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Adventures in the Land of Diagnosis:
Exploring the Psychological Implications of Positive and Negative Diagnosis Following Advanced Cardiac Testing Procedures

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A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Health Psychology

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ABSTRACT

Advanced cardiac testing procedures such as conventional coronary angiography and coronary CT angiography offer precise diagnostic methods for investigating the presence of underlying ischaemic heart disease. As such, these tests can have important consequences for patients undergoing them, as definitive results can lead to treatment for underlying disease, on the one hand, and the provision of reassurance that symptoms are not of cardiac origin on the other. The amount of psychological research in this area does not, however, reflect the frequency with which these tests are utilised in medicine. Three studies were conducted into the psychological implications of diagnosis in the context of these cardiac imaging tests. The first study tested the efficacy of a brief pre-testing intervention aimed at enhancing reassurance among non-acute chest pain patients referred for diagnostic coronary angiography. Previously shown to be effective in another cardiac testing environment, the intervention involved the administration (plus discussion) of preparatory information regarding the implications of receiving normal cardiac test results. Although the results failed to show any differences in reassurance levels between the intervention group and treatment-as-usual controls, the study nonetheless raised considerations around the practicability of conducting interventions in angiogram settings and among patients with noncardiac chest pain. Supplementary analysis found that patients with lower levels of reassurance were more likely to have higher trait anxiety and more negative illness perceptions, with illness identity being the most important. The second study explored the psychological impact of diagnostic test results from a coronary CT angiogram with respect to two particular domains: (1) effects on patients’ illness perceptions and (2) effects on health behaviour intentions and subsequent health behaviours. Study results were dependent on the diagnosis itself, with negative-testing patients reporting post-testing decreases in illness perceptions (e.g., concern, consequences and emotion) in comparison to positive-testing patients, who showed no change on these
variables. Conversely, only positive-testing patients showed increases in intentions to take cardiac medication as well as intentions to exercise following testing, which was backed up by increased physical activity at 6-week follow-up. These findings show that, first, patients cognitively prepare themselves for an unfavourable diagnosis and, second, coronary CT angiography has a positive effect on engagement in health-protective behaviours. Other findings showed that both groups reported a higher level of illness coherence following testing and that control beliefs were dependent on testing also, with positive-testing patients scoring higher on treatment control beliefs and negative-testing patients demonstrating stronger beliefs in personal control over their illness. The third study was a qualitative investigation into patients’ impressions of and reactions to coronary CT angiography. Pre-diagnostic interviews revealed that patients had expectations of gaining knowledge and understanding from testing and that testing was the sine qua non for taking cardiac medication. Post-diagnostic interviews revealed themes relating to patients’ generally positive reactions to testing and their appreciation of seeing their heart images, which helped in their heart-related understanding. Additionally, patients communicated increased motivation to maintain or increase heart-healthy behaviours following testing. Taken together, the results of all three studies raise points of discussion relating to the search for more effective means of enhancing reassurance, the delineation of the effects testing can have on patients’ illness appraisals and health behaviour, and the beneficial aspects of using patients’ scan images to facilitate the post-diagnostic consultation. The work of this thesis therefore extends current understanding of the psychological implications of cardiac diagnosis, provides direction for further research in this area, and offers guidance for future clinical practice.
For Mum and Dad
ACKNOWLEDGEMENTS

There are many people who have helped to make this PhD possible and whom I would like to take this opportunity to thank. I would like to acknowledge, first and foremost, Professor Keith Petrie for his guidance and support throughout the entire process of my doctoral research. It has been a privilege to have worked alongside a scholar who is held in such high esteem in the field of health psychology and who has managed to make this whole process an enjoyable, challenging, and rewarding experience. Cheers KP!

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SECTION I

§

INTRODUCTION
CHAPTER ONE

MEDICAL TESTING IN CARDIAC SETTINGS

Medical testing is a large component of clinical practice. Within cardiology, a wide range of medical tests is available to help guide diagnosis and inform medical intervention. It follows that undergoing medical testing can be a significant event for patients, as within a short space of time the presence of disease or illness can be verified or dismissed and worry reinforced or allayed. Research on the psychological effects of cardiac testing is thus an important endeavour that deserves not to be overlooked.

Psychological responses to medical testing can be categorised into two distinct areas: (1) responses to a positive diagnosis, where cardiac disease is diagnosed, perhaps in situations where no disease may have been suspected; and (2) responses to a negative diagnosis, where no evidence of cardiac disease is found, even though symptoms suggestive of cardiac pathology may be present. This chapter looks at defining medical testing and the tests used in cardiology, particularly conventional coronary angiography and computed tomography angiography. As this thesis is an exploration of psychological aspects of medical testing, the chapter ends with a brief overview of the ways in which medical testing can have a psychological impact on patients.

Defining Medical Testing

A medical test is a procedure that is carried out in order to verify or refute the presence of disease in a patient. Within the clinical context, medical tests are used as part of an overall diagnostic procedure, typically for patients experiencing symptoms suggestive of a particular disease or illness. Such symptoms may spark specific concerns for the patient or doctor, and the diagnostic procedure consequently may be performed to either justify medical intervention on the one hand or dispel the concerns on the other.
Medical tests can carry with them risks of undergoing the procedure itself. For example, significantly higher radiation levels are associated with computed tomography in comparison to other X-ray imaging tests, and this has prompted concern over the potential risk of patients developing associated malignancy (Semelka, Armao, Elias, & Huda, 2007). Cardiac catheterisation also carries with it radiation risks as well as the risk of cardiac events caused by dislodging atherosclerotic plaques during the procedure (Cuddy, Robertson, Cross, & Isles, 2005), although mortality rates related to the procedure are extremely low (Ugalde et al., 2007). Naturally, weighing up the ostensible risks and benefits of undergoing a medical test is part of the decision-making process for physicians when considering proceeding with a test to aid diagnosis. As well as physiological risks, medical tests also bring with them the potential risk of psychological harm. Most contentious are the so-called iatrogenic complications that can result in exacerbating psychological illness in certain patient populations. This issue will be revisited in a later chapter.

Referrals for cardiac testing can be for a wide range of cardiac pathologies, which run the gamut from cardiac arrhythmia through to heart valve issues and congenital disorders. A majority of tests, however, are used to diagnose the presence of underlying cardiovascular disease, particularly ischaemic heart disease.

**Ischaemic Heart Disease**

Cardiovascular disease, a significantly serious worldwide health problem, accounts for around 30% of all worldwide annual deaths (World Health Organization, 2003) and up to 40% of deaths in developed countries including New Zealand (Hay, 2004; Kochanek, Murphy, Anderson, & Scott, 2004). The lion’s share of cardiovascular diseases is constituted by ischaemic heart disease (IHD). According to worldwide mortality figures, IHD accounts for around half of all cardiovascular deaths and is particularly problematic in developed
countries such as the United States (Kochanek et al., 2004), the United Kingdom (Petersen, Peto, & Rayner, 2004) and New Zealand (Hay, 2004).

Pathogenesis

IHD is associated with progressive narrowing of the main arteries that supply the heart with oxygen and nutrients. These main coronary arteries—the left circumflex artery, the left anterior descending artery, and the right coronary artery—stem directly from the aorta and divide into many smaller coronary vessels that ensure sufficient coverage of the heart tissue (myocardium). Occlusion of any of the major coronary vessels, therefore, can have serious consequences ‘downstream’ for the function of the myocardium.

Atherosclerosis—the deposit of fat and cholesterol plaques within the walls of the coronary arteries—is the primary cause of IHD (Underwood, 2000). Over time, as atherosclerotic plaques accumulate, abnormal narrowing (stenosis) of the coronary vessels becomes more pronounced, and this can eventually lead to deleterious pathophysiological effects. The lack of blood flow (ischaemia) to cardiac tissue due to constriction of the lumen of blood vessels results in the heart being effectively starved of oxygen. Consequently, excessive pressure demands are placed upon cardiac tissue. When ischaemia is severe enough, it culminates in damage to the myocardium and cell death (necrosis) downstream from the occlusion. This is termed as a myocardial infarction (MI).

There are a variety of risk factors associated with atherosclerosis, some of which are unmodifiable—for example, gender (males are at greater risk), heredity (higher risk when there is a family history of premature IHD for men younger than 55 and women younger than 65) and age (risk increases with age). However, modifiable behavioural factors feature prominently as well. Three major modifiable risk factors that lead to atherosclerosis are smoking, poor diet, and sedentary lifestyle (Blane et al., 1996). Some of the most prominent
clinical risk factors are also modifiable, with many having behavioural components: high blood pressure (hypertension), high serum cholesterol (and low HDL cholesterol), diabetes, obesity and stress can be influenced by lifestyle along with genetic factors.

**Symptomatology—Chest Pain**

IHD is a silent killer: symptoms may not be present with underlying pathology until reasonably advanced stages of the disease process. The primary symptom of IHD, however, is angina pectoris—chest pain that is caused by oxygen deficiency in the myocardium. Angina has specific features that can help alert to the presence of IHD. These include: pain during physical stress which is relieved by rest; referred pain (usually on the left side) that radiates proximally from the jaw and neck down through the arm towards the hand; laboured breathing; nausea; and changes in electrocardiogram wave patterns (Klein, 1984).

The presence of angina is an indication of ischaemia. If ischaemia is severe enough, however, chest pain may also indicate a myocardial infarction (MI). Symptoms of an MI are much the same as angina symptoms. However, because cell death is involved, clinical diagnosis of an MI involves measuring fluctuations of biochemical markers and the observation of ECG wave patterns that are indicative of myocardial necrosis (Alpert, Thygesen, Antman, & Bassand, 2000). The presence of angina-like symptoms is treated with high priority, and in clinical settings testing is undertaken post-haste in order to investigate the primary cause of the chest pain.

**Ischaemic Heart Disease and Cardiac Testing**

A number of tests are utilised to help diagnose ischaemic heart disease. Patients experiencing chest pain may present to an emergency department or to their doctor for assessment of their chest pain or other symptoms. From this point onwards, diagnostic
protocols can be applied and integrated to help stratify patients in relation to their risk of cardiac ischaemic events (Braunwald et al., 2000).

The standard approach to patient evaluation includes an initial medical examination as well as relevant history taking. History taking can incorporate assessment of pain characteristics, such as time of onset and symptom duration, as well as examination of vital signs and cardiovascular status (Lee & Goldman, 2000). Following this, further diagnostic testing may be required to better understand the situation. This may include blood tests to measure particular biochemical markers such as creatine kinase MB isoenzyme and troponins, which are specific blood enzymes that indicate myocardial damage. Other tests may also be ordered to help evaluate the clinical status of the patient. These include electrocardiogram testing and exercise tolerance testing.

An electrocardiogram (ECG) graphs the electrical activity of the heart over a period of time and is considered the most important test for aiding initial analysis of chest pain (Lee & Cannon, 2005). The readings on the ECG graph reflect electrical impulses from the sinoatrial node, the heart’s pacemaker, that travel through the heart muscle. These impulses can be detected on the skin through electrodes placed on the arms, legs and various points across the chest. This creates a unique waveform that can be analysed to infer pathologies associated with the heart such as irregularity of the heart rhythm (arrhythmia), coronary ischaemia, or myocardial infarction.

An exercise tolerance test (ETT), or treadmill test—as it is usually performed on a specially designed exercise treadmill—may also be ordered by the doctor to further investigate the source of a patient’s chest pain. The treadmill test is a useful diagnostic tool, and evidence indicates that early testing provides reliable prognostic information for low-risk patient populations (Lee & Cannon, 2005). For the procedure, patients are connected to an ECG machine and begin to walk on the treadmill. The level of exercise is increased in 3-
minute stages, both in terms of treadmill incline and walking speed, creating progressively more work for the heart. The test works on the principle that as physical exertion increases, the need for blood flow through the coronary vessels also increases, and any undue strain on the heart due to vessel narrowing should result in significant ECG changes. The patient’s ECG readings, along with blood pressure, heart rate and symptoms, are monitored carefully throughout the progression of the test, and results can provide insight into the cause of chest pain symptoms.

Patients with positive or inconclusive exercise stress test results, despite ongoing chest pain, may be referred for angiography. An angiogram is an imaging study that views the major arteries of the heart for the purpose of determining any vessel stenosis (narrowing) or other disease due to atherosclerosis. Angiograms may be either conventional catheter angiograms or computed tomography angiograms. Table 1 compares and contrasts the two angiography testing procedures.

Table 1. Features of Conventional Coronary Angiography Versus Computed Tomography Angiography

<table>
<thead>
<tr>
<th></th>
<th>Conventional Coronary Angiography</th>
<th>Computed Tomography Angiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic purpose</td>
<td>Shows the distribution and severity of coronary artery narrowing (stenosis)</td>
<td>Investigates the presence of coronary artery disease (atherosclerosis)</td>
</tr>
<tr>
<td>Attendance time for patient</td>
<td>6-9 hours</td>
<td>1-2 hours</td>
</tr>
<tr>
<td>Invasive</td>
<td>Yes (minimally invasive)</td>
<td>No</td>
</tr>
<tr>
<td>Contrast dye used</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>X-ray used</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Simultaneous intervention possible</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Conventional coronary angiography (Cardiac Catheterisation)

Conventional coronary angiography is an imaging technique that uses X-rays to create two-dimensional images of the heart and vessels. Regarded as the gold standard for diagnosing ischaemic heart disease (Scanlon et al., 1999), coronary angiography provides a detailed outline and representation of coronary vasculature. A large number of conventional coronary angiograms are carried out worldwide, with over a million conducted annually by cardiologists in the US alone (Achenbach & Daniel, 2001). In New Zealand, coronary angiograms are typically conducted in public hospitals where catheterisation laboratories and adequate resources are available.

Coronary angiography is considered a minimally invasive procedure, as it involves the insertion of a catheter into the femoral artery by way of an incision in the groin. The catheter is then moved up through the aorta and into each of the major coronary arteries. Once the catheter is in place, contrast dye is injected into the lumen of the vessels and X-ray images of the coronary arteries are then taken. The resultant X-ray images provide a real-time anatomical map of the distribution and severity of atherosclerotic lesions, and the attending cardiologist and technical staff can effectively assess the severity of lumen narrowing in any of the main coronary arteries.

A day’s stay in hospital is usually required for a coronary angiogram. Patients arrive at least an hour before the procedure in order to give sufficient time for preparation, which includes the administration of a local anaesthetic and monitoring. Patients are then taken to the catheterisation laboratory, where they undergo their angiogram. The procedure typically takes around 30-45 minutes. Throughout the procedure, the patient is able to view the angiogram images, and it is possible to interact with the cardiologist and other medical staff while the images are being taken (see Figure 1). After the angiogram, patients are taken back
to the ward, where they remain for at least another 5 hours before being discharged. A follow-up clinic session is scheduled, usually around a month after the angiogram.

Figure 1. Conventional coronary angiography at Auckland Hospital.

One of the major functions of a coronary angiogram is to assess the level of atherosclerotic disease in the coronary arteries. Patients are referred for coronary angiography for a variety of reasons, ranging from the examination of the severity of suspected stenosis to the investigation of coronary vasculature as a precautionary measure prior to other surgery. For patients with undiagnosed chest pain, undergoing a coronary angiogram can shed light on the cause of their symptoms, and ischaemic heart disease can often be ruled out or confirmed simply by viewing the images from the test. The information from an angiogram can thus be used to guide decision-making regarding the type of intervention required, some of which may be applied during the angiogram procedure (e.g., angioplasty and stenting).
Atherosclerotic lesions show up on the angiogram as hazy areas, with significant disease appearing as clearly defined narrowing of the coronary vasculature (see Figure 2). As such, patients are able to gain a clear visual representation of either the healthy nature of their heart or any disease processes that may be operating in relation to their chest pain. At present, conventional coronary angiography images are the ideal test for identifying the severity of established lumen narrowing due to advanced atherosclerosis, but new developments in CT technology mean that CT angiography has arguably become equally feasible in cardiac diagnosis (Hlatky & Sanders, 2006).

Figure 2. Conventional coronary angiogram image (arrow shows artery narrowing).

**Coronary Computed Tomography (CT) Angiography**

Coronary CT angiography is a coronary vessel imaging technique that is carried out using computed tomography (CT) technology. CT technology has been used in other areas of
medicine, such as neurology and nephrology, but more recently it has been applied to cardiology as a highly accurate cardiac test for artery disease, with relatively high diagnostic accuracy in comparison to conventional coronary angiography (Amsterdam & Caputo, 2008). Cardiac settings in which CT angiography has been applied include: emergency departments, specifically among low-risk patients presenting with chest pain; in patients with inconclusive cardiac test results; and in preoperative evaluation (Raff & Goldstein, 2007). The use of CT angiography in New Zealand is a relatively recent development and is currently available primarily through private cardiology clinics, although the technology is likely to become available in the public sector in the not-too-distant future as testing demand increases.

CT angiography is considered a non-invasive diagnostic test, as it only requires the insertion of a small needle in a peripheral vein—typically in the arm—in order to administer a contrast agent, as opposed to conventional coronary angiography, which requires the insertion of a catheter into the aorta. Once the contrast media is administered, a series of X-ray views are taken from a variety of angles and are combined to produce detailed images of the heart. The most advanced multislice CT scanners can produce highly detailed cross-sectional images of the heart, much like a loaf of sliced bread, allowing for additional investigation of its structure and extensive evaluation of coronary stenosis and lesions (Siegel & Birnbaum, 2007). Radiation doses are reasonably low, although they can be three times higher than conventional angiography (Coles et al., 2006).

CT angiography requires a shorter testing time period than conventional coronary angiography. At a typical clinic, patients arrive at least 30 minutes before their scan and are given medication to slow their heart rate down. Once their heart rate is at the appropriate level, patients are taken to the CT room (see Figure 3) where they lie supine on a scanning table. Contrast die is then injected into a vein in the arm and patients are instructed to hold their breath, at which point the scanning table moves through the ‘doughnut’ part of the CT scanner and images are taken. The scanning procedure itself takes around 3-5 minutes.
Following scanning, patients remain at the clinic for a further 30-60 minutes for post-test monitoring. In order to give enough time for data processing and review of the CT images, results of the test are given at follow-up clinic around 3 weeks later.

Figure 3. CT angiography machine at The Auckland Heart Group clinic.

As with conventional coronary angiography, the purpose of a coronary CT angiogram is to assess the level of atherosclerotic disease in the coronary arteries. However, the test has particular usefulness during the early phases of ischaemic heart disease. Here, imaging is used to determine the build-up of calcium deposits in the coronary arteries among patients at risk of heart disease. In terms of clinical utility, the test is particularly useful for asymptomatic patients who have three or more cardiac risk factors present (Moser, O'Keefe, Bateman, & McGhie, 2003). Such patients may present with no definite symptomatology, but may be at risk of coronary artery calcification due to lifestyle or genetic factors. CT angiography testing at this time point, therefore, may enable early detection and diagnosis of ischaemic heart disease even before telling signs and symptoms manifest.
CT angiography can produce clearly defined images indicating early disease (see Figure 4). Calcium deposits are plainly visible and provide a tangible visible representation of the disease process (see Figure 5). In comparison to other cardiac diagnostic tests, where interpretation of results requires a certain degree of medical knowledge or training in order to understand their significance (e.g., ECG tracings or cholesterol level reading), the nature of CT testing images is arguably more conducive towards ease of interpretation by patients. In this context, CT angiogram images could be used to promote change of unhealthy heart behaviour for patients at risk of IHD who do not present with any cardiac symptoms, as seeing images that clearly show disease in a tangible manner may encourage patients’ motivation towards behaviour change.

Figure 4. Image of the heart taken from a CT angiogram.
The Psychology of Medical Testing and Diagnosis

Undergoing a medical test can be a potentially significant experience for patients. Even from a brief outline of angiography testing methods, it is clear to see that there are many psychological issues that patients may face during testing. However, research has shown that even waiting for a diagnostic test may have a negative impact on patients’ psychological health. An Australian study, for example, conducted in a hospital angiogram clinic indicated that many patients experience anxiety prior to testing (Gallagher, Trotter, & Donoghue, 2010). Similar findings were also reported by De Jong-Watt and Arthur (2004), who showed that patients awaiting coronary angiography experience significant increases in anxiety as well as decreases in health-related quality of life up to 1 week before testing. The invasive nature of conventional coronary angiography may contribute to high levels of anxiety prior to
testing, as patients tend to be more concerned about undergoing conventional coronary angiography in comparison to the less-invasive CT angiography testing procedure (Schönenberger et al., 2007).

Patients appear to bring with them certain expectations relating to the medical testing procedure. This was shown by Kravitz and Callahan (2000) in a large qualitative study of internal medicine patients, where it was identified that patients recognise pragmatic and symbolic dimensions to medical testing. So-called pragmatic elements of medical testing include providing diagnosis as well as disease prevention, management and monitoring. Conversely, symbolic elements are related more to patients’ values, wherein they provide a foundation for making inferences about their health care. Medical testing may thus symbolically validate patients’ concerns, help to provide specific reassurance, and enhance the patient–doctor relationship. When patients communicate disappointment at not receiving tests, claim Kravitz and Callahan, they may in fact be expressing concerns relating to these symbolic aspects of medical testing.

Patients may also experience fear around a medical testing procedure, particularly for a test such as conventional coronary angiography, which involves a degree of invasiveness and potential pain. Heikkilä, Paunonen, Virtanen, and Laippala (1998), using visual analogue questionnaire items, investigated the fears of patients undergoing an angiogram and found that over 80% reported fear related to the testing procedure. Exploring the topic further in a later study, the Finnish research group investigated the nature of the generalised fear associated with the procedure (Heikkilä, Paunonen, Laippala, & Virtanen, 1999). The study unveiled a dynamic and complex picture: high-intensity fears such as those related to illness uncertainty, fear of further cardiac intervention (e.g., coronary artery bypass grafting and angioplasty) and fear of pain significantly decreased after testing; less obvious fears, such as fear of lying flat in bed after the procedure and fear of not receiving social support, however, significantly increased.
Age-related and gender-related differences concerning fear of pain seem to be present among patients undergoing coronary angiography, as patients who are younger and female are more likely to report fear of pain (Heikkilä, Paunonen, Virtanen, & Laippala, 1999). This fear is perhaps well founded for conventional coronary angiography, as it has been shown that significantly more patients experience pain in conventional coronary angiography over CT angiography, and among those that experienced pain, conventional coronary angiography was rated as being significantly more painful (Schönenberger et al., 2007). Taken together, however, these studies have implications for assessment and management of anxiety and pain in cardiac testing situations, as interventions may help patients to manage their anxiety more effectively.

It has been argued, in a study of chronic back pain patients’ experience of testing (Rhodes, McPhillips-Tangum, Markham, & Klenk, 1999), that diagnostic testing can play an important part in the legitimization of pain for patients. The study revealed a desire of patients for the testing process to provide an element of reality to their pain. This perhaps reflects, as Rhodes and colleagues (1999) have noted, cultural assumptions that regard seeing into the body as central to the confirmation and normalisation of symptoms. In other words, medical tests may indeed play a role in objectively verifying subjective symptom experience. In this respect, a medical testing image can provide the basis from which a process of healing can take place (Good, 1994).

Some research has examined the change in illness beliefs following a diagnostic label. One particular study of patients with suspected multiple sclerosis (O’Connor, Detsky, Tansey, & Kucharczyk, 1994) examined the relationship between health perception change and diagnostic testing using MRI and CT scanning. The results showed that patients diagnosed with multiple sclerosis reported a decrease in uncertainty over their condition as well as a significant worsening of both perceived current health status and future health outlook. In addition, all diagnostic outcome groups, whatever the test outcome, reported decreases in both
anxiety and distress over symptoms. A study involving a similar study population—patients with suspected multiple sclerosis—also showed that it may not be so clear cut for all symptoms (Mushlin, Mooney, Grow, & Phelps, 1994). Here, anxiety decreased following a positive diagnosis and increased for those for whom no clear diagnosis was given. The researchers noted that the reason for this effect might have been because the clinicians portrayed the diagnosis in a positive way. It is possible, then, that the reason for the rise in anxiety following no clear diagnosis may relate to the way in which the test results were framed, despite the fact that to all intents and purposes it was a favourable diagnostic outcome.

A more recent study compared changes in cognitive and emotional illness perceptions among patients undergoing a diagnostic coronary angiogram (Devcich, Ellis, Gamble, & Petrie, 2008). The Brief IPQ (Broadbent, Petrie, Main, & Weinman, 2006), a questionnaire developed to give a quick measurement of illness perceptions, was administered to patients \(N = 57\) before and immediately following their angiogram. Results showed that patients who received normal results reported a significant reduction in how much their illness affected them emotionally; patients receiving unfavourable results, on the other hand, reported no change. A similar pattern was found for some cognitive illness perceptions (i.e., illness identity and illness consequences), demonstrating that patients who are not ultimately diagnosed with IHD modify their original illness perceptions in a positive direction compared to those receiving an IHD-positive diagnosis. This pattern suggests that patients may be cognitively preparing themselves for an unfavourable diagnosis and outcome, and the study further shows that illness perceptions appear to change following the application of a diagnostic label.

Post-testing interactions between doctor and patient also need to be considered, since important decisions concerning treatment options are made at this point, and in cardiac diagnostic testing settings such as coronary angiography this often involves invasive surgical
intervention (Gordon, Street, Kelly, Soucek, & Wray, 2005). Indeed, in an ideal setting all patient fears and concerns should be addressed following cardiac testing, but research suggests that this may not always be the case. Gordon and colleagues (2005) have pointed out that interactions here are typically brief and dominated by the doctor, and a qualitative study of angiography patients by Lyons, Fanshaw, and Lip (2002) showed that medical jargon might also be a barrier to effective communication in angiography settings. As one participant in the study put it: “[doctors] tend to speak to you, you know, as though you know all the lingo and you don’t…you might nod your head and say, yes, yes, but when you go away you think, ‘what the heck was that all about’” (Lyons et al., 2002, p. 464). The authors suggest that sufficient time should be set aside for education on the procedure in order to ensure that patient expectancies match the medical testing experience and to increase effectiveness of the communication process.

Diagnostic test results can have beneficial effects on the way in which patients view their health, as shown in a study involving patients undergoing treadmill testing (Mushlin, Kern, Paris, Lambert, & Williams, 2005). One week after testing results, patients reported decreases in anxiety and uncertainty as well as an increase in perceived life expectancy. Also following testing, many patients claimed to be less troubled by their symptoms, all of which suggests that there are measurable psychological benefits to be gained from medical testing. The authors argue that measurement of such variables should be standard components when evaluating the value of diagnostic tests.

