (New Zealand Guidelines Group, 2002) and so was selected for assessing psychological well-being in this study. The HADS is a 14 item scale which consists of seven items for assessing anxiety and seven items for assessing depression. All items are rated on a four point Likert scale with total scores for each subscale ranging from 0-21, and with higher scores indicating increased levels of anxiety and depression (Joekes et al., 2007). There are also three suggested cut-off levels, specifically a total score of 0 to 7 referring to the normal range, a score of between 8 and 10 indicating a mild case or being just suggestive of the respective state, and a score of 11 or higher indicating likely presence of the mood disorder (Snaith, 2003). Herrmann (1997) conducted a review on studies that have utilized the questionnaire and concluded that the “HADS gives clinically meaningful results as a psychological screening tool, in clinical group comparisons and in correlational studies with several aspects of disease quality of life” (p. 17).

Medical Outcomes Study Short Form Health Survey questionnaire (SF-36v2): Health-related quality of life was assessed by the SF-36v2 questionnaire. This is a generic self report survey which is a valid, reliable and acceptable tool for measuring physical as well as mental health status (Aude et al., 2006; Brazier et al., 1992; Dempster & Donnelly, 2000; Muller-Nordhorn, Roll, & Willich, 2004) and is one of the most well known instruments for measuring health status in cardiac patients (Aude et al., 2006; Muller-Nordhorn et al., 2004; Pashkow et al., 1995). The original SF-36 (version 1) was first made available in 1988 (Ware, 2000). In 1996, version 2 was introduced which incorporated a number of improvements including simplification of the Vitality and Mental Health response scales, an improved layout for questions and answers as well as greater compatibility with widely used translations and cultural adaptations (Ware, 2000). It was designed for use in clinical practice and research, health policy and general population surveys (Ware & Sherbourne, 1992) and for use in longitudinal studies of health outcomes among the chronically ill, but has also been widely adopted by researchers for studies in clinical and non clinical populations.

The SF-36v2 is a multi-item scale consisting of eight subscales which measure the health concepts of Vitality (VT), Role limitations due to Emotional difficulties (RE), Role limitations due to Physical difficulties (RP), Bodily Pain (BP), Social Functioning (SF), Physical Functioning (PF) General Health (GH) and Mental Health (MH). In addition, one single item assesses change in health status over the last year (Jorngarden et al., 2006). Most items have been adapted from instruments over the last 20-40 years, or even longer (Ware & Sherbourne, 1992).



Figure 2 . The SF-36 design structure (Ware, 2000)

Based on the eight scales, two summary scales have been constructed for physical health and mental health. The Physical Component Summary (PCS) is a measure of physical health and includes the Physical Functioning, Role Physical, Bodily Pain, and General Health subscales. The Mental Component Summary (MCS) is a measure of mental health and encompasses the Vitality, Social Functioning, Role Emotional and Mental Health subscales (Jorngarden et al., 2006). As the MCS subscales are indicative of mental and emotional health, these were also

used for assessing psychological well-being. An overview of the design structure of the SF-36v2 questionnaire is provided in Figure 2. For further details on the subscales see Ware and Sherbourne (1992).

As per standard coding protocol, all the scale items were coded into a raw score and then recalibrated, summed and transformed into a scale, from 0 (worst health) to 100 (best health). Instructions for transforming the scores are provided in the SF-36v2 manual (Ware, Kosinski, & Dewey, 2000).

Resting heart rates and blood pressures

Resting heart rates were taken manually by palpating the radial pulse for a period of 60 seconds. Blood pressures were measured manually using a sphygmomanometer (Accoson Duplex Aneroid model, Essex, London) and stethoscope.

Blood analyses: cholesterol (TC, HDL and TC/HDL) and blood glucose

Blood analyses were obtained by taking blood samples via the finger prick method. This involved using an Accu-chek multiclix lancet and lancet pen. The samples were put on a lipid analyser strip (Lipid Panel test strips, Polymer Technology Systems, Indianapolis, US) and glucometer analyser strip (Medisense Optimal Blood Glucose Electrodes, Medisense, Australia). Total cholesterol (TC), high-density lipoprotein (HDL), and TC/HDL cholesterol were measured using a lipid analyser (CardioChek PA Analyzer, Polymer Technology Systems, Indianapolis). Blood glucose was measured on a glucometer (Optimum Exceed, Medisense, Australia). The cardiocheck lipid analyzer is considered a valid tool for producing accurate results, which meets the accuracy guidelines established by the National Cholesterol Education Program (NCEP) of the National Institutes of Health (NIH), (Polymer Technology Systems, 2008).

Shuttle walking test (SWT)

The shuttle walking test was used to determine each participant's cardiovascular fitness. This test has been designed to assess functional capacity for people with cardiopulmonary conditions; for example, chronic airflow obstruction, chronic heart failure, cardiac disease, rheumatoid arthritis, people awaiting heart transplantation, patients with pacemakers, patients undergoing cardiac rehabilitation, patients with intermittent claudication and advanced cancer (Singh et al., 2010). It has been validated and is a reliable and reproducible measure of functional capacity and VO₂ peak (Fowler, Singh, & Revill, 2005; Lewis, Newall, Townend, Hill, & Bonser, 2001; Singh, Morgan, Hardman, Rowe, & Bardsley, 1994). The test involves participants walking up and down a 10 metre course with cones at either end in

synchrony to an audio beep signal which over time, sounds at increasingly shorter intervals. Participants are required to reach the cones in time to the beep signals, and continue the test until they are unable to keep up or choose to stop the test. A longer distance walked indicates a better performance. A distance of 10 metres was measured out and permanent marks were made on the floor to ensure the distance remained consistent for each testing session. Orange road cones were used as visual cues and for participants to walk around at the end of the 10 metre course. The audio beep test was played to participants on a Panasonic portable stereo system (RX-D29). The beep test CD and instruction leaflet was obtained from the Department of Respiratory Medicine, Glenfield General Hospital, Leicester, UK.

Safety precautions

During this study safety precaution procedures, as described in Chapter Three, were utilized.

Ethical considerations

- The inclusion criteria incorporated any participant who had experienced a cardiac event such as an MI and/or undergone cardiac surgery. Participants would have been referred by their cardiologist or GP and completed their respective hospitals' cardiac rehabilitation programme. Exclusion criteria included people who were unable to speak English as they would not be able to answer the questionnaires, those who had not received a referral to participate, and current Wellington Massey Cardiac Rehabilitation Clinic clients, as these people would already be familiar with the exercise protocol and have established social networks.
- All participants were informed they were able to withdraw from the study at any stage.
- All data were stored in a locked filing cabinet and in order to ensure confidentiality of participants, everyone was assigned a pseudonym ID.
- On completion of the study all participants received a short summary of their results. Following final data collection and analysis of the main study, everyone was sent a full report of the research.
- For any participants reporting elevated levels of anxiety and/or depression (as indicated by the HADS, i.e. a score of 11 or higher), participants were advised to talk with their GP and were provided with a list of psychological services available in the Wellington region including the Massey University Wellington Psychology clinic. In this study, one participant was advised to make contact with his GP due to his elevated levels of anxiety and depression reported during the first baseline test. This participant did not start the study, but was followed up three weeks later to ensure he had made contact with his GP.

- The following modifications were made following recommendations from the New Zealand Health and Disability Ethics Committee:
 - All participants were exempt from paying the normal fee of \$200 for attending the cardiac clinic. In order to pay for each participant's clinic fees, some funding was provided by Massey University.
 - Changes were made to the information sheet so it included information about the risks and benefits of blood testing and the 'standard wording for withdrawal' according to ethical requirements.
 - The informed consent form was modified so it included permission to let the participant's GP know of their intention to take part in the current research study.

The New Zealand Health and Disability Ethics Committee provided full approval for the study.

Results

All statistical analyses were carried out using the Statistical package for Social Sciences (SPSS/PC +), version 17. When comparing changes from the start to the end of the study the HADS was used to assess changes in psychological well-being, and the SF-36v2 was used to determine changes in health-related quality of life. Changes in physiological status were determined from blood pressure and resting heart rate readings, blood cholesterol and blood glucose, and performance on the shuttle walking test, as discussed earlier. In terms of comparing the social and individual exercise interventions, changes in psychological well-being were determined with the HADS and the Mental Component Summary SF-36v2 subscales.

Changes in psychological well-being, physical status and health-related quality of life

Paired t-tests were conducted on all variables in order to compare changes from the start to the end of the study. All difference scores analysed were checked to make sure they had an approximately normal distribution.

Psychological well-being and health-related quality of life

A lower HADS score is representative of lower anxiety and/or depression. In comparison, higher SF-36v2 scores represent better quality of life. The mean values at the start and end of the study are displayed in Table 2. A statistically significant decrease in anxiety occurred over the course of the study. All other changes were not statistically significant, although changes occurred in depression and all SF-36 subscale scores, except for role emotional and bodily pain, in the expected direction.

Table 2.

Means, Standard Deviations and t-values for Assessing Changes in Psychological Status

Psychological variables	Start of study	End of study	t	p-value
	Mean (SD)	Mean (SD)		
<i>HADS</i>				
Anxiety	7.70 (6.77)	3.83 (5.00)	4.00	0.01
Depression	2.17 (2.56)	1.33 (1.86)	2.10	0.09
<i>SF-36v2</i>				
Physical functioning	84.17 (12.81)	89.17 (7.34)	-1.50	0.20
Role physical	79.17 (12.91)	87.50 (18.96)	-1.40	0.22
Bodily pain	85.00 (8.37)	82.33 (15.36)	0.62	0.56
General health	67.00 (16.73)	75.00 (23.58)	-0.90	0.41
Vitality	71.88 (12.96)	76.04 (16.96)	-1.35	0.24
Social functioning	75.00 (17.68)	89.58 (8.18)	-2.15	0.08
Role emotional	91.67 (16.67)	93.06 (17.01)	-1.00	0.36
Mental health	78.33 (11.25)	83.33 (19.66)	-1.04	0.35

Table 3.

Means, Standard Deviations and t-values for Assessing Changes in Physiological Status

Physiological variables	Start of study (T1)	End of study (T5)	t	p-value
	Mean (SD)	Mean (SD)		
Systolic blood pressure	121.67 (20.21)	110.00 (10.00)	1.20	0.34
Diastolic blood pressure	78.33 (10.41)	73.33 (5.77)	1.70	0.23
Heart rate	60.67 (5.03)	65.33 (4.62)	-1.30	0.34
Total cholesterol	3.74 (0.89)	3.40 (0.89)	1.40	0.22
HDL cholesterol	1.05 (0.42)	1.10 (0.29)	-0.52	0.63
TC/HDL cholesterol	3.86 (1.21)	3.03 (0.52)	2.50	0.58
Blood sugar	5.85 (0.58)	5.92 (0.98)	-0.32	0.76
SWT	736.67 (282.11)	685.00 (242.11)	1.51	0.19

Changes in physiological status from start to end of study

The mean values at the start and end of the study and the main effects for all variables are displayed in Table 3. There were no significant changes; however, trends occurred in the predicted direction for systolic blood pressure, diastolic blood pressure, total cholesterol, TC/HDL cholesterol and HDL cholesterol. Against predictions, heart rate and blood sugar increased, and total distance walked on the SWT reduced over time.

Changes in psychological well-being following participation in the social exercise intervention compared to the individual exercise intervention

Intervention change scores

Intervention change scores were calculated by subtracting the pre-score before entering an intervention from the post-score after it was completed. As lower HADS scores indicate a reduction in anxiety and/or depression, a negative HADS change score is indicative of an improvement in psychological well-being. Unlike the HADS, a positive change score for the SF-36v2 is indicative of improved well-being. Change scores were used as they provided a convenient method for analysing potential carryover effects with the two interventions in 2-way mixed model ANOVAs (repeated measures change scores x between subjects order of intervention).

Crossover design requirements

The crossover design should only be used if there are no carry-over effects and a return to baseline between interventions. That is, the order of presentation of intervention A and intervention B should have no influence on their effects. Such carry-over effects should be tested for by determining if there is an interaction between type of intervention and the order of presentation of the interventions. A significant interaction would indicate a carry-over effect. If no carry-over effects are detected then the full analytic power of the crossover design can be employed by comparing the difference between all participants for the two interventions in a repeated measures analysis. If there is a significant carry-over effect then the difference between the two interventions in the first phase only should be compared in a between-subjects analysis, which has considerably less statistical power than the repeated measures comparison.

Analyses were conducted with a two-way ANOVA (intervention x order of intervention) in order to determine the presence of any carry-over effects and to measure the main effect of the intervention. The results for the interaction effects and main effects are displayed in Table

4. The lack of significant interaction effects for all measures ($p > .05$) indicated that there was no evidence of any carry-over effects. Consequently a repeated measures analysis of all participants' responses was appropriate. The psychological status change scores were not significantly different for the individual intervention and social intervention conditions for any of the measures (see Table 4). However, there was a consistent trend for scores following the individual intervention to show improvement on all six measures, as indicated by greater negative change scores on the HADS and positive change scores on the SF-36v2, and to show greater improvement on all six measures compared to the social intervention.

Table 4.