Chapter Summary

Medical testing can be a psychologically significant event for patients at all time points—before, during and after the procedure. Testing can impact on a variety of psychological constructs, including anxiety, worry, illness cognitions and coping, and this is indeed apparent in relation to cardiac testing. Conventional coronary angiography and
coronary CT angiography offer ideal opportunities to investigate such effects, as such tests have profound implications for the patient in terms of their symptom experience and health. The diagnostic accuracy of these tests can often lead to justifying medical interventions that are able to address the underlying pathology, and normal findings may ostensibly help to reassure the patient that there is no underlying disease present. Both of these aspects will be revisited in later chapters.

During the testing procedure for conventional coronary angiography—and also afterwards at follow-up clinic in the case of CT angiography—the patient usually has the opportunity to view the images from the test, and this may help grasp the presence or absence of disease in a concrete manner. This is in contrast to receiving a number or classification from a non-imaging medical test (e.g., cholesterol tests). In any case, studies have shown that throughout the testing procedure patients may experience a major shift in the way they view their symptoms as well as their emotional response to their symptoms as well as the test itself (e.g., Devcich et al., 2008; Heikkilä, Paunonen, Laippala et al., 1999; Kravitz & Callahan, 2000; Mushlin et al., 2005). It is thus important to attempt to gain a better understanding of the psychological effects that medical testing procedures such as conventional coronary angiography and CT angiography may have on patients. Such an endeavour may have implications for interventions in medical testing settings.
Chest pain is a common symptom: it is one of the most frequently cited reasons for consulting a physician (Cherry & Woodwell, 2002) and is the second most common presenting complaint at emergency departments within the United States, accounting for anywhere between 4 to 8 million visits annually (McCaig & Nawar, 2006; Storrow & Gibler, 2000). In more than half of such cases, the cause of the chest pain appears to be noncardiac (Mayou, Bryant, Forfar, & Clark, 1994). Within the general population, the annual prevalence rate of noncardiac chest pain (NCCP) has been estimated to be approximately 16% (Chambers & Bass, 1990), perhaps even reaching proportions up to a quarter of the general population (Fass & Dickman, 2006; Rakshit & de Caestecker, 2008).

Although NCCP patients typically have a benign course in terms of cardiac morbidity and mortality, the ongoing effects of symptoms can nonetheless affect quality of life and can play a major role in ongoing disability (Potts & Bass, 1995). Yet despite this, NCCP has been relatively neglected in comparison to ischaemic heart disease (Bass & Mayou, 2002), and for this reason alone there is a comprehensive need to address, at all points—from initial diagnosis right through to coping with symptoms and addressing erroneous illness cognitions—the issue of chest pain of noncardiac origin.

Clinical Features of NCCP

The International Association for the Study of Pain defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Bonica, 1979, p. 250). As discussed in the previous chapter, angina pectoris is the key symptom associated with ischaemic heart disease (IHD).
The diagnosis of NCCP is primarily one of exclusion; at its most simplistic and literal level, NCCP can be defined as chest pain that is not due to IHD. Medical testing is therefore utilised to aid the diagnostic process.

Upon further inspection, it becomes clear that NCCP by nature is a complex, heterogeneous disorder, and it has thus proven to be particularly difficult to define (Kachintorn, 2005). There are many potential causes for NCCP, and for this reason the diagnostic process may also be difficult (Richter, 1992). To identify the cause of their chest pain, patients may require many further diagnostic tests beyond already-conducted cardiac tests in order to unravel the complex aetiology.

Causal factors aside, however, some simple symptomatic differences between cardiac (typical) and noncardiac (atypical) chest pain can be delineated. A study conducted by Cooke, Smeeton and Chambers (1997) investigated the symptomatologic differences between NCCP patients and sex-matched patients with cardiac chest pain. Out of a total of 50 chest pain characteristics, three were particularly useful for distinguishing between typical and atypical chest pain: reproducibility of pain through exercise, duration of pain, and frequency of pain at rest. In other words, atypical chest pain was less likely to be associated with exercise, more likely to be unprovoked at rest, and more likely to have a longer duration. In this respect, then, a simple, objectively definable differentiation can be made between the features of typical (cardiac) and atypical (noncardiac) chest pain. As well as this, patients with atypical chest pain are generally younger and are more likely to be female (Mayou, 1989); patients with typical chest pain, on the other hand, are more likely to have a history of smoking and a previous myocardial infarction (Devcich et al., 2008).
Aetiology and Maintaining Factors

There has been much debate over the exact nature of NCCP. Over the last couple of centuries, under various guises, NCCP has been referred to as soldiers heart, irritable heart, neurocirculatory asthenia, effort syndrome, and Da Costa’s syndrome (Mayou, 1989). The advent of the Second World War saw a shift towards a more psychological and psychiatric focus, with one significant study describing the cause of effort syndrome as typically psychological, with proposed aetiological factors including “misinterpretation of emotional symptoms, certain vicious circular patterns, the growth of the conviction that the heart is to blame, consequent fears of sudden death on exertion, conditioning and hysteria” (cited in Mayou, 1989, p. 394).

This perhaps reflects the fact that, once ischaemic heart disease (IHD) has been excluded from a differential diagnosis, explanation for chest pain can become difficult and evaluation can be complicated (Castell, 1992). A number of conspicuous pathophysiological mechanisms have been proposed, including gastroesophageal, musculoskeletal, psychiatric and psychological factors, all of which are sufficient causal factors that are not necessarily mutually exclusive (Husser, Bollmann, Kuhne, Molling, & Klein, 2006).

Gastro-Oesophageal Abnormalities

Gastro-oesophageal mechanisms have been studied as hypothesised origins of NCCP—gastro-oesophageal reflux, oesophageal dysmotility and irritable oesophagus have all been implicated as NCCP causal factors. The oesophagus has a similar anatomical location as the heart, as well as similar nerve innervations, and for this reason oesophageal-related disorders have appeared to be the logical choice for investigating the cause of NCCP (Castell, 1992).
Oesophageal motility disorders such as “nutcracker oesophagus”, characterised by hypertensivity of the lower oesophageal sphincter, have received some focus for research, but it is unclear that such pathologies provide robust aetiological pathways for NCCP (Castell, 1992). Gastro-oesophageal reflux disease (GERD), on the other hand, appears to be a more plausible aetiological factor: a number of studies have shown a significant proportion of patients (around 40%) with unexplained chest pain also have evidence of gastro-oesophageal reflux during pH monitoring in ambulatory as well as clinical settings (DeMeester et al., 1982; Hewson, Sinclair, Dalton, & Richter, 1991; Schofield et al., 1987). Further studies, however, have shed additional light on this connection, indicating that it may not be as clear-cut as initially assumed. Cooke, Anggiansah, Smeeton, Owens, and Chambers (1994) investigated the association between NCCP and gastro-oesophageal reflux among 50 patients with normal coronary angiograms. During ambulatory monitoring, it was shown that many patients (38%) had indeed a high incidence of spontaneous reflux; however, this rarely occurred during exertion and overall was poorly associated with chest pain. A follow-on review of the literature surrounding NCCP and oesophageal mechanisms concluded that a causal link is likely in only a small proportion of patients and that in many others oesophageal abnormality may only be coincidental (Wu, Cooke, Anggiansah, Owen, & Chambers, 2000).

Psychiatric comorbidity is also common among this patient group. Ortiz-Olvera and colleagues (2007) showed, for example, that comorbid psychiatric disorders were present in around half of NCCP patients who tested positive for gastro-oesophageal reflux disease. Anxiety, panic disorder, major depression, and somatisation have all been shown to be present among patients with oesophageal abnormalities and NCCP (Kindt & Tack, 2008). Findings such as these support multidisciplinary approaches to treating NCCP.

Overall, the literature indicates that oesophageal pathophysiology is among one of the many potential causes of NCCP and only in a few cases is it the primary cause. Furthermore, with the advent of new investigative techniques, the pathophysiology of NCCP appears to be
not as straightforward as at first considered (Kindt & Tack, 2008). Put simply, the evidence for oesophageal origin of NCCP is by and large circumstantial, and there is a strong case for an interaction between psychiatric morbidities and oesophageal abnormalities leading to unexplained chest pain (Chambers & Bass, 1990; Fang & Bjorkman, 2001).

**Musculoskeletal Disorders**

Musculoskeletal causes of chest pain are fairly common but frequently overlooked (Jensen, 2001). A few small prospective studies have shown that chest pain can be easily explained through musculoskeletal mechanisms for a small-but-significant proportion of patients. For example, in a study conducted by Husser and colleagues (2006), 15% of chest pain patients with normal coronary angiogram results were found to have musculoskeletal disorders as the primary cause. An earlier study of 100 NCCP patients also showed that 16% had chest wall tenderness that replicated typical chest pain upon palpitation, suggesting a chest wall pain syndrome as the primary causal factor (Wise, Semble, & Dalton, 1992).

Musculoskeletal causes of chest pain can be varied in nature and can include fractures of the bones of the thoracic wall, costochondritis (inflammation and associated tenderness of the cartilage that attaches the front of the ribs to the sternum), dislocation of the costosternal and costochondral joints due to trauma, and strains of the pectoralis and intercostal muscles, perhaps due to exercise, lifting or other activity (Watson, 2006). Chest pain may also be caused by arthritis and referred pain from the cervical and thoracic spine (Mayou, 1989). Despite the many potential causes, however, the majority of patients presenting with chest pain of a putative musculoskeletal origin show atypical symptomatology that is associated with changes in posture and breathing (Chambers & Bass, 1990).
Psychiatric Illness

Psychiatric illness is common among NCCP patients, occurring in at least 50% of cases (Chambers & Bass, 1990). Furthermore, psychiatric disorders are more prevalent in NCCP patients than in the general population or cardiac patients (Mayou, 1989). Anxiety disorders (e.g., panic disorder, generalised anxiety disorder, obsessive-compulsive disorder) and major depression have been implicated as factors contributing to NCCP (Watson, 2006).

Panic disorder affects around one third of patients with NCCP (Beitman, 1992), a proportion considerably higher than the lifetime prevalence rate of no more than 3% in the general population (Weissman et al., 1997). The association of panic disorder with NCCP may be due to psychophysiological and cognitive mechanisms: an individual with a family history of IHD, for example, upon being exposed to information about the cardiological implications of chest pain, may misinterpret benign somatic sensations as evidence of heart disease, thus triggering a spiral into panic around its inferred consequences (Beitman, 1992). Furthermore, the experience of panic can lead to magnified symptom awareness, thus creating a vicious cycle that can quickly lead to a full-scale panic attack, which the individual consequently experiences as chest pain (Mukerji, Beitman, & Alpert, 1993).

While evidence has revealed anxiety focused on the heart to be associated with chest pain among patients with IHD (Zvolensky, Eifert, Feldner, & Leen-Feldner, 2003), the construct may have more implications for NCCP patients. A study comparing heart-focused anxiety patients, who reported chest pain or palpitations, with three other patient groups (cardiac inpatients, orthopaedic patients, and non-patients) showed significant differences for the study group on a number of psychiatric dimensions (Eifert, Hodson, Tracey, Seville, & Gunawardane, 1996). Compared to all other groups, patients with heart-focused anxiety reported more panic and other anxiety disorders. They were also more likely to have
hypochondriacal beliefs and obsessive-compulsive concerns, as well as higher rates of depression.

Although present, depression is less common among NCCP patients in general (Chambers, Bass, & Mayou, 1999; Eslick, Jones, & Talley, 2003; Pearce, Mayou, & Klimes, 1990). A study of attendees at a rapid access chest pain clinic found no differences in depression between NCCP patients and patients with cardiac-related chest pain prior to clinic attendance; anxiety, on the other hand, was significantly higher for NCCP patients (Robertson, Javed, Samani, & Khunti, 2008). An Australian community-based study (Eslick et al., 2003) also found a similar pattern when measuring prevalence rates of depression and anxiety in NCCP subjects vis-à-vis individuals with no chest pain—that is, no between-group difference in rates of depression but significantly higher rates of anxiety among NCCP patients.

Cardiologists who see patients for suspected IHD rarely consider a diagnosis of depression upon ruling out a cardiac cause for patient symptoms (Sheps, Creed, & Clouse, 2004). Although underlying mechanisms between NCCP and depression are not as clear as mechanisms connecting anxiety and NCCP (Mayou, 1989), the possibility of depression as having an aetiological role in NCCP should not be ruled out, and further investigation is warranted in order to identify patients for whom this is an issue.

Somatoform disorders may also potentially play a part in NCCP, although such causes have not received as much attention in the literature (Schwartz, Trask, & Ketterer, 1999). Somatization disorder has been shown to be associated with a small proportion—under 10%—of NCCP patients (Husser et al., 2006). Cardio-respiratory symptoms (e.g., chest pain, breathlessness) are common in somatization disorder, and many of these symptoms also overlap with symptoms associated with panic disorder (Chambers & Bass, 1990). Further, hypochondriasis has been reported in NCCP patients. However, perhaps because
hypochondriasis in general is not well differentiated from somatization disorder (Davison & Neale, 1994), more research needs to be conducted in this area to untangle potential aetiological mechanisms.

Psychiatric disorders can also contribute to NCCP through mediating factors. For example, panic and anxiety can lead to hyperventilation, which has been reported among NCCP patients. Aetiologically, hyperventilation in these instances may be a secondary factor to psychiatric causes (Mayou, 1989), but it can also play a primary role by inducing muscle fatigue or spasm (Magarian & Hickam, 1986).

Overall, psychiatric factors appear to play a critical role in the development and maintenance of NCCP in a number of ways: first, a psychiatric disorder may be indirectly causative (e.g., anxiety, inducing hyperventilation, may potentially result in coronary or microvascular spasm); second, a psychiatric disorder may lead to increased awareness of normal somatic symptoms which are interpreted as symptoms of a cardiological pathology; and finally, induced anxiety from chest pain of noncardiac origin may compound symptoms (Chambers & Bass, 1990).

**Psychosocial Factors**

Psychosocial factors may be important in the aetiology and maintenance of NCCP. Even when a psychiatric diagnosis is absent, psychological variables can inform the perception and interpretation of bodily sensations, and factors such as the patient’s past experience and knowledge may inform symptom interpretation (Chambers et al., 1999). Benign symptoms can be misinterpreted as serious illness and, through a resultant increase in anxiety, may lead to further psychologically caused chest pain (Mayou, 1989). Eliciting patients’ illness beliefs is considered important, as patients may harbour exaggerated fears of death, conviction of heart disease, and bodily preoccupation (Chambers & Bass, 1998).
Mayou, Sprigings, Birkhead, and Price (2003), in their study of clinic patients with (mostly benign) palpitations have argued that psychological factors may influence the perception of symptoms, thereby driving consultation. More complex interactions may occur, though, which can result in situation-specific pain experience. For example, oesophageal abnormalities may only cause pain in particular circumstances, such as similar environments (Chambers & Bass, 1990).

Psychosocial variables appear to play a role in exacerbating symptoms. In a study comparing patients with unexplained chest pain to various other patients groups (patients with IHD, patients with GERD, patients with irritable bowel syndrome, and healthy controls), it was shown that pain coping strategies and perceived self-efficacy were factors that distinguished the chest pain patients (Bradley, Richter, Scarinci, Haile, & Schan, 1992). Chest pain patients reported using significantly more maladaptive coping strategies and reported lower levels of self-efficacy for controlling their pain than patients with IHD. In addition, NCCP patients reported relatively high levels of reinforcement of pain behaviours from significant others.

A maladaptive coping style was also found to be a risk factor for NCCP among Chinese patients in a study conducted by Cheng and colleagues (2003). Using a matched case-control design, the authors compared three groups (NCCP patients, patients with rheumatism, and healthy controls) on coping style, monitoring style, social support, as well as anxiety and depression. Along with being more likely to have a problem-focussed coping style (displaying a coping pattern with poor strategy–situation fit), NCCP patients also tended towards a monitoring perceptual style and were more likely to receive less emotional support in times of stress. Bearing in mind the usual caveats of making causal inferences from cross-sectional studies, the findings nonetheless highlight the importance of further investigation of coping styles and symptom attention among patients with NCCP.
Cognitive factors also appear to be important for the maintenance of NCCP. In a study of 56 NCCP patients with ongoing chest pain despite negative investigation (Pearce et al., 1990), it was shown that nearly half continued to believe that heart disease was the only explanation for their symptoms. A further 28%, although no longer believing that heart disease was the cause of their symptoms, remained concerned that another serious physical problem was the reason for their chest pain. The study also shows how the actions of medical professionals can inadvertently reinforce patients’ illness cognitions: despite reassurance from their cardiologist or doctor to the contrary, patients viewed further medical tests, ongoing medication, and other incidental cardiac diagnoses (e.g., mitral valve prolapse) as confirmation of heart disease.

Work by Sensky (1997) has further explored the attributional processes associated with symptom reporting. Here, the distinction can be made between internal (somatic) versus external (i.e., “normalising”) causes that individuals attribute to their symptoms. Research has shown an association between frequent general practice visits and a lack of normalizing attributions for common bodily sensations (Sensky, MacLeod, & Rigby, 1996). Investigating further, Rief, Nanke, Emmerich, Bender, and Zech (2004) found that patients with somatoform disorders consider both psychological and organic explanations for their symptoms; perceived organic causes, however, seem to be more important with regard to illness behaviour.

NCCP patients, compared to patients with cardiac chest pain, appear to find their condition less understandable and controllable (Robertson et al., 2008), and medical testing may only exacerbate such illness cognitions. This highlights the danger of iatrogenic risk associated with NCCP patients. Individuals who attribute many symptoms to a cardiac condition may face increased symptom worry if an alternative explanation for their chest pain cannot be found following negative diagnostic test results. Paradoxically, then, medical testing—particularly where ambiguous or inconclusive findings are concerned—may in fact
reinforce patients’ illness models, thus resulting in increased disability and somatisation (Howard & Wessely, 1996).

Iatrogenic effects can also come from patient–doctor interactions. Not only can the prescription of antianginal medication reinforce patient suspicions of underlying heart disease, but mixed messages from health professionals offering inconsistent or ambiguous advice and ongoing prescription of such medication despite the provision of verbal reassurance that the pain is of noncardiac origin, can also strengthen illness conviction (Mayou, Bass, Hart, Tyndel, & Bryant, 2000). Illness conviction is already high in NCCP patients, at a comparable level to that of cardiac patients (Eifert et al., 1996). The strengthening of such convictions through poor doctor–patient interactions can cause an iatrogenic effect, and patients may seek further unnecessary testing, resulting in a vicious cycle that reinforces somatic attributional styles and strengthens illness conviction.

Combined Aetiological Models—An Integral Approach

Combined aetiological models (e.g., Chambers & Bass, 1990; Mayou, 1989) attempt to integrate the multi-causal nature of NCCP. As we have seen, psychiatric and certain physiological disorders are major aetiological factors for NCCP, but psychosocial factors seem to play a role in exacerbating and maintaining symptoms. Indeed, subtle interactions between multiple psychological and physical factors have been shown in the literature, but patients’ cognitive symptom appraisals are nonetheless unduly overlooked (Chambers & Bass, 1998). This is perhaps reflective of the gulf between psychological and physiological research (Mayou, 1989).

Figure 6 shows a simple diagrammatic representation of how psychosocial factors may be conceptualised within appraisal framework for NCCP. As Chambers and Bass (1990) have argued, awareness and interpretation of chest pain involves an interplay of physical,
emotional and cognitive factors such as illness beliefs and attitudes, which may be shaped by daily life events ranging from the trivial (information from the media) to the more serious (death of a friend from heart disease).

As this is a simple model used for heuristic purposes, it does not necessarily take into account all factors and mechanisms associated with NCCP. Other integrated evidence-based models have been proposed for elucidation of medically unexplained symptoms, and it has been argued that other processes including expectation, distraction, and memory processes should be included in such models in order to further understand such symptoms (Rief & Broadbent, 2007).

Figure 6. Integration of factors influencing NCCP.

Living with NCCP

The long-term prognosis of NCCP patients in terms of cardiac morbidity and mortality is excellent. An 11-year longitudinal study of NCCP patients (i.e., patients with normal angiograms) found that only 2.2% died from ischaemic heart disease over the follow-up
period (Potts & Bass, 1995). A majority of patients with normal coronary anatomy nonetheless continue to experience pain, remain on cardiac medication, continue to see a physician and continue to report disability in their lives (Chambers & Bass, 1990).

The association between NCCP and ongoing psychological morbidity has been shown in a number of studies. For example, a 3-year longitudinal study of patients who were referred from general practices in the United Kingdom to a cardiac clinic and who reported chest pain and palpitations showed that over three quarters of the noncardiac patients reported ongoing disability and limitation of activities (Mayou et al., 1994). Moreover, around a quarter of the noncardiac patients remained convinced or suspicious of underlying heart pathology.

High levels of anxiety persist for NCCP patients following ostensibly reassuring cardiac test results. Robertson and colleagues (2008) measured levels of affective disturbance and anxiety among 246 patients with acute, undifferentiated chest pain at a British rapid access chest pain clinic. Using the Hospital Anxiety and Depression Scale (HADS) and the Health Anxiety Inventory (HAI), the researchers showed that on both measures anxiety levels remained above community norms 1 week after clinic attendance and 2 months later, with two-thirds being clinically anxious at follow-up; patients with a cardiac disease, on the other hand, saw a drop in anxiety levels towards community norms at follow-up. The ongoing health anxiety following diagnosis highlights the potential difficulty of conveying an effective reassuring message and that any uncertainty about a diagnosis may have iatrogenic consequences, effectively increasing focus on health and undue anxiety.

Research has shown that work absenteeism and interruptions to daily activities and life are high among patients with noncardiac chest pain. One study reported work absenteeism and interruption to daily activities to be at 29% and 63%, respectively among a group of NCCP patients (Eslick & Talley, 2004). A qualitative study of NCCP patients (Jerlock, Gaston-Johansson, & Danielson, 2005) revealed that NCCP symptoms can intrude into everyday life in a number of ways—through fear and anxiety, by creating feelings of
uncertainty and stress, and through loss of strength. Many participants in the study reported hopelessness and resignation about finding a cure for their chest pain, as they had never received adequate explanations for their symptoms. Another qualitative study (Janson Fagring, Gaston-Johansson, & Danielson, 2005) found that physical and psychological consequences of chest pain had a negative influence on daily life, and the impact of NCCP on functions in daily life overall led to weaker social networks.

It is clear that noncardiac chest pain negatively affects quality of life, with NCCP patients reporting a quality of life poorer than healthy subjects and more akin to cardiac patients (Eslick, et al., 2003). Indeed, chest pain per se is demonstrably associated with impairment of quality of life, with a study by Goodacre, Mason, Arnold, and Angelini (2001) showing impairment in all dimensions of a quality of life measure (SF-36) for patients presenting at a chest pain observation unit in the United Kingdom with acute chest pain (cardiac and noncardiac). A Hong Kong study (Wong et al., 2002) comparing NCCP patients with healthy controls on responses to the SF-36 also showed significantly lower physical functioning and poorer general health perceptions for the NCCP group.

Bass and Mayou (2002) have provided a useful biopsychosocial model for conceptualising the interplay of factors contributing to symptoms of chest pain and subsequent disability (see Figure 7). The model highlights the multifactorial nature of NCCP and its consequences, where the outcomes of symptom appraisal and disability are influenced by physical perceptions, psychosocial factors, illness experience, as well as iatrogenic and behavioural maintaining factors. This is particularly relevant considering the many diffuse aetiological factors associated with NCCP.

The influence of these factors can be summarised simply, as Pearce and colleagues (1990 p. 993) have concisely stated:
Initial chest discomfort is most likely to be misinterpreted as due to heart disease or another serious illness if the patient (1) has a psychologically vulnerable personality or is anxious, depressed or hypochondriacal; (2) is under chronic or acute stress; or (3) has special reasons for being aware of heart disease (such as a family history of heart disease).

At this point, symptom interpretation may be reinforced by others (e.g., reinforcement of illness behaviour) or may be strengthened through iatrogenic factors such as medical testing or poor doctor–patient interaction, with subsequent disability being the final outcome of erroneous symptom interpretation. Overall, then, the nature and impact of NCCP can thus be conceptualised as a dynamic interplay of biological, psychological, and social factors.

Figure 7. A biopsychosocial model of NCCP and subsequent disability (Bass & Mayou, 2002).
Patients with high health anxiety and somatization tendencies are more likely to be higher utilisers of health care resources than other patients (Barsky, Ettner, Horsky, & Bates, 2001). Evidence also suggests that NCCP patients are high users of medical services (Keavney, Haider, McCance, & Skehan, 1996) and often have long medical histories (Mayou et al., 2000). The threshold for seeking medical care may thus be lower for such patients.

Potts and Bass (1993) conducted a long-term follow-up study of NCCP patients who, over a decade prior to follow-up, had undergone coronary angiography and subsequently received normal results. The study indeed showed that medical resources are heavily utilised among NCCP patients, with 71% taking cardiac medication (e.g., beta-blockers, calcium channel blockers, etc.) at follow-up and 58% receiving further hospital treatment for their chest pain, of which nearly a quarter had undergone further angiography, with some undergoing three or more angiograms. Using a retrospective cost-benefit analysis methodology, comparing the 12 months before and after a coronary angiogram, one study has shown that costs of coronary angiography can be recouped within 2 years (Keavney et al., 1996). This study, however, may not take into account patients who, in the long term, may undergo multiple medical testing and continue to take cardiac medication. Ultimately, over time, these patients become a potentially avoidable drain on the health care system. A successful testing process, then, would need to take into account the needs of NCCP patients at risk of iatrogenic complications by providing an efficacious method of reassurance.

**Treatment and Management of NCCP**

Due to its complex aetiology, NCCP may be treated using multiple treatment modalities—treatment can be pharmacological, psychological, or a combination of the two. In some cases where gastro-oesophageal disorders are the cause of symptoms, surgical procedures may be possible treatment options (Watson, 2006).
Pharmacological treatments cover the wide base of aetiological factors associated with NCCP, with popular pharmaceutical treatment agents including proton pump inhibitors, antacids, motility facilitators, analgesics, anxiolytics, and antidepressants (Tibbling, 1992). There is a certain amount of risk associated with prescribing drugs for NCCP, however, as unnecessary drugs—and testing, for that matter—may reinforce erroneous cognitions about having a serious illness (Mukerji et al., 1993).

Psychological treatment for NCCP has mainly taken the form of reassurance (Salkovskis, 1992). However, such “reassurance therapy” has taken many forms and results have varied (see, for example, Channer, James, Papouchado, & Rees, 1987; Petrie et al., 2007). Cognitive-behavioural therapy (CBT) has been used to address illness conviction and worry around NCCP. The focus of CBT therapy for NCCP is threefold: the first point of focus is to identify symptom patterns and associated misinterpretations and anxiety around the chest pain; secondly, CBT aims to challenge patients’ negative interpretations by calling into question the evidence for such illness beliefs; and finally, CBT aims to experiment with patient behaviours in order to disconfirm patients’ worst fears around their symptoms (Salkovskis, 1992).

Psychological treatment, however, is not without its difficulties. Two particular problems exist when applying such treatment—doubts in the patient about their diagnosis and doubts from the doctor, also concerning the diagnosis (Salkovskis, 1992). In other words, there may be difficulty in initiating treatment in patients who hold a strong conviction that their symptoms can only be explained by physical causes, and, in any case, many patients are suspicious of any mention of psychological factors and psychological treatment (Mayou, 1989). Doubts from doctors about the diagnosis may have iatrogenic effects on the patient, reinforcing erroneous illness beliefs.

While physical pathologies may coexist alongside psychological factors associated with NCCP, psychological therapy aims to address cognitions and processes that either cause
or exacerbate symptoms. The delivery of such therapies may pose its own difficulties, however, as it typically involves referral to psychologists, who may be perceived negatively by patients, and patients may show reluctance in accepting the therapy message (Weinman, Petrie, Moss-Morris, & Horne, 1996). To attenuate this aspect, doctors or nurses, in a manner that is more integral to the health care consultation, could deliver relevant psychological information to patients. To this end, routine care should include the presentation of adequate information by clinical staff that covers three essential bases: (1) normalisation of presenting symptoms and explanation that the type of testing is appropriate and outcomes are excellent; (2) explanation of the alternative causes for chest pain; and (3) advice regarding coping and resuming normal activities (Mayou et al., 1994).

**Chapter Summary**

Chest pain is a common condition both at the community level and among hospital admissions. A significant proportion of chest pain is noncardiac, and being a heterogenous condition, chest pain of this type has a complex aetiology. Important aetiological factors include gastro-oesophageal abnormalities, musculoskeletal disorders, psychiatric illness, and various psychosocial factors. Psychosocial factors appear to be particularly important for maintaining ongoing NCCP, and combined aetiological models have attempted to integrate these factors in order to facilitate better understanding of mechanisms associated with NCCP.

The effects of NCCP can be wide ranging. NCCP patients typically show poor quality of life outcomes despite low cardiac morbidity and mortality. Furthermore, anxiety and disability are seen as major issues for these patients, and use of health care resources (e.g., ongoing medical testing) remains high for NCCP patients following testing.
Treatment for NCCP is multi-modal and can involve pharmacological approaches as well as psychological treatments. Psychological treatment, for the most part, takes the form of reassurance therapy, although, as delineated in the following chapter, the form of such treatment varies considerably, as do the results.
CHAPTER THREE

MEDICAL REASSURANCE

Reassurance is considered one of the most common and important interventions carried out in clinical practice (Buchsbaum, 1986). It is one of the most frequently recommended procedures for pain (Linton, McCracken, & Vlaeyen, 2008) and is valued for its potentially simple, safe and cost-effective approach to treating noncardiac chest pain (Richter, 1991). But despite the important clinical and economic relevance, research on reassurance remains scarce (Coia & Morley, 1998). Moreover, there have been very few intervention studies that have examined the best methods of providing effective reassurance (Fitzpatrick, 1996).

One of the problems concerns defining the nature of reassurance: what is meant by the term ‘medical reassurance’, and is it best defined and understood as a process or an outcome? This chapter introduces the issues around the construct of medical reassurance and how it can be better understood. As part of this understanding, the chapter also looks at the experimental research that has investigated the reassurance process in cardiac settings.

Defining Medical Reassurance

Given that reassurance is considered an important clinical intervention, it is surprising that little exists within the literature concerning its definition. Medical reassurance is a poorly defined construct, and it is for this reason that there is some confusion as to what the construct denotes. In a review of the efficacy of reassurance in the pain field, Linton and colleagues (2008) have identified two discrete perspectives of ‘reassurance’ that, for the most part in the literature, have been poorly distinguished. First, reassurance can refer to a process or method from the medical professional’s perspective. Second, from the patient’s perspective, it can be considered as an outcome or endpoint. Reassurance can thus be measured and understood within two domains: medical reassurance as procedure and medical reassurance as outcome.
Medical Reassurance as Procedure

Medical reassurance as procedure encompasses the methods by which doctors or health professionals impart a reassuring message. It could thus be thought of as the communication between the health professional and the patient with the intention of allaying the patient’s health-related concerns (Loft, Meechan, & Petrie, 2007).

The process of providing a reassurance message was first specifically addressed in the literature by Sapira (1972), who proposed a model that involved a series of six steps: (1) elicit a detailed description of the symptom; (2) elicit the affective meaning of the symptom; (3) examine the patient; (4) make a diagnosis; (5) explain the symptom to the patient; and (6) reassure the patient. Omission of any one of these steps, according to Sapira, results in ineffective reassurance. While this model goes some way towards attempting to map the reassurance procedure, nothing is mentioned about the tools and techniques used to impart the reassurance message per se. Kathol (1997) later proposed a six-step process model centred on the act of giving reassurance itself. The model is aimed at patients with benign disease or medically unexplainable symptoms and places emphasis on guiding the patient towards a return to normality as well as reducing future illness disability. Key steps in the model include: (1) question and examine the patient; (2) assure the patient that serious illness is not present; (3) suggest that the symptom will resolve; (4) tell the patient to return to normal activity; (5) consider non-specific treatment; (6) conduct patient follow-up.

Work by Kessel (1979) has emphasised that the practice of giving reassurance within the clinical setting should be carefully considered and deliberate. In this respect, good reassurance practice should consist of appropriate and relevant information and should also address patient fears. In other words, just telling the patient that there is nothing wrong may only deny the reality of their concerns (Fitzpatrick, 1996). The development of good rapport
between patient and doctor is also important for increasing reassurance, as this can facilitate the process by helping patients feel that they have been understood by their doctor.

Coia and Morley (1998), echoing Kessel, argue that medical reassurance should be carefully customised for individual patients in order to maximise patient health outcomes. Their work has focussed on sketching out a working definition of reassurance framed within a dual process model of persuasion. In this respect, they argue that there are important differences between emotional reassurance and cognitive reassurance: emotional reassurance focuses on reducing distress in the patient; cognitive reassurance, on the other hand, addresses the patient’s cognitive representations of their illness and may be more important for long-term reassurance. These two processes are independent, and an ideal form of medical reassurance as process not only involves clear and systematic processing of good evidence of no disease, as shown through negative test results, but also poor evidence of disease itself, which is mainly facilitated through addressing the patient’s symptom experience.

**Patient Factors Influencing the Reassurance Procedure**

A number of patient factors have been shown to have implications for the delivery of effective reassurance. Although variables including gender (MacSwain et al., 2009), education (Meechan, Collins, Moss-Morris, & Petrie, 2005), medical knowledge (McDonald, Daly, Jelinek, Panetta, & Gutman, 1996) and age (Cunningham et al., 1998) have been implicated as factors influencing reassurance, the literature overall shows that anxiety and, to a lesser extent, depression are by far the most important.

Trait anxiety has been shown to have consequences for reassurance. There is evidence to suggest that in cases where the pain itself is associated with psychological morbidity, attempts to reassure the patient will most likely fall short, since the symptoms are characteristic of underlying psychiatric disease (Channer et al., 1987). It has been argued that
patients with psychiatric comorbidity need to have their psychosocial needs met prior to receiving reassurance, and treatment of coexisting psychiatric disorders is required in the first instance before such patients are able to accept a message of reassurance (Howard & Wessely, 1996). When psychiatric morbidity is not present, reassurance is more effective. This is illustrated in a study by Fitzpatrick and Hopkins (1981), who interviewed patients attending neurological clinics due to headaches unrelated to structural disease. They found that those with significant psychiatric morbidity were particularly likely to be dissatisfied with the consultation; the majority of patients, however, did not have any underlying psychiatric disease, with around two thirds having fears about underlying pathology alone. These fears were generally allayed by the consultation.

The patient’s level of health anxiety is an important consideration for doctors when delivering a message of reassurance. A study conducted in an endoscopy clinic (Lucock, Morley, White, & Peake, 1997) assessed patients’ self-rated health anxiety and illness beliefs at a number of time points: prior to gastroscopy, immediately following reassurance given by the doctor, and at various follow-up points up to a year later. Patients who had high health anxiety prior to testing showed a resumption of their health worry and illness belief even 24 hours following test results, and these levels were maintained a year later at follow-up. This, however, was not the case for patients with low health anxiety, who maintained low levels of health worry and illness belief at all follow-up points. Indeed, further partial correlational analyses showed health anxiety to be a significant predictor of later levels of worry and illness belief. This implies, then, that efforts by doctors to reassure patients may only result in short-term reductions in worry and illness belief in patients for whom health anxiety is particularly high beforehand. Other studies have also confirmed that providing reassurance is particularly difficult with this population (e.g., Laakso, Niemi, Gronroos, & Karlsson, 2008; Meechan et al., 2005).
Drawing parallels with obsessive-compulsive disorder, Salkovskis and Warwick (1986) have discussed health anxiety and reassurance, arguing that excessive reassurance seeking is a form of avoidance behaviour that only serves to maintain the preoccupation with health among this particular patient population. This can help explain immediate-but-transient reductions in anxiety following consultations. Consequently, far from being beneficial, giving reassurance may only encourage patients to seek even more reassurance. Salkovskis and Warwick’s solution is therefore confrontational: intervention should focus on self-directed exposure and cognitive change, and physicians need to base their investigations on clinical indications rather than patients’ anxiety.

Patients’ previous experiences of illness can have an effect on reassurance, even years after the event. The triggering of residual memories of such events can elicit anxiety and worry about current symptoms. For example, childhood experiences of illness might foster particular illness beliefs about one’s heart, and these beliefs and associated worry can return to the fore later in life following illness of a family member, stories in the media, or the occurrence of similar symptom experiences (McDonald et al., 1996).

Patients’ needs and expectations about medical tests also need to be considered. A qualitative study by Price and colleagues (2005) explored the needs and experiences of patients referred to a UK chest pain clinic. Patients were interviewed following the receipt of the results of their treadmill test. Major themes that were identified around what patients wanted included being given a diagnosis (i.e., to know “is it my heart or isn’t it?”) as well as understanding what the diagnosis meant (e.g., why the pain occurred and what the future holds). Patients also wanted the ability to help themselves. Discussions around what patients received, however, revealed shortfalls concerning the above themes: patients expressed concerns about not receiving a diagnosis, having limited understanding of what was causing their chest pain, and feelings of inability to help themselves. Overall, the interviews highlight
that there is much room for improvement in health care surrounding cardiac testing or, for that matter, medical testing in general.

**Diagnostic Testing**

Diagnostic testing is in many ways central to clinical decision making. A positive or negative test can mean the difference between medical intervention on the one hand and reassurance as intervention on the other, oftentimes with the negative test result itself being used as part of the reassurance process. But while on the surface it could be assumed that a simple negative test result would be sufficient to provide adequate reassurance to patients, evidence suggests that this is not the case, and the task of providing reassurance in the context of testing provides many challenges. Indeed, some have argued that the idea that patients can be reassured solely by negative test results is an outdated myth that is potentially dangerous (Neal & Morley, 1999).

There may be uncertainties on the doctor’s side that can impede the reassurance process. Diagnostic uncertainty may spark continued investigation of patient symptoms out of doctors’ fears of missing an organic pathology (Howard, 1996). Such a clinical cascade of medical testing may spiral out of control and increase the potential for causing patient harm either directly through the damaging physiological effects of undergoing the test itself (e.g., radiation exposure) or related medical procedures (e.g., surgical investigation), or indirectly through placing excessive strain of health care resources (Schattner, 2008).

Undergoing diagnostic procedures may be associated with harmful psychological effects. A study conducted in the United States by Verrilli and Welch (1996) traced the rise in diagnostic testing procedures and the subsequent rates of medical interventions over a 7-year period from 1987 to 1993. The increase in diagnostic testing procedures such as cardiac catheterisation and spinal imaging tests (viz., computerised tomography and magnetic
resonance imaging) accounted for the majority of the variance (more than 80%) in the respective rates of medical interventions such as coronary artery bypass grafting and percutaneous coronary intervention on one hand and back surgery on the other. The authors discussed the implications of this finding in relation to potentially adverse psychological effects associated with medical testing, warning that increased medical testing can lead to increased vulnerability experienced by the individual through the subsequent transformation of ‘person’ into ‘patient’.

There may be questions around the necessity of testing for the provision of reassurance as well. A recent meta-analysis of randomised trials comparing immediate imaging versus usual care without immediate imaging among low-back pain patients showed that lumbar imaging does not improve clinical outcomes when there are no indications of serious organic pathology (Chou, Fu, Carrino, & Deyo, 2009). The authors concluded that clinicians should refrain from routine, immediate lumbar imaging in such cases. An exploratory study by McDonald and colleagues (1996) interviewed patients referred for echocardiography because of chest pain symptoms. Despite normal test results, patients presenting with symptoms still remained anxious about their heart following a normal diagnosis. The authors advise against referring for testing too hastily, since reassurance may not be guaranteed, even in the face of normal test results. Furthermore, iatrogenic effects of testing should be considered, as patient anxiety can be engendered in the first place by the mere experience of undergoing testing procedures.

While diagnostic tests can have beneficial effects on reassurance, there is some evidence to suggest that these effects may not be long lasting. For example, a randomised controlled study (Howard et al., 2005) set in a secondary care headache clinic examined the effect of undergoing a brain scan (MRI) among patients with chronic daily headaches. Patients were randomised to receive either an MRI or treatment as usual. Results were positive at the 3-month follow-up, with patients who were offered a scan reporting less worry
about there being a serious cause for their headaches; however, no between-group difference was found on this measure at the 1-year follow-up, and the scan did not improve other psychosocial measures, which included health anxiety, quality of life and illness perceptions.

Specifically in the cardiac literature, a few exploratory studies have investigated reassurance following exercise tolerance testing (ETT). Channer and colleagues (1987) explored reassurance levels among cardiac patients following negative ETT results and found that 71% of patients continued to experience chest pain, with more than half of these patients not reporting a decrease in the amount of worry about their symptoms. Furthermore, of all patients followed up in the study, around 28% were not reassured by the test result and 10% reported not being reassured by their doctor. Factors contributing to poor reassurance were not clear, but a more recent study (Donkin et al., 2006) suggested that anxiety and illness perceptions may play a role in positive reassurance outcomes among such a patient population.

Providing Information

Part of the reassurance process is providing adequate and appropriate information, either in the form of discussion or supplementary reading material. Providing information is seen as an important part of the clinical encounter, as it can have beneficial effects on patient knowledge and satisfaction, and it can result in a reduction of clinical depression (Smith et al., 2008). Some research, however, has attempted to explore how reassurance can be augmented and strengthened by the provision of information. Although receiving adequate information is important for patients, it has also been shown that communicating this need may be difficult, as patients with medically unexplained symptoms may be more guarded and indirect in communicating their need for explanation (Salmon, Humphris, Ring, Davies, & Dowrick, 2007).
One question to ask is: How much information is required? There is evidence to suggest that vague information in a patient–doctor encounter may promote mistrust towards the doctor, and in many cases patients may be confused with the information they receive (Collins, Clark, Petersen, & Kressin, 2002). This has implications for reassurance. For example, a study by Deyo and Diehl (1986) found that the most frequently cited source of dissatisfaction among patients was related to their doctor not providing adequate explanation about symptoms; these patients were more likely to want further diagnostic testing. An exploratory study of patients’ responses to their general practitioner’s reassurance information found that the explanations that were most accepted were grounded in the patients’ concerns and often linked physical and psychological factors (Dowrick, Ring, Humphris, & Salmon, 2004). When doctors offered basic reassurance, on the other hand, and information given did not address patients’ concerns, patients persisted in requesting additional explanation and further testing.

Another issue to consider is not how much information is given but how much is remembered. Patients’ recall of medical information in the clinical settings is poor (Ley, 1997). In an analogue study by Rief, Heitmuller, Reisberg, and Ruddel (2006), however, it has been suggested that patients with medically unexplained symptoms may be more inclined to incorrectly recall the likelihood of medical causes for their symptoms. Three groups of patients—those with medically unexplained symptoms, patients with major depression patients, and healthy controls—listened to a recorded medical report and were asked to rate what the doctor thought was the likelihood that the complaints were caused by a medical condition. Although most of the medical explanations for the symptoms were rejected by the doctor’s verbal report, patients with medically unexplained symptoms remembered a higher likelihood for medical explanations. This suggests that there may be memory recall biases among this patient group.
Medical Reassurance as Outcome

On the flip side, reassurance has been identified in the literature in terms of patients’ health outcomes. Typically, reassurance in clinical populations has been quantified using self-report measures (see, for example, Petrie et al., 2007; Serinken, Zencir, Karciglu, Sener, & Turkcuer, 2009). Items here have been developed in order to capture or ascertain key aspects of medical reassurance (e.g., “How worried are you about your health?” and “To what extent do you believe that there is something seriously wrong with your heart?”). Another study included the item “Do you think there is something seriously wrong with your body?” as an indication of medical reassurance following negative colonoscopy results (Spiegel et al., 2005).

Proxy measures have also been used to gauge outcome reassurance. These measures are often reframed within context in order to reflect patients’ levels of reassurance following intervention. Sanders and colleagues (1997), for example, used the Whitely Index (Pilowsky, 1967) to assess beliefs about the significance of physical causes, and general health perception has been assessed using items from the SF-36 elsewhere (Arnold, Goodacre, Bath, & Price, 2009). Such measures are arguably insufficient for gauging reassurance, since they have been designed specifically for evaluating hypochondriasis and general functioning, respectively. A reassurance measure more likely to possess higher validity would aim at targeting worry about specific symptoms that are associated with a particular illness.

A criticism of reassurance literature has been that so-called ‘hard’ measures—for example, re-attendance rates, health care costs, and further medical investigations—have not been used to measure reassurance outcomes (Jones & Mountain, 2009). While some investigations have shown significant effects on a range of self-report measures, there is nevertheless a call to investigate how reassurance interventions have an impact on tangible outcomes such as readmittance rates and ongoing health care costs. Indeed, failure to reassure
can have an effect on ongoing seeking of medical resources, both in terms of frequent medical consultation and unremittent taking of prescribed medication (Potts & Bass, 1993).

**Reassurance Trials in Cardiac Settings: A Review of the Experimental Literature**

Studies have shown that reassurance in cardiac setting is an issue. For example, A study by Channer and colleagues (1987) reported that 71% of patients followed up 1 month after negative stress test results continued to experience chest pain, and more than half of these patients did not report a decrease in the amount of worry about their symptoms. Of all the patients followed up, around 28% were not reassured by the test result and 10% reported not being reassured by their doctor. Another study involving patients undergoing exercise stress testing showed that illness perceptions may be an important factor to consider in improving reassurance (Donkin et al., 2006). Prior to testing, 62 patients completed questionnaires assessing illness perceptions and anxiety and, following testing, also completed a reassurance questionnaire. Analysis showed that both anxiety and illness perceptions were significant predictors of reassurance at 1 month, although after controlling for anxiety, longer timeline beliefs and lower treatment control beliefs predicted lower reassurance. The researchers concluded that interventions targeting patients with these illness perceptions prior to testing may help to improve reassurance.

One of the aims of this thesis will be to conduct a trial into the use of providing early information to angiography patients in order to improve reassurance. In order to better understand the most appropriate and effective methods of improving and strengthening medical reassurance among patients with NCCP, further experimental studies need to be conducted. However, to better understand the value of conducting a trial on reassurance, it is useful to first review the experimental literature in the context of cardiology and NCCP. To this end, the following questions need to be addressed: How has reassurance been studied in this area? What types of interventions have been conducted? And how successful have they
been at improving reassurance in NCCP patients? A review of the experimental literature was therefore conducted.

**Selection Criteria**

The review only included randomised controlled trials (RCTs) conducted in primary or secondary health care settings involving cardiac testing. Studies were required to have a primary or secondary aim of examining the reassurance process among patients diagnosed with NCCP (or, alternatively, this could be defined as atypical chest pain, nonorganic chest pain, or chest pain that is medically unexplained or has an unknown cause). Studies could either focus on the value of testing versus not testing or could explore the value of a psychological intervention versus care as usual.

Outcome measures needed to be related to cognitive or emotional aspects of medical reassurance. Studies could therefore address worry about chest pain, inappropriate symptom beliefs, or, more specifically, reassurance patterns following medical testing. The primary reason for expanding the definition of relevant outcome measures is to identify early studies that have examined factors that may be highly relevant for reassurance outcomes.

**Search Strategy**

Sources used to identify relevant studies included medical databases (Scopus, Medline) academic search engines (Google Scholar), citation lists, and contact with study authors. Boolean searches were conducted in all of the databases using the following key terms: “reassurance OR symptom worry OR cardiac anxiety” in conjunction with the search terms “NCCP OR noncardiac chest pain”. All years were searched, with the results narrowed down to only include randomised controlled trials.
Findings

From the literature search, eight studies were identified that met all inclusion criteria (see Table 2 for a summary). The earliest identified RCT conducted in a medical clinic explored the psychologically mediated effects of diagnostic testing for ischaemic heart disease among patients with non-specific chest pain (Sox, Margulies, & Sox, 1981). The focus of the study was to investigate the benefits of medical testing \textit{per se} on a number of psychosocial variables related to outcome reassurance. Study participants were randomised to undergo either an electrocardiogram along with serum phosphokinase test or to have the tests withheld (control group). Fewer patients in the test group reported short-term disability in the weeks following testing, and further analysis showed that diagnostic testing itself was an independent predictor of recovery. Also, in comparison to the control group, patients in the intervention group were less dissatisfied with their medical care and felt that their care was better than usual. Although these results suggest tests may be of some benefit for patients in terms of reassurance, other findings disconfirm this. For example, there was no difference between the groups regarding concern that serious disease was the cause of their chest pain, and both groups sought other medical care for their chest pain equally.

Some of the earliest interventions to address patients’ symptom worry following normal cardiac test results attempted to apply a cognitive behavioural therapy (CBT) framework to the problem. Most of these interventions were aimed at patients living with chronic NCCP, and as such addressed reassurance through modifying health beliefs and worry further on down the track rather than immediately following test results. Interventions were also typically lengthy and highly structured. For example, an early study (Klimes, Mayou, Pearce, Coles, & Fagg, 1990) took 31 patients, who were recruited from general practice and had persistent atypical chest pain, and tested a five-session CBT-style programme over a 3-month period. Patients were taught CBT techniques such as progressive muscle relaxation, the role of breathing, distraction techniques, monitoring the effects of pain,
and management of any maintaining factors, as well as how to anticipate and control symptoms. Cognitively, there was an emphasis on modifying inappropriate health beliefs. The researchers reported successful results, with significant intervention group reductions in psychological morbidity and disruption of daily life compared with no changes in the control group. The effects were maintained up to 6 months later at follow-up.

Mayou and colleagues (1997) conducted a similar CBT-focused trial that again involved NCCP patients but this time was set in a cardiac outpatient clinic. The study participants were patients who experienced persistent NCCP, despite negative findings and purported reassurance from a cardiologist. Participants (N = 37) were randomised into either an assessment-only control group or a CBT intervention group. The latter underwent a treatment that had three main aims: to explore alternative noncardiac explanations for symptoms within a biopsychosocial framework; to teach behavioural coping skills; and to examine symptom-maintaining problems. The intervention produced positive results, supporting the findings of the previous trial: significant differences were found between the treatment group and the control group at the 3-month follow-up regarding severity of symptoms, concern about heart disease and associated symptoms, and limitation of activity. The authors argued that the study supports the idea of the need for ‘stepped’ care to bolster initial reassurance procedures in the cardiac clinic.

Following on from this, another trial (Sanders et al., 1997) was conducted involving patients with chest pain and normal coronary angiograms. The focus here was on examining the efficacy of individualised provision of information as well as discussion following the results of the angiogram. The intervention itself incorporated many CBT features: discussion about likely causes of the symptoms; provision of information regarding coping methods, such as controlled breathing and relaxation exercises; and information about progressively increasing physical activity with the aim of encouraging patients to return to normal activities. However, it was extremely condensed and of much shorter duration than the previous trials,
with each session lasting approximately an hour. Although there is much pragmatic merit in condensing a CBT-style intervention, results of the study found no evidence of intervention efficacy at follow-up 3 months later. Moreover, some patients found the treatment unacceptable, particularly those who had strong illness beliefs of there being an organic cause for their chest pain. These patients in particular tended to find the psychological content of the intervention upsetting.

Van Peski-Oosterbaan, Spinhoven, Van der Does, Bruschke, and Rooijmans (1999) examined the efficacy of a CBT intervention for NCCP patients \((N = 65)\), who were randomised to receive either care as usual or a CBT intervention. The intervention consisted of 4-12 weekly sessions and targeted patients’ cognitive misrepresentations of bodily symptoms. Results showed efficacy for the treatment group over the control group regarding pain measures. Moreover, there was a significant association between pain reduction and more accurate illness cognitions, perhaps highlighting the importance of targeting illness cognitions among NCCP patients. In fact, the authors concluded that addressing cognitive misrepresentations of chest pain symptoms is more critical to reducing pain than targeting global levels of anxiety.