Differences in Psychological Status across Social and Individual Intervention Conditions

Psychological variables	Change scores means (SDs)		Interaction effects		Main effects	
	Social intervention	Individual intervention	F	p-value	F	p-value
<i>HADS</i>						
Anxiety	-0.17 (1.94)	-0.50 (1.38)	1.13	0.35	0.13	0.74
Depression	0.00 (0.00)	-0.67 (0.82)	1.00	0.37	4.00	0.12
<i>SF-36v2</i>						
Vitality	6.25 (7.91)	7.29 (10.76)	2.31	0.20	0.03	0.87
Social functioning	2.08 (16.61)	6.25 (22.01)	4.71	0.53	0.12	0.75
Role emotional	4.17 (6.97)	6.95 (11.08)	1.60	0.28	0.40	0.56
Mental health	2.50 (10.37)	3.33 (13.29)	0.52	0.51	0.01	0.92

Discussion

The aim of this pilot study was to investigate the effectiveness of the study design and methodological practices in preparation for the main study. It also enabled the researcher to evaluate and decide on the statistical procedure for analysing the results. The experimental procedure and analysis generally worked well.

From the start to end of this study there was a significant reduction in self-reported anxiety.

Even though non-significant, there was also a trend in the predicted direction for depression and nearly all quality of life subscales. Such results provide support for the possibility that a 16 week cardiac rehabilitation programme may improve psychological well-being and quality of life, although there are limitations to the study that are further discussed in the general discussion chapter. Given that participants had just completed 16 weeks of a structured exercise programme, it is highly likely that they were feeling better about their physical abilities and health in general. In terms of the physiological variables, results were mixed in that changes occurred in the predicted direction for five out of eight variables. These results will be further discussed below.

In terms of differences between the social exercise and individual exercise interventions, there was no evidence of any significant differences, according to the HADS outcomes or the Mental Component Summary subscale scores. There was however a non-significant trend showing greater improvement following the individual exercise intervention compared to the social exercise intervention, contrary to expectations. The limitations of this pilot study and how they will be addressed in the main study are described below.

Statistical power

G Power analyses were conducted to determine a suitable sample size for the main study (see Erdfelder, Faul, Lang and Buchner (2007) for more details on G Power). Based on the pilot study a number of analyses were conducted. For example, for the HADS score difference obtained between the start and end of the study (Table 2) it was determined that 10 participants would be required to detect that magnitude of difference with a statistical power of 80% (for a within subjects t test).

Limitations

Low participant numbers

The low number of participants was clearly the biggest limitation of this study; with only six participants in the pilot study it is statistically underpowered. It is likely that the low participant numbers and chance effects could explain the changes which occurred in the opposite direction to those predicted (e.g. blood sugar, heart rate and SWT results from the start to the end of the study, and greater benefits following the individual exercise intervention compared to the social intervention). Also it is possible that the low participant numbers could explain why, for example, Bodily Pain and the SWT scores did not improve over the course of the study. Specifically, and in regards to the latter, two participants incurred

knee injuries half way through the course of the study. This meant they were not able to perform as well on the SWT and it is likely that they would have reported higher levels of pain according to the Bodily Pain subscale. There was also an unexpected increase in heart rate from the start to end of the study. This may be attributed to one participant forgetting to follow his normal morning routine prior to his final testing session. On this particular morning the participant showed up early for the test and started stretching and jumping around while waiting for the researcher to turn up. Small samples will always be influenced by these random events, so a larger sample size is needed in order to show if reliable differences exist and to improve the validity of this research.

The low number of participants was unavoidable due to the small number of referrals from Wellington and Wakefield hospitals. As mentioned earlier Wakefield Hospital decided to discontinue their education seminars and this occurred half way through the recruitment of participants. Additionally, it is a well known phenomenon that many cardiac patients do not proceed on to and/or complete their cardiac rehabilitation. In New Zealand, approximately 64% do not proceed on to stage two cardiac rehabilitation (Doolan-Noble, Broad, Riddell, & North, 2004). During the time of this pilot study a good rapport was established with the cardiac nurse from Wellington Hospital. After discussing with him the low number of referrals coming through for the study, he informed the researcher it was likely that there would be a lot more patients becoming available early in the following year, when the main study was conducted. He further acknowledged he would be referring many patients through at that time, who he thought would be suitable for the main study.

Exercise interventions

Individual exercise intervention

During this intervention the goal was to minimise social interaction between the participants and supervisor in order to simulate 'individual' exercise sessions. This was straightforward to maintain during the cardiovascular component of the session. During the final 30 minutes when participants were completing their floor exercises however, on more occasions than expected, interaction and conversing took place between the participant and supervisor. This was especially evident during the first week of the intervention, when the participants were becoming accustomed to the exercises and routine. One participant actually commented in the final testing session that she enjoyed this intervention as she felt it provided her with some 'one on one' attention.

A second limitation of this intervention was that the floor exercise routine was not the same as the routine in the cardiac clinic. In the clinic the sessions are led by one of the staff or students, and participants receive a varied workout each session. Because of the consistency of the floor exercise routine over the four weeks, it meant that participants became familiar with the exercises and gained some benefits from a repetitive programme. For example, two participants in the study made comments about how they felt they were making good gains in strength as they were able to 'repeat the exercises consistently' and became more confident in their ability. While it is valuable for one to feel such benefits from an exercise routine, for the purposes of the study, it highlighted the need to maintain consistency in the exercise protocol for all conditions. For the main study it was decided that the exercise protocol in the individual intervention would be consistent with the other conditions in that participants would be offered a range of exercises and routines throughout the four weeks of the intervention. The main researcher would also emphasize to clinic supervisors on a regular basis the importance of keeping social interaction between themselves and the participants to a minimum.

Social interaction exercise intervention

This social exercise intervention was nearly identical to the conditions of baseline, with the only difference that participants were encouraged to increase their social interaction. With the way the cardiac clinic is set up, it is a social and supportive environment for everyone, with a lot of interaction occurring between clinic staff, cardiac patients and students. It was therefore difficult to detect a social intervention effect. In order to create an intervention of increased social interaction compared to baseline, in this study participants in the social exercise intervention were encouraged to talk more with other members of the cardiac clinic, staff and students. They were also asked to attend morning coffee/breakfast after the session with other members of the clinic. For some people, work commitments prevented them from attending these sessions. In the main study, an attempt was made to further increase the amount of social interaction by way of encouraging participants to 'buddy up' with another person in the cardiac clinic. Participants would also receive a written set of instructions in order to reiterate and emphasize the importance of social interaction in this intervention (see Appendix 9).

Hospital Anxiety and Depression Scale

This questionnaire is widely used in a range of clinical populations in order to assess psychological well-being and emotional distress. While it is recognized as being a valid and reliable questionnaire (Bjelland et al., 2002; Herrmann, 1997), due to the small sample size it

was questioned whether the four point Likert scale would be precise and sensitive enough to detect substantive changes in participants' responses. A literature review of the scale (Bjelland et al., 2002) revealed a small sample as being larger than that of the pilot study. Even though it is likely that the main study would include a larger number of participants it is still likely that the total number would still be below 20. In the main study, it was decided to increase the sensitivity of the scale by changing the HADS response scale to a visual analogue scale whereby participants could rate their answers on a continuous scale of 0-100 as to how they felt about each of the HADS items. More details will be provided in the methodology section of the main study.

Equipment for testing physical variables

Even though the results showed decreased blood pressure over the course of the study, this trend was not significant. It was suggested by one of the supervisors that more consistency in blood pressure readings could be obtained if an electronic blood pressure cuff was utilized in the main study. In most of the testing sessions in this study blood pressure was taken by the same person, although on occasions it was taken by one of the other researchers. It is therefore possible that some inconsistency may have occurred when taking recordings.

Inclusion of additional questionnaires – physical activity history and social desirability scale

From observations and discussions with the participants, the researcher identified two other ways for possibly improving the main study. Specifically, two participants in this study were already accustomed to exercise and had an established exercise history prior to commencing the study. These were the two participants who commented at the end of the study that they were quite comfortable exercising on their own. Gaulin (2007) acknowledges how an independent exerciser is not normally brand new to fitness. It is therefore a possibility that participants who are *not* accustomed to exercise will gain the most benefits from a socially interactive group exercise programme. In the main study it was decided that a physical activity questionnaire would be incorporated and correlational analyses would be conducted in order to determine whether a socially interactive exercise regime is more beneficial for people without an established exercise history.

The other way of possibly improving the main study was to include a personality scale. This was incorporated to determine whether personality tendencies (such as extraversion) will influence the type of exercise environment that is preferred and is most beneficial for people. Specifically the researcher wanted to determine in the main study whether extraverted individuals would benefit more from a socially interactive exercise environment. In the main

study, a personality scale including an extraversion subscale would be included and correlational analyses conducted between extraversion scores obtained and results for the interventions. The personality scale that was included in the main study is discussed in the main study method section below.

Chapter Five: Main Study - Method

Introduction

The pilot study was conducted to assess the research design and highlight any limitations for the main study. In terms of the statistical power, the pilot study calculated that at least 10 participants would be needed for sufficient power. There were some limitations that were identified in the pilot study and these were addressed in the main study. A summary of the changes that were made and the rationale for these are described as follows:

Participant numbers

An effort was made to further increase participant numbers in the main study. Firstly, the main researcher kept in regular contact with the cardiac nurse from Wellington Hospital, and as discussed in the pilot study, was informed that it was likely more patients would become available when the main study was conducted, in the new year. The cardiac nurse also commented that the number of patients completing rehabilitation at Wellington hospital was, at the time of the pilot study (latter part of the year) quite low, and that it was common for numbers to increase early in the year. Secondly, the main researcher sent a letter to all the cardiologists from Wellington Hospital and Wakefield Hospital, in order to inform them about the research study and to provide contact details for the main researcher. Hence it was anticipated that the low participant numbers could be addressed in the main study.

Modifying the individual exercise intervention

As discussed in the pilot study, this was necessary in order to achieve consistency with the other conditions of the study. In the individual exercise intervention, the exercise protocol for the floor routine involved participants following a number of exercises as outlined on a set of exercise cards. In the baseline phases and social exercise intervention, participants were offered a variety of exercises every session, and these were demonstrated to them by one of the cardiac clinic staff or students. The details for how this intervention was modified in order for it to be identical to the other conditions are explained below.

Encouraging more interaction during the social exercise intervention

As mentioned in the pilot study, there was a moderate amount of social interaction during the baseline phases, however this was unavoidable due to the nature the clinic. The baseline phases were designed to create a condition whereby participants could become accustomed

to the exercise protocol and conditions (baseline one) and as a washout from the first intervention (baseline two). In order to create a distinction between the baseline phases and the social intervention, participants were instructed to 'increase' their social interaction during the intervention. An effort was made to increase further the amount of social interaction in this intervention, from that of the pilot study. The details for how this was modified are provided in the method section below.

Modifying the HADS scale

The HADS response scale was modified so it allowed participants to rate on a scale of 0-100 how they felt about each item (Appendix 6). The decision to modify the scale was based on recommendations made by a previous supervisor (A. Walmsley, personal communication, 2009). It was suggested that increasing the scale rating would enable it to become a more sensitive instrument, and that this was needed with such a small sample size. In order to determine the validity of this measurement with respect to the HADS, correlational analyses were conducted between the two scales.

Changing to an electronic measuring device for taking blood pressure

This was included in the main study to ensure more consistent readings in blood pressure were obtained. In the pilot study readings were taken by more than one researcher which meant some inconsistency may have occurred.

Additional questionnaires

Two additional questionnaires were included, specifically a self-report physical activity history and a personality scale. These were incorporated to assess whether an individual's exercise history and personality had an impact on results following participation in the interventions. Further details are provided below.

Exercise history and physical activity questionnaire

In terms of physical activity questionnaires, the literature has suggested that a longer recall period (e.g. three months) can provide a more accurate indicator of an individual's activity history, compared to a shorter recall time, such as seven days (Le Grande, Elliott, Worcester, Murphy, & Goble, 2008). In terms of the criteria in physical activity questionnaires, items such as the type of activity, frequency, time and/or duration are normally reported. Based on these criteria, the total amount of energy expended can be calculated using assigned MET values (or the energy cost for different activities). A MET value can be defined as "the ratio of work

metabolic rate to a standard resting metabolic rate of 1.0 kcal (4.184 kJ)/kg/hr" (Elley, Kerse, Swinburn, Arroll, & Robinson, 2003, p. 173). One MET is considered the resting metabolic rate while sitting quietly (Ainsworth et al., 2000), and values are dependent on the nature and intensity of an activity. In order to ensure compatibility in the literature and provide codes for various activities, Ainsworth et al., (1993) developed a compendium of MET values for a wide range of activities, both sedentary and active. While time spent sleeping or resting is coded as one MET, activities such as cycling at a 'very light effort' have an assigned MET value of 3.0, while 'general cycling' has a value of 5.0. Total energy expenditure is then calculated by multiplying the body weight of an individual by the MET value and duration of the activity, and is expressed in terms of kcal.kg⁻¹.body weight.h⁻¹, kcal.min⁻¹, or kcal.24⁻¹ (Ainsworth et al., 1993). As an example, a 60kg individual cycling for 40mins will expend 160kcal (60kg x 4 (assigned MET value) x (40min/60 min) = 160kcal). In the main study a physical activity questionnaire which requires participants to report their physical activity patterns over a three month period was utilized, as well as one which asks for a record of the type, duration and frequency of activity. The researcher was particularly interested in determining whether those who reported lower energy expenditure values (and hence less active, minimal exercise history) would benefit more following the social exercise intervention.

Personality questionnaire

A personality questionnaire was included to assess introversion/extroversion, to determine whether extraverted individuals showed greater benefit after engaging in the social exercise intervention. A social desirability or lie scale was also included to detect for reporting bias (which could then be statistically controlled for). See the method section below for details on the personality questionnaire. Unfortunately the final sample size was not adequate for these analyses, and this is discussed in the results chapter.