Three studies have investigated the efficacy of providing information in the immediate context of medical testing and normal test results. Aiming to examine the effectiveness of providing information prior to testing, Petrie and colleagues (2007) randomised patients undergoing exercise stress testing and with subsequent normal findings \((N = 92)\) into one of three groups: one group received a pamphlet before testing that explained the meaning of a negative test result; another group received the same pamphlet as well as discussion about the major points of the pamphlet; and a final control group received standard care. The pamphlet explained the purpose of the test, what it might mean to have normal test results, and what other possible and less serious causes of chest pain may be present. Results were encouraging: self-reported reassurance following testing and doctor’s feedback was better for
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<td>6 months and 1 year</td>
<td>Intervention group saw reductions in chest pain ($p &lt; .05$). Results suggested a mediating role of illness cognitions vis-à-vis pain.</td>
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<td>Petrie, Müller, Schirmbeck, Donkin, Broadbent, Ellis, Gamble, &amp; Rief (2007)</td>
<td>NCCP patients ($N = 92$); outpatient cardiac clinic.</td>
<td>Pamphlet prior to testing ($n = 30$); pamphlet and discussion prior to testing ($n = 34$)</td>
<td>Standard information ($n = 28$)</td>
<td>Reassurance, chest pain, cardiac medication.</td>
<td>Immediately following testing and 1 month</td>
<td>Reassurance was significantly higher in the discussion group at follow-up. Chest pain also decreased for both interventions groups but not controls.</td>
</tr>
<tr>
<td>Arnold, Goodacre, Bath, &amp; Price (2009)</td>
<td>Patients with acute non-specific chest pain ($N = 700$); emergency department.</td>
<td>Verbal advice with supplemented information sheet ($n = 349$)</td>
<td>Verbal advice only ($n = 351$)</td>
<td>Anxiety and depression (HADS), health-related quality of life (SF-36), patient satisfaction, chest pain.</td>
<td>At least 1 month following diagnostic assessment</td>
<td>Intervention group had lower mean anxiety and depression levels as well as higher scores for mental health and perception of general health. No significant difference regarding subsequent symptoms.</td>
</tr>
<tr>
<td>Serinken, Zencir, Karcioglu, Sener, &amp; Turkcuer (2009)</td>
<td>Patients with atypical chest pain ($N = 523$); emergency department.</td>
<td>Information prior to testing ($n = 175$); information concurrent with testing ($n = 174$)</td>
<td>No written information ($n = 174$)</td>
<td>Reassurance, anxiety.</td>
<td>At discharge</td>
<td>Prior information intervention group showed higher reassurance scores at discharge in comparison to concurrent information intervention group and control group ($p &lt; .001$).</td>
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the pamphlet plus discussion group over the pamphlet alone group and controls. This pattern was maintained at the 1-month follow-up, which perhaps suggests that the key to strengthening lasting reassurance may be in providing a context for the patient to interpret negative results. In other words, the study points to the potential value of targeting cognitive schemas relating to symptoms and illness prior to testing in order to improve later reassurance and decrease illness concern.

More recently, a large study (Serinken et al., 2009) has looked at reassurance among cardiac patients in emergency settings, examining the effect of the time at which a brief information intervention was provided to patients. The study involved patients who presented with atypical chest pain, a diagnosis that was made following normal cardiac enzyme tests. Patients ($N = 523$) were randomised into one of three groups: the first group received information about the test and normal parameters in relation to heart disease prior to testing; the second group received information at the time of test results; and a control group, who received no information sheet. Findings at discharge showed higher reassurance scores for the intervention groups (particularly for the early information group) in comparison to the control group. Lower anxiety scores following test results were also found for the intervention groups. Although lack of follow-up was a severe limitation, the study nonetheless points to the reassurance-increasing potential of information interventions, particularly if implemented prior to testing.

A large intervention study by Arnold and colleagues (2009) examined whether providing an information sheet to chest pain patients would reduce anxiety and improve perception of general health. Set within a hospital emergency department, the study randomised 700 patients into two groups, one receiving standard verbal advice following testing, the other receiving verbal advice supplemented with an information sheet. Following the intervention, patients in the information sheet group had significantly higher scores for general health perception, as well as scoring lower on anxiety. The study shows that written
information can assist with communication after assessment for acute chest pain, and this may have relevance for augmenting the reassurance message.

**Conclusions from the Literature**

Only eight studies met the review criteria. This demonstrates a lack of experimental research on the process of providing effective reassurance in cardiac settings. Considering the widespread view that reassurance is an important clinical intervention, it is surprising that research into interventions for patients with noncardiac chest pain is so scarce. Nonetheless, the review identified a handful of trials that have been conducted in a variety of medical settings ranging from emergency departments to outpatient clinics. A majority of the studies have been set within a context of common diagnostic tests used in cardiology (e.g., coronary angiography). Studies for the most part have been modest in size with most demonstrated some effect associated with improving reassurance.

The identified intervention studies utilised a wide variety of intervention strategies ranging from short information-based interventions through to extended CBT-based programmes. For the most part, CBT interventions have shown signs of effectiveness at improving reassurance outcomes. Such programmes have been specifically tailored to address maladjusted symptom cognitions primarily but have also addressed coping strategies that help mitigate the anxiety associated with atypical chest pain. The trade-off for the suggested success of such programmes is that they require a large amount of resources, and one study suggests that shortening CBT programmes and retaining efficacy is a challenging task.

Nonetheless, the search for shorter interventions based around providing information alongside the testing process has yielded mostly promising results. Such interventions have their value in their simplicity, inexpensiveness and applicability to a variety of medical settings. Trials here have shown that there is much to consider when providing information
interventions. Issues include timing (either prior to testing or at the time of receiving results), content, and the use of discussion in combination with information sheets.

Due to the low number of trials in this area, any conclusions about the effectiveness of one intervention over another are indeed tentative. However, the encouraging signs from studies investigating brief reassurance interventions point to avenues for future experimental research. The available evidence suggests that short information-based interventions that are combined with discussion and are presented prior to testing may be the way forward in improving reassurance outcomes among cardiac patients in a cost-effective manner.

**Chapter Summary**

Chest pain is a significant problem for patients, since the very experience of it carries an inherent threat of death (Fitzsimons, Parahoo, & Stringer, 2000). This poignancy imbues the process of providing effective reassurance to NCCP patients with much importance, not only for reducing unnecessary suffering, but also for addressing the potential drain on health care resources. Given the lack of experimental research in the field, the area of cardiology thus provides fertile ground for understanding the nature of medical reassurance.

Far from being a clear-cut process, however, the task of providing effective reassurance is a difficult one for medical professionals and involves much more than simply telling the patient that there is nothing wrong. Patient factors, particularly health anxiety, need to be considered in the reassurance process, as do the effects of undergoing diagnostic tests, which carry with them certain iatrogenic risks and should be used wisely in the context of providing medical reassurance.

The experimental research on reassurance in cardiac settings is sparse, but nonetheless the studies that have been conducted have demonstrated the usefulness and possible efficacy of psychological interventions in improving reassurance outcomes. More research needs to be
conducted in this area in order to improve patient outcomes and reduce excessive strain on medical resources.
CHAPTER FOUR
MEDICAL TESTING AND HEALTH BEHAVIOUR CHANGE

The previous chapter explored psychological issues around medical testing and negative diagnosis, paying particular interest to the problem of providing effective reassurance. The flipside of the coin, however, relates to the psychological impact of a positive diagnosis. One of the obvious ways this can impact on the patient relates to initial coping with an unfavourable diagnosis, which may result in a major cognitive and emotional shift in the way patients view their symptoms, as also explored in a previous chapter. The implications of a positive diagnosis may not only mean coming to terms with the immediate presence of disease, however, as some tests may only identify the individual as merely being at risk of a particular disease. For the doctor in this situation, this can mean using persuasive techniques in order to change health-behaviour attitudes and encourage the patient to make behavioural changes that can help reduce the risk of future disease.

The focus of this chapter will be to outline some of the theories behind health behaviour change, paying particular interest to cognitive factors that are seen as important for the process. This is of particular interest in the context of medical testing, where consultation can be augmented by diagnostic results. Of particular interest here is the use of medical images from cardiac diagnostic tests as catalysts for health behaviour change.

Changing Health Behaviour—The Art of Persuasion

Convincing patients to change their health behaviour is a difficult task for health professionals. Doctors use methods of persuasion with the aim to change attitudes and effect behaviour change. Methods of persuasion can take many forms. The elaboration likelihood model, however, makes a clear distinction between two ways through which the persuasive message can be communicated—that is, via the *central route* and through the *peripheral route*
(Petty, Cacioppo, Strathman, & Priester, 2005). The central route is dependant on carefully constructed arguments and incorporates situations where the individual considers the points of the argument. Here, successful attitude change is associated with the overall strength of the argument. The peripheral route, on the other hand, relies not so much on the message itself but rather on the external features unrelated to the message. In a clinical situation this may mean that the fact that the message is given by a specialist in the first place may influence the appropriate attitudinal change, as the *perceived credibility* of the communicator is an important factor in relation to persuasion (Petty & Cacioppo, 1986). Other factors that play a part in persuasion via the peripheral route include *source attractiveness* and *message length*, as in each case, attitude change relies on simple cues and shortcuts (Petty et al., 2005).

Such efforts by health professionals, however, may not always lead to successful outcomes, as although patients may have seen an appropriate change in attitude and have good intentions to engage in a particular health behaviour, they may not necessarily follow through with the behaviour change itself—indeed, a meta-analysis that looked at psychoeducational programmes for cardiac patients found this to be the case for most patients (Dusseldorp, van Elderen, Maes, Meulman, & Kraaij, 1999). This so-called intention–behaviour gap is a recognised issue in the health psychology literature and has been the focus of much research.

Certain patient factors appear to play an important role in bridging the intention–behaviour gap. In a prospective study involving cardiac rehabilitation patients, Sniehotta, Scholz and Schwarzer (2005) examined three psychological constructs—action planning, self-efficacy, and action control—as potential mediators between intention and behaviour. The study involved three measurement time points: exercise intentions were measured at baseline during patients’ second week at a cardiac rehabilitation centre, the predictor variables were measured 2 months after discharge, during what might be termed the motivational phase, and behaviour was measured 2 months later again. Structural equation modelling showed that the
three factors were uniquely contributing mediators between earlier exercise intentions and later physical activity. The findings of this study and others (see Gollwitzer & Sheeran, 2006) suggest that certain post-intentional factors may be important for addressing the gap between intention and behaviour.

Notwithstanding this, however, there also appear to be many factors even earlier in the process that play an important role in forming the behavioural intentions per se. Various health behaviour models have been developed to investigate and better understand the factors behind behavioural intention and predict ensuing health-protective behaviour.

**Predicting Health-Protective Behaviour—Four Theoretical Approaches**

Some early theories that have been useful in explaining engagement in preventive health behaviour include the health belief model and protection motivation theory. Other later models such as the theory of reasoned action and the theory of planned behaviour have looked at the factors influencing health behaviour intentions. Each model has its own unique focus and application, and an outline of their central tenets and predictive usefulness is relevant at this point.

The *health belief model* (Rosenstock, 1966) focuses on individuals’ attitudes and beliefs as mediators of health behaviour. The model takes into account appraisals of constructs representing the perceived health threat as well as the associated health behaviour. According to the model, health behaviours are predicted by an individuals’ perception of their *perceived susceptibility* to a health threat, the *perceived severity* of the threat, and the *perceived benefits* and *perceived barriers* associated with the cessation of a health-compromising behaviour. Additionally, *cues to action* are influences that help promote the desired behaviour. These influences can be either internal (e.g., symptoms) or external (e.g., media messages). Additionally, a later revision of the model incorporated self-efficacy as a
separate independent variable in order to better account for health-related behaviour and guide more effective behavioural interventions (Rosenstock, Strecher, & Becker, 1988).

Protection motivation theory (Rogers, 1975) also places importance on cognitive appraisals of disease threat as mediating factors for behavioural change, although as a reworking of the health belief model, it defines and structures these factors with notable difference. External and internal sources of information about a health threat initiate two cognitive processes: (1) threat appraisal, which consists of the perceived seriousness of a health threat (severity) and the probability of it occurring (vulnerability); and (2) coping appraisal, a factor comprising perceived efficacy of the recommended preventive behaviour (response efficacy) and perceived self-efficacy in undertaking the behaviour. According to the theory, these factors lead to maximised behavioural responses through the mediating factor of protection motivation under the right appraisal conditions—that is, when the threat is severe and the individual feels vulnerable, when the adaptive response is perceived to be effective, and when perceived self-efficacy of undertaking the response is high (Prentice-Dunn & Rogers, 1986).

The theory of reasoned action (Ajzen & Fishbein, 1980) provides a parsimonious theoretical approach in explaining health behaviour. The model focuses on two factors that feed into behavioural intention: (1) the individual’s attitude towards the behaviour, which is informed by beliefs that the behaviour leads to a certain outcomes and the extent to which the behaviour is evaluated favourably or unfavourably; and (2) subjective norms, which incorporate beliefs about the views of specific individuals or groups regarding the behaviour—in other words, the perceived social pressure to perform the behaviour (Norman & Smith, 1995). These two factors, then, determine behavioural intention, which in the model is the last predictor variable of health behaviour.
The theory of reasoned action was aimed towards the prediction of volitional behaviour alone (Norman & Smith, 1995). The model thus inherently exhibited limited application when addressing behaviours over which individuals do not have complete volitional control. To address these limitations, Ajzen (1988) developed a theoretical extension of the theory—the *theory of planned behaviour*. In addition to the constructs comprising the theory of reasoned action (i.e., attitudes towards the behaviour and subjective norms), the theory of planned behaviour also incorporates *perceived behavioural control* as an important predictor variable (see Figure 8). Perceived behavioural control is defined as the extent to which a particular behaviour is perceived to be under an individual’s control (Norman & Smith, 1995), and the construct shares similarities to self-efficacy (Bandura, 1977) and to a lesser extent locus of control (Rotter, 1966).

![Diagram](image)

*Figure 8. The theory of planned behaviour (from Ajzen, 1991).*

All four models have shown varying degrees of efficacy in predicting health behaviour. Initially developed to investigate and explain uptake of health services, the health belief model has gone on to be used to investigate other preventive health behaviours as well as post-diagnostic compliance with recommended medical regimens (Conner & Norman, 1996). The predictive value of the model is limited, however, as evidence suggests that at best
any one dimension of the model accounts less than 10% of the variance across a variety of health behaviours and effect sizes overall are weak to modest (Harrison, Mullen, & Green, 1992). Protection motivation theory, on the other hand, has demonstrated greater efficacy for predicting health behaviour and has shown flexible application. A meta-analysis conducted by Floyd, Prentice-Dunn and Rogers (2000), for example, included 65 studies that covered 20 separate health issues and showed the model to have a moderate mean effect size (0.52) overall.

The theory of reasoned action and the theory of planned behaviour are among the most common models employed to examine health behaviour (Armitage & Conner, 2001). The theory of planned behaviour has been applied to a wide range of behaviour from healthy eating (Shepherd, 1999) and exercise (Hausenblas, Carron, & Mack, 1997) through to safe sex behaviour (Sheeran & Orbell, 1998). Meta-analyses have shown that the theory of planned behaviour predictor variables account for a large part of the variance when predicting intentions: one meta-analysis (Downs & Hausenblas, 2005) showed the variables to account for around 30% of the variance with regard to intentions to exercise, whereas Armitage and Conner (2001), analysing a wider range of behaviours, reported almost 40% of the variance accounted for with regard to intentions and 27% for the behaviour itself. In terms of diet, exercise and smoking behaviour—which are significant behaviours for heart health—the theory of reasoned action has shown greater predictive power than the health belief model (Mullen, Hersey, & Iverson, 1987).

The varying degrees of success that these four models have had at predicting health behaviours related to different diseases may lead one to overlook some of the similarities that they share. In fact, Weinstein (1993) has argued that the models share more similarities than differences in a number of ways. For example, each view that motivation towards protection is a result of perceived disease threat as well as the desire to avoid a potential negative outcome. The theories also maintain a cost–benefit analysis component, where individuals
weigh up the expected benefits in risk reduction and the expected costs engaging in the health behaviour. And finally, with the exception of the theory of reasoned action, the construct of self-efficacy is built into each model to various degrees, although the subtleties of its definition vary from model-to-model.

Overall, the above social cognition models view the individual as engaging in an appraisal process that can take into account perceptions of the illness, risk assessment, and beliefs about a particular behaviour and its consequences for health. The appraisal process is by definition iterative, and this may be particularly important to keep in mind in diagnostic settings where perceptions of illness—or illness representations—can change dramatically (Devicich et al., 2008). Such illness representations have been shown to have many implications for health behaviour.

**Illness Representations and Behaviour Change**

Research into individuals’ cognitive representations of illness is predominantly placed within a self-regulation theoretical framework. The common-sense model of self-regulation (Leventhal et al., 1997; Leventhal, Nerenz, & Steele, 1984) proposes that individuals form common-sense beliefs concerning their illness in order to assist in understanding and coping, and patients evaluate their treatment in respect to their perception of their condition (Karamanidou, Weinman, & Horne, 2008). The model assumes that individuals are active processors of illness information, and this information is processed via two parallel pathways—cognitive and emotional. Both cognitive and emotional pathways are seen as important in the model. Indeed, it has been argued that problem-focused regulation and emotional regulation processes should each be given adequate attention in order to maximise treatment effects when designing patient interventions based on a self-regulation framework (Cameron & Jago, 2008).
The self-regulation model consists of three stages that are closely related, suggesting an information-processing pathway dynamic in nature (Leventhal, Leventhal, & Cameron, 2001). According to the model, the individual must decide upon a coping strategy for an illness as well as monitor the results of the strategy—these are referred to as *coping* and *appraisal* stages in the model (see Figure 9). These factors feed back on each other to the extent that the appraisal stage may lead to adjustment of the coping strategy, depending on the extent of its success.

![Diagram of the self-regulation model](image)

*Figure 9. The common-sense model of self-regulation (adapted from Leventhal et al., 2001).*

Individuals’ cognitive (and emotional) representations of their illness (also referred to as illness perceptions) are outlined in the model. Within the field of self-regulation research, five specific content domains have been identified as sets of attributes pertaining to how individuals perceive illness: (1) illness *identity*, which is the label given to an illness and the symptoms that define it in the view of the individual; (2) beliefs about the development and duration of the disease, referred to as *timeline*; (3) the illness *cause*, which can be attributed to a range of factors that can be categorised as external (e.g., bacteria), internal (e.g., genetic predisposition), or behavioural, such as diet and exercise; (4) the *consequences* of the illness, with outcomes ranging from physical and emotional impact to social and economic costs; and (5) *control* beliefs—that is, the perceived responsiveness of the illness to treatment from
expert intervention or self-treatment (Leventhal, Brissette, & Leventhal, 2003; Leventhal et al., 2001).

According to Leventhal’s (1984) model, then, an individual’s representations of an illness are based around specific components that, in the process, determine coping, which in turn is monitored and may be modified by the appraisal stage. The self-regulation model has been adapted to a variety of issues including treatment adherence (Horne, 1997), coping with chronic illness (e.g., Cameron et al., 2005) and behaviour change following illness (Petrie, Cameron, Ellis, Buick, & Weinman, 2002). Patients illness perceptions certainly have implications for health behaviour (see Petrie, Jago, & Devcich, 2007) and thus may be useful to measure in medical testing environments aimed to encourage health behaviour change.

**Measuring Illness Perceptions**

The interest in measuring patients’ perceptions or representations of their illness was fostered from the increasing attention placed on the importance of understanding patients’ views of their illness. Understanding illness representations was seen as important particularly in the attempt to understand illness-related coping as well as in developing interventions for the facilitation of self-management strategies in patients with chronic illness (Weinman et al., 1996).

Initially, semi-structured interviews were used to explore patients’ illness representations. However, in response to the psychometric validity issues that are inevitably associated with such methods, new measures were developed to allow for more reliable methods of measurement. The Illness Perceptions Questionnaire (IPQ) was an attempt by Weinman and colleagues (1996) to develop an assessment questionnaire that was flexible enough to be administered to a wide variety of patient groups but still possessed good psychometric properties. The IPQ comprises five scales that represent the discrete illness
perception domains—identity, cause, timeline, consequences, and cure control. With regard to psychometric properties, it was shown in initial testing to be acceptable with regards to various aspects of reliability, as well as with respect to concurrent, discriminative and predictive validity.

Further development of the scale led to a revised version that extended on the initial domains. The so-called Revised Illness Perception Questionnaire (IPQ-R; Moss-Morris et al., 2002) included an assessment of patients’ perceptions of how well they understood their illness (coherence) as well as their emotional response to the illness. During the evaluation phase of the questionnaire, the researchers tested the discriminant validity of the measure and showed that it was not a reflection of affective disposition. In fact overall the IPQ-R provides a more psychometrically robust means of assessing illness representations with applicability to a wide range of illnesses. Indeed, the measure has been used in well over 100 studies (Petrie, Jago, & Devcich, 2007) ranging from patients with acute injuries (Chan et al., 2009) through to patients coping with chronic illness (Sciacchitano, Lindner, & McCracken, 2009) and patients with end-stage disease conditions (Timmers et al., 2008). This is due to one of the central features of the IPQ-R being adaptable to a variety of illness, a feature that the authors of the measure encourage other researchers to take advantage of in acknowledgement of the influences cultural factors or particular illness characteristics can have on patients’ perceptions.

One of the drawbacks with the IPQ-R, however, is the time required to complete the questionnaire. This may become an issue when there is limited time in clinical settings or when working with elderly or especially ill populations. To address these issues, Broadbent and colleagues (2006) developed the Brief Illness Perception Questionnaire (Brief IPQ), a nine-item measure that can be completed within a few minutes. The questionnaire assesses eight discrete illness perception domains (i.e., consequences, timeline, personal control, treatment control, identity, concern, understanding, and emotional response) on eight Likert-
type scale items and also includes one item that requires patients to list what they consider the three most important causal factors of their illness. The authors of the questionnaire argue that the Brief IPQ is particularly useful in situations where researchers need to assess illness perceptions repeatedly over short time periods (e.g., Devcich et al., 2008), thus reducing the burden on participants. Nonetheless, a majority of studies that have utilised the Brief IPQ to the present have used cross-sectional methodologies (e.g., Figueiras et al., 2010; Petriček et al., 2009).

Patient Drawings—An Alternative Assessment Method

Patients’ drawings of their illness can provide some insight into cognitions and emotions concerning their health. Here—using heart patients as an example—patients are typically asked to draw a picture of what they think their heart looks like at the present time. The intention is to explore patients’ ideas of how they see the condition of their heart, which may have an impact on health outcomes. Indeed, it has been shown that the size of heart damage drawn by myocardial infarction patients can significantly predict recovery (Broadbent, Petrie, Ellis, Ying, & Gamble, 2004). In comparison to patients who drew no damage on their heart at baseline, patients who drew heart damage were less recovered at follow-up 3 months later and had lower perceived control over their heart condition. There was also a significant positive association between the amount of heart damage drawn and a slower return to work. A clinical indicator of heart damage (troponin T) did not, on the other hand, predict speed of return to work, nor was it associated with most of the other outcomes predicted by patient drawings.

Another study by Broadbent, Ellis, Gamble, and Petrie (2006) showed that the size of the drawing can be an important indicator of illness anxiety. Cardiac patients who were admitted following a myocardial infarction drew pictures of their heart at discharge and at follow-up 3 months later. Patients who drew larger pictures at follow-up engaged in exercise
less frequently and showed increased activity restriction vis-à-vis before their myocardial infarction. As well as this, an increase in the size of the drawing at follow-up was associated with higher cardiac anxiety, more phone calls to health services and greater worry about having another myocardial infarction. Similar findings were also reported in a study of heart failure patients by Reynolds and colleagues (2007), where larger drawings, as measured by height and area, were associated with higher levels of heart-specific anxiety.

The rationale for using this method of assessment is that particular aspects of patient drawings reflect specific psychological states. For example, the size of the drawing may reflect the extent to which a condition is salient in the patient’s mind (Broadbent, Ellis, et al., 2006). While this is indeed plausible, as some studies outside the medical field (e.g., Craddick, 1961; Thomas, Chaigne, & Fox, 1989) suggest, further research needs to be conducted in this area to explore particular phenomenological aspects of patient drawings (e.g., size, detail, etc.) and their psychological correlates. The results so far are nevertheless encouraging and indicate that drawings may provide a useful alternative tool for assessing patients’ cognitions and emotions relating to their illness. Indeed, the use of such methods is predicted to increase as valid assessment methods are also developed (Petrie, Jago, et al., 2007).

**Medical Testing and Behaviour Change**

Research has shown that medical testing can have positive effects on patients’ health behaviour. Indeed, one of the foremost researchers in cardiac exercise testing procedures discovered that patients taking a treadmill test seemed to be motivated to change behaviour afterwards, with 63% of respondents in one study reporting that they modified one or more risk factors and health habits as a result of taking the test (Bruce, DeRouen, & Hossack, 1980). Moreover, the patients most likely to be motivated to change their behaviour were
those receiving an abnormal test result, suggesting the potential role testing may have in the modification of risk factors and health behaviours among at-risk populations.

But the picture is not entirely clear for some testing procedures. For example, a randomised controlled trial (Robertson et al., 1992) involving a considerably large number of patients ($N = 578$) recruited from a number of UK general practices examined the motivational effects of cholesterol measurement with respect to smoking cessation and adherence to dietary advice on reducing fat intake. The advice given was the same for all participants, but those randomly allocated to the intervention group also received immediate feedback on their cholesterol concentration. At follow-up 3 months later, participants were assessed on total cholesterol level and smoking behaviour, with results showing no significant difference in effect size between groups. In other words, patients who were told their cholesterol level test results were no more likely to respond to dietary advice or to stop smoking than those who were not informed.

One method to help effect changes in attitudes and perceptions is through the use of imagery. Karamanidou and colleagues (2008), for example, tested a psycho-educational intervention designed for patients with end-stage renal disease who were prescribed phosphate-binding medication—a type of medication used for phosphate control in order to reduce cardiovascular events among this patient population. The intervention aimed to enhance patients’ understanding of how the medication works inside the body and provided a rationale for its use. Compared to care-as-usual controls, the participants in the experimental group received an information leaflet about the medication and also watched a demonstration that replicated the action of phosphate-binding drugs using a plastic model of a human stomach (see Figure 10). Outcome variables included medication knowledge, treatment beliefs and adherence using self-report and blood phosphate level measurements. Within-group analysis showed an effect on patients’ treatment beliefs and knowledge for the experimental group immediately following the intervention, although not all effects were
maintained at the follow-up points 1 and 4 months later. Between-group analysis at 4 months also showed significant differences for general understanding, understanding problems of high-phosphate levels, and medication outcome efficacy.

![Figure 10](image)

*Figure 10. Using imagery via a model of the human stomach (left) to explain the action (right) of phosphate-binding drugs (courtesy of Karamanidou, Weinman and Horne, 2008).*

Yet while it appears that the intervention was successful in changing beliefs, its effect on adherence behaviour was not evident. Although the authors highlighted the effect the intervention had on patient understanding of the medication and that, based on participant feedback, the demonstration helped patients to develop a concrete representation of how the medication worked, they also conceded that future interventions need to provide sufficiently convincing reasons for the need to adhere to medication in order to enhance motivation of adherence behaviour. In terms of the elaboration likelihood model, a central route persuasive message may be needed to augment the effects of the intervention.

**Using Medical Tests with Images to Change Cardiac Risk Behaviour**

The use of medical testing imagery—in conjunction with an appropriate persuasive message—thus has a possibility of becoming a viable means for encouraging changes in patients’ health behaviour. This is evidenced by a burgeoning level of research in the area, which for the most part has focussed on healthy sun-protection behaviour and cardiac health
behaviours (Hollands, Hankins, & Marteau, 2010). This research is not without its caveats: using tests with poor sensitivity and specificity may result in false reassurance, where apparently normal scans may have a limiting effect on behavioural compliance (Wijeratne, Iversen, Hall, & Hall, 2004), which indicates that much of the success relating to using images of biomarkers for behavioural change rests on the diagnostic accuracy of the medical test. With the increasing accuracy of diagnostic tests within cardiology, this becomes less of an issue, then, and some research has thus begun to explore the efficacy of using medical images within cardiac settings to change health behaviour.

A pilot study conducted by Shahab, Hall and Marteau (2007) examined the impact of medical images on smoking cessation, focusing in particular on behavioural intentions among smokers attending a cardiovascular outpatient clinic. Participants were randomly allocated to receive, following ultrasonography, either (a) ultrasound images contrasting a healthy artery with their own arteries showing atherosclerotic plaques, or (b) standard verbal feedback. Outcome measures were assessed at two points: Immediately following the intervention, the study looked at intention to quit smoking in the following month, perceived susceptibility to smoking-related illnesses, perceived severity of smoking-related illnesses, and perceived self-efficacy to quit smoking. At follow-up 4 weeks later, the study examined smoking cessation behaviours. The experimental group showed increases in perceptions of susceptibility to smoking-related diseases. There were also trends towards a higher mean intention to stop smoking and reported engagement in cessation behaviours for the intervention group. Although these latter results were not statistically significant, the authors were nonetheless encouraged, arguing that the effect sizes were suggestive of potential intervention effectiveness in terms of both motivational and behavioural outcomes and warrant further investigation beyond the limited scope of the pilot study.

Another study (Bovet, Perret, Cornuz, Quilindo, & Paccaud, 2002), conducted on smokers selected from the general population, showed promising results as well. Participants
were randomised to one of two experimental conditions: one group received ultrasonography of their carotid and femoral arteries, with those showing one or more plaques given two images of their plaques plus explanation and a 10-minute smoking cessation counselling session; the other group received smoking cessation counselling only. Seven-day abstinence from smoking was measured at follow-up 6 months later, with results showing higher quit rates for smokers allocated to ultrasonography and particularly in those receiving photographs. The study showed that providing smokers with images demonstrating the presence of atherosclerosis was an effective addition to advice on quitting smoking and may prove to be a helpful means to dissuade smoking behaviour.

Rodondi and colleagues (2008), using a non-experimental design, also explored the use of ultrasound images as a potential motivator for modifying smoking behaviour. Daily smokers \((N=30)\) underwent carotid ultrasonography, along with an educational tutorial on atherosclerosis, smoking cessation counselling and nicotine replacement therapy. Motivation to change smoking behaviour was assessed at baseline and at 2-month follow-up, at which point there was a smoking cessation assessment also. Motivation to quit smoking increased significantly from baseline to follow-up, and this was particularly evident for the patients who had plaques showing on their ultrasound images. A non-significant trend towards higher quit rates for those with plaques versus those without was also observed at follow-up. The non-experimental nature of the study makes it difficult to draw substantial conclusions from the findings, but taken as a feasibility study, however, it nonetheless highlights the potential for using images in conjunction with other interventions for the purpose of increasing motivation to quit smoking. Indeed, the authors of the paper argue that the findings call for larger randomised controlled trials to be conducted in this population to look at the long-term impact of carotid plaque screening on smoking cessation rates.

Kalía and colleagues (2006) conducted a study that examined patients who were on cardiac medication (statins) and who had undergone coronary calcium evaluation using
electron beam tomography at least 1 year prior. Participants were questioned at baseline and at follow-up around an average of 3 years later. As well as statin use, variables assessed included a variety of health behaviours such as lifestyle modifications, diet, exercise, smoking and vitamin usage. Using the coronary artery calcium score as a means for stratifying patients according to cardiac risk—with higher scores corresponding to greater presence of disease—it was shown that a significantly greater proportion of participants with high scores demonstrated adherence to their cardiac medication compared with those who had low scores. Multivariate analysis further showed that, after adjusting for covariates (i.e., cardiovascular risk factors, age, and gender), higher coronary artery calcium scores at baseline were strongly associated with adherence to statin therapy. These results reflect the findings of an earlier study that suggested important cardiac risk-reducing behaviours (i.e., consulting with a physician, decreasing dietary fat) may be reinforced by the knowledge of results from an electron beam tomography scan (Wong et al., 1996).

Despite the promising results of such studies, other research has not been so successful at demonstrating effects. A study by Lederman, Ballard, Njike, Margolies, and Katz (2007), for example, examined behaviour change in relation to cardiac risk among postmenopausal women, comparing the effects of cardiac risk factor screening with and without CT imaging of the coronary arteries. Participants \((N = 56)\) were randomly assigned to conventional screening or screening with additional CT imaging and were assessed at 6 months and 1 year following screening on key cardiac risk behaviours including physical activity level, use of prescribed medication (blood pressure and cholesterol medication) and changes in dietary consumption such as fat and fibre intake. Patients were also categorised into one of four coronary artery disease risk factor groups. Results showed no behavioural effect relating to the use of images, with no between-group differences at either follow-up point on all of the above behavioural outcomes. The hypothesis that the presence of visible disease on the CT images would have an impact on behavioural outcomes was perhaps thwarted by the fact that
most participants were reported to have low levels of arterial calcification. Such images may thus have had little salience for patients when viewing them. In fact an opposite effect may occur of seeing such images, as the researchers also reported significant decreases in diastolic blood pressure and cholesterol levels for the control group but not for the CT intervention group. The authors suggest the possibility of deleterious effects of normal images in relation to cardiac risk behavioural modification, while in higher risk groups positive effects remain to be demonstrated.

A randomised controlled trial conducted by O’Malley, Feuerstein and Taylor (2003) examined the efficacy of using an electron beam tomography scan as a motivational tool for changing health behaviour. The trial aimed to assess the effects of incorporating a medical testing procedure into a cardiovascular screening programme for active-duty US Army personnel but with the additional experimental condition of testing the integration of intensive case management versus care as usual. Follow-up was conducted at 1 year and assessed a primary outcome measure of change in a composite cardiac risk measure (Framingham Risk Score) and a variety of psychosocial and behavioural measures including physical activity, motivation to change behaviour, smoking cessation, BMI, blood pressure, as well as anxiety and depression. Although there were significant positive effects for the case management group versus controls with regard to cardiac risk score and motivation to change behaviour, the study failed to show an effect on any of the outcome measures for electron beam tomography versus non-testing controls. Although the study failed to demonstrate any substantial motivational effects of cardiac test imaging among a relatively asymptomatic cohort, the authors nonetheless suggest that further research needs to be conducted on higher-risk populations where there is a higher prevalence of coronary calcification. Here, testing effects on coronary risk profile may be more evident.

Finally, Ashraf and colleagues (2009) found no difference in smoking cessation rates at 1 year between an experimental group receiving CT screening and a no-treatment control
group. Within-group analysis, however, showed that a positive result from CT scanning motivated quitting and led to lower relapse rates in comparison to negative findings. Moreover, higher motivation to quit was a significant predictor for quitting behaviour at follow-up, as were low nicotine dependency and a longer period of abstinence from smoking.

Conclusions from the Literature

The current research overall suggests somewhat limited success so far in using medical test images in cardiac settings to encourage behaviour change in patients. The few studies that exist provide equivocal results, and any firm conclusions about using images to help reduce cardiac risk behaviours cannot be drawn at this stage, since studies using cardiac patient populations are so few. For this reason, further research using clinical groups needs to be undertaken, and studies need to include a wide range of cardiac risk behaviours on top of smoking behaviour, which has been the main outcome examined thus far.

While further randomised controlled trials need to be conducted in the area, proof-of-principle studies also need to be undertaken for new testing procedures such as CT angiography. Even though CT angiography is growing in popularity among clinicians as a means of profiling cardiac risk, the under investigation of its utility for encouraging behaviour change is nonetheless patently clear. Investigating the effects of CT testing images among a cardiac patient group could help unravel its effects on subsequent health behaviours among patients at cardiac risk and could help guide future interventions that aim to enhance such effects.

A number of questions, then, still remain to be answered through experimental and nonexperimental investigation: First, do medical images shift attitudes towards healthy behaviour and if so, how do they work with regard to social cognition models mentioned above that predict healthy behaviour? Second, what particular aspects of the images are
important for such effects and how can they be used effectively for enhancing attitude change? And finally, are there any negative effects associated with using medical images? Such questions need to be addressed in diagnostic settings that use detailed medical images, and CT angiography is a prime example here.

**Chapter Summary**

Changing the health behaviour patterns of at-risk patients is seen as an important-yet-difficult task for health professionals. Even when a persuasive message changes attitudes and intentions, the patient may not necessarily follow through with the actual health behaviour. A variety of theories have been developed to attempt to account for variables important for the process of behaviour change. Although the theories highlighted in this chapter differ in their approach and structure, they nonetheless share many similarities: all agree on the importance of the individual’s engagement in a process of appraisal, whether that be in terms of their perceived risk of a disease or their perception of the effectiveness of a behaviour. As well as this, most of the identified theories share a number of psychological constructs, including self-efficacy and perceptions of the costs and benefits of engaging in a particular health behaviour.

Research has shown that changing patients’ illness perceptions has many consequences for health behaviour, and some investigators have suggested that using imagery as a means of enhancing this process could result in more effective results when persuading patients to change their health behaviour. The use of medical testing images as catalysts for attitude and behaviour change, then, provides an adequate opportunity to effect such a change.

Overall, however, the studies identified in this chapter that have looked at using medical testing imagery to change behaviour have provided equivocal results. Because of this, further research needs to be conducted on such methods, particularly when considering new
imaging techniques such as CT angiography—a diagnostic test that is dramatically increasing in usage within cardiology but is yet to be adequately reviewed on its efficacy for changing cardiac risk behaviours. In short, further proof-of-principle studies may help to guide future interventions that aim to enhance the effectiveness of CT angiography on changing health behaviour among at-risk cardiac patient populations.
SECTION II

§

STUDY ONE
CHAPTER FIVE

TESTING THE EFFICACY OF A BRIEF CARDIAC REASSURANCE INTERVENTION: A RANDOMISED CONTROLLED TRIAL

Symptoms of chest pain can bring much concern for the individual. This is indeed understandable, as the very experience of such symptoms carries with it an inherent threat of death (Fitzsimons et al., 2000). In many cases, however, chest pain is benign and does not point to underlying cardiac pathology. Such noncardiac chest pain (NCCP) occurs commonly in both the general population and among people admitted to hospital for chest pain (Chambers & Bass, 1990; Mayou et al., 1994). Although cardiac causes of chest pain can be ruled out through advanced diagnostic testing, patients may continue to feel worried or anxious about their chest pain. In fact, despite good cardiac health outcomes for NCCP patients, there is an increased risk of poor quality of life and ongoing disability in this patient population (Potts & Bass, 1995).

Part of the cardiologist’s role is to provide adequate reassurance following benign cardiac test results in order to allay patients’ fears of underlying heart disease. Reassurance is considered an important intervention that is performed regularly by medical professionals in clinical practice (Buchsbaum, 1986; Linton et al., 2008) and has the potential to provide a safe, simple and cost-effective approach to reducing NCCP (Richter, 1991). Even so, the task of providing reassurance involves more than simply telling the patient that there is nothing wrong, and the process of providing effective reassurance has for the most part been poorly defined (Linton et al., 2008). Moreover, there has been a lack of research to date on the efficacy of reassurance interventions among patients with NCCP.

There is good evidence for the efficacy of cognitive-behavioural interventions aimed at improving reassurance among NCCP patients (Klices et al., 1990; Mayou et al., 1997; Van
Peski-Oosterbaan et al., 1999). However, such approaches are costly and typically require multi-session treatments, which begs the question as to whether cheaper more time-effective methods for enhancing reassurance can be just as efficacious.

Taking this approach, Petrie and colleagues (2007) developed a brief one-session psychological intervention aimed at improving reassurance. The intervention involved administering a pamphlet augmented with discussion to cardiac patients with NCCP prior to undergoing exercise stress testing. Results showed an improvement in reassurance at follow-up as well as a decrease in reported chest pain for those receiving the intervention in comparison to controls. Despite the promising results, however, it remains to be seen whether this type of intervention can be extended to other diagnostic settings within cardiology.

The first study of this thesis aimed to test the efficacy of this brief psychological intervention in enhancing reassurance among cardiac patients with normal coronary angiograms. Specifically, the study was a replication study of a successful trial conducted by Petrie and colleagues (2007) in an exercise stress testing setting. The present study thus looked at examining the generalisability of this type of brief, pre-testing intervention to another cardiac setting.

**Study Aims and Hypotheses**

The study conducted by Petrie and colleagues (2007) showed significant differences in self-reported reassurance immediately following stress testing and at 1-month’s follow-up between those receiving a pre-testing reassurance pamphlet along with discussion and those who received treatment as usual. The present study thus aimed to investigate the effect of the same pre-testing intervention on self-reported reassurance and experience of chest pain following normal coronary angiography test results.
**Hypothesis 1.** Patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly higher levels of reassurance compared to treatment-as-usual controls immediately following their test results.

**Hypothesis 2.** Patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly higher levels of reassurance compared to treatment-as-usual controls at follow-up 6 weeks after testing.

Petrie and colleagues also investigated patients’ experience of chest pain as well as behavioural correlates of reassurance, which included taking medication. The present study therefore aimed to investigate the effect of the intervention on chest pain experience as well as behavioural correlates of reassurance, particularly utilisation of health care resources. These points were addressed in the following hypotheses:

**Hypothesis 3.** Patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly lower chest pain severity at follow-up 6 weeks after testing.

**Hypothesis 4.** Patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report a significantly lower level of limitation to day-to-day activities due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing.

**Hypothesis 5.** Significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would make visits to their GP due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing.
Hypothesis 6. Significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would make calls to a health professional due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing.

Hypothesis 7. Significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would make emergency department visits due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing.

Hypothesis 8. Significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would be taking cardiac medication compared to treatment-as-usual controls at follow-up 6 weeks after testing.

Information sheets have been developed for use in cardiology in order to assist with communication, and most patients have seen value in receiving extra written material (Price et al., 2005). A further aim of the present information-based intervention study therefore was to look at the level to which patients’ questions about their condition had been addressed while in hospital. Further, as patient satisfaction has also been looked at in reassurance interventions (e.g., Arnold et al., 2009), another related aim of the present study was to examine patient satisfaction with the information received while at hospital. The following hypotheses were therefore formed to address these aims:

Hypothesis 9. Patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly higher levels of satisfaction with information received compared to treatment-as-usual controls immediately following their test results.
Hypothesis 10. Patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would have significantly fewer questions about their condition compared to treatment-as-usual controls immediately following their test results.
CHAPTER SIX

METHOD

The present study was an experimental design involving randomising patients to one of two conditions: either a brief psychological intervention prior to their angiogram or treatment as usual. Measures of reassurance following coronary angiography were observed immediately after the angiogram and at follow-up 6 weeks later.

Participants

The study comprised non-acute patients aged 18 years and over who were referred to the Coronary Care Unit at Auckland City Hospital for diagnostic angiography which showed negative findings for ischaemic heart disease from their coronary angiogram. Only patients undergoing angiography for the first time were recruited. Angiograms conducted for the purpose of cardiac examination prior to unrelated surgery or performed with the intention of proceeding to cardiac intervention immediately following the procedure—for example, percutaneous coronary intervention (angioplasty), coronary artery bypass grafting, or vascular stenting—were considered as non-diagnostic for the purposes of the present study. Patients typically came from the Auckland metropolitan area, but the study also included referrals from the Northland region. Exclusion criteria ruled out patients who did not speak English and patients demonstrating impaired cognitive ability.

Eighty-five consecutive patients who met the inclusion criteria were approached on the ward by the researcher. Of these, nine declined the invitation to participate and 12 were excluded because of insufficient English language comprehension. Furthermore, three participants did not complete the second questionnaire and one participant was lost to final follow-up. In total, then, 60 participants completed the study, with ages ranging from 45 to 79 years. The sample consisted of a slightly higher ratio of males to females (53.3% male), with
a large majority of participants identifying themselves as New Zealand European or Pakeha (78.3%). Most participants were retired (41.7%), married or in a de facto relationship (80.0%), and had received a secondary school education (66.7%). Full details of the sociodemographic characteristics for the study population are given in Table 3.

<table>
<thead>
<tr>
<th>Sociodemographic characteristic</th>
<th>Study group</th>
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<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(n = 29)</td>
<td>(n = 31)</td>
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<td>Age in years, M (SD)</td>
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<td>62.3 (8.0)</td>
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<tr>
<td>Gender</td>
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<td>16 (51.6)</td>
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<tr>
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<td>15 (48.4)</td>
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<td>25 (80.6)</td>
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<td>4 (12.9)</td>
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<td>4 (12.9)</td>
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<tr>
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<td>10 (32.3)</td>
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</table>

*Note.* Except where indicated, values show number of participants (with percentages in parentheses). *M* = mean, *SD* = standard deviation.
Procedure

The study received ethical approval from the Northern X Regional Ethics Committee in April 2008. Participant recruitment began June 2008 and ended with the completion of all follow-up assessments in April 2010.

Patients were approached on the ward at the Coronary Care Unit at Auckland City Hospital by the researcher. Patients received a participant information sheet and, after providing a description of the study and what was required from participants, the researcher asked potential participants whether they would be interested in taking part. Following written consent, patients completed the baseline questionnaire prior to undergoing their angiogram. This was done either in the waiting room or on the ward itself. The baseline questionnaire covered demographic data, trait anxiety, illness perceptions and attitudes towards the angiography procedure. Clinical data were also collected at this time using available medical records.

Following baseline data collection, patients were randomised to receive either the intervention (pamphlet and discussion) prior to their angiogram or treatment as usual (control). Randomisation was achieved via a ‘coin toss’ random number generator (www.random.org). Patients then underwent their angiogram, which typically took 30-40 minutes to complete. As a diagnostic test, the angiogram was performed to assess the degree of coronary atheroma present and establish the diagnosis of flow-limiting coronary artery disease. The angiogram allowed for classification of patients as having either normal or diseased arteries: patients with diseased arteries were identified as having greater than or equal to 50% luminal diameter narrowing of at least one major coronary artery as per visual assessment and measurement by the attending cardiologist; patients identified as normal, on the other hand, were diagnosed by the cardiologist as having either “no significant disease” or “normal arteries” on the angiogram report sheet and were therefore included in the study.
After their angiogram, patients were required to rest for around 2 hours to allow for recovery and monitoring. Once rested, participants with normal test results were administered the second questionnaire, which again covered illness perceptions as well as patients’ views of the procedure and levels of reassurance based on the information they received from their angiogram results. Patients were discharged around 5 hours after the procedure.

Patients with normal coronary arteries were included in the telephone follow-up at 6 weeks (this time period was used to take into account a post-angiogram clinic that patients attended, typically around 3 to 4 weeks after testing). The questionnaire administered at this point measured reassurance levels, health care activity and experience of chest pain leading up to the time of follow-up. Figure 11 shows a CONSORT diagram of patient flow through the study.

**Intervention**

Patients allocated to the intervention group received a brief pamphlet detailing features of the angiogram procedure and implications of positive and negative test results (see Appendix C). The pamphlet was designed to outline the function of the diagnostic angiogram, as well as explain what negative findings might mean and outline other possible reasons for chest pain that are less serious. Participants read through the pamphlet and were then asked by the researcher if they had any questions about what they had read. The researcher then reiterated the main points of the pamphlet: that a lot of people who experience chest pain worry that there may be something seriously wrong with their heart; that just because the patient’s pain is not cardiac related does not mean that it is not real or legitimate pain and there may be a number of other causes for their chest pain that are less medically serious; and that worry about chest pain can be a factor in ongoing chest pain. The intervention took on average around 15 minutes to complete.
Figure 11. CONSORT diagram showing the flow of participants through study comparing reassurance intervention and controls.
Measures

Data were collected from each participant at three time points using three questionnaires (see Appendix B): a pre-diagnostic baseline questionnaire was administered before the angiogram; a post-diagnostic questionnaire was filled out following the angiogram but before discharge; and a final questionnaire was administered to participants by telephone at the 6-week follow-up. Relevant clinical data were also collected on the day of the angiogram by means of retrieval from medical records. The composition of the three questionnaires administered to the participants is detailed below.

Pre-Diagnostic Questionnaire

Participants completed a five-page baseline questionnaire that assessed illness perceptions, self-rated health, trait anxiety, as well as general background information. Details of the items and scales used are shown below.

Demographic Data. Participants were asked to provide information including gender, age, marital status, ethnicity, employment status, living arrangements, and level of education. As well as this, participants were asked to indicate whether they had previously undergone any cardiological testing, which included exercise tolerance testing and electrocardiogram testing.

Self-Rated Health Scale. This measure was used to assess self-reported perception of health at the time of questionnaire administration. Participants rated their current health, in comparison to someone in excellent health, by indicating which of seven descriptors (‘terrible’, ‘very poor’, ‘poor’, ‘fair’, ‘good’, ‘very good’, and ‘excellent’) fitted best with their perception. The scale has been used to assess individual perceptions of health vis-à-vis perceived health of others (Johnston, Wright, & Weinman, 1995).
Illness Identity Subscale—Revised Illness Perceptions Questionnaire. The Revised Illness Perception Questionnaire (IPQ-R; Moss-Morris et al., 2002) provides a comprehensive assessment of the main components of patients’ illness representations. The identity subscale consists of 14 items covering a wide array of symptoms, some more relevant than others for certain illnesses. For this reason, 10 items were drawn from the original subscale in accordance with their relevance for cardiac illness. The measure requires subjects to indicate whether or not they have experienced each of the listed symptoms over the previous year. For each symptom experienced, subjects also have to indicate whether they believe that the symptom is related to their heart. A total illness identity score is gained by summing the number of symptoms experienced that are perceived by the patient to be cardiac related.

Brief Illness Perception Questionnaire. Patients’ illness perceptions were measured using the Brief Illness Perception Questionnaire (Brief IPQ; Broadbent, Petrie et al., 2006), a shortened version of the IPQ-R. The Brief IPQ comprises nine items designed to assess the main dimensions of illness perceptions. Items require subjects to respond on a continuous rating scale to questions about particular illness beliefs. For example, responses to the item ‘How much control do you feel you have over your illness?’ range from ‘absolutely no control’ (score = 0) to ‘extreme amount of control’ (score = 10). Items were modified to increase face validity for a cardiac patient population. (For example, the above item was changed to ‘How much control do you feel you have over your heart problem?’ to better reflect cardiac illness.) The authors of the Brief IPQ reported good test–retest reliability and concurrent validity was demonstrated with the IPQ-R.

Short Form of the State-Trait Anxiety Inventory. The shortened version of the 40-item State-Trait Anxiety Inventory (STAI; Marteau & Bekker, 1992) was used to gauge patients’ trait anxiety. The short form of the STAI is a six-item measure that covers six emotional states (calm, tense, upset, relaxed, content, worried) and requires participants to respond on a 4-point Likert-type scale regarding how they feel most of the time for each state (i.e., ‘not at
all’, ‘somewhat’, ‘moderately’, or ‘very much’). Marteau and Bekker (1992) reported good internal consistency of the measure (α = .82), which is comparable to the reliability coefficient of the original STAI.

Other Items. Various items from the post-diagnostic questionnaire and the follow-up questionnaires were also included for the purpose of comparison. These included items concerning recovery beliefs (e.g., ‘How much do you think your heart can physically recover from your heart problem?’) and experience of chest pain (e.g., ‘On average, how frequent was your chest pain over the past month?’).

Post-Diagnostic Questionnaire

This questionnaire included a re-administration of the Brief IPQ and recovery beliefs items. The main focus of the questionnaire is on patients’ views of the angiogram procedure and the information received. Reassurance was also assessed at this point.

Angiogram Satisfaction Scale. A four-item measure was developed to measure patient satisfaction with the angiogram procedure. The items addressed various elements of the procedure as perceived by the patient, including satisfaction with how well the procedure was explained, how well the results were explained, how seriously patient concerns were dealt with, and how thoroughly the procedure was conducted. Again, each item response was measured on a continuous linear scale that ranged from 0 to 10, with high scores corresponding to higher satisfaction. Items were summed to give a total angiogram satisfaction score. The scale showed high internal consistency (α = .86).

Reassurance Scale. A four-item measure was used to assess reassurance following angiogram results. The scale included an item assessing patients’ self-reported reassurance from the angiogram, as well as three reversed items that measured patients’ worry about their health, belief that there was something seriously wrong with their heart, and belief in the need
for further testing. Each item response was measured on a 10-point continuous linear scale, and a total reassurance score (max = 40) was acquired by summing all four item scores. Thus, high scores indicated higher levels of reassurance. The scale has been used to assess reassurance after exercise stress testing (Donkin et al., 2006) and was shown to have good internal consistency immediately following testing (α = .84) and at 1-month follow-up (α = .88).

**Recovery Beliefs.** Two items were used to measure patient recovery beliefs. The first item (“How much do you think your heart can physically recover from your heart problem?”) required participants to respond on a continuous linear scale that ranged from 0 to 10, with high scores indicating better recovery beliefs. The second item required participants to indicate the number of weeks they felt it would take them to feel completely recovered from their heart problem.

**Other Items.** Four further items were included to assess various other health beliefs. These included the amount of distress about symptoms, the amount of worry about having a heart attack, how much patients felt they would have to restrict their activities in the long term, as well as the perception of how strongly heart disease runs in their family. Once again, items were measured on a 0–10 continuous linear scale. A final item measured the extent to which patients had questions about their condition. The scale ranged from 0 (‘no questions at all’) to 10 (‘a lot of questions’).