Attendance

An effort was made to ensure the effects of the baseline phases and interventions were maintained in terms of attendance rates. Specifically, if longer than two weeks had been missed after completing a baseline phase it was thought that the effects of the baseline would start to diminish. If participants missed two weeks or less from the study after completing a baseline, when they returned, they continued at the point at which they had left off. If longer than two weeks had lapsed, participants were asked to complete another baseline phase before moving into the intervention. A second criteria was to ensure (as much as possible) that

each four week section of the study was completed without any breaks in between, that is, as 11 consecutive sessions, before being tested. If more than four sessions were missed consecutively during the middle of a baseline or intervention, when participants returned, they were asked to restart that particular section of the study.

Method

Participants

Fifteen participants indicated an interest in the study, and twelve participants were recruited. Nine participants were recruited from Wellington Hospital, and the other three, through word of mouth. The other three participants were unable to commit to the 16 weeks of study duration due to work schedules, but were informed they were still able to join the cardiac clinic. No participants were recruited from Wakefield Hospital as their cardiac rehabilitation programme had not re-commenced by the time the main study was conducted (this also meant the researcher was unable to promote the study to potential participants). As with the pilot study, all participants had received referrals from their cardiologist or GP prior to commencing. Mean age of participants was 54.25 years (SD = 8.6). For participants' demographic and medical details see Table 5.

Completion of the study and attendance

Of the 12 participants who started the study, 11 completed. One participant (Kendall) was forced to withdraw at week five, due to a knee injury. Of the 11 participants that completed the study, five completed it in 16 weeks. The other six participants took longer than 16 weeks to complete due to injury, illness, travel or work commitments. Time to complete the study ranged from 16 weeks to 29 weeks. Two participants (Susan and Mike) took two weeks out following the first and second baseline (respectively). When they returned to the study they continued at the point at which they had left, that is with the first and second intervention, respectively. A third participant (Caleb) took a month off from the study, but because he left following the first intervention, when he returned he re-commenced with the next section of the study, that is the second baseline, as this would have re-familiarised him with the research conditions as well as acted as a washout from the first intervention, if any effects were remaining. One participant (Jim) was forced to take two months out from the study due to an operation. Before he left the study, he had just completed the second baseline. When he returned, he repeated the second baseline, in order to re-familiarise himself with the research conditions. In terms of completing the study sections consecutively (i.e. without any breaks),

one participant (Helen) took two weeks off a week after starting the second baseline. When she returned she restarted the second baseline, in order for the sessions in that section to be completely consecutive. Another participant (Jason) took four weeks off after attending a week of the second baseline. When he returned, ideally he would have completed four weeks of the second baseline, however due to work commitments he was only able to complete three weeks. It should be noted that when all participants were asked to complete extra sessions, they did so at their own will. It was fortunate that there was only one participant who was unable to complete one section of the study consecutively (Jason). For all details relating to participant attendance patterns, see Appendix 10.

Table 5.

Participant Demographic and Medical Details

Participant pseudonym	Gender	Age	Recruited from	Cardiac event
Sally	F	52	Wellington Hospital	MI, stent insertion
Susan	F	44	Wellington Hospital	MI
Mike	M	50	Wellington Hospital	MI, stent insertions x 2
Helen	F	65	Word of mouth	Angina and angioplasty
Jim	M	57	Word of mouth	Angina and angioplasty
John	M	54	Wellington Hospital	Cardiac arrest
Caleb	M	48	Wellington Hospital	MI x 2, stent insertions x 2
Molly	F	75	Wellington Hospital	Mitral valve replacement
Jason	M	47	Wellington Hospital	MI
Keith	M	61	Wellington Hospital	Angina, stent insertion
Kendall	F	55	Word of mouth	Angina, stent insertion
Wayne	M	48	Wellington Hospital	MI, stent insertion

Individual exercise intervention

For the floor exercise routine in the main study participants were shown a range of exercises which were identical to those offered in the cardiac clinic. In the month before the main study commenced, the researcher filmed four sessions of the floor exercise routine in the cardiac clinic. A Sony DVCR-TRV950E video camera and Sony Digital Video cassettes (Mini DVM60) were used for the filming, and each session was copied onto one of four DVDs. These were then played to participants while they completed the floor exercise routine during the individual exercise intervention. As well as ensuring that this intervention was consistent with the other conditions of the research, it also meant there was less interaction between the supervisor and participants during the floor exercise routine.

Social interaction exercise intervention

In order to create a condition of increased social interaction, in the main study participants were asked to talk more with clinic staff and students, cardiac clinic members and study participants. Additionally they were encouraged to 'buddy up' with one of the clinic members or study participants. As with the pilot study, participants were also encouraged to join in for breakfast/coffee with the staff and members of the clinic following the morning sessions if possible. They were also provided with some written instructions about enhancing their social interaction prior to entering this intervention. These instructions re-iterated the researcher's requests for them to increase their social interaction, for example, "during this phase you are encouraged to increase your social interaction, for example increased talking with the exercise physiologists and other cardiac members. You are welcome to also form a 'buddy system' with one or more cardiac clients during this time" (see Appendix 9).

Testing protocol

The same testing protocol was used for participants in the main study as in the pilot study, with the following exceptions:

1. At the first testing session (before starting the study) participants were administered with the Auckland heart study physical activity history questionnaire and the abbreviated revised Eysenck Personality Questionnaire (EPQR-A).
2. The modified HADS (see below for details) was administered to participants at every testing session.
3. The HADS was only administered at the start of the study and at study completion for purposes of identifying anyone who reported elevated anxiety and/or depression.

4. Participants' blood pressure was monitored with an electronic measuring device instead of being taken manually, at every testing session.

Testing procedure and equipment

The following changes to the testing procedure and equipment occurred in the main study:

1. *Blood pressure equipment*

The electronic blood pressure monitor that was utilized was an Omron automatic digital blood pressure monitor, model HEM-703CP. These monitors have been shown to consistently provide accurate results, and are tested and meet the criteria according to the protocols of the Association for the Advancement of Medical Instruments (AAMI), European Society of Hypertension (ESH) and British Hypertension Society (BHS) (Omron Healthcare Inc., 2010).

2. *Self-report questionnaires*

Modified Hospital Anxiety and Depression scale (Appendix 6)

As explained earlier, the response scale of the HADS was modified to a visual analogue scale from 0-100, in order to increase its sensitivity. No HADS items were modified. The rating scale was changed to be one worded statements (e.g. "never", "occasionally", "frequently" and "always", as opposed to items like "most of the time", "a lot of the time", "from time to time, occasionally", and "not at all"). Items were reverse-scored as appropriate (e.g. items 2, 4, 6, 7, 12 and 14).

Auckland heart study physical activity questionnaire (Appendix 7)

The Auckland heart study questionnaire was developed by Jackson (1989) and has been used in cardiac populations for assessing physical activity history (Elley, Kerse, Swinburn, et al., 2003). It has been validated by Arroll, Jackson and Beaglehole (1991), and was also used in a 12 month evaluation of the green prescription physical activity intervention (Elley, Kerse, Swinburn, et al., 2003). The questionnaire requires participants to self-report their physical activity and sedentary patterns for a typical fortnightly period, as estimated over the last three months. Physical activity (PA) has been defined as "bodily movement produced by skeletal muscles that requires energy expenditure and produces progressive health benefits", whereas exercise has been defined as "planned PA with bodily movements that were structured and repetitively performed for the purpose of improving or maintaining physical fitness" (NIH Consensus Development Panel on Physical Activity and Cardiovascular Health, 1996, p. 242). As this research was primarily interested in the exercise history of participants, only those activities that involved planned exercise (e.g. walking and running, as opposed to sleep and

household chores) were recorded. As well as recording the type and duration of activity, the questionnaire includes a section for filling in calculated energy expenditure values for each activity. Energy expenditure values were calculated by using MET values as indicated on the standard compendium developed by Ainsworth et al. (2000). This compendium has been utilized worldwide among physical activity specialists in exercise science and public health (Ainsworth et al., 2000). A summary of participants' planned exercise activity over a week is shown in Table 6 and a more detailed description of their exercise history is provided in Appendix 11.

Table 6.

Summary of Exercise History per Week (Means, Standard Deviations, Maximum and Minimum Values)

Activity details	Mean (SD)	Maximum	Minimum
Minutes of planned activity	147 (110)	412	30
Total minutes of all planned activities	373 (101)	490	205
Energy expended per planned activity (METS, kJ/kg/hr,)	662 (550)	2178	210
Total energy expended of planned activities	1686 (993)	2702	210

Abbreviated Revised Eysenck Personality Questionnaire (Appendix 8)

The personality questionnaire that was implemented in the main study was the abbreviated Revised Eysenck Personality Questionnaire (EPQR-A). This instrument was designed by Francis et al. (1992) and was based on the short form Revised Eysenck Personality Questionnaire (EPQR) (Eysenck, Eysenck, & Barrett, 1985). One of the reasons Francis and colleagues (1992) devised a shorter version of the EPQR was to address the practical disadvantages of longer questionnaires in research projects. The abbreviated EPQR-A contains 24 items in total for assessing the scales of psychoticism (social-psychopath, solitary, troublesome, cruel, inhumane traits), neuroticism (anxious, worrying, moody and frequently depressed), extraversion (sociable, craves excitement, carefree, optimistic) and a lie scale (to assess social desirability)(Forrest, Lewis, & Shevlin, 2000; Maltby, Macaskill, & Day, 2001). The scale has been shown to be a "reliable functional equivalent to the 48-item short form EPQR" (Francis et al., 1992, p. 443) and satisfactory levels of internal consistency have been found for the subscales of Extraversion (0.74-0.84), Neuroticism (0.70-0.77), and Lie scores (0.59-0.65)

against both the EPQR and the well established Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975). The questionnaire has also been utilized in research studies to investigate the relationship between personality and a variety of constructs, for example USA college students, attitudes towards Christianity and psychological well-being (Forrest et al., 2000). The items are scored with a Yes/No format and scores range from 0-6 for each subscale with higher scores indicating higher levels of the personality trait (Forrest et al., 2000). Example questions include “Are you a talkative person” (item-2, Extraversion), and “Were you ever greedy by helping yourself to more than your share of anything” (item-4, Lie scale). In the main study, only scores for the subscales of extraversion and the lie scale were considered. Table 7 below shows a summary for participant scores on the extraversion and lie subscales.

Table 7.

Summary of Extraversion and Lie Scale Scores for Participants (Means and Standard Deviations)

Subscale	Mean (SD)	Maximum	Minimum
Extraversion	4.45 (2.06)	6	0
Lie Scale	3.36 (1.91)	6	1

Note: Scores range from 0-6. A score of 0 indicates the lowest tendency towards the personality, and a score of 6 indicates the highest tendency.

Chapter Six: Main Study - Results

Introduction

Analyses were conducted in an identical manner as in the pilot study, but with some additional correlational analyses. Statistical analyses were once again conducted using SPSS/PC+, v17. Further analyses were also planned to determine whether extraversion scores and reported exercise history had an influence on the intervention results.

Modified HADS questionnaire

Total scores for the anxiety and depression subscales on the HADS is 0-21, while on the modified HADS scores range from 0-700 (0-100 for each item, Appendix 6). Correlational analyses were conducted on scores obtained at the main study first testing session between the HADS and the modified HADS. The correlations were .85 ($p < .000$) for the anxiety subscale and .89 ($p < .000$) for the depression subscale. Such strong correlations between the two instruments provide some support that the modified HADS measure is a valid measure of psychological well-being.

Correlations between the modified HADS and MCS subscales

Correlational analyses were conducted between the MCS subscale scores from the SF-36v2 and modified HADS scores for the first testing session before any intervention took place. These were conducted to determine the relationship of the MCS subscales with the HADS which is a widely utilized measure of psychological well-being. There were moderate to strong significant correlations between the HADS scales and all the MCS subscales as would be expected (see Table 8). This provides some support that the MCS is a valid measure of psychological well-being.

Table 8.

Correlations between the Anxiety and Depression HADS Subscales and MCS subscales

HADS	MCS subscales			
	Vitality	Social functioning	Role emotional	Mental health
Anxiety	-.782***	-.610*	-.596*	-.849***
Depression	-.797***	-.651*	-.653*	-.865***

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Changes in psychological well-being, health-related quality of life and physiological status

As with the pilot study, data was compared from the first baseline testing session to the last testing session when the study was completed.

Analyses

In the pilot study, paired t-tests were conducted on all variables to compare changes between the start and end of the research. As there was a larger sample size in the main study, a mixed model ANOVA was conducted in order to assess for any possible interaction effects in the cross-over design that would indicate that the order of the two interventions makes a difference to the overall intervention effects.

Tables 9 and 10 below show the main and interaction effects for psychological well-being, quality of life and physical status from the start to end of the study. As with the pilot study, psychological well-being was assessed by comparing changes in self-report scores on the modified HADS, quality of life by changes across all SF-36v2 subscales, and changes in physiological status by changes in performance on the SWT, blood pressure, heart rate, blood sugar and cholesterol levels.

Psychological well-being and health-related quality of life

Order of intervention effects

The lack of significant interactions (Table 9) indicated that the order of the two interventions made no difference to the overall change in scores from start to end of the study and therefore the main effects could be analysed disregarding the order of intervention.

Main effects

None of the main effect changes were significant (Table 9). However as trends, both anxiety and depression reduced over the course of the research and, in terms of quality of life, there was an improvement for Vitality, Social Functioning, Bodily Pain, Role Physical and General Health. These results suggest possible evidence for changes in the predicted direction.