**Patient Comments.** Patients were invited to write any comments about the testing procedure from perceptions of the angiogram itself to comments about the hospital and staff.

**Follow-Up Questionnaire**

A final follow-up questionnaire was administered via telephone 6 weeks following the patients’ coronary angiogram. The five-item reassurance scale administered in the previous
questionnaire immediately following angiography was re-administered at this point. Participants were also asked if they still experienced chest pain and, if so, how frequent it was over the previous month. Along with this, two further self-report items also assessed chest pain severity and effect on day-to-day activity over the previous month.

In addition to the above items, the self-rated health scale used in the baseline questionnaire was also administered at this point, and four further questions were asked which assessed behavioural correlates of reassurance:

1. How often have you visited your GP for chest pain over the past month?

2. Have you made any phone calls to any health professionals (e.g., GP, nurse, cardiologist) regarding your heart or symptoms?

3. How many times have you been to a hospital emergency department or received emergency medical care for chest pain over the past month?

4. Over the past month have you taken any medication for your heart?

Clinical Data

Relevant clinical data were collected on the day of patients’ angiogram (see Appendix B). Data included assessment of risk factors (i.e., smoking, family history of IHD, hypertension), lipid levels and heart history. Results from the angiogram test from the attending cardiologist were also recorded here.

Power Analysis

The power analysis for the present study was based on previous reassurance intervention study conducted by Petrie and colleagues (2007). The study investigated whether a brief psychological intervention could improve reassurance for cardiac patients following
normal test results from an exercise stress test. The researchers found that patients who received a pamphlet and discussion prior to testing reported significantly higher levels of reassurance than patients receiving treatment as normal. The present study aimed to replicate these findings within a patient population undergoing coronary angiography.

Formulas for power analysis \( n = 2 \times \left( \frac{\delta}{\gamma} \right)^2 \) and effect size \( \gamma = \frac{U^1 - U^0}{SD} \) were utilised to calculate the number of participants required for the present study, with the study by Petrie and colleagues (2007) used to substitute values for \( U^1, U^0 \) and \( SD \) (43.4, 34.4 and 12.3, respectively) in the effect size formula. This yielded 0.73 for the effect size \( (\gamma) \) value. A power calculation was conducted for the difference between two independent means (Howell, 1992) allowing for .8 power \((\beta)\) and .05 level of significance \((\alpha)\). Using these values for a two-tailed test, appendix power tables show that the equation would require \( \delta = 2.80 \). Substituting the numbers into the power analysis formula \( n = 2 \times \left( \frac{2.80}{0.73} \right)^2 \) gave the value of 29.49. Thus, 30 participants per group were required for the present study.

**Data Analysis**

Data were entered into and analysed with SPSS (version 11 for Mac) statistical software. Data cleaning procedures involved checking that all data fell within the possible range for a particular variable. Where anomalous values were found, they were checked against the original questionnaire and replaced with the correct value. In appropriate cases, missing values were substituted with means: where missing values within scales were less than 20 percent for individual cases, data were substituted with the mean of the non-missing responses on the items within that scale for that particular case.

Data were screened for normality and found to be acceptable for parametric analysis. A combination of analysis of variance (ANOVA) tests, chi-square tests and Fisher’s exact tests were used for initial exploration of data and comparison of study groups at baseline.
Tests for the main outcome measures included independent-samples $t$ tests, chi-square tests and Fisher’s exact tests, where appropriate.
CHAPTER SEVEN

RESULTS

The following results section is divided into four parts: initial exploratory data analysis, involving the investigation of any confounding differences between study groups in the trial at baseline; analysis of the intervention effects and hypothesis testing; and further analysis and exploration of the data.

Comparison of Groups at Baseline

Preliminary analyses were carried out to test for potential confounding differences between the two study groups at baseline. Socio-demographic variables (see Table 3) as well as important clinical variables (Table 4) such as cholesterol levels and smoking history were analysed for any differences across groups following randomisation. Continuous variables were tested using Student’s independent-samples $t$ tests and categorical variables were tested using chi-square ($\chi^2$) tests. Fisher’s exact tests were used for categorical variables with low expected frequencies.

No significant between-group differences were found at baseline regarding the sociodemographic variables (i.e., gender, ethnicity, marital status, employment status, and education level). Neither were there any significant differences in clinical variables (see Table 4). Independent-samples $t$ tests of mean STAI scores and self-rated health scale scores revealed no significant between-group differences in trait anxiety ($t(58) = 0.84, p = .41$) and self-rated health ($t(57) = -1.17, p = .25$) at baseline.

Overall, the tests revealed no detectable between-group differences with regards to important clinical and demographic variables following randomised allocation of participants into study groups.
Table 4. Clinical Characteristics Across Study Groups at Baseline

<table>
<thead>
<tr>
<th>Baseline variable</th>
<th>Study group</th>
<th></th>
<th></th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(n = 29)</td>
<td>(n = 31)</td>
<td></td>
</tr>
<tr>
<td>Lipids, M (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td></td>
<td>4.8 (0.8)</td>
<td>4.7 (0.8)</td>
<td>.86</td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td></td>
<td>1.3 (0.3)</td>
<td>1.3 (0.4)</td>
<td>.74</td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td></td>
<td>2.6 (0.7)</td>
<td>2.5 (0.7)</td>
<td>.70</td>
</tr>
<tr>
<td>Triglycerides</td>
<td></td>
<td>2.0 (0.7)</td>
<td>1.8 (0.8)</td>
<td>.44</td>
</tr>
<tr>
<td>Smoking history</td>
<td></td>
<td>17 (58.6)</td>
<td>15 (48.4)</td>
<td>.43</td>
</tr>
<tr>
<td>Clinical hypertension</td>
<td></td>
<td>15 (51.7)</td>
<td>15 (48.4)</td>
<td>.80</td>
</tr>
<tr>
<td>Family history of IHD</td>
<td></td>
<td>13 (44.8)</td>
<td>10 (32.3)</td>
<td>.37</td>
</tr>
<tr>
<td>Trait anxiety, M (SD)</td>
<td></td>
<td>13.0 (3.4)</td>
<td>13.9 (4.4)</td>
<td>.41</td>
</tr>
<tr>
<td>Self-rated health, M (SD)</td>
<td></td>
<td>4.9 (0.8)</td>
<td>4.6 (1.0)</td>
<td>.25</td>
</tr>
</tbody>
</table>

Note. Except where indicated, values show number of participants (with percentages in parentheses). HDL = high-density lipoprotein, LDL = low-density lipoprotein, M = mean, SD = standard deviation.

Hypothesis Testing

Hypothesis testing was conducted to examine intervention effects on (1) self-reported reassurance levels as well as (2) behavioural correlates of reassurance at follow-up. The hypotheses were based on previous research where a similar pre-testing psychological intervention was conducted on treadmill testing patients with non-cardiac chest pain (Petrie, Müller et al., 2007).

Self-Reported Reassurance

Self-reported reassurance levels were measured at two time points—immediately following coronary angiography and at follow-up 6 weeks after testing. Table 5 shows the means and standard deviations for self-reported reassurance at both time points across the study groups.
Table 5. Mean Values (with Standard Deviations in Parentheses) of Self-Reported Reassurance Levels Across Study Groups Immediately Following Testing and at Follow-Up

<table>
<thead>
<tr>
<th>Self-reported reassurance</th>
<th>Study group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (n = 29)</td>
<td>Intervention (n = 31)</td>
<td></td>
</tr>
<tr>
<td>Immediately following testing</td>
<td>35.6 (8.0)</td>
<td>37.2 (6.5)</td>
<td></td>
</tr>
<tr>
<td>At 6 week follow-up</td>
<td>37.2 (7.3)</td>
<td>36.4 (7.5)</td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 1. The first hypothesis stated that patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly higher levels of reassurance compared to treatment-as-usual controls immediately following their test results. An independent-samples t test was conducted to explore differences in self-reported reassurance immediately following testing. The test was not significant ($t(58) = 0.83, p = .41$) and thus did not support the hypothesis that patients receiving the intervention would report higher levels of reassurance immediately following testing in comparison to controls.

Hypothesis 2. The second hypothesis stated that patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly higher levels of reassurance compared to treatment-as-usual controls at follow-up 6 weeks after coronary angiography. An independent-samples t test was conducted to explore differences in self-reported reassurance at follow-up. The test was not significant ($t(58) = −0.41, p = .68$) and thus did not support the hypothesis that patients receiving the intervention would report higher levels of reassurance at the 6-week follow-up in comparison to controls.
Correlates of Reassurance at Follow-Up

Correlates of reassurance at follow-up were also explored as part of the hypothesis testing (see Table 6). Correlates such as chest pain effects on life—namely, chest pain severity and effect on day-to-day activity—and use of medical resources due to chest pain were examined. The latter included GP and emergency visits due to chest pain as well as calls to health professionals regarding chest pain. The number of participants taking medication related to chest pain at follow-up was also examined.

Table 6. Summary of Reassurance Correlates Across Study Groups at Follow-Up 6 Weeks After Coronary Angiography

<table>
<thead>
<tr>
<th>Follow-up variable</th>
<th>Study group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (n = 29)</td>
</tr>
<tr>
<td>Chest pain</td>
<td></td>
</tr>
<tr>
<td>Severity, M (SD)</td>
<td>4.1 (2.1)</td>
</tr>
<tr>
<td>Limitation, M (SD)</td>
<td>4.1 (2.2)</td>
</tr>
<tr>
<td>Behavioural correlates</td>
<td></td>
</tr>
<tr>
<td>Visits to GP</td>
<td>3 (10.3)</td>
</tr>
<tr>
<td>Calls to health professional</td>
<td>2 (6.9)</td>
</tr>
<tr>
<td>Visits to ED</td>
<td>—</td>
</tr>
<tr>
<td>Taking cardiac medication</td>
<td>24 (82.8)</td>
</tr>
</tbody>
</table>

Note. Except where indicated, values show number of participants (with percentages in parentheses). M = mean, SD = standard deviation, GP = general practitioner, ED = emergency department.

Hypothesis 3. This hypothesis predicted that patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly lower chest pain severity at follow-up 6 weeks after testing. An independent-
samples $t$ test was conducted to explore differences in self-reported pain severity at follow-up. The test was not significant ($t(29) = 0.46, p = .65$) and thus did not support the hypothesis that patients receiving the intervention would report lower levels of pain severity at the 6-week follow-up in comparison to controls.

**Hypothesis 4.** It was predicted that patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report a significantly lower level of limitation to day-to-day activities due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing. An independent-samples $t$ test was conducted to explore differences in self-reported limitation due to chest pain at follow-up. The test was not significant ($t(29) = -0.54, p = .59$) and thus did not support the hypothesis that patients receiving the intervention would report lower levels of limitation of day-to-day activities due to chest pain at the 6-week follow-up in comparison to controls.

**Hypothesis 5.** It was predicted that significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would make visits to their GP due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing. A Fisher’s exact test was conducted to explore between-group differences in GP visits at follow-up. The test was not significant (Fisher’s exact test, $p = .67$) and thus did not support the hypothesis that fewer patients receiving the intervention would make visits to their GP due to chest pain at the 6-week follow-up in comparison to controls.

**Hypothesis 6.** The next hypothesis stated that significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would make calls to a health professional due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing. A Fisher’s exact test was conducted to explore between-group differences in calls to health professionals at follow-up. The test was not significant (Fisher’s exact test, $p = .23$) and thus did not support the hypothesis that fewer
patients receiving the intervention would make calls to a health professional due to chest pain at the 6-week follow-up in comparison to controls.

**Hypothesis 7.** It was also predicted, as stated by the next hypothesis, that significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would make emergency department visits due to chest pain compared to treatment-as-usual controls at follow-up 6 weeks after testing. At the time of follow-up, however, no participants in either group had visited the emergency department for chest pain, thus the hypothesis that patients receiving the intervention, in comparison to controls, would make fewer emergency department visits due to chest pain at the 6-week follow-up was rejected.

**Hypothesis 8.** The final hypothesis that looked at reassurance correlates predicted that significantly fewer patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would be taking cardiac medication compared to treatment-as-usual controls at follow-up 6 weeks after testing. A chi-square test was conducted to explore between-group differences in cardiac medication use at follow-up. The test was not significant ($\chi^2(1, N = 60) = 0.74, p = .39$) and thus did not support the hypothesis that fewer patients receiving the intervention would be taking cardiac medication at the 6-week follow-up in comparison to controls.

**Patient Satisfaction**

Patient satisfaction was measured immediately following testing prior to patients being discharged from hospital. This encompassed two aspects—self-reported satisfaction with the information received while in hospital and the amount of questions patients had about their condition prior to discharge. The means for these variables of patient satisfaction across study groups are presented in Table 7.
Table 7. Mean Values (with Standard Deviations in Parentheses) of Self-Reported Patient Satisfaction Variables Across Study Groups Immediately Following Testing

<table>
<thead>
<tr>
<th>Patient satisfaction variable</th>
<th>Study group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control ($n = 29$)</td>
</tr>
<tr>
<td>Satisfaction with information</td>
<td>9.3 (1.3)</td>
</tr>
<tr>
<td>Questions about condition</td>
<td>3.6 (3.5)</td>
</tr>
</tbody>
</table>

**Hypothesis 9.** It was hypothesised that patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would report significantly higher levels of satisfaction with information received compared to treatment-as-usual controls immediately following their test results. To test this hypothesis, an independent-samples $t$ test was conducted to explore differences in satisfaction with information received prior to discharge. The test was not significant ($t(55) = −1.21, p = .23$) and thus did not support the hypothesis that patients receiving the intervention would report higher levels of satisfaction with information prior to discharge in comparison to controls.

**Hypothesis 10.** The final hypothesis stated that patients receiving a brief reassurance intervention (pamphlet and discussion) prior to their coronary angiogram would have significantly fewer questions about their condition compared to treatment-as-usual controls immediately following their test results. An independent-samples $t$ test was conducted to explore differences in the extent to which patients had questions about their condition at discharge. The test was not significant ($t(55) = 0.52, p = .61$) and thus did not support the hypothesis that patients receiving the intervention would report having fewer questions about their condition prior to discharge in comparison to controls.
Additional Exploration of Data

Further examination of the data was conducted to explore the relationship that trait anxiety and illness perception variables prior to discharge had with self-reported reassurance at both time points for all patients. Correlations were carried out between the eight items of the Brief IPQ as well as trait anxiety, as measured by the STAI (see Table 8). Trait anxiety was positively related to emotional effect of the illness, and significant positive associations were found between the key illness perception of illness identity, on the one hand, and illness concern, emotion effect of the illness, illness consequences and timeline, on the other. Illness concern showed a significant positive relationship to consequences and timeline—that is, participants who reported more concern about their illness were also more likely to report more perceived consequences of their illness and a longer perceived timeline.

Relationships between the above variables and reassurance both at discharge and at follow-up for participants in the present study were then explored using Pearson product moment correlations (see Table 9). A Bonferroni-corrected significance level was used ($p = .05/18$), as multiple correlations were conducted in the analysis with no pre-planned comparisons. At the time of discharge from hospital, self-reported reassurance was significantly negatively associated with trait anxiety as well as a number of Brief IPQ items: illness identity, illness concern, emotional effect of the illness, and perceived illness consequences. At the time of follow-up 6 weeks later, however, only illness identity showed a significant association with self-reported reassurance, where participants reporting lower reassurance at follow-up were more likely to have higher illness identity at the time of discharge.
Table 8. Correlations Between Trait Anxiety (STAI) and Illness Perceptions (Brief IPQ) Among Study Participants

<table>
<thead>
<tr>
<th></th>
<th>STAI</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAI</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Identity (1)</td>
<td>.25</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Concern (2)</td>
<td>.18</td>
<td>.58**</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Coherence (3)</td>
<td>-.17</td>
<td>-.04</td>
<td>.01</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Emotion (4)</td>
<td>.33*</td>
<td>.58**</td>
<td>.66**</td>
<td>-.07</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Consequences (5)</td>
<td>.15</td>
<td>.46**</td>
<td>.64**</td>
<td>.12</td>
<td>.44**</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Timeline (6)</td>
<td>-.01</td>
<td>.45**</td>
<td>.34**</td>
<td>-.09</td>
<td>.20</td>
<td>.42**</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Control (7)</td>
<td>.03</td>
<td>-.25</td>
<td>-.18</td>
<td>.24</td>
<td>-.29*</td>
<td>-.18</td>
<td>-.39**</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Brief IPQ Treatment (8)</td>
<td>.02</td>
<td>.06</td>
<td>.21</td>
<td>.28*</td>
<td>.01</td>
<td>-.11</td>
<td>.11</td>
<td>.42**</td>
<td>—</td>
</tr>
</tbody>
</table>

*p < .05, 2-tailed. **p < .01, 2-tailed.
Table 9. Correlations of Trait Anxiety (STAI) and Illness Perceptions (Brief IPQ) with Self-Reported Reassurance at Discharge and 6-Week Follow-Up

<table>
<thead>
<tr>
<th>Variable</th>
<th>Self-reported reassurance</th>
<th>( p &lt; .003, 2\text{-tailed.} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At discharge</td>
<td>At 6-week follow-up</td>
</tr>
<tr>
<td>STAI</td>
<td>−.43*</td>
<td>−.19</td>
</tr>
<tr>
<td>Brief IPQ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identity</td>
<td>−.56*</td>
<td>−.39*</td>
</tr>
<tr>
<td>Concern</td>
<td>−.55*</td>
<td>−.25</td>
</tr>
<tr>
<td>Coherence</td>
<td>.32</td>
<td>−.08</td>
</tr>
<tr>
<td>Emotion</td>
<td>−.48*</td>
<td>−.27</td>
</tr>
<tr>
<td>Consequences</td>
<td>−.44*</td>
<td>−.31</td>
</tr>
<tr>
<td>Timeline</td>
<td>−.33</td>
<td>−.34</td>
</tr>
<tr>
<td>Control</td>
<td>.19</td>
<td>.13</td>
</tr>
<tr>
<td>Treatment</td>
<td>.01</td>
<td>−.15</td>
</tr>
</tbody>
</table>
CHAPTER EIGHT

DISCUSSION

The present experimental study sought to test the effects of a brief pre-testing intervention aimed at enhancing reassurance among a cohort of non-acute, negative-testing patients undergoing conventional coronary angiography. The study compared an intervention group with treatment-as-usual controls on a variety of reassurance outcomes. Self-reported reassurance was measured immediately following testing and at follow-up 6 weeks after angiography. Various behavioural and other related correlates of reassurance (e.g., chest pain occurrence and use of medical resources) were measured at the 6-week follow-up.

Intervention Study Findings

The present study failed to show any effects on self-reported reassurance both immediately following testing and at follow-up, with no statistically significant differences in levels of reassurance reported by patients at either time point. As well as this, no differences were found between the intervention group and the control group regarding chest pain variables—namely, chest pain severity and limitation of day-to-day activities due to chest pain—and no effects were found on a range of variables assessing putative behavioural correlates of reassurance. These variables included reassurance-seeking behaviours such as patient visits to their general practitioner and calls to a health professional as a result of chest pain, visits to an emergency department due to chest pain, and use of cardiac medication. Measures of patient satisfaction did not differ between groups immediately following coronary angiography.

The findings of a previous study conducted by Petrie and colleagues (2007) in a cardiac treadmill testing environment were thus not able to be replicated in a coronary angiography setting using a similarly designed intervention. Both interventions followed the
same protocol of explaining normal test results prior to testing using a pamphlet containing
information on the testing procedure and noncardiac chest pain (NCCP) and a brief discussion
of the main points of the pamphlet. While the prior study showed an effect on both self-
reported reassurance and aspects of chest pain at follow-up, the present study’s lack of an
effect provides no evidence that the same intervention is able to transfer effectively over to
coronary angiography settings.

Additional analyses of illness perception variables and trait anxiety showed a number
of significant correlations with self-reported reassurance immediately following testing: trait
anxiety along with various illness perception variables (illness identity, illness concern,
emotional effect of the illness, and illness consequences) were all negatively associated with
reassurance at this time point. This meant that high levels of reassurance prior to discharge
were related to low illness identity beliefs, low heart illness concern, less of an emotional
response to heart illness, and fewer perceived consequences of heart illness. At follow-up 6
weeks after testing, only illness identity was significantly correlated with reassurance—in
other words, those who had low illness identity beliefs in hospital were more likely to report
being reassured at follow-up.

The relationships found between reassurance and illness perceptions in the present
study are consistent with previous findings from a study conducted in a treadmill testing
setting (Donkin et al., 2006). In that study, patients undergoing treadmill testing were likewise
assessed on trait anxiety and illness perceptions as well as self-reported reassurance
immediately following testing and at 1-month follow-up. As was the case in the present study,
Donkin and colleagues (2006) found reassurance to be associated with identity, concern,
emotional effect and consequences. Findings at follow-up differed from the present study,
however, with timeline and treatment control beliefs being linked to reassurance at that point
for the treadmill testing patients. Still, taken as a whole, both studies showed that negative
illness perceptions hold some predictive power for reassurance, and both suggest that
targeting patients’ with negative illness beliefs may be an avenue towards enhancing reassurance. In addition, the previous finding that NCCP patients, following efforts to provide reassurance, are more likely to display more negative illness perceptions than patients with cardiac chest pain (Robertson et al., 2008) further indicates a need for tailored interventions that address seemingly key negative illness beliefs associated with low self-reported reassurance among NCCP patients.

**Why Was the Intervention Not Effective?**

The present study joins a small list of intervention studies that have not reported an effect on levels of self-reported reassurance levels among NCCP patients (e.g., Sanders et al., 1997; Sox et al., 1981). Despite the lack of an intervention effect, speculation on the reasons for this the current study’s results may help in further understanding the elements of enhancing reassurance in clinical settings. A number of reasons for finding no intervention effect can be postulated, and these relate to methodological issues as well as broader issues around the delivery of pre-testing reassurance interventions.

The coronary angiography environment itself may have affected the study in a number of significant ways. First, the setting had an influence on the manner in which the intervention was conducted. As the intervention took place prior to testing, this meant that nursing staff and pre-procedure patient care protocols had to be taken into account when administering the baseline questionnaire and intervention. This had feasibility implications for intervention delivery: prior to testing, patients needed to be prepared for their coronary angiogram by medical staff—which included, among other tasks, taking blood samples, administering a local anaesthetic, the insertion of an intravenous line, and so on. The intervention clearly needed to be worked around these important protocols. Often this resulted in a shortened available delivery timeframe than what was initially desired for the intervention, in many cases leaving little time for discussion after the patient had read through the pamphlet. The
discussion element has been shown to be a significant component of the present study’s intervention (Petrie, Müller et al., 2007), and therefore not allowing enough attention to it may have attenuated the intervention’s effectiveness.

Two further possible environment-related influences on the present study were the difficulty of controlling the information that patients received and the difficulty of providing adequate allocation concealment for the duration of patients’ stay in hospital. As part of the coronary angiogram procedure, patients were required to remain on the ward for a considerable time to allow for observation by staff in order to ensure necessary preparation prior to the procedure as well as an adequate level of recovery following angiography. During this time, patients were in close contact with doctors and nurses. For pragmatic reasons, it was not possible to neither regulate nor standardise the information that patients received from medical staff, and consequently a lack of control over additional reassurance and information received from staff may have influenced the outcome of the results. Furthermore, the nature of the intervention, which involved the provision of an information pamphlet, meant that doctors and nurses on the ward were not able to be satisfactorily blinded to the treatment allocation of participants.

Another likely influence was the fact that patients were able to freely interact with other patients undergoing coronary angiography. So over the course of their stay in hospital, patients may have been unblinded to their group, which again could have had an effect on the study outcome. Even though these aspects to an extent contribute to the study’s ecological validity—psychological interventions, after all, are not necessarily performed in hermetic social isolation—the resultant decrease in experimental control may have nonetheless had an influence on the outcome of the study, resulting in a possible reduction of between-group differences and an inability to detect and control for confounding effects.
Another factor that may have impacted on the effect of the intervention is the stress and anxiety patients might have experienced undergoing the procedure. Patients who undergo coronary angiography have reported many significant fears and apprehensions around conventional coronary angiography (Heikkilä, Paunonen, Laippala et al., 1999) and have been shown to report general apprehension and worry prior to testing (Lyons et al., 2002). While stress has been shown to help cognitive processes such as recall in the clinical setting (Ley, 1997), it is unclear whether the potentially stressful and busy environment of a pre-testing coronary angiography setting would have been conducive to the cognitive and emotional processes involved in enhancing reassurance among NCCP patients. Previous research has shown that providing reassurance to patients with high levels of health anxiety may be particularly difficult (Lucock, White, Peake, & Morley, 1998), and the present study found a significant relationship between high trait anxiety and low self-reported reassurance immediately following testing. Additionally, it has been shown that high state anxiety can interfere with comprehensibility of medical information (Pickersgill & Owen, 1992). Given this apparent link between anxiety and low-level reassurance reporting, it is possible that state anxiety as well as worry and stress from the coronary angiogram environment could have had a role to play in an unsuccessful reassurance intervention, which was, at the end of the day, conducted on a patient population that typically has high levels of anxiety in the first place (Mayou, 1989; Watson, 2006).

Finally, influences impacting on the results of the study’s outcome that relate to the therapist in the present study’s intervention need to be considered. As a simple information-based intervention was involved in the study, it was determined from the outset that there was no need for training a nurse or doctor in administering to patients the pamphlet and discussion, and it was decided that the author should assume the responsibility of delivering the intervention. This decision was informed by the protocol that was used in Petrie and colleagues’ (2007) previous reassurance intervention, where medical staff were not involved.
in delivering the intervention. However, there may have been some disadvantageous consequences of using this approach in the present study. A reassurance intervention study conducted by Sanders and colleagues (1997) examined the application of an information-based intervention that was administered to NCCP patients following coronary angiography. Results showed no treatment efficacy relating to a variety of reassurance-related outcomes, and the intervention was even shown to be unacceptable to some patients. One of the reasons proposed for the outcome of that study was the nature of the intervention, including the choice of therapist. A nurse was trained as therapist for the intervention and, as noted by the study’s authors, worked somewhat separately from doctors on the ward. It was postulated that this lack of integration with other aspects of the setting may have contributed to the findings of the study, and it was further suggested that more active endorsement from cardiologists may have helped reinforce the central messages of the intervention and garnered more support and acceptance from patients involved (Sanders et al., 1997). The present study’s lack of an intervention effect might have likewise been influenced by similar factors, perhaps to an even greater extent due to the degree of separation of the therapist from medical staff on the wards. This could have influenced patients’ responses to the messages of the intervention through undermining its face validity and thereby hindering the delivery of key messages aimed at enhancing later reassurance. Although there were no reports of the intervention being unacceptable to study participants, by the same token the results failed to show any effect on levels of patient satisfaction for the intervention group vis-à-vis treatment-as-usual controls.

**Clinical Relevance**

The experimental findings from the present study, though not bearing any notable statistical significance, still have important implications for clinical practice. The aim of the current study was to test the efficacy of a brief psychological intervention that was shown to be successful in enhancing reassurance among NCCP patients undergoing exercise tolerance
testing (Petrie, Müller et al., 2007). Results, however, did not support the application of the intervention to a coronary angiography environment. The reasons speculated on above may have influenced the outcome to various degrees, and such aspects could be borne in mind in the future when designing interventions involving NCCP patients in coronary angiography settings specifically or interventions in cardiac testing settings in general. Some of these aspects will be discussed below as part of the suggestions for further research.

Nevertheless, the additional findings of significant associations between various illness perceptions and self-reported reassurance could be used to investigate the enhancement of reassurance among NCCP patients. Findings from studies conducted in two different cardiac diagnostic settings—namely, findings by Donkin and colleagues (2006) from an exercise tolerance testing setting and findings from the present study conducted within a coronary angiography setting—have raised an awareness of particular illness perceptions that appear to have consequences for reassurance: identity, illness concern, emotional effect and perceived consequences. Changing illness perceptions in the clinical setting is indeed possible, and this can allow for the opportunity to have an effect on future patients’ health outcomes (Petrie & Weinman, 2006). What remains to be seen, however, is the measurable extent to which focusing on and changing key negative illness perceptions will lead to improved levels of later reassurance among negative-testing cardiac patients. This could be a way forward in addressing reassurance among patients with normal coronary angiograms or indeed normal test results in other cardiac diagnostic settings.

**Strengths and Limitations**

One of the major strengths of the present study relates to the setting in which it was conducted. The study took place on a busy ward in a major public hospital and involved non-acute patients who were referred for diagnostic coronary angiography. This naturalistic environment along with a highly relevant and representative patient population arguably
contributes to a high level of external validity: As a real-to-life experimental laboratory, the coronary angiography ward provided an ideal setting for testing the viability, utility and efficacy of a simple psychological intervention.

Nevertheless, while being a considerable strength for the present study, the naturalistic setting in many ways contributed to some significant limitations, resulting in a threat to the study’s internal validity. Two of the major limitations were, first, the lack of control over information given to patients by medical staff on the ward and, second, the issue over limited group allocation concealment. As mentioned above, both of these factors could have had an influence over the study outcomes. Even so, it would have been genuinely impossible—and of course unethical—to have controlled all aspects of information flow to patients, and blinding would have likewise provided its own impractical challenges considering the pragmatic limitations of conducting experimental research on a busy ward around a sophisticated and involved diagnostic procedure.

The inability to assess any potential influences due to the therapist was another limitation. An assessment of the therapist that took into account patients’ appraisals of therapist credibility, for example, could have been included to help evaluate possible confounding variables related to the patients’ perception of the therapist, which may have had an influence over the intervention effect (cf. Sanders et al., 1997). At the very least, a simple assessment of the participants’ perception of the intervention’s face validity would have been useful.

A further limitation of the present study is the short follow-up period. Assessment of the efficacy of interventions aimed at enhancing reassurance among NCCP patients should include the measurement of effects on patients’ health care utilisation over time (Jones & Mountain, 2009), and therefore it was essential to include such measures in the present study. Even so, the use of health care utilisation measures in the present study may have been
limited by the follow-up timeframe. In other words, although the study showed no between-group differences in the use of health care resources at follow-up, the time period that was set in the first place may have been too short to detect any clinically significant intervention effects on health care use. A longer follow-up period—perhaps of at least 12 months in duration—may have allowed for the detection of more meaningful effects of the reassurance intervention related to behavioural correlates of reassurance and health resource utilisation by patients.

Finally, issues around some of the outcome variables need to be raised. While the reassurance scale used in the present—which has been used in previous research (Petrie, Müller et al., 2007)—made use of reversed items to address response bias, the measure used to look at aspects of patient satisfaction did not. This perhaps raises some concern around response bias. Social desirability and acquiescence, which are factors that can lead to spuriously high levels of reported satisfaction, are commonly reported problems regarding the measurement of patient satisfaction (Hudak & Wright, 2000; Sitzia & Wood, 1997). Along with balancing questionnaire items, placing emphasis on anonymity can help counteract response bias effects due to social desirability (Nederhof, 1985), and in the present study patients’ anonymity was indeed stressed to participants during questionnaire administration at all measurement time points. The exclusion of balanced items in the patient satisfaction measure, however, may not have helped this cause and could have contributed to a reduction of measurement sensitivity.

Suggestions for Further Research

Noncardiac chest pain remains a debilitating symptom for many patients (Chambers & Bass, 1990; Eslick et al., 2003), and for this reason alone further research still needs to be carried out on finding the most effective methods for enhancing reassurance among NCCP patients. Within the setting of coronary angiography, this appears to be a difficult task.
Further research, however, could be undertaken following some of the present study’s findings as well as in response to some of the issues that were raised.

First, on a general note, research could be undertaken to explore the possibility of using the pre-testing intervention paradigm in other cardiac testing settings. This could involve, for example, cardiac diagnosis following electrocardiography or diagnostic settings that make use of X-rays or blood tests. The intervention could be applied in chest pain clinics, where it is suggested that pre-testing information protocols can help in the improvement of care for patients (Price et al., 2005). Additionally, the intervention is simple enough to be modified and trialed in noncardiac settings. In principle, a brief pre-testing reassurance intervention could therefore be used in other medical environments that have received attention in the reassurance literature, including neurological settings (Howard et al., 2005), breast clinics (Meechan et al., 2005), and settings where gastroscopy procedures are involved (Lucock et al., 1997). In any case, future intervention studies should ideally utilise a longer follow-up period in order to gauge long-term reassurance-seeking patterns in the form of health resource utilisation among patients.

Within a coronary angiography hospital environment, it appears that considerations and modifications may need to be made concerning both the intervention and the setting itself. The main challenge that faces a pre-testing intervention on the ward is allowing for adequate time to apply the intervention and finding means of working around pre-procedure patient care protocols. Engaging nursing staff in the process and thereby integrating the intervention more seamlessly with pre-angiography tasks could remedy this issue. Furthermore, pursuing a nurse-led intervention strategy may be of particular value in the angiography setting, as nurses can potentially provide an important role in providing information for coronary angiography patients during their stay in hospital (Lyons et al., 2002).
It has been argued that NCCP patients, being part of a heterogeneous group, require a multidisciplinary approach to health care (Rosengren, 2008). If this is accepted, then it could also be argued that NCCP patients may require more individualised treatment when applying reassurance interventions. Patients with high levels of anxiety may require targeted care that seeks to address concerns and works towards allaying fears around chest pain, symptom worries and issues related to the procedure itself. An approach like this is important, as failure to address patients’ specific fears may leave them more anxious than they were prior to testing (Dowrick et al., 2004; Fitzpatrick, 1996). As it would be very difficult to work in such a time-intensive intervention in the short window of time available prior to testing, this approach could be more easily applied during the period between testing and discharge and could ideally work in combination with a pre-testing reassurance intervention in the attempt to reinforce key reassurance messages.

Finally, a further line of research could explore the effect of targeting and changing certain illness perceptions as an avenue for enhancing reassurance. Some of the illness perceptions highlighted in the present study (i.e., identity, illness concern, emotional effect and illness consequences) appear to have implications for levels of reassurance. Further research could explore these relationships in more detail, perhaps leading to interventions based on the self-regulation model (Leventhal et al., 1984) that target key illness perceptions that are important in cardiac settings (Donkin et al., 2006; Hirani & Newman, 2005; Weinman et al., 1996). An intervention designed in this way could, to take illness identity as an example of focus, help patients reframe or reinterpret the symptoms perceived as most relevant for them and causing them most concern. In theory, this could facilitate the appraisal process tied up with illness identity, potentially contributing towards improved health outcomes (Petrie & Weinman, 2006).
Conclusions

While the present study failed to show an effect for a pre-testing reassurance intervention previously shown to be successful for treadmill testing patients, it nevertheless has raised many important considerations for conducting interventions in cardiac testing environments. Some of the potential factors put forward as having plausible influences on the study’s outcome related to issues around the study setting and therapist, as well as the methodological challenges involved in conducting experimental research in a time-constrained hospital setting. These factors all have implications for further cardiac-based research aiming to look at enhancing reassurance around diagnostic testing procedures.

The study also raises the importance of considering patient factors in medical reassurance interventions. The additional exploratory findings concerning the connection between reassurance and a selection of key illness perceptions are results that could inform further experimental research: reassurance interventions could stand to benefit by eliciting and targeting patients’ negative illness appraisals along with other relevant factors such as health anxiety. It may well be that illness perceptions are well entrenched among NCCP patients by the time they are referred for diagnostic coronary angiography. If this is the case, then more intensive and individualised reassurance interventions could hold the key for enhancing reassurance among this patient group.

As medical reassurance is an under-researched topic in health care, the findings and resultant considerations of the present study have considerable value in shaping future interventions. Lessons learnt from the study have the potential to contribute to more effective approaches to strengthening reassurance following normal cardiac test results. Consequently, this may lead to the minimising unnecessary health care costs and improving patients’ quality of life, but this needs to be demonstrated through ongoing clinical research.
SECTION III
§
STUDY TWO
CHAPTER NINE

COMPUTED TOMOGRAPHIC ANGIOGRAPHY AND HEALTH BEHAVIOUR: EXPLORING THE PSYCHOLOGICAL IMPACT OF RESULTS FROM A DIAGNOSTIC TEST

Diagnostic tests play an important role within medicine, helping to diagnose disease and illness as well as guide treatment. A wide variety of modern cardiac tests are able to provide increasingly accurate diagnoses, often early enough to allow for effective clinical intervention. One such test, coronary computed tomography (CT) angiography, has the potential for diagnosing early signs of ischaemic heart disease, and the test is indeed valued for its high diagnostic accuracy compared to concurrent cardiac imaging techniques (Raff & Goldstein, 2007).

Yet while coronary CT angiograms are increasingly performed worldwide, with around 2 million procedures performed annually in the United States alone (Einstein et al., 2010), some have warned of the lack of research investigating its role in patient management (Amsterdam & Caputo, 2008). While it has been argued that measurement of patients’ experience of medical testing should be a standard component of diagnostic test evaluation (Mushlin et al., 2005), the research on the psychological impact of CT angiography remains scarce, with no research on the test’s impact on patients’ illness and symptom beliefs and very little on its impact on patients’ health behaviours.

Prior studies have demonstrated that undergoing a cardiac imaging testing procedure can be a significant experience for patients, both cognitively (Devcich et al., 2008) and emotionally (Heikkilä, Paunonen, Laippala et al., 1999). While there are potential psychological benefits to be gained from undergoing cardiac testing (see Mushlin et al., 2005), examination of illness perceptions can nonetheless provide further insight into the
ways in which patients appraise symptoms and think about their illness, which can have profound implications for health outcomes (Hagger & Orbell, 2003; Petrie et al., 2002; Petrie, Jago et al., 2007). Furthermore, imaging tests such as coronary CT angiography provide an ideal opportunity to gauge the effects of testing on patients’ cardiac health behaviour and behavioural intentions. As coronary CT angiography can provide detection of early heart disease for patients with particular cardiac risk factors, any impact on behaviour at this point can have profound implications for patients’ cardiac risk and health.

The present study examined the effects of coronary CT angiogram test results on non-acute patients’ illness perceptions. As well as this, the study aimed to investigate testing effects on patients’ behavioural intentions and later cardiac health behaviour following test results. The present study thus looked at examining the psychological impact and value of coronary CT angiography within a cardiac diagnostic setting.

**Study Aims and Hypotheses**

Hypotheses relating to changes in illness perceptions were based on previous research conducted in a conventional coronary angiogram setting (Devch et al., 2008). The research found significant changes in key illness perceptions following testing: for patients with negative test results, illness identity, illness emotion, illness concern and perceived illness consequences all decreased significantly. The present study thus aimed to investigate changes in these key illness perceptions (as well as explore any changes in other illness perceptions) within a different cardiac testing setting—coronary CT angiography.

*Hypothesis 1.* Patients receiving negative CT angiogram results, in comparison to patients with positive angiogram test results, would show a significant decrease in illness identity following testing.
Hypothesis 2. Patients receiving negative CT angiogram results, in comparison to patients with positive angiogram test results, would show a significant decrease in illness emotion following testing.

Hypothesis 3. Patients receiving negative CT angiogram results, in comparison to patients with positive angiogram test results, would show a significant decrease in illness concern following testing.

Hypothesis 4. Patients receiving negative CT angiogram results, in comparison to patients with positive angiogram test results, would show a significant decrease in perceived illness consequences following testing.

Emerging research on the use of patient drawings has highlighted the potential of patient drawings as an alternative method for assessing the way in which patients view their illness. Studies on cardiac patients’ heart drawings not only have suggested that drawings may have predictive power in terms of cardiac rehabilitation but may also be able to identify patients with more heart-focused anxiety, with the size of the drawing being important in this respect (Broadbent, Ellis et al., 2006; Broadbent et al., 2004). The present study aimed to investigate aspects of cardiac patients’ heart drawings as potential indicators of heart-focused anxiety among a coronary CT angiogram patient population.

Hypothesis 5. The size of patients’ heart drawings would show a significant positive relationship with worry about having a heart attack both at baseline and immediately after receiving test results.

Hypothesis 6. The size of patients’ heart drawings would show a significant positive relationship with illness concern both at baseline and immediately after receiving test results.
Hypothesis 7. The amount of detail of patients’ heart drawings would show a significant positive relationship with heart attack worry both at baseline and immediately after receiving test results.

Of the few studies that have examined cardiac imaging tests and health behaviour change, some have pointed towards the beneficial effects that these tests may have on important behaviours such as adherence to cardiac medication (Kalia et al., 2006) and smoking behaviour (Bovet et al., 2002). As well as this, research on other imaging tests has pointed to effects on motivation and intentions to change health behaviour (Rodondi et al., 2008; Shahab et al., 2007). To date, however, research on the impact of cardiac imaging tests—particularly coronary CT angiography—on key cardiac health behaviours such as diet and exercise remains scarce. A further aim of the present study therefore was to test the effect that coronary CT angiography has on key cardiac health behaviours and intentions to engage in such behaviours. With the abovementioned studies in mind, the following hypotheses were formed:

Hypothesis 8. It was hypothesised that patients with positive CT angiogram results, in comparison to patients with a negative angiogram test, would show a significant increase in intention to take cardiac medication.

Hypothesis 9. A similar hypothesis was also made for diet intentions: patients with positive CT angiogram results, in comparison to patients with a negative angiogram test, would show a significant increase in intention to engage in heart-healthy diet behaviour.

Hypothesis 10. A further hypothesis stated that patients with positive CT angiogram results, in comparison to patients with a negative angiogram test, would show a significant increase in intention to exercise.
Hypothesis 11. In terms of health behaviours, it was hypothesised that patients with positive CT angiogram results, in comparison to patients with a negative angiogram test, would show a significant increase in heart-healthy diet behaviour at follow-up 6 weeks after receiving CT angiogram test results.

Hypothesis 12. Finally, a hypothesis was made for exercise behaviour: patients with positive CT angiogram results, in comparison to patients with a negative angiogram test, would show a significant increase in exercise behaviour at follow-up 6 weeks after receiving CT angiogram test results.
CHAPTER TEN

METHOD

The present descriptive study employed a prospective cohort design. Patients undergoing a diagnostic CT angiogram were measured before and after their angiogram on illness perceptions and attitudes towards cardiac medication, exercise and diet. A final follow-up 6 weeks after patients received their test results looked at cardiac risk behaviours including diet and exercise.

Participants

The study comprised non-acute adult patients aged 18 years and over from the Auckland metropolitan area who were referred to a private heart clinic in Auckland for diagnostic CT angiography for assessment of coronary plaques. Only patients undergoing CT angiography for the first time were recruited. CT angiograms conducted for calcium scoring only were not included, as this procedure did not involve capturing detailed images of the patient’s heart. Exclusion criteria included patients who did not speak English and patients demonstrating impaired cognitive ability.

Sixty-nine consecutive patients who met the inclusion criteria were approached at the clinic by the researcher, with 12 patients declining the invitation to participate. Of the 57 participants enrolled in the study at baseline, one withdrew prior to receiving the second questionnaire and a number did not complete the questionnaires satisfactorily, either at baseline ($n = 3$) or following their angiogram ($n = 5$). Three participants were also lost to follow-up due to being either overseas ($n = 2$) or unable to be contacted because of being admitted to hospital for a comorbid condition ($n = 1$). This left a total of 45 participants in the present study for per-protocol analysis.
Ages of the participants ranged from 35 to 80 years, with a mean of 55.6 years. The sample consisted of a higher ratio of males to females (68.9% male), with a large majority of participants identifying themselves as New Zealand European or Pakeha (91.1%). Most participants were in full-time employment (68.9%) and had received a tertiary education (75.6%). Following patients’ angiogram, 20 were diagnosed with normal coronary vasculature and 25 showed calcium plaques on their arteries. Full details of the sociodemographic characteristics for the study population across both diagnostic groups are given in Table 10.

Table 10. Sociodemographic Characteristics Across Diagnostic Groups in Coronary CT Angiography Study

<table>
<thead>
<tr>
<th>Sociodemographic characteristic</th>
<th>CT angiography diagnostic group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative test result</td>
</tr>
<tr>
<td></td>
<td>( n = 20 )</td>
</tr>
<tr>
<td>Age in years, ( M (SD) )</td>
<td>53.4 (7.8)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9 (45.0)</td>
</tr>
<tr>
<td>Female</td>
<td>11 (55.0)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>NZ European / Pakeha</td>
<td>18 (90.0)</td>
</tr>
<tr>
<td>Maori</td>
<td>—</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>—</td>
</tr>
<tr>
<td>Asian</td>
<td>—</td>
</tr>
<tr>
<td>Other</td>
<td>2 (10.0)</td>
</tr>
<tr>
<td>Employment Status</td>
<td></td>
</tr>
<tr>
<td>Full-time employment</td>
<td>13 (65.0)</td>
</tr>
<tr>
<td>Part-time employment</td>
<td>3 (15.0)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>—</td>
</tr>
<tr>
<td>Retired</td>
<td>2 (10.0)</td>
</tr>
<tr>
<td>Work at home</td>
<td>2 (10.0)</td>
</tr>
<tr>
<td>Beneficiary</td>
<td>—</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>Secondary school</td>
<td>5 (25.0)</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>15 (75.0)</td>
</tr>
</tbody>
</table>

Note. Except where indicated, values show number of participants (with percentages in parentheses). \( M = \) mean, \( SD = \) standard deviation.
Procedure

The study received ethical approval from The University of Auckland Human Participants Ethics Committee in September 2009. Participant recruitment began in October 2009 and final follow-up assessments were completed in August 2010.

Patients were approached in the clinic waiting room at Mercy Hospital by nursing staff and were asked if they were interested in taking part in the study. This method of initial participant recruitment was utilised to ensure patient confidentiality. Patients who were interested were then approached by the researcher and were provided with a participant information sheet and given a description of the study along with what was required from them. After providing written consent to take part in the research, patients completed the baseline questionnaire before undergoing their CT angiogram. The baseline questionnaire covered demographic data, trait anxiety, illness perceptions and attitudes towards cardiac health behaviour as well as current self-reported dietary habits and frequency of exercise. Some clinical data were collected from patients at this point with the remainder being gathered afterwards using available medical records.

Patients then underwent their CT angiogram, which typically took around 10 minutes to complete. The diagnostic CT angiogram was conducted to assess the level of coronary artery calcification, with a test deemed positive if significant calcification is detected within the coronary arteries. In order to gauge this, an Agatston score is given by the cardiologist based on the density of calcification, and this and can help to predict the patient’s risk of experiencing a future cardiac event (Hoffmann, Brady, & Muller, 2003). The Agatston score is then referenced against tables that compare the patient’s score with age- and gender-matched population samples. A final quartile score thus shows how the patient’s artery health stacks up against people of the same gender and similar age. For the present study, patients who were placed in the first quartile and who had an Agatston score less than 10 (cf. Oschatz,
Benesch, Kodras, Hoffmann, & Haas, 2006) where classified as having normal test results; those within the remaining three quartiles were considered to have a positive test result confirming the presence of disease.

After their CT angiogram, patients remained at the clinic for at least half an hour in order to monitor pulse and blood pressure and to ensure of the absence of any allergic reactions to the contrast media used during the testing procedure. Test results, however, were not fed back to patients until a scheduled follow-up consultation with their cardiologist, which typically took place around a week after the CT angiogram. At this point, following their consultation, participants were administered the second questionnaire, which again covered illness perceptions as well as attitudes towards medication and cardiac health behaviours. The questionnaire also assessed patients’ intentions to engage in exercise and heart-healthy dietary habits. Finally, patients were administered a third questionnaire by telephone 6 weeks after they received their test results. This questionnaire measured health behaviours as well as dimensions of cardiac risk appraisal.

**Measures**

Data were collected from each participant at three time points using three questionnaires (see Appendix E): a pre-diagnostic baseline questionnaire was administered before the CT angiogram; a post-diagnostic questionnaire was filled out immediately following diagnostic consultation; and a final follow-up questionnaire was administered to participants by telephone at the 6-weeks. Relevant clinical data were also collected from medical records. The composition of the three questionnaires administered to the participants is detailed below.
Pre-Diagnostic Questionnaire

Participants completed an 11-page baseline questionnaire that assessed illness perceptions, self-rated health, trait anxiety, current health behaviours and attitudes towards these behaviours, behavioural intensions, and basic sociodemographic variables. Details items and scales used are given below.

Demographic Data. Background demographic data collected at this point included gender, age, ethnicity, employment status, and level of education. As well as this, participants were asked to indicate whether they had undergone any cardiac testing, including exercise tolerance testing and electrocardiogram testing.

Self-Rated Health Scale. This item was used to assess self-reported perception of health at baseline. Participants were required to rate their current health in comparison to someone in excellent health by choosing one of seven responses (i.e., ‘terrible’, ‘very poor’, ‘poor’, ‘fair’, ‘good’, ‘very good’, and ‘excellent’). The scale has been used to assess individual perceptions of health in relation to perceived health of others (Johnston et al., 1995).

Illness Identity Subscale—Revised Illness Perceptions Questionnaire. The Revised Illness Perception Questionnaire (IPQ-R; Moss-Morris et al., 2002) assesses the main components of patients’ illness representations according to the Leventhal and colleagues’ (1984) self-regulation model. The identity subscale consists of 14 items covering a range of symptoms. As some of the listed symptoms have little relevance to heart disease, the number of items was reduced to 10 in order to better reflect potential symptoms of cardiac illness. The measure requires subjects to indicate whether or not they have experienced each of the listed symptoms over the previous year. For each symptom experienced, subjects are also required to indicate whether or not they believe that the symptom is related to their heart. By summing
the number of symptoms experienced that are perceived by the patient to be cardiac related, a total illness identity score is obtained.

**Brief Illness Perception Questionnaire.** The Brief Illness Perceptions Questionnaire (Brief IPQ; Broadbent, Petrie et al., 2006) was used to measure the range of patients’ illness representations. A shortened version of the IPQ-R, the Brief IPQ comprises nine items designed to assess the main dimensions of illness perceptions. Each item is scored on a continuous rating scale and relates to a particular illness belief according to Leventhal and colleagues’ (1984) model of self regulation. For example, the item assessing patients’ illness identity beliefs asks ‘How much do you experience symptoms from your illness?’, with the responses ranging from ‘no symptoms at all’ (score = 0) to ‘many severe symptoms’ (score = 10). To increase face validity for a cardiac patient population, items were modified accordingly—for example, the illness identity item was reworded to ‘How much do you presently experience symptoms related to your heart?’ so as to better reflect cardiac illness. The Brief IPQ has been shown to have concurrent validity with the IPQ-R and has demonstrated good test–retest reliability (Broadbent, Petrie et al., 2006).

**Drawing Item.** A drawing item used in previous research with cardiac patients (Broadbent, Ellis et al., 2006; Broadbent et al., 2004) was employed in the present study to further investigate patients’ cardiac health beliefs. Participants were asked to draw a picture of what they thought their heart looked like at the time. Emphasis was placed on the fact that of interest for the research was their own ideas around how they saw the condition of their heart and that drawing ability was not important. A box measuring 140mm x 120mm (height x width) was placed underneath the instructions to allow space for participants to draw their heart image. Drawings were measured on height and width in millimetres and were also rated on detail using a 10-point scale ranging from 1 (simple) to 10 (complex). Two separate raters were used for the drawing detail component, with the mean of the two raters used for the final drawing detail score. Intraclass correlation coefficients were calculated and showed inter-rater
reliability to be at an acceptable level at baseline ($\alpha = .92$) as well as immediately following testing ($\alpha = .79$).

**Short Form of the State-Trait Anxiety Inventory.** The six-item version of the State-Trait Anxiety Inventory (STAI; Marteau & Bekker, 1992) was used to measure patients’ trait anxiety. The short form of the STAI covers six emotional states (calm, tense, upset, relaxed, content, worried) and requires participants to respond on a 4-point Likert-type scale regarding how they feel most of the time for each state (i.e., ‘not at all’, ‘somewhat’, ‘moderately’, or ‘very much’). All six items are summed to give a total trait anxiety score. The short form of the STAI has shown good internal consistency ($\alpha = .82$), which is comparable to the reliability coefficient of the original STAI (Marteau & Bekker, 1992).

**Cardiac Health Behaviour Intentions.** Intentions to take regular cardiac medication, to eat a heart-healthy diet, and to engage in regular exercise were measured on three 7-point scales, one scale for each behaviour intention (Norman, Conner, & Bell, 2000). For example, exercise intentions were measured using the item “I intend to take regular exercise during the next 6 months”, and patients were required to respond within the range between −3 (not at all) to +3 (definitely).