There was evidence for repeated trends between the pilot study and the main study in that there was a reduction in anxiety and depression, Vitality, Social Functioning, Role Physical and General Health, in both the pilot study and main study.

Table 9.
Means and Standard Deviations, Interaction and Main Effects for Changes in HADS and SF-36v2

Psychological variables	Mean (SD)		Interaction effects		Main effects	
	Start of study	End of study	F	p-value	F	p-value
<i>Modified HADS</i>						
Anxiety	38.83 (11.93)	35.34 (15.14)	0.11	0.75	2.01	0.18
Depression	34.47 (11.85)	33.03 (13.89)	0.05	0.84	0.85	0.38
<i>SF-36v2</i>						
Vitality	47.16 (17.54)	50.00 (18.54)	0.01	0.94	0.57	0.47
Social functioning	64.77 (24.25)	70.45 (22.55)	0.07	0.80	0.81	0.39
Role emotional	78.03 (17.59)	75.00 (29.58)	0.00	0.97	0.19	0.67
Mental health	69.10 (20.23)	65.91 (24.98)	0.34	0.58	0.76	0.41
Physical functioning	87.73 (39.90)	82.27 (14.72)	0.44	0.52	0.34	0.57
Role physical	65.91 (21.72)	71.02 (20.78)	0.03	0.87	0.76	0.41
Bodily pain	65.64 (14.86)	75.81 (17.05)	3.31	0.10	4.76	0.57
General health	57.27 (20.27)	61.72 (22.56)	0.00	0.96	0.68	0.43

Physiological status

Order of intervention effects

The lack of significant interactions (as shown in Table 10) indicated that the order of the two interventions made no difference to the overall change in physiological scores from the start to the end of the study and therefore the main effects could be analysed disregarding the order of intervention.

Main effects

There were two significant changes, one for total cholesterol and one for HDL cholesterol (Table 10). Also changes occurred in the predicted direction for diastolic blood pressure, total cholesterol and blood sugar. In the pilot study changes occurred as predicted for systolic blood pressure, diastolic blood pressure, total cholesterol, HDL cholesterol and TC/HDL cholesterol. These results are not indicative of consistent trends between the pilot study and main study.

Table 10.

Means and Standard Deviations, Interaction and Main Effects for Changes in Physiological Status

Physiological variable	Mean (SD)		Interaction effect		Main effect	
	Start of study	End of study	F	p-value	F	p-value
Systolic blood pressure	116.36 (14.82)	121.36 (16.80)	1.67	0.23	3.39	0.10
Diastolic blood pressure	79.09 (15.42)	74.82 (11.04)	0.42	0.53	2.18	0.17
Heart rate	61.73 (10.82)	67.00 (15.52)	1.15	0.31	4.18	0.71
Total cholesterol	3.85 (1.26)	3.50 (1.29)	0.83	0.39	8.85	0.02
HDL cholesterol	1.24 (0.41)	1.07 (0.42)	1.38	0.27	36.61	0.00
TC/HDL Cholesterol	3.12 (1.09)	3.34 (1.52)	0.07	0.80	0.81	0.39
Blood sugar	5.52 (0.46)	5.36 (0.63)	0.98	0.35	0.57	0.47
SWT	519.09 (194.65)	603.64 (205.54)	0.43	0.53	4.22	0.07

Unlike the pilot study, in the main study there was a significant reduction in total cholesterol over the course of the research ($p=0.018$). There also an improvement in performance on the SWT, and this approached significance ($p = .07$). Against predictions, heart rate, systolic blood

pressure and TC/HDL increased, although these changes were not significant. Unexpectedly, HDL cholesterol also significantly decreased ($p = 0.00$).

Psychological well-being: Social exercise versus individual exercise

All measures were investigated even though there may not have been a significant change from beginning to end of the study (reported earlier) as it is possible one intervention could lead to improvement and another be detrimental with the combined result that there is no overall change across the entire study encompassing both interventions.

Change scores

As with the pilot study, intervention change scores were calculated by subtracting the pre-score before entering an intervention from the post-score after it was completed. The mean change scores for all psychological variables are displayed in Table 11.

Table 11.

Differences in Anxiety, Depression and Quality of Life Scores across the Conditions^a

Psychological variables	Mean (SD)		Interaction effect		Main effect	
	Social exercise intervention	Individual exercise intervention	F	p-value	F	p-value
<i>Modified HADS</i>						
Anxiety	-1.79 (5.50)	2.58 (5.45)	0.58	0.46	4.40	0.65
Depression	-2.16 (8.19)	-1.97 (9.21)	0.37	0.55	0.01	0.92
<i>SF-36v2</i>						
Mental health	-5.91 (7.68)	0.91 (12.00)	1.91	0.20	4.04	0.08
Role emotional	-5.30 (19.82)	0.00 (8.33)	0.00	0.96	0.93	0.36
Vitality	1.14 (11.12)	0.00 (11.52)	1.82	0.21	0.09	0.76
Social functioning	-1.14 (21.25)	0.00 (16.77)	0.01	0.91	0.01	0.91

^a a greater negative HADS change score indicates more improved psychological well-being, whereas a greater positive SF-36v2 change score indicates improved well-being.

Carry-over effects

As with the pilot study, an intervention x order of intervention mixed model ANOVA was conducted to assess for any carry-over effects. A mixed model ANOVA was used for the analyses rather than an alternative analysis with control of covariates (e.g. ANCOVA) due to the small sample size. Results are displayed in Table 11. As in the pilot study, there was no evidence of any significant carry-over effects. Consequently the crossover design could be analysed by comparing the difference between the two interventions for all participants in a repeated measures analysis.

Main effects

The changes that occurred for the two interventions were inconsistent and non-significant. Specifically there were non-significant trends to show greater improvement in anxiety, depression and the vitality subscale for the social exercise intervention. For the other three quality of life subscales, improvements were greater following the individual intervention. In summary there is not enough evidence to indicate preference for either intervention.

Exercise history and personality scales

In order to assess whether exercise history and extraversion scores had an influence on the intervention results, a series of ANCOVAS were planned. ANCOVA can be used to remove the effect of covariates that are correlated with the dependent variables (e.g. extraversion scores might be correlated with anxiety and depression scores) and can potentially increase statistical power in the analysis. However if a covariate is correlated with the independent variable, which normally occurs with a small sample such as in the present study, then the ANCOVA adjustment is not appropriate and can produce “highly questionable conclusions” (Jamieson, 2004, p. 282). With such a small sample size in the current research (i.e. with a final sample size of 11, there was only five or six participants in each group for the ANCOVA analyses), it was proposed that no conclusions could be drawn from the analyses. A small number of exploratory ANCOVAS were conducted to confirm this prediction and as expected, findings were inconclusive with no new findings of relevance being detected.

Participant comments

The researcher asked the participants to comment on how they felt about the interventions, specifically whether they preferred the social exercise or the individual exercise intervention

and why. These comments are shown in Table 12 below. These comments suggested that most participants preferred the social interaction intervention. Also included are some other relevant comments about how participants felt during the study.

Table 12.

Participant Comments about the Study

Participant pseudonym	Comments about study interventions and other relevant information
Sally	Without a doubt preferred the group exercise option and being in the clinic as it was more fun, it was a bigger room with more variety and was good to be chatting with people. I was motivated during the four months but would have given up on exercising in the individual situation which wasn't much fun if it had gone on for longer. Was glad to be back exercising with the group after the individual intervention.
Susan	Preferred the social exercise intervention more than the individual intervention due to the social contact. Discovered I was motivated to exercise by the music playing in the gym next door during the individual intervention.
Mike	Felt a lot less motivated during the individual intervention, and recognized I was more motivated when exercising with others. Especially enjoyed the social interaction during the floor exercises in the baseline and social interaction conditions. I had external stress during the individual intervention that affected my attendance.
Helen	Did not enjoy the individual intervention at all.
Jim	Enjoyed the social exercise intervention more than the individual intervention.
John	Was fine with both interventions and had no preference for one over the other.
Caleb	Enjoyed the social exercise intervention and was more motivated when exercising in a group.
Molly	Really enjoyed the social exercise intervention a lot more and thought it was a great experience. During the last four weeks of the social exercise intervention, I had external stress and think this may have impacted on my results.
Jason	Did not prefer one intervention over the other, just would have liked more variety in floor exercise routines during the individual exercise intervention.
Keith	Was fine with the individual intervention, but think there may have been an order effect. Completed the individual intervention first, and felt that if this had been completed second, I would have missed the social aspect of the group a lot more, as by this stage I had developed a good rapport with a number of people in the clinic.
Wayne	Preferred the social interaction intervention as I enjoy exercising with other people, and kept me more motivated. When exercising on my own, I was not as motivated and did not push myself as much.

Chapter Seven: Discussion

The primary aim of this research was to investigate the effects of a 16 week phase two cardiac rehabilitation programme for improving psychological well-being, quality of life and physiological status in cardiac patients. A secondary aim of the research was to investigate whether a socially interactive exercise programme was more beneficial for improving psychological well-being and quality of life compared to an individual based programme.

A pilot study was conducted in order to assess the effectiveness of the research design and methodology, as well as any other practical issues arising, in preparation for the main study. The pilot study revealed a number of limitations which were addressed in the main study. These included modifying the HADS response scale so it was more sensitive, modifying the individual exercise so it was identical to the other conditions of the research by using a DVD, encouraging more social interaction during the social exercise intervention, including additional questionnaires to assess extraversion/introversion, exercise history, and social desirability reporting bias and incorporating an electronic measuring device for taking blood pressure. However, the main limitation that was highlighted in the pilot study was the small sample size. A power analysis detected that a sample size of ten participants was required in order for the main study to be of sufficient power. In the main study, an effort was made to recruit higher numbers of participants. In the pilot study six participants took part, and in the main study eleven participants took part.

Changes in psychological well-being, health-related quality of life and physiological status

In terms of the changes in psychological status, health related quality of life and physiological status during the 16-week programme, in the pilot study there was a significant reduction in anxiety over the course of the study. While no other changes were significant, there was a trend in the predicted direction in terms of HADS depression scores and for health-related quality of life in terms of all subscales except two (bodily pain and role emotional). In the main study, non-significant trends occurred in the predicted direction for HADS anxiety and depression and for health-related quality of life in terms of vitality, social functioning, role physical, bodily pain and general health. Non-significant but repeated trends were observed between the pilot study and main study for decreases in HADS anxiety and depression as well

as improvements in health-related quality of life for four SF-36 subscales (vitality, social functioning, role physical and general health). Such results suggest there may be some benefits of 16 weeks participation in a phase two exercise programme for improving anxiety and depression and health-related quality of life.

In terms of the physical variables, there were no significant results in the pilot study, although there were changes in the predicted direction for blood pressure (both systolic and diastolic) and cholesterol levels (for total cholesterol, HDL cholesterol and TC/HDL) but not for the SWT, blood sugar or heart rate. Decreased performance on the SWT may be explained in terms of participants incurring injuries during the study. On both occasions the participants were restricted and unable to walk as fast in the test. Secondly the increase in heart rate could have been explained by one participant raising his heart rate by warming up while waiting outside the testing laboratory when he was waiting for the researcher to turn up prior to the last testing session. Had this been a larger sample size, this probably would not have impacted on the results.

In the main study, there was also a significant reduction in total cholesterol across the 16 week programme. Non-significant changes occurred in the predicted direction for diastolic blood pressure but not in the predicted direction for systolic blood pressure or heart rate. As predicted, blood sugar levels decreased over time and performance on the SWT improved. Improvements on the SWT also approached significance ($p=.07$). The differences in performance on the SWT between the pilot study and main study could be explained in that all participants were free of injury throughout the research in the main study and therefore were able to improve their performance. Unlike the pilot study, and against predictions, HDL cholesterol significantly increased and TC/HDL cholesterol decreased. Such results may be partially due to the medication which some participants were prescribed, as some medications are known to reduce cholesterol without distinguishing HDL cholesterol (that is, the medication reduces overall cholesterol, including HDL cholesterol, which ideally should be raised).

These unexpected results could be explained in terms of the inflating alpha effect which occurs when a large number of analyses are conducted (as with the current research). With multiple statistical testing there is an increased probability of type one errors occurring (i.e. getting a significant result when the null hypothesis is actually true). Such an effect can however be controlled for by using an alpha level of 0.01, or some other conservative approach such as the Bonferroni correction. The disadvantage of taking this approach however, is that it can result

in overly conservative tests, which may miss real effects in the population (i.e. a type 2 error). With such a small sample size, as in the current research and pilot study, which do not have a lot of statistical power to begin with, conservative alpha levels like .01 or a Bonferroni correction would be too conservative (i.e. the risk of a type 2 error would be too great) and consequently were not used. However, because a relatively lax alpha level of .05 was used in all statistical tests it is distinctly possible that some significant results that occurred may be type 1 errors. Consequently significant findings found in the current study would need to be investigated further.

Socially interactive versus individual exercise interventions

The pilot study results showed no statistically significant difference in psychological outcomes between the social interaction and the individual interventions of the exercise programme. Unexpectedly, however, participants' comments and feedback highlighted that they preferred the individual exercise intervention. These unexpected preferences may be due to a number of limitations highlighted in the pilot study. For example, it became evident on completion of the study that the amount of social interaction occurring in the individual exercise intervention between the supervisors and participants was greater than anticipated.