**Past Cardiac Health Behaviour.** Participants were asked to indicate how frequently they engaged in exercise on a 12-point scale, with exercise defined as activities (e.g., aerobics, jogging, walking) that did not form part of everyday life, such as walking to the bus stop (Norman & Smith, 1995). Possible responses ranged from 0 (‘never’) to 11 (‘every day’). Additionally, two 7-point items, ranging from −3 to +3, were used to measure past dietary behaviour—namely, “How strictly do you follow a heart-healthy diet?” and “How often do you follow a heart-healthy diet?” These two items were combined to give a scale for healthy diet behaviour, with the scale showing a very good level of internal consistency ($\alpha = .88$).
Theory of Planned Behaviour Constructs. Key theory of planned behaviour (Ajzen, 1988) constructs were measured at this time point, as they have been shown to have significance for health behaviour prediction (Armitage & Conner, 2001; Downs & Hausenblas, 2005). The theory of planned behaviour constructs, or predictor variables, include: attitude towards the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991). Items for each construct were adapted from previous research on exercise behaviour based on the theory of planned behaviour (Norman et al., 2000; Norman & Smith, 1995), with every item scored on a 7-point scale (range: −3 to +3). Attitude was measured using three semantic differential scales (i.e., ‘bad–good’, ‘harmful–beneficial’, and ‘foolish–wise’) and the subjective norms construct was measured using an item that asked participants to rate how they felt people of importance to them would think about their engagement in a particular cardiac health behaviour, with the extreme ratings being ‘extremely unlikely’ and ‘extremely likely’ (for example, the following item was used for exercise: “Most people who are important to me think I should take exercise”). Finally, perceived behavioural control was measured using two items. Again, using exercise as an example, the following items were used: “How much control do you feel you have over taking exercise over the next 6 months?” (response ranged from ‘no control’ through to ‘total control’) and “For me to take exercise over the next 6 months is” (‘difficult–easy’).

Beliefs About Medication Items. Patients’ beliefs about their prescribed cardiac medication were measured with two items derived from the Beliefs about Medicines Questionnaire (BMQ; Horne, Weinman, & Hankins, 1999), a measure that assesses cognitive representations of medicines. The BMQ-Specific—a section of the BMQ that gauges representations of prescribed medicine—comprises two factors assessing beliefs about the necessity of prescribed medication and concerns about the medication. For the present study, a modified version of the BMQ-Specific was used to measure patients’ cognitive representations on these key dimensions (i.e., ‘How much do you feel you need medication
prescribed for your hear?’ and ‘How concerned are you about medication prescribed for your heart?’

*Other Items.* Various items from the post-diagnostic questionnaire as well as the follow-up questionnaire were also included at baseline to allow for comparison. The items assessed patients’ concerns and beliefs about general health (How worried are you about your health?) and cardiac health (‘To what extent do you believe there is something seriously wrong with your heart?’). Two questions looked at patients’ beliefs and concerns around their heart attack risk: ‘Overall, how worried are you that you will have a heart attack?’ and ‘How much do you feel you can help to reduce your risk of having a heart attack?’

*Post-Diagnostic Questionnaire*

The eight-page post-diagnostic questionnaire again included the Brief IPQ and the theory of planned behaviour constructs—attitude towards the behaviour, subjective norms, and perceived behavioural control—from the baseline questionnaire. Also included were the items measuring cardiac health behaviour intentions regarding medication, diet and exercise as well as the items assessing patients’ concerns and beliefs about their health in general and their cardiac health. The drawing item was included again to monitor changes in heart health perceptions following testing.

*Follow-Up Questionnaire*

A final follow-up questionnaire was administered over the telephone 6 weeks after participants had received the results of their CT angiogram. Some of the items from the baseline questionnaire were also included at this point in order to monitor changes in these variables. These included: the modified BMQ items, the items measuring cardiac health behaviours (i.e., diet and exercise) and self-rated health. Items assessing patients’ concerns
and beliefs about their health in general and their cardiac health were also included at this point. For patients taking medication, two further questions were also included: “How many cardiac medication pills are you prescribed to take each day?” and “During the last 7 days how many times did you miss taking one of your pills?”

**Clinical Data**

Clinical data were collected on the day of patients’ CT angiogram. Data included assessment of risk factors (i.e., smoking history, family history of IHD, clinical hypertension), lipid levels and heart history. Results from the CT angiogram were also recorded here (see Appendix E).

**Power Analysis**

The power analysis for the present study was based on previous research that examined changes in illness perceptions following cardiac testing (Devcich et al., 2008). Formulas for power analysis \( n = 2 \times \left[ \frac{\delta}{y} \right]^2 \) and effect size \( y = \frac{U^1-U^0}{SD} \) were used to calculate the number of participants required for the present study. Taking values from the above study for changes in the key illness perception of illness identity (Leventhal et al., 2003), values for \( U^1, U^0 \) and \( SD \) were substituted in the effect size formula (5.2, 2.8 and 2.7, respectively). This yielded 0.9 for the effect size \( y \) value. A power calculation was conducted for the difference between two independent means (Howell, 1992) allowing for .8 power \( (\beta) \) and .05 level of significance \( (\alpha) \). Using these values for a two-tailed test, appendix power tables show that the equation would require \( \delta = 2.8 \). Substituting the numbers into the power analysis formula \( n = 2 \times \left[ \frac{2.8/0.9}{2} \right]^2 \) gave the value of 19.4. The present study thus required at least 20 participants in each diagnostic group (i.e., patients receiving a positive test result and patients receiving a negative test result) to meet power requirements.
Data Analysis

Data were entered into and analysed with SPSS (version 11 for Mac) statistical software. Data were checked to ensure that all values fell within the possible range for each variable. Irregular or questionable data were checked against the original questionnaire and if erroneously entered were replaced with the correct value. Missing values were substituted with means where appropriate—that is, where missing values within scales were less than 20 percent for individual cases, data were substituted with the mean of the non-missing responses on the items within that scale for that particular case. Data were screened for normality and were found to be within an acceptable range for parametric tests. A combination of analysis of variance (ANOVA) tests, chi-square tests and Fisher’s exact tests were used for initial exploration of data and comparison of study groups at baseline. Hypothesis testing of the main outcome variables involved using repeated measures ANOVAs and post hoc $t$ tests. Finally, supplementary exploration of data involved using Pearson correlations and independent-samples $t$ tests.
CHAPTER ELEVEN

RESULTS

The following results section is divided into four parts: initial exploratory data analysis of differences between groups at baseline prior to testing; testing of hypotheses relating to CT angiography effects on illness perceptions, behavioural intentions and health behaviour; and further analysis and exploration of the data.

**Between-Group Differences at Baseline**

Preliminary analyses were carried out to test for any differences between the two diagnostic groups regarding sociodemographic variables (see Table 10) and relevant clinical variables (see Table 11) at baseline. Continuous variables were tested using analysis of variance (ANOVA) tests and *t* tests where appropriate. Categorical variables were tested using chi-square (*χ²*) tests, with Fisher’s exact tests used for categorical variables with low expected frequencies.

Results showed little difference between the two diagnostic groups at baseline. No significant between-group differences were found for the sociodemographic variables (i.e., ethnicity, employment status, and education), although there was a non-significant trend towards more males being in the positive-testing group (*χ²*(1, *N* = 45) = 3.4, *p* = .07). There were no significant between-group differences regarding any of the clinical variables at baseline.

As well as the relevant clinical variables, measures of trait anxiety and self-rated health were also examined at baseline (see Table 11). Independent-samples *t* tests of mean STAI scores and self-rated health scale scores revealed no significant between-group differences in trait anxiety (*t*(43) = −0.50, *p* = .62) and self-rated health (*t*(42) = 0.61, *p* = .55).
Table 11. Baseline Clinical and Health Behaviour Variables Across Diagnostic Groups

<table>
<thead>
<tr>
<th>Baseline variable</th>
<th>CT angiography diagnostic group</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Negative test result</td>
<td>Positive test result</td>
<td>$p$-value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>($n = 20$)</td>
<td>($n = 25$)</td>
<td></td>
</tr>
<tr>
<td>Lipids, $M (SD)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>5.6 (1.1)</td>
<td>5.3 (0.9)</td>
<td>.27</td>
<td></td>
</tr>
<tr>
<td>HDL cholesterol</td>
<td>1.6 (0.4)</td>
<td>1.5 (0.5)</td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>LDL cholesterol</td>
<td>3.5 (1.1)</td>
<td>3.1 (0.7)</td>
<td>.26</td>
<td></td>
</tr>
<tr>
<td>Triglycerides</td>
<td>1.2 (0.5)</td>
<td>1.4 (0.6)</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Taking cardiac medication</td>
<td>6 (30.0)</td>
<td>10 (40.0)</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>Smoking history</td>
<td>2 (10.0)</td>
<td>5 (20.0)</td>
<td>.44</td>
<td></td>
</tr>
<tr>
<td>Clinical hypertension</td>
<td>1 (5.0)</td>
<td>5 (20.0)</td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>Family history of IHD</td>
<td>10 (50.0)</td>
<td>17 (68.0)</td>
<td>.30</td>
<td></td>
</tr>
<tr>
<td>Trait anxiety, $M (SD)$</td>
<td>11.5 (3.6)</td>
<td>12.0 (3.2)</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td>Self-rated health, $M (SD)$</td>
<td>5.8 (0.7)</td>
<td>5.6 (0.6)</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td>Exercise frequency, $M (SD)$</td>
<td>7.9 (2.8)</td>
<td>7.3 (3.1)</td>
<td>.52</td>
<td></td>
</tr>
<tr>
<td>Healthy diet behaviour, $M (SD)$</td>
<td>9.0 (1.3)</td>
<td>8.8 (2.9)</td>
<td>.73</td>
<td></td>
</tr>
</tbody>
</table>

Note. Except where indicated, values show number of participants (with percentages in parentheses). HDL = high-density lipoprotein, LDL = low-density lipoprotein, $M =$ mean, $SD =$ standard deviation.

Finally, past cardiac health behaviours were also explored to determine whether there were any significant baseline differences between the two groups with regard to each of the measured cardiac health behaviours (see Table 11). Independent-samples $t$ tests were conducted and showed no between-group differences in both of the health behaviour variables—exercise frequency ($t(43) = 0.65$, $p = .52$) and healthy diet behaviour ($t(43) = 0.35$, $p = .73$).
Hypothesis Testing

Hypothesis testing was conducted in two main areas: (1) changes in illness perceptions before and after testing and (2) changes in health behaviour intentions in relation to diagnostic test results. The latter section also included an examination of changes in health behaviours at follow-up in relation to results of the CT angiogram.

Changes in Illness Perceptions

Hypotheses for changes in illness perceptions were based on previous illness perception research conducted in a diagnostic coronary angiography setting (Devcich et al., 2008). It was hypothesised that illness identity, illness emotion, and perceived illness consequences would significantly decrease for patients receiving negative test results but would remain unchanged for patients receiving results showing diseased arteries. All Brief IPQ items were measured before and after testing, with Table 12 showing the means and standard deviations of these variables for each patient group.

Table 12. Illness Perceptions (Brief IPQ) Before and After Coronary Angiography Across Diagnostic Groups.

<table>
<thead>
<tr>
<th>Brief IPQ variable</th>
<th>Negative-testing patients</th>
<th>Positive-testing patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before testing</td>
<td>After testing</td>
</tr>
<tr>
<td>Illness identity</td>
<td>1.8 (1.7)</td>
<td>1.2 (1.6)</td>
</tr>
<tr>
<td>Illness emotion</td>
<td>4.0 (2.7)</td>
<td>2.7 (2.6)</td>
</tr>
<tr>
<td>Illness concern</td>
<td>6.1 (2.1)</td>
<td>3.4 (2.8)</td>
</tr>
<tr>
<td>Illness consequences</td>
<td>5.9 (2.3)</td>
<td>3.8 (2.9)</td>
</tr>
</tbody>
</table>

*Note.* Values show means of measured variables (with standard deviations in parentheses).
Hypothesis 1. The first hypothesis stated that patients with negative CT angiogram results, in comparison to patients with a positive angiogram test, would show a significant decrease in illness identity. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results (diagnostic group) on illness identity. The Group x Time interaction effect was significant \((F(1, 40) = 5.52, p = .02)\), but both the Time main effect \((F(1, 40) = 0.05, p = .82)\) and the Group main effect \((F(1, 40) = 0.41, p = .53)\) were not significant. A post hoc independent-samples \(t\) test and paired-samples \(t\) tests for each group—with the Bonferroni approach \((p = .05/3)\) used to control for Type I error—were conducted to identify the illness identity differences between groups following CT angiography as well as the illness identity differences over time. There was no significant between-group difference in illness identity following CT angiography \((t(41) = −1.53, p = .13)\). Likewise, differences across time for illness identity were not significant for either negative-testing patients \((t(18) = 2.31, p = .03)\) or positive-testing patients \((t(22) = −1.36, p = .19)\). Post hoc analyses thus failed to show any differences between patient groups, and therefore these findings failed to support the hypothesis that patients with negative CT angiogram results would show a significant decrease in illness identity.

Hypothesis 2. The second hypothesis predicted that patients with negative CT angiogram results, in comparison to patients with a positive angiogram test, would show a significant decrease in illness emotion. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on illness emotion. The Group x Time interaction effect was significant \((F(1, 38) = 4.82, p = .03)\). Both the Time main effect \((F(1, 38) = 3.14, p = .09)\) and the Group main effect \((F(1, 38) = 0.16, p = .69)\) were not significant. Bonferroni-corrected post hoc \(t\) tests (independent- and paired-samples) were conducted to identify the illness emotion differences between groups following CT angiography as well as the illness emotion differences over time. There was no significant between-group difference in illness emotion following CT angiography \((t(40) = −0.26, p = .
nor was there a significant change over time for patients receiving positive test results ($t(21) = -0.31, p = .76$). However, patients receiving negative test results showed a significant drop in illness emotion following testing ($t(17) = 2.80, p = .01$). The findings thus support the hypothesis that patients with negative CT angiogram results would show a significant decrease in illness emotion in comparison to positive testing patients. Figure 12 shows the pre-testing to post-testing changes in illness emotion.

Figure 12. Mean Brief IPQ scores (with standard error bars shown) for illness emotion before and after CT angiography for patients with negative and positive test results.

Hypothesis 3. The third hypothesis predicted that, in comparison to patients with a positive CT angiogram test result, patients with negative CT angiogram results would show a significant decrease in illness concern. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on illness concern. The Group x Time interaction effect was significant ($F(1, 40) = 12.29, p = .001$), as was the Time main effect ($F(1, 40) = 15.93, p < .001$). The Group main effect, however, did not reach the level of significance ($F(1, 40) = 3.85, p = .06$). Post hoc $t$ tests with Bonferroni corrections ($p = .05/3$)
were conducted to identify the illness concern differences between groups following CT angiography as well as the illness concern differences over time. There was a significant between-group difference in illness concern following CT angiography \((t(41) = -2.93, p = .006)\) along with a significant change in illness concern for negative-testing patients \((t(18) = 4.11, p = .001)\). Illness concern remained unchanged for patients receiving a positive test patients \((t(22) = 0.48, p = .64)\). The results therefore support the hypothesis that patients with negative CT angiogram results would show a significant decrease in illness concern in comparison to positive-testing patients. Pre-testing and post-testing measurements of illness concern are shown in Figure 13.

![Graph showing mean brief IPQ scores for illness concern before and after CT angiography for patients with negative and positive test results.](image)

**Figure 13.** Mean Brief IPQ scores (with standard error bars shown) for illness concern before and after CT angiography for patients with negative and positive test results.

**Hypothesis 4.** It was hypothesised that patients with negative CT angiogram results would show a significant decrease in perceived illness consequences, in comparison to patients with a positive CT angiogram result. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results (diagnostic group) on illness
consequences. The Group x Time interaction effect \( F(1, 40) = 1.52, p = .23 \) and the Group main effect \( F(1, 40) = 2.50, p = .12 \) were not significant, but there was a significant Time main effect \( F(1, 40) = 8.80, p = .005 \). A post hoc independent-samples \( t \) test and paired-samples \( t \) tests for each group were conducted to identify the illness consequences differences between groups following CT angiography as well as the illness identity differences over time. Using Bonferroni-corrected significance levels \( p = .05/3 \), results showed no significant between-group difference in illness identity following CT angiography \( t(41) = -1.73, p = .09 \). Differences across time for illness consequences were not significant for positive-testing patients \( t(22) = 1.36, p = .19 \) but did change significantly for negative-testing patients \( t(18) = 2.68, p = .015 \). The results thus support the hypothesis that patients with negative CT angiogram results would show a significant decrease in illness consequences in comparison to patients with positive CT angiogram results (see Figure 14).

![Figure 14](image)

*Figure 14. Mean Brief IPQ scores (with standard error bars shown) for illness consequences before and after CT angiography for patients with negative and positive test results.*
Remaining Illness Perceptions. The remaining illness perception items from the Brief IPQ were also examined for any changes following testing (see Table 13). A series of two-way repeated-measures ANOVAs were conducted to evaluate the effect of CT angiogram test results on remaining Brief IPQ illness perception items. There were significant Group x Time interactions regarding personal control \((F(1, 37) = 8.06, p = .007)\), and treatment control \((F(1, 37) = 6.05, p = .019)\). Post hoc Bonferroni-corrected \(t\) tests \((p = .05/3)\) revealed that patients with negative CT angiogram results, compared to patients who received positive test results, reported significant increases in perceived illness control \((t(16) = −3.17, p = .006\) vs. \(t(21) = 1.24, p = .23)\). Regarding treatment control, patients with positive CT angiogram results, compared to patients who received negative test results, reported significant increases in treatment control \((t(20) = −2.70, p = .014\) vs. \(t(17) = 0.81, p = .43)\). Between group differences following testing were significant for both illness control \((t(40) = 2.50, p = .017)\) and treatment control \((t(41) = 2.79, p = .008)\).

<table>
<thead>
<tr>
<th>Brief IPQ variable</th>
<th>Negative-testing patients</th>
<th>Positive-testing patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before testing (T1)</td>
<td>After testing (T2)</td>
</tr>
<tr>
<td>Personal control</td>
<td>6.7 (2.3)</td>
<td>8.1 (1.1)</td>
</tr>
<tr>
<td>Treatment control</td>
<td>7.1 (1.8)</td>
<td>6.5 (3.0)</td>
</tr>
<tr>
<td>Illness coherence</td>
<td>5.5 (2.5)</td>
<td>8.3 (1.5)</td>
</tr>
<tr>
<td>Illness timeline</td>
<td>5.6 (3.2)</td>
<td>4.4 (4.3)</td>
</tr>
</tbody>
</table>

*Note.* Values show means of measured variables (with standard deviations in parentheses).

* \(p\) significant on post hoc tests \((p = .05/3)\)

These results show that patients who received a negative diagnosis reported significant increases in perceived illness control in comparison to positive-testing patients, who conversely reported significant increases in perceived treatment control (see Figure 15).
Figure 15. Mean Brief IPQ scores (with standard error bars shown) for personal control over illness (left) and treatment control (right) before and after CT angiography for patients with negative and positive test results.

For the remaining two illness perceptions, there was a significant Time main effect for illness coherence ($F(1, 38) = 28.03, p < .001$) and a significant Group main effect for illness timeline ($F(1, 35) = 4.92, p = .03$). Post hoc Bonferroni-corrected $t$ tests ($p = .05/3$) revealed that negative-testing patients as well as positive-testing patients showed significant increases in illness coherence following testing ($t(18) = −3.81, p = .001$ and $t(20) = −3.66, p = .002$, respectively). In terms of illness timeline, post hoc Bonferroni-corrected $t$ tests failed to show any significant differences between the two patient groups either at baseline ($t(39) = −1.37, p = .17$) or following testing ($t(39) = −2.43, p = .20$). These results show that patients reported significant increases in illness coherence irrespective of the CT angiogram result (see Figure 16). The results also show that there were no significant differences between groups with regard to illness timeline.

**Hypothesis 5.** The fifth hypothesis stated that the size of patients' heart drawings would show a significant positive relationship with worry about having a heart attack. Pearson product-moment correlation coefficients were computed to assess the relationship between the size of patients' heart drawings at either measurement time point and the concurrent level of heart attack worry. Results showed no significant correlation between the two variables either at baseline ($r = .241, p = .14$) or immediately following testing ($r = .012, p = .94$). The
hypothesis that the size of patients’ heart drawings would show a significant positive relationship with heart attack worry was therefore not supported.

Figure 16. Mean Brief IPQ scores (with standard error bars shown) for illness coherence before and after CT angiography for patients with negative and positive test results.

Hypothesis 6. It was also hypothesised that the size of patients’ heart drawings would be significantly positively related to illness concern, as measured by the Brief IPQ item. Pearson product-moment correlation coefficients were computed to assess the relationship between the size of patients’ heart drawings at either measurement time point and the concurrent level of illness concern. Results showed no significant correlation between the two variables either at baseline ($r = .051, p = .76$) or immediately following testing ($r = .106, p = .52$). The hypothesis that the size of patients’ heart drawings would show a significant positive relationship with illness concern was therefore not supported.
Hypothesis 7. The final hypothesis regarding patients’ perceptions of their illness tested the relationship between the detail of patients’ heart drawings and heart attack worry: it was hypothesised that more detailed drawings would be significantly positively related to worry about having a heart attack. Pearson product-moment correlation coefficients were computed to assess the relationship between the detail of patients’ heart drawings at either measurement time point and the concurrent level of heart attack worry. Results showed a significant correlation between the two variables at baseline ($r = .45$, $p = .004$) but no difference immediately following testing ($r = .17$, $p = .31$). The hypothesis that the detail of patients’ heart drawings would show a significant positive relationship with heart attack worry was therefore partially supported.

CT Angiography and Health Behaviour, Attitudes and Intentions

The second part of the hypothesis testing for the present study looked at the impact of diagnostic CT angiography on health behaviour, attitudes and intentions. It was predicted that health behaviour intentions would significantly increase for patients receiving positive test results but would remain unchanged for patients receiving results showing normal arteries. Conversely, it was predicted that positive-testing patients would show significant increases in health behaviours at follow-up in comparison to negative-testing patients.

Health behaviour intentions were measured before and immediately following patients receiving their test results. Table 14 shows the means and standard deviations of these variables for each patient group. Cardiac health behaviours were measured before testing and at follow-up 6 weeks after patients received their CT angiogram test results. Means and standard deviations for health behaviours are shown in Table 15.
Table 14. Cardiac Health Behaviour Intentions Before and After Coronary Angiography Across Diagnostic Groups

<table>
<thead>
<tr>
<th>Cardiac health behaviour intentions</th>
<th>Negative-testing patients</th>
<th>Positive-testing patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before testing</td>
<td>After testing</td>
</tr>
<tr>
<td>Cardiac medication</td>
<td>3.7 (1.8)</td>
<td>4.4 (2.3)</td>
</tr>
<tr>
<td>Heart-healthy diet</td>
<td>5.3 (0.7)</td>
<td>5.6 (0.6)</td>
</tr>
<tr>
<td>Exercise</td>
<td>5.6 (0.7)</td>
<td>5.5 (0.7)</td>
</tr>
</tbody>
</table>

*Note.* Values show means of measured variables (with standard deviations in parentheses).

Table 15. Cardiac Health Behaviour Across Diagnostic Groups Before Coronary Angiography and at Follow-up 6 Weeks Later

<table>
<thead>
<tr>
<th>Cardiac health behaviour</th>
<th>Negative-testing patients</th>
<th>Positive-testing patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before testing</td>
<td>At follow-up</td>
</tr>
<tr>
<td>Heart-healthy diet</td>
<td>9.0 (1.3)</td>
<td>8.1 (2.2)</td>
</tr>
<tr>
<td>Exercise</td>
<td>7.9 (2.8)</td>
<td>6.9 (3.4)</td>
</tr>
</tbody>
</table>

*Note.* Values show means of measured variables (with standard deviations in parentheses).

**Hypothesis 8.** It was hypothesised that patients with positive CT angiogram results, in comparison to patients with a negative angiogram test, would show a significant increase in intention to take cardiac medication. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on cardiac medication intention. A significant result was found for the Group x Time interaction effect ($F(1, 40) = 6.24, p = .017$) and the Time main effect ($F(1, 40) = 18.26, p < .001$). The Group main effect, however, was
not significant \(F(1, 40) = 1.56, p = .22\). Bonferroni-corrected post hoc t tests were conducted to identify the cardiac medication intention differences between groups following CT angiography as well as the cardiac medication intention differences over time. There was a significant between-group difference in cardiac medication intention following CT angiography \(t(41) = -3.25, p = .002\) and a significant difference differences across time for cardiac medication intention among positive-testing patients \(t(23) = -5.41, p < .001\). Negative-testing patients, on the other hand, remained unchanged on cardiac medication intention \(t(17) = -1.11, p = .28\). Post hoc analyses thus showed that patients receiving a positive CT angiogram diagnosis reported an increase in intention to take cardiac medication in comparison to negative-testing patients (See Figure 17). The results therefore support the hypothesis that patients with a positive CT angiogram result would show a significant increase in cardiac medication intention.

![Figure 17. Mean cardiac medication intention scores (with standard error bars shown) for before and after CT angiography for patients with negative and positive test results.](image-url)
**Hypothesis 9.** It was predicted that, in comparison to patients with a negative angiogram test, patients with positive CT angiogram results would show a significant increase in reported intention to eat a heart-healthy diet. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on healthy diet intention. There was a significant Time main effect \(F(1, 42) = 8.06, p = .007\), although the Group x Time interaction effect \(F(1, 42) = 0.08, p = .78\) and the Group main effect \(F(1, 42) = 0.22, p = .61\) did not reach the level of significance. Post hoc paired-samples t tests with Bonferroni corrections \(p = .05/2\) were conducted to explore the significant Time main effect. Results showed no significant changes in healthy diet intentions, although there were non-significant trends towards increasing intentions for both groups—positive-testing patients \(t(24) = −2.32, p = .03\) and negative-testing patients \(t(18) = −1.76, p = .096\). The results therefore failed to support the hypothesis that patients with positive CT angiogram results would show a significant increase in healthy diet intentions in comparison to patients with negative findings from their CT angiogram.

**Hypothesis 10.** The final hypothesis that looked at health behaviour intentions predicted that patients with positive CT angiogram results, in comparison to patients with a negative test result, would show a significant increase in exercise intentions. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on exercise intentions among the two diagnostic patient groups. The Group x Time interaction effect was significant \(F(1, 42) = 7.84, p = .008\) and both the Time main effect