In the main study, results demonstrated an opposite trend to the pilot study, in that preference was shown for the social exercise intervention. This may have been due to the change in exercise protocol so it was consistent with the social interaction intervention, with participants following an exercise routine on a DVD that was identical to the cardiac clinic and which was demonstrated by one of the clinic staff or students. Thus there was much less social interaction between the supervisors and participants during the individual intervention in the main study compared to the pilot study (where participants were following exercises as shown to them on a set of exercise cards and often asked the supervisor questions relating to the exercises). In the main study, clinic supervisors were also instructed to try and not engage with the participants too much and only if necessary in the individual intervention.

Changes in anxiety, depression, and health related quality of life across the two interventions were inconsistent and non-significant in the main study. Specifically there were non-significant trends to show greater improvement in anxiety, depression and the vitality subscale for the social exercise intervention. For the other three quality of life subscales, improvements were

greater following the individual intervention. There is not enough quantitative evidence to indicate preference for either intervention.

The interventions may not have appeared effective due to type 2 error. Despite the relatively lax alpha level of .05 used, non significant results nevertheless could still be type 2 errors due to the small sample size. A type 2 error occurs when the null hypothesis is accepted when it is actually false (Runyon, Haber, Pittenger, & Coleman, 1996). That is, in the current study it is possible that the interventions were effective but the sample size was not large enough to detect them; only large effects would be reliably detected.

Consideration also needs to be given to the choice of analytic technique employed. In pre-post designs, ANCOVA can be used to control for individual differences at baseline. However the potential efficiency gains and increased power with ANCOVA are low or absent if the baseline scores are highly correlated with the post-test measurements (Vickers & Altman, 2001). High correlations between pre and post scores did exist in the current study, for example the correlation between the pre and post scores for anxiety was 0.85. Analysis of change scores is considered the reasonable alternative in such situations (Van Breukelen, 2006; Vickers & Altman, 2001).

The 4-week baseline condition was not ideal, as it involved participants attending the main cardiac rehabilitation clinic and having some social interaction by default. Ideally the baseline at the start, and between the two interventions, would have involved no social interaction. However as it stands, the study design actually compared some social interaction (baseline) to more social interaction (social intervention), and may help to explain the lack of social intervention impact. A larger social intervention contrast would have been desirable. Additionally, some participants had some prior exercise history, and ideally would have been entering the programme with no prior exercise of any kind, including individual exercise experience. However, the practicalities of the study meant these issues were unavoidable, and it was difficult to control and gain increased social interaction in the social condition for the study.

Possible explanations for null results

Below are considerations regarding possible reasons for the dominance of non-significant results in the two studies.

Sample issues

As already mentioned, the small sample sizes in both the pilot and main studies may have meant there was not enough statistical power to detect effects. Additionally, it is possible that there may have been some carry-over effects, but a sample size of 12 would not have been large enough to detect this. It is also worth considering the participants who did take part in this study. Many of them had already been in a rehabilitation programme for some time, which may have meant they had already reached a plateau and therefore had no possibility of further change in terms of physical and psychological well-being. Future research would benefit from ensuring all participants were starting their first rehabilitation programme to avoid this possibility. Participants also varied widely in the time since their cardiac event, and a more homogenous group may have been more effective in examining the hypotheses under examination.

Measurement of health-related quality of life

Previous research has also demonstrated few changes across a cardiac rehabilitation programme on SF-36 quality of life subscales. Smith, Taylor and Mitchell (2000) compared four quality of life questionnaires before and following a comprehensive rehabilitation programme over six weeks and found the only significant improvement was for the SF-36 subscale, vitality. Five SF-36 subscales showed moderate sensitivity and the others showed poor sensitivity. According to these researchers, all four questionnaires showed generally good agreement but lacked sensitivity to change and they concluded that “further research is needed using other cardiac populations and interventions in order to verify these findings, with a view to developing more sensitive quality of life measurements” (p. 390). They note that some of the SF36 subscale scores (e.g. bodily pain and social functioning) comprise two questions each, and conclude that “any change in answers from baseline to follow up are more likely to alter scores significantly than a subscale containing more items”. While Smith and colleagues suggested their sample size (16 participants) may have been “insufficient to show a change in the period of the study” (p. 393), this was unlikely, given that it was based on a formal power calculation from the results of a previous study evaluating change in quality of life using a similar population of cardiac patients and a similar intervention. Second, it is possible that the particular intervention evaluated in this study (a six week outpatient programme) was inadequate to bring about improvements in patients quality of life. Again this seems to have been unlikely, given that previous studies have shown improvements in quality of life with rehabilitation programmes of similar duration and content, although some research suggests

that psychological improvements can take longer to occur, such as up to 12 weeks to see any changes. Smith et al. (2000) strongly suggest that the assessment of quality of life in cardiac rehabilitation patients needs further development and work. The current null results with quality of life outcomes may have been due to the insensitivity of the quality of life measures employed.

Dempster and Donnelly (2000) have also raised questions about the sensitivity to change of the SF-36. They note that “as an evaluative tool in the field of ischaemic heart disease, the mental health and general health scales do not appear to be responsive to change, and the role emotional and role physical scales are prone to ceiling effects. These scales may not measure specific changes that a patient with ischaemic heart disease experiences as his/her condition improves or deteriorates. So, results obtained from these four scales should be interpreted with caution” (p. 642). Dempster and Donnelly’s (2000) review argues that some aspects of generic health-related quality of life instruments may not be sensitive or perhaps relevant to the specific problems faced by ischaemic heart disease patients, who have impacts on their lives due to the disease which are not measured by the generic instruments. These authors suggest that “a disease specific measure of HRQoL provides a useful, if not a necessary, addition to the generic instrument” (p. 644).

Length of rehabilitation programme

There is no standard programme length for achieving cardiac rehabilitation goals; however, “physical improvements are generally seen first while mental health recovery occurs later. Some researchers recommend 8 weeks of cardiac rehabilitation, while others recommend 12 weeks or longer” (Aude et al., 2006, p. 57). Research suggests that cardiac rehabilitation programmes vary widely in length, and can be 6, 8, or 12 weeks, and as long as six months. As Aude et al. (2006) note, “physical functioning tends to improve in the first 3 months, while mental health may take as long as 6 months” (p. 60). Most research suggests that it takes a longer time to improve psychological compared to physical well-being, however Hevey and colleagues’ (2003) study demonstrated psychological improvements as early as four weeks into the programme.

Type of rehabilitation programme

It may be that the intensity of the exercise training in the rehabilitation programme was not strong enough to show significant physical gains. Thow (2006) notes that for phase two cardiac rehabilitation, moderate intensity exercise is recommended as it is important for patients

recovering from a cardiac event. Tielemans (2010) describes how a high intensity programme (12- week phase 2 exercise rehabilitation) was responsible for decreasing heart rate, blood pressure, glucose levels and cholesterol: “on average, there is a mean decrease of 10 beats per minute in resting heart rate, a mean decrease of 21mmHg in systolic blood pressure and a mean decrease of 13mmHg in diastolic BP” (Tielemans, 2010, p. 19).

Equipment and assessments

There were some equipment issues during the study. The cholesterol metre lacked sensitivity reading low levels of cholesterol, and there were some difficulties with the reliability of the electronic blood pressure measuring cuff. Additionally, it may have been useful to have asked participants to undertake a practice test for the SWT, as suggested by Fowler et al. (2005).

Modifying the HADS response scale to improve its sensitivity may not have been enough to detect changes in participants’ anxiety and depression across the course of the study. Altering the HADS response scale also meant it was not formally validated. There were also some possible limitations in determining exercise history, as some participants included their exercise rehabilitation at the hospital (and indeed, one participant commented that he was very sedentary before this time). Some participants had also only just started exercising since their cardiac event, and it may have been beneficial to ask participants about their exercise patterns a year prior to their cardiac event.

Future research

Physical inactivity is one of the major risk factors in the secondary prevention of heart disease (Tielemans, 2010) and there is ‘overwhelming evidence’ that physical inactivity is one of the leading causes of “death, health care costs, morbidity, and disease” (Yancey & Sallis, 2009, p. 277). Surprisingly, physical activity and exercise training is often regarded the ‘Cinderella of risk factors’ (Yancey & Sallis, 2009) with many people not completing or even starting their phase two rehabilitation. Research by Doolan-Noble et al. (2004), for example, identified that only 36% of hospitalized patients for cardiac disorders were referred to a phase two programme. Additionally, Baldi and Resnick (2003) acknowledge how a number of people suffering from a cardiac event may have sedentary lives to begin with and hence will be more reluctant to commence an exercise programme. Future research would benefit from focusing on ways of improving commencement of cardiac rehabilitation programmes, especially those that involve physical exercise, and ways of improving adherence to these programmes once they have started. Some research suggests that depression is one of the strongest predictors of non-

completion of cardiac rehabilitation programmes (Turner et al., 2003). Future research might also beneficially explore whether increased social support would prevent the severity of depression and thereby improve adherence to such programmes. There is also a need for ongoing support such as counselling (e.g. the green prescription programme; Elley, Kerse, Arroll, & Robinson, 2003).

The aim of the current study was to investigate whether group based training is more beneficial for cardiac patients than exercising alone. In this way the study sought to examine whether it is the physical exercise training per se, or the social support mechanisms involved in the exercise training, that are having an effect on psychological well-being. Perhaps those without any exercise history may particularly benefit from group-based training. Patients with an established exercise history may be more comfortable exercising on their own, while for those with no exercise history, the social interaction component of group exercise may be essential to provide the guidance and support that will encourage continuation. Cardiac patients who are new to an exercise programme will need more social support (Baldi & Resnick, 2003), and social interaction has been found to be important for those commencing an exercise programme (Worcester & Le Grande, 2008). Such interaction can affect adherence, group cohesion and therefore motivation (see, for example, Ryan, Frederick-Recascino, Lepes, Rubio, & Sheldon, 1997).

There is anecdotal evidence that some patients prefer to exercise in a setting where they are supervised because “they feel reassured by the monitoring and know they are exercising at the level that is beneficial” (Tielemans, 2010, p. 19). These patients know ‘what to do’ but not necessarily ‘how to do it’ and the programme gives these patients the confidence to implement changes. “This is important since some patients, although involved in regular physical activities, are not doing moderate aerobic exercise and therefore not increasing their aerobic and cardiac fitness” (Tielemans, 2010, p. 19). Future research could also usefully explore aspects of the exercise itself. For example, it would be useful to know what sort of emotional well-being components exercise is most strongly related to, and whether this varies by exercise session length and intensity.

Conclusions

There is wide variation in the uptake of cardiac rehabilitation across countries, and most cardiac patients do not receive rehabilitation – it is estimated “that around 70% of the patients who would benefit from cardiac rehabilitation do not receive it” (Thompson & Clark, 2009, p.

1898). There are many reasons for this, including issues to do with transport, convenience, lack of referral, lack of funds, little interest, illness, and family and work obligations (Thompson & Clark, 2009). Patients who do attend cardiac rehabilitation programmes view their condition as controllable, and see the programme as necessary and appropriate. As Thompson and Clark (2009) note, when “determining suitability for rehabilitation, it may be beneficial to assess patients’ beliefs and correct any misconceptions, thus increasing attendance and optimising outcome and recovery” (p. 1898). Physicians are also important for encouraging and supporting patients into a rehabilitation programme. These researchers also state that dislike of groups and hospital based settings can affect uptake: “some patients prefer a home-based programme and community-based cardiac rehabilitation programmes appear to be effective at increasing enrolment, reducing risks and containing costs” (p. 1898). Ideally patients would be offered a choice of place of rehabilitation. Thompson and Clark (2009) note that in order to optimise involvement in cardiac rehabilitation programmes, “alternative modes of programme delivery need to be explored and evaluated to identify what works for whom, when and where” (p. 1899). In the UK, a widely used model is The Heart Manual, which encompasses a home-based programme using written and audio-taped materials. It is six weeks long and supervised by phone, or through home visits, by a trained facilitator, normally a nurse or physiotherapist. A national minimum dataset and an online database were developed in order to assist with patient assessments and their progress on the programme, and this has been endorsed by the British Heart Foundation. The Heart Manual programme has been shown to produce comparable gains to hospital-based CR (Jolly et al., 2007).

The New Zealand Guidelines Group (2002) highlight how psychosocial factors in people with coronary heart disease are related to mortality, readmission to hospital, and recovery. As they note, “major prognostic factors include: anxiety, hostility or depressive states, socio-economic status, social support, connectedness” (p. 46). Patient perceptions about their illness are also important. A person’s belief about the severity, cause, controllability, and the perceived consequences of their illness, is related to anxiety, depression, and non-adherence to recommended treatment regimes and delayed return to activities (see New Zealand Guidelines Group, p. 46 for more details). There are benefits of patient education, counselling, and behavioural techniques for alleviating psychological distress. This is particularly important given the link between depression and further cardiac events (Lesperance et al., 2000). Depression has also been related to non-attendance to regimens (Ziegelstein, 2001) and poor attendance at cardiac rehabilitation programmes (Blumenthal et al., 1999).

Exercise should be an important component of a CR programme and it is unfortunate that adherence numbers to exercise in New Zealand after experiencing a cardiac event are quite low (Doolan-Noble et al., 2004). The present study attempted to explore the benefits of an exercise-based, 16 week cardiac rehabilitation programme on both physical and psychological well-being outcomes. It additionally sought to investigate whether individual or group-based exercise interventions were most beneficial. Unfortunately it was difficult to recruit a large and homogenous group of cardiac rehabilitation patients, and although many of the changes in physical and psychological well-being were in the expected directions, these were suggestive trends only and were not statistically significant. However, they do suggest that it is worth conducting further research in this area. Future research may also beneficially include patients' perceptions and beliefs about their condition, as well as previous exercise history and preference for individual or group-based exercise programmes. Previous research also highlights the importance of support and education for improving outcomes in cardiac rehabilitation patients.

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Appendices

Appendix 1: Information sheet



Does an exercise-based cardiac rehabilitation programme improve physical and emotional well-being?

Information Sheet

Cardiovascular disease is a major health issue in New Zealand, and is on the increase. Regular exercise has been shown to decrease the risk of a heart attack, and is a vital part of cardiac rehabilitation. We would like to invite people who have had a cardiac event and who have completed Phase one rehabilitation to join in a study at the Massey University Phase two Exercise Rehabilitation Programme. The study looks at the effects of group based exercise and individual exercise on your health and well-being, both physically and emotionally.

The Researchers

Venessa Green (BPhed, BSc) is a Masters of Health Science candidate, who will be using the results from the study as the basis of her thesis. Venessa has over 15 years of experience in the health and fitness industry, has been a personal trainer and also an Industry Training Advisor within the New Zealand fitness industry, and has completed a degree in Physical Education from Otago University. Dr Alan Walmsley is a senior lecturer in Biomechanics, and has conducted extensive research into performance, posture and balance with older people, and using Tai Chi as exercise. Dr Antonia Lyons is a senior lecturer in the School of Psychology and has conducted extensive research in the area of health psychology including cardiac health. Ms Wilma Tielemans [RN, MA (Ed)] is a lecturer within the Bachelor of Health Science/Sport & Exercise Science/Nursing programmes, and is a cardiac nurse and researcher.

Why is this study being done?

Previous research has shown that long-term, moderate exercise reduces the risk of hypertension and cardiovascular disease, and is vital in rehabilitation following a cardiac event. Participation in group based exercise has also been found to improve an individual's emotional well-being (e.g. increased feelings of confidence, lowered anxiety

and depression). In New Zealand, 56% of patients who are referred to Phase two cardiac rehabilitation do not attend their rehabilitation classes, putting themselves at risk of another event. There is limited Phase two rehabilitation available in the community for such clients, and many of the hospital-based programmes are not run by trained exercise physiologists. Our research project will monitor the physical and emotional responses during rehabilitation exercise while you are exercising in a group and when you are exercising without any social interaction. We will explore whether you show improvements in your physical and psychological well-being from the start to the end of the programme, as well as when exercising with others versus alone.

Participants needed?

We require volunteers who have had a cardiac event, have completed phase one cardiac rehabilitation and who have been cleared to commence an exercise programme. Potential participants need to have been referred to the Massey University Cardiac Rehabilitation Exercise Programme by their cardiologist. Please note that our Exercise Programme is available to ALL referred patients. You do not have to join this study to be in the Rehabilitation Programme, however you will still need a referral from your cardiologist to take part. If you do not wish to volunteer to be part of this study, you will receive the same exercise programme as those people who have volunteered. We are aiming to get 12 participants to take part in the study. In the normal cardiac rehabilitation group there are approximately 30 people that attend the programme.

What is involved?

You need to be referred by your cardiologist and come to the Exercise Science laboratory for an interview and explanation of the programme. Please bring along a copy of your referral letter when you first arrive at the Massey cardiac rehabilitation centre. You will be asked to complete a medical questionnaire and consent form at the interview, have blood pressure and heart rate readings taken, and perform a short exercise test (during which we monitor how far you can walk in either six or 12 minutes). You will also have your blood sugars and cholesterol levels measured from a finger prick sample and be asked to complete a questionnaire asking about how you are feeling. These assessments and tests are necessary in order for us to assess changes in both your physical status and emotional well-being. All of your assessments will occur before starting the programme and after every four weeks during the programme, and will take about an hour each time. The project involves 16 weeks of moderate aerobic exercise and resistance training in the Exercise Science Centre at Massey University. The sessions are three times per week and last for about 60 minutes (Monday, Wednesday and Friday, between 7am and 8.30am,). Sessions are split into 30 minutes of moderate intensity cycling (on an exercise bike) followed by 30 minutes of light resistance training and stretching.

Blood pressures and heart rate are recorded before and after training, and at five minute intervals during the cycling activity. For 12 weeks of the study you will be exercising with the rest of the cardiac group in the Recreation Centre, and for the other four weeks, you will be exercising individually, in the gym. During this time, you will be required to refrain from any social interaction activities with the rest of the cardiac group (including catch ups and coffee breaks!). All sessions are supervised by qualified exercise physiologists and a cardiac nurse is available during the sessions. Previous research participants have all shown reduced resting heart rates, blood pressure and increased strength and flexibility!

At the end of the 16 week period, you have the choice of leaving the programme OR continuing with it if your cardiologist feels you might benefit from further supervised exercise, such as the Massey University Phase three (low risk) exercise programme.

All your personal medical data will remain confidential. Your exercise programme results will be recorded by the researchers each training session, and will remain confidential. Your overall results will be available to you and your referring cardiologist (with your consent) in the form of a short report on completion of the study. The final results of the research study will be collated, with participants remaining anonymous (i.e. no names will be divulged). A summary of the group results will be available to you and your referring cardiologist. The anonymous group data may be used in published research articles, and may be available to health organisations to improve the quality of community health programmes.

The cost for enrolling in the programme in the Massey Rehabilitation programme is normally \$200 every 12 weeks. This is to cover items like exercise and cardiac equipment. ***If you volunteer for this study the \$200 will be waived.*** At the end of this period you will have the option of continuing in the cardiac programme for the standard price.

What are the potential risks of participating in the programme?

As with all exercise programmes for cardiac patients, there is a small risk that you may experience a cardiac event while participating in the programme. Should this occur, there will be safety measures in place, for example a direct phone line to the ambulance service is close by (in the gym), a cardiac crash trolley with relevant cardiac equipment is available, and a cardiac nurse is in attendance for most of the sessions. The risk of any infection occurring from the blood samples taken is extremely minimal (in fact less than a random finger prick injury). The equipment used to take the blood samples is sterile and the site where the blood sample was taken from will be covered afterwards. Please note all of the above risks exist in the current rehabilitation programme that has been running for over five years, The programme is run by qualified professionals who closely monitor your exercise intensity which is tailored to

your abilities. Taking part in this project will not incur any further risks than the current cardiac programme.

What are the benefits of participating in the programme?

As well as improving your physical health, if the results reveal improvements in your emotional well-being as a result of the exercise programme, it may result in improved cardiac rehabilitation services. To this point in time there have been no studies in New Zealand that have investigated the effects of group based exercise on emotional health in cardiac patients. If the results show that social interaction is important, it may result in the establishment of more specialised group based clinics throughout New Zealand.

What about your information and rights?

If you agree to take part in this study, you are free to withdraw at any time, without having to give a reason. Participation in the study will also be stopped if your cardiologist feels it is not in your best interests to continue. Please remember that you are free to join the normal cardiac programme without participating in the study if you wish.

If you do wish to participate in the study, you also have the right to:

- decline to answer any particular question
- ask any questions at any time during the study
- provide information to the researchers on the understanding that your name will not be used
- be given access to your training results and a summary of the project findings when the study is concluded

We have had great success training previous groups, and we look forward to hearing from you. Please feel free to contact us for further details or any concerns you have. Our contact details are:

Principal investigator:
Venessa Green (Masters student)
ph 0274 465 463
Email : V.Green@massey.ac.nz

Supervisors:
Dr Alan Walmsley
ph 04 801 6749
Email: A.Walmsely@massey.ac.nz

Dr Antonia Lyons
ph 801 2794 extn 62164

Email: A.Lyons@massey.ac.nz

Ms Wilma Tielemans

ph 801 2794 extn 6469

Email : W.Tielemans@massey.ac.nz

1. Committee Approval Statement

If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact a Health and Disabilities Advocate by telephoning,

Free phone: SUPPORT (0800 2787 7678)

Free fax:

Email: advocacy@hdc.org.nz

This project has received ethical approval from the Central Regional Ethics Committee, ethics reference number CEN/09/04/018. If you have any concerns about the conduct of this research, please contact Sally Cook, National Co-ordinator of Ethics Committees, telephone 496-2053, email sally_cook@moh.govt.nz.

2. Compensation for Injury

In the unlikely event of a physical injury as a result of participating in this study, you may be covered by ACC under the Injury Prevention, Rehabilitation, and Compensation Act. ACC cover is not automatic, and your case will need to be assessed by ACC according to the provisions of the Injury Prevention, Rehabilitation and Compensation Act 2001. If your claim is accepted by ACC, you still might not get compensation. This depends on a number of factors, such as whether you are an earner or non-earner. ACC usually provides only partial reimbursement of costs and expenses, and there may be a lump sum compensation payable. There is no cover for mental injury unless it is the result of a physical injury. If you have ACC cover, generally this will affect your right to sue the investigators.

If you have any questions about ACC, contact your nearest ACC office or the investigator..

You are also advised to check whether participation in this study would affect any indemnity cover you have or are considering, such as medical insurance, life insurance and superannuation. If physical injury results from your participation in this study, you should visit a treatment provider to make a claim to ACC as soon as possible. ACC cover and entitlements are not automatic and your claim will be assessed by ACC in accordance with the Injury Prevention, Rehabilitation and Compensation Act 2001. If your claim is accepted, ACC must inform you of your entitlements, and must help you access those entitlements. Entitlements may include, but not be limited to, treatment costs, travel costs for rehabilitation, loss of earnings, and/or lump sum for permanent impairment. Compensation for mental trauma may also be included, but only if this is incurred as a result of physical injury.

If your ACC claim is not accepted you should immediately contact the researcher. The researcher will initiate processes to ensure you receive compensation equivalent to that to which you would have been entitled had ACC accepted your claim.

Appendix 2: Medical history questionnaire



*Massey University Institute of Food, Nutrition & Human Health
College of Sciences*

Massey University Cardiac Rehabilitation Study

Medical History Questionnaire

Name: _____

Address: _____

Phone: () _____ (W) Phone: () _____ (H)

Phone: () _____ (Mob) DOB: _____

M/F (circle) Name of referring Medical Practitioner: _____

Please read the following questions very carefully, and circle which ones apply to you. If you are not sure on any questions, or have difficulty filling in the questionnaire, please ask and/or advise your medical practitioner.

1. Family history. Please indicate if any of your immediate family (parents, brothers, sisters, grandparents) have experienced any of the following. For each, note the age at which diagnosis occurred, and their relationship to you:

- High blood pressure
- High cholesterol
- Stroke
- Diabetes
- Cancer
- Heart attack/disease

2. Personal medical history. Please indicate if you experience any of the following:

- Pain or discomfort in the chest following exercise, eating or exposure to cold.
- Frequent heart palpitations or flutter
- Pain in lower lungs when walking or climbing
- Unusual shortness of breath
- Very poor exercise tolerance
- Frequent dizziness
- Chronic cough
- Frequent colds or flu
- Frequent headaches
- Frequent aches or pains in the joints
- Frequent backache
- Other current symptoms that exercise may effect

Are you presently experiencing, or have you ever been treated by a doctor for any of the following:

3. Allergies such as hay fever, eczema or other rashes?

Yes

No

Details:

4. Lung problems (asthma/emphysema/bronchitis/shortness of breath/other)

Yes

No

Details:

5. Heart problems (rheumatic fever/chest pain/palpitations/ankle swelling/other)

Yes

No

Details:

6. Blood pressure problems

Yes

No

Details:

7. Cholesterol problems

Yes

No

Details:

8. Unexplained weight loss

Yes

No

Details:

9. Abnormal blood loss (vomit/sputum/bowel action/hay fever/urine)

Yes

No

Details:

10. Easy bruising

Yes

No

Details:

11. Endocrine problems (diabetes/thyroid/other)

Yes

No

Details:

12. Fitting, fainting, blackouts, muscle weakness, loss of consciousness, loss of sensation

Yes

No

Details:

13. Headaches

Yes

No

Details:

14. Sight or hearing problems

Yes

No

Details:

15. Nervous conditions

Yes

No

Details:

16. Bone or Joint Injury

Yes

No

Details:

17. Other joint problems

Yes

No

Details:

18. Work related injuries

Yes

No

Details:

19. Medication. Are you taking any medication prescribed by your Doctor or another Health Care Provider? If so, list details such as type of drugs, dosage etc

Yes

No

Details:

20. How often do you take over the counter medications such as aspirin etc?

Daily Occasionally Weekly Never

21. Sleeping patterns. How many hours do you sleep on average per night?

_____ hours

22. Do you ever have trouble falling asleep?

Yes

No

Occasionally

23. Please provide your smoking status

Never smoked

Quit smoking more than 10 years ago

Quit smoking less than 10 years ago

Currently smoke (number of years)_____

24. If currently smoking, how many cigarettes do you smoke per day?

25. Physical activity. How many times per week do you exercise- for at least 20 – 30 minutes?

Do not have a regular program

Once per week

2 – 3 times per week

4 – 5 times per week

more than 5 times per week

26. Alcohol consumption. In the past 2 weeks, on how many days did you consume an alcoholic beverage?

Did not drink in past 6 months

Did not drink in past 2 weeks

1 – 2 days

3 – 4 days

5 – 7 days

8 – 10 days

11 – 14 days

27. In the past 2 weeks how many drinks did you drink ON AVERAGE?

Did not drink in past 6 months

Did not drink in past 2 weeks

1 – 3 drinks per week

4 – 6 drinks per week

7 or more drinks

Thank you for taking the time to fill out this form. If you have any further questions, please do not hesitate to contact Venessa Green, phone 0274 465-463 for more details.

Appendix 3: Informed consent form

Effects of cardiac rehabilitation on physical and emotional well-being

PARTICIPANT CONSENT FORM

This consent form will be held for a period of five (5) years
Indicate your answers to the points below by circling YES or NO

I have read and understood the information sheet dated 9 May 2009, for volunteers taking part in the study designed to investigate physical and emotional well-being following participation in a phase two cardiac rehabilitation programme.	YES / NO
I have had the opportunity to discuss this study and I am satisfied with the answers I have been given.	YES / NO
I have had the opportunity to use whānau support or a friend to help me ask questions and understand the study.	YES / NO
I understand that taking part in this study is voluntary (my choice), that I may withdraw from the study at any time, and this will in no way affect my future health care.	YES / NO
I understand that I can participate in the Massey University cardiac programme whether or not I participate in this study.	YES / NO
I understand that my participation in this study is confidential and that no material that could identify me will be used in any reports on this study.	YES / NO
I have had time to consider whether to take part in the study, and know who to contact if I have any questions about the study in general.	YES / NO
I understand that blood samples will be taken intermittently during the study (using a finger prick method). I understand that I can, at any time, decline to have a blood sample taken.	YES / NO
I understand that, for four weeks during the study while I am exercising 'alone' (i.e. without the rest of the cardiac group), I am required to refrain from interacting with any other members of the group.	YES / NO
I understand that there may be a delay between finishing the study and publishing the results, and that I will receive a report of my results along with a summary of the overall results when the analysis is completed.	YES / NO
I would like the researcher to discuss my results with me on completion of the study	YES / NO
I agree to bring along a copy of the referral letter from my GP or cardiologist so I can participate in the study, and agree to him/her being sent a copy of my results.	YES / NO
I give permission for researchers to inform my GP of my intention to participate in this study.	YES / NO

I, _____ (full name) consent to take part in this study.

Date:	
Signature:	
Full names of researchers:	
Contact phone number for researchers:	
Project explained by:	
Project role:	
Signature:	
Date:	

Appendix 4: Wellington Massey University Cardiac Rehabilitation Clinic forms

CARDIAC CLINIC PATIENT INFORMATION

GP/Consultant/ Next of Kin

Patient's Name.....

Address.....

.....

Date of Birth:.....

Telephone: (home).....(mobile).....

GP's name

Surgery Name.....

Address:.....

Telephone.....

Consultant's name.....

Hospital.....

Department.....

Next of Kin

Name.....

Relationship.....

Telephone (home).....(mobile).....

(please notify the clinic of any change of details)

CARDIAC CLINIC PATIENT CONSENT

INFORMED CONSENT FOR ENTRANCE AND PARTICIPATION IN OUTPATIENT CARDIAC EXERCISE REHABILITATION PROGRAMME

I _____ consent to take part in the Cardiac Exercise Rehabilitation Programme at Massey University. I **will** attend three exercise sessions of up to one hour a week for a period of 16 weeks.

Before starting this programme I **consent** to have a clinical evaluation including a medical history, blood test, and measurements of my heart rate, and blood pressure. An exercise stress test, which includes an electrocardiogram at rest and with effort, will be done. I understand that the purpose of this evaluation is to judge the correct level of exercise for me and to find any condition that would suggest that I should not exercise. After the test, and with the approval of the exercise physiologist/programme manager, an exercise plan will be prepared for me.

I **understand** that the activities are designed to place a gradually increasing workload on my circulatory system, and that my reaction cannot be predicted with complete accuracy. There is a risk that changes may occur during or after exercise. These include changes in blood pressure or heart rate, in some cases "heart attack" and very rarely a chance of death.

I **understand** that I **must** report any pain or distress I feel during or after the exercise session, to the exercise physiologist/exercise trainer.

I **agree** to have appropriately qualified rehabilitation personnel to start any immediate resuscitation measures that she/he feels are needed.

I **understand** the risks and potential benefits of this programme that have been explained to me by the Cardiac Clinic staff and that if I have any further concerns or questions I may contact any of the rehabilitation staff.

I **agree** that information and data collected throughout this programme may be passed onto my GP physician or consultant cardiologist.

Patient _____ Date _____

Witness _____ Date _____



CARDIAC CLINIC PATIENT INFORMATION

Surname..... First Name.....
 Date..... Contact telephone number.....
 Address.....

Date of Birth (dd/mm/yr)..... Male/female

- Choose one of the following:
- European descent
 - Maori
 - Pacific Islander
 - Asian
 - Indian
 - Other

Choose one of the following: married / single / divorced / widowed(r) / cohabitating

Height (cm)..... Mass (kg).....

Waist (cm)..... Hip (cm).....

Do you drink alcohol? Y/N Do you smoke? Y/N

How many units do you drink per week? Circle your choice 0 1-2 2-4 4-6 6-8 8-10 >10

Cardiac Event:

Which cardiac event(s) did you experience?

- | | |
|-------------------------|------------------|
| Heart attack (MI) | Angina |
| Ventricular dysrhythmia | Infection |
| Valvular heart disease | Arteriosclerosis |
| Hypertension | |
| Other (?)..... | |

Have you had more than one cardiac event in the past 5 years? **Y/N**

Were you hospitalized for your last cardiac event ? **Y/N**

Did you undergo a surgical procedure? **Y/N**

If yes, which surgical procedure did you have?

- Coronary bypass
- Stent insertion
- Other (?)

- Triple coronary bypass
- coronary angioplasty

Drug Therapy:

Indicate all the pharmacological drugs you currently take and current dosage:

- Vasodilators (e.g. nitroglycerin, other nitrate drugs)
- Beta blockers for angina (e.g. propranolol)
- Diuretics for hypertension
- Anticoagulants (e.g. warfarin)
- Other (?)

Co-morbidities:

.....

Do you suffer from other health problems? **Y/N**

Indicate which of the following health problems apply to you diabetes / COPD / asthma / digestion problems / arthritis / osteoporosis
skeletal malformity / neural disorders / mental disorders /
other (?)

Staff Use Only:

Measurements:

- ECG Normal Abnormal (describe).....
- Fasting Cholesterol Lipid Profile.....
- Fasting Glucose
- Resting Blood pressure: Seated (1)..... Seated (2).....
(duplicate measures) Standing (1) Standing (2).....
- Resting Heart Rate

Comment

Appendix 5: 2009 Pilot study floor work and resistance exercises

1) Wide Squats – 1 set of 12



INSTRUCTIONS:

1. Begin in a wide stance with toes out at a comfortable angle. Your knees will need to stay aligned with your toes, so don't bring your feet out too far.
2. To add weight you can hold some light dumbbells on the upper thighs, or dumbbells in front at shoulder height.
3. Bend the knees and lower down into a squat, keeping your knees in line with your toes (i.e. don't let your knees collapse in). Push your bottom out slightly as you lower down and keep your abs contracted.
4. Only go down as low as you can without compromising your flexibility or your balance. Keep your chest open and your shoulders back.
5. Push back to start, by pushing down through your heels and without locking the knees as you come up.
6. Remember to maintain your breathing the whole time, by breathing in as you go down and out as you go up

Photo source: www.about.com/exercise

2) One arm rows – 1 set of 10 each side



INSTRUCTIONS:

1. Place the right foot on a step or platform and rest the right hand or forearm on the upper thigh.
2. Hold a light weight in the left hand, tip forward by bending at your hips, keeping the back flat with your shoulders down and back, and your abdominals in
3. Slowly lower the weight down towards the floor until your elbow is nearly straight but not locked out.
4. Bend the elbow and pull it up in a rowing motion until it is level with the torso or just above it.
5. At the top of the movement, squeeze the back while keeping the hips square and the abs engaged.
6. Remember to maintain your breathing the whole time, by breathing in as you let your arm go forward and out as you bring your arm back.

Tips

- Be sure to keep all the movement in the arm and avoid turning at the hips.

Source:

http://exercise.about.com/od/exerciseworkouts/ss/backexercises_5.htm

3) Lunges – 1 set of 10 on each side



INSTRUCTIONS:

1. Begin in a wide stance with your feet facing forward. Your knees will need to stay aligned with your toes, so don't go out too far.
2. To add weight you can hold dumbbells next to the upper thighs, or up at shoulder height
3. Bend your back knee and lower down into a squat, keeping your knees in line with your toes, your abs contracted and back straight. Make sure you don't bend more than 90 degrees.
4. Only go down as low as you can without compromising your flexibility or your balance
5. Push back up through your front heel, without locking the knees as you come up.
6. Remember to maintain your breathing the whole time, by breathing in as you go down and out as you go.

Photo source: www.about.com/exercise

4) Overhead press with dumbbells (one arm at a time) – 1 set of 10 each side



INSTRUCTIONS:

1. Begin standing or sitting on a ball with elbows bent and light weights down by your side.
2. **Using one arm at a time**, raise the weight upwards over your head.
3. At the uppermost part, make sure the elbow is still slightly bent, as shown in the diagram.
4. Lower the weights, bringing it back down by your side and repeat with the other arm.
5. Remember to maintain your breathing the whole time, by breathing out as you lift the weight up and in as you lower it back down

Tips

- Keep the abs engaged and keep your back nice and straight as you press the weights up.
- Try to keep the hands just slightly forward as you press up, rather than going straight overhead, which can contribute to arching the back.

Source:

http://exercise.about.com/od/exerciseworkouts/ss/shoulderexercis_4.htm

5) Modified push ups - 1 set of 8 - 12



INSTRUCTIONS:

1. Start on all fours with hands a bit wider than the shoulders.
2. Walk the knees back a bit in order to lean your weight on the hands and flatten the back from the head down to the back of the knees.
3. Pull the abs in and, keeping back straight, bend the elbows and lower body toward the floor until elbows are at 90-degree angles. If you can't go to 90 degrees that is okay.
4. Remember to maintain your breathing the whole time, by breathing in as you go down and out as you push up.

Tips

- Don't lead with your chin. Keep your head down so that your neck is in alignment with the rest of your body throughout the movement.

Source:

<http://exercise.about.com/od/exerciseworkouts/ss/chestexercises.htm>

6) Alternate arm/leg raises on knees – 1 set of 8 each side

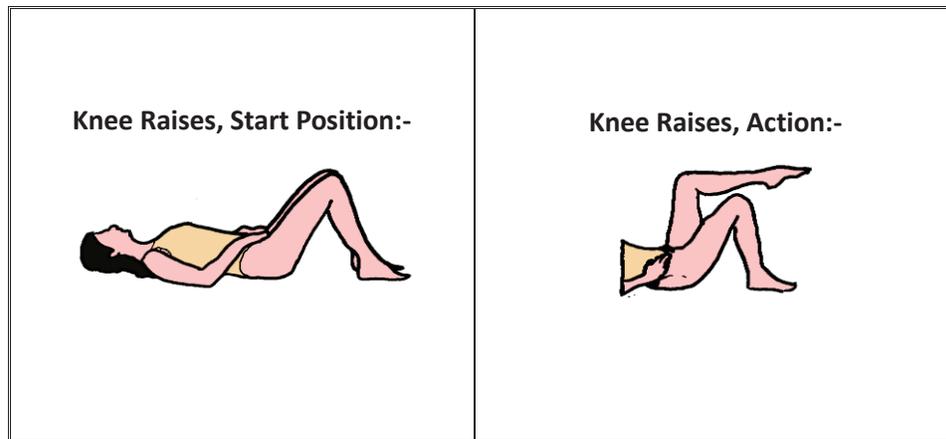


INSTRUCTIONS:

1. Begin on hands and knees, with your hand directly under shoulders
2. Your knees should be under hips with your back straight, and your abdominals tight.
3. Slowly raise right arm and left leg up until level with the body, holding your balance and keeping torso tight. Extend your arm out in front and your leg behind.
4. Hold for a second or two, and then lower back down and repeat on the other side
5. Take your time--this exercise will challenge your balance!
6. Remember to maintain your breathing the whole time!

Photo source: <http://exercise.about.com/cs/abs/l/blbeginnerabs.htm>

**7) Abdominal exercise (alternate knee raises) – 1 set of 10
each side**



INSTRUCTIONS:

1. Lie on your back with your knees bent and feet flat on the floor
2. Find a neutral spine, and maintaining this, breathe in. As you breathe out slowly raise one foot off the floor so your knee is bent to 90 degrees (as shown in diagram).
3. Hold it there for a couple of seconds and then breathe in and lower the leg back to the floor to the starting position.
4. Repeat on the other side.
5. Be sure to maintain your breathing the whole time.

Tips

- Ensure to keep your upper body relaxed the whole time

Photo source: http://www.easyvigour.net.nz/fitness/h_Asst_Knee_Rse.htm

8) Abdominals (alternate arm and leg lowering) –1 set of 8-10 each side (keeping one knee bent with foot flat on floor)



INSTRUCTIONS:

1. Begin by lying on your back, your feet on the floor and your knees bent.
2. Raise your arms upwards so your fingers are facing the ceiling. Keep your shoulders back down on the mat and down your back.
3. Leaving one knee on the ground (**not raised up as shown in diagram**) raise the other knee so it is bent to 90 degrees.
4. Take the opposite arm straight up overhead while you straighten out the uppermost leg so it is nearly straight (as shown in diagram, i.e. opposite arm and legs are straight).
5. Hold this position for a moment, making sure your abs are in tight and your back isn't arching off the floor (if it is, lower the feet to the ground for this exercise).
6. Slowly bring your arm back to vertical and your straight leg back to the floor with the other leg before repeating on the other side.

7. Remember to maintain your breathing the whole time!

Photo source: <http://exercise.about.com/cs/abs/l/blbeginnerabs.htm>

9) Stretches:

Calf stretch



INSTRUCTIONS:

Come on to your hands and knees. Straighten your legs, but keep them slightly bent. Gently press one or both feet towards the floor, keeping back flat and abs in. Continue for 30 seconds – 1 minute. Maintain your breathing the whole time.

Source: <http://exercise.about.com/cs/flexibility/l/blstretch.htm>

Hip flexor stretch



INSTRUCTIONS:

In the lunge position as shown in the diagram, balance on one knee on the floor with the front knee at a 90 degree angle. Gently pull up your lower abs and squeeze your gluts on the back leg. Gently press forward until you feel a stretch in the front of the leg/hip. Hold for 30 seconds. Switch legs.

Source: <http://exercise.about.com/cs/flexibility/l/blstretch.htm>

Hamstring stretch with band or towel



INSTRUCTIONS:

Lie on the floor and loop a resistance band, strap or a towel around the right foot. If you're using a band, you may need to grab onto the band higher up towards the foot to create tension. Straighten the right leg as much as you comfortably can while keeping the left leg bent on the floor. Gently pull the right leg towards you, stretching the back of the leg. Keep your shoulders back and down your back as much as you can. Hold for 15-30 seconds and switch sides. Maintain your breathing the whole time

Source: <http://exercise.about.com/b/2008/03/04/exercise-of-the-week-hamstring-stretch-with-bands.htm>

Spinal twist



INSTRUCTIONS:

Lying on the floor, place right foot on the left knee. Using your left hand, gently pull your right knee towards the floor, twisting your spine and keeping left arm straight out, hips and shoulders on the floor. Hold for 30 seconds. Switch sides. Maintain your breathing the whole time.

Source: <http://exercise.about.com/cs/flexibility/l/blstretch.htm>

Upper chest stretch



INSTRUCTIONS:

Stand in a doorway and place your left forearm on the side of the doorway wall at chest level, elbow bent to 90 degrees. Try to keep your shoulders relaxed and down your back. Slowly turn your body to the right. You should feel a nice stretch all through your chest. Hold for 30 seconds. Switch sides

Source: <http://exercise.about.com/cs/flexibility/l/bltotalstretch.htm>

Appendix 6: Modified HADS scale

MODIFIED HADS SCALE

Read each item below and make a vertical line on the scale (0-100) to show how you have been feeling in the past week. Don't take too long over your replies; your immediate reaction to each item will probably be more accurate than a long, thought out response.

ID	Study Phase
----	-------------

I feel tense or 'wound up'

0				100
Never	Occasionally	Frequently	Always	

I still enjoy the things I used to enjoy

0				100
Not at all	Not as much	Almost as much	Definitely	

I get a sort of frightened feeling as if something awful is going to happen

0				100
Never	Occasionally	Moderately	Definitely	

I can laugh and see the funny side of things

0				100
Never	Not as much	Frequently	Always	

Worrying thoughts go through my mind

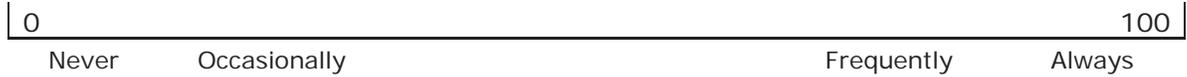
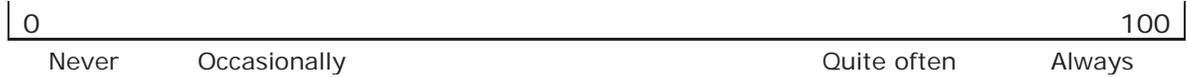
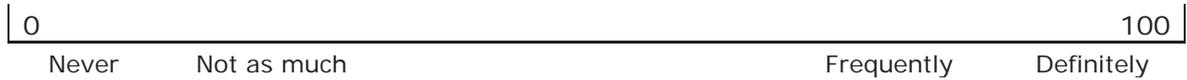
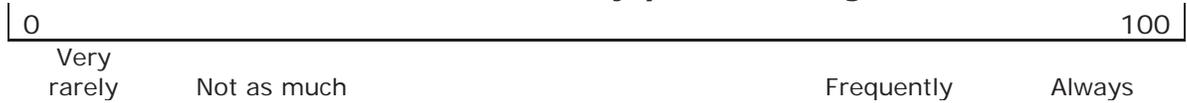
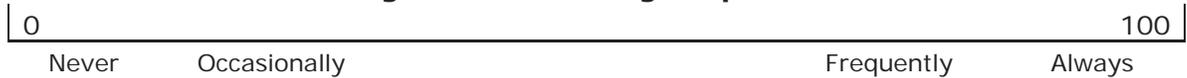
0				100
Not at all	Not as much	Frequently	Always	

I feel cheerful

0				100
Never	Not often	Most of the time	Always	

I can sit at ease or relax

0				100
Never	Occasionally	Frequently	Definitely	

I feel as if I am slowed down**I get a sort of frightened feeling like 'butterflies' in the stomach****I have lost interest in my appearance****I feel restless as if I have to be on the move****I look forward with enjoyment to things****I get sudden feelings of panic****I can enjoy a good book or radio or television programme**

Appendix 7: Auckland Heart Study (AHS) physical activity questionnaire

DateID Number

These questions are about your activities during the last three months. Please circle the correct answer.

1. During the last 3 months, did you engage in any vigorous leisure time activity long enough to make you breathe hard and sweat, at least once per fortnight? (e.g. tennis singles, dancing, jogging, squash, soccer, swimming, aqua-aerobics, exercycle, gym workout etc.)

YES NO

If YES, please record these below:

Sport or recreation	Times per FORTNIGHT	Minutes per time

OFFICE USE			
Code	Times	Min	(Met)

2. During the last 3 months did you engage in any other regular leisure time activity? (Moderate activity, e.g. walking for exercise or pleasure, bush walking, table tennis, golf, bowling, tennis doubles, rebounder, biking etc.) (excluding gardening)

YES NO

Sport or recreation	Times per FORTNIGHT	Minutes per time

OFFICE USE			

3. How many hours do you usually rest and sleep each night? _____ hrs

4. What is your current occupation?

(If household activities only, retired, or beneficiary, go straight to Question 9)

5. How many hours do you work in an average week?
 _____ hours

--

(If more than one occupation, state how many hours at each job)

6. During the last 3 months, did you engage in any vigorous activity at work long enough to make you breathe hard and sweat on a regular basis? (e.g. heavy carpentry, fencing or construction work, physical labour, chopping wood, etc.)

YES NO

If YES, please record these below:

Work activity	Times per FORTNIGHT	Minutes per time

OFFICE USE			

7. During the last 3 months did you engage in any moderate activity at work? (e.g. delivering mail, milking cows, house painting, lifting, carrying light objects, brisk or farm walking etc.)

YES NO

Work activity	Times per FORTNIGHT	Minutes per time

OFFICE USE			

8. How many mins per day would you spend walking to and from work? ____

(e.g. from home, car, bus). And how many days per week?

9. Have you done any (other) brisk walking on a regular basis, (that is at least once per 2 weeks) in the last 3 months? e.g. to or around shops, library, or church?

YES NO

If YES, minutes per day _____ Number of days walked per week _____

OFFICE USE	

10. How many hours did you spend on the following activities in an average week?

Hours	Minutes

Hanging out clothes, light housework

Mopping, vacuuming, cleaning windows or car, moving furniture, clearing out garage, or heavier housework

Gardening, weeding, pruning, lawn-mowing

Home maintenance, light carpentry, painting

Other (specify)

OFFICE USE	
Hrs	Min

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--	--

Code	Hrs	Min

11. Compared with 12 months ago, are you now:

Less active More active The same

OFFICE USE

12. If more or less active, is there any reason?

Appendix 8: Revised Eysenck Personality Questionnaire (EPQR-A)

ID _____

Please read each question carefully and answer yes or no.

- 1 Does your mood go up and down? Y/N
- 2 Are you a talkative person? Y/N
- 3 Would being in debt worry you? Y/N
- 4 Are you rather lively? Y/N
- 5 Were you ever greedy by helping yourself to more than your share of everything? Y/N
- 6 Would you take drugs which may have strange or dangerous effects? Y/N
- 7 Have you ever blamed someone for doing something that you knew was your fault? Y/N
- 8 Do you prefer to go your own way rather than act by the rules? Y/N
- 9 Do you often feel 'fed up'? Y/N
- 10 Have you ever taken anything (even a pin or a button) that belonged to someone else? Y/N
- 11 Would you call yourself a nervous person? Y/N
- 12 Do you think marriage is old-fashioned and should be done away with? Y/N
- 13 Can you easily get some life into a rather dull party? Y/N
- 14 Are you a worrier? Y/N
- 15 Do you tend to keep in the background on social occasions? Y/N
- 16 Does it worry you if you know that there are mistakes in your work? Y/N
- 17 Have you ever cheated at a game? Y/N
- 18 Do you suffer from nerves? Y/N
- 19 Have you ever taken advantage of someone? Y/N
- 20 Are you mostly quiet when you are with other people? Y/N
- 21 Do you often feel lonely? Y/N
- 22 Is it better to follow society's rules rather than go your own way? Y/N
- 23 Do other people think of you as being lively? Y/N
- 24 Do you always practice what you preach? Y/N

EPQR-A: Questionnaire Answers

ID _____

Please read each question carefully and answer yes or no.

ITEM	KEY	SCALE	
1	Y	N	Does your mood go up and down? Y/N
2	Y	E	Are you a talkative person? Y/N
3	N	P	Would being in debt worry you? Y/N
4	Y	E	Are you rather lively? Y/N
5	N	L	Were you ever greedy by helping yourself to more than your share of everything? Y/N
6	Y	P	Would you take drugs which may have strange or dangerous effects? Y/N
7	N	L	Have you ever blamed someone for doing something that you knew was your fault? Y/N
8	Y	P	Do you prefer to go your own way rather than act by the rules? Y/N
9	Y	N	Do you often feel 'fed up'? Y/N
10	N	L	Have you ever taken anything (even a pin or a button) that belonged to someone else? Y/N
11	Y	N	Would you call yourself a nervous person? Y/N
12	Y	P	Do you think marriage is old-fashioned and should be done away with? Y/N
13	Y	E	Can you easily get some life into a rather dull party? Y/N
14	Y	N	Are you a worrier? Y/N
15	N	E	Do you tend to keep in the background on social occasions? Y/N
16	N	P	Does it worry you if you know that there are mistakes in your work? Y/N
17	N	L	Have you ever cheated at a game? Y/N
18	Y	N	Do you suffer from nerves? Y/N
19	N	L	Have you ever taken advantage of someone? Y/N
20	N	E	Are you mostly quiet when you are with other people? Y/N
21	Y	N	Do you often feel lonely? Y/N
22	N	P	Is it better to follow society's rules rather than go your own way? Y/N
23	Y	E	Do other people think of you as being lively? Y/N
24	Y	L	Do you always practice what you preach? Y/N

N = neuritis

P = psychotism

L = lie

E = extraversion

Appendix 9: Written instructions regarding social interaction

GROUP AND SOCIAL INTERACTION INTERVENTION

During the next four weeks you will be in the cardiac clinic as per the previous four weeks, but during this phase you are encouraged to increase your social interaction. For example increased talking with the exercise physiologists and other cardiac members. You are welcome to also form a 'buddy system' with one or more cardiac clients during this time.

As with the other phases of the study, you are encouraged to maintain consistency with your normal exercise behaviour, for example, if you normally walk twice a week with a friend, try to maintain this same behaviour throughout the entire study.

Any questions, don't hesitate to contact me – v.green@massey.ac.nz or 0274 465 463

Happy training! 😊

Appendix 10: Participant attendance details

Participant pseudonym	Attendance: Weeks to complete and comments	Social intervention attendance (out of 11 sessions)	Individual intervention attendance (out of 11 sessions)
Sally	16	8	10
Susan	18 : Two weeks off after first baseline	8	10
Mike	18: Two weeks off after second baseline	9	5
Helen	18: Two weeks off a week into second baseline; repeated second baseline	9	8
Jim	29: Two months off after second baseline; on coming back to the study repeated second baseline	7	7
John	16	9	7
Caleb	20: Four weeks off after first intervention	7	6
Molly	16	10	11
Jason	23: Four weeks off a week into second baseline; repeated three weeks of second baseline	9	
Keith	16	9	11
Wayne	16	10	10

Appendix 11: Exercise history for participants as an average per week

Participant pseudonym	Type of exercise	Minutes	Total minutes	Energy expended (METS)	Total energy expended (METS)
Sally	Walking hills	170	480	1020	3375
	Moderate walking	175		1050	
	Swimming	45		360	
	Walking to and from work	90		945	
Susan	Pilates	60	270	270	1035
	Walking easy-moderate and walking return to work	210		765	
Mike	Golf	420	480	1890	2100
	Walking	60		210	
Helen	Hill walking	105	205	420	770
	Walking easy to moderate	100		350	
Jim	Walking the dog	290	490	1015	1715
	Walking to work	200		700	
John	Running/walking	250	360	2177.5	2702.50
	Farm walking	50		350	
	Walking to work	60		175	
Caleb	Bush walking	262	382	757.50	1417.50
	Rehabilitation	120		660	
Molly	Walking to work	300	300	210	210
Jason	Walking	110	425	850	2185
	Biking	60		300	
	Gym work	120		240	
	Walking to work	75		525	
	Rehabilitation	60		270	
Keith	Walking	412	457	1915	2162
	Gym work	45		247.50	
Wayne	Rehabilitation	60	254	330	869
	Cycling (stationary)	30		165	
	Walking	164		374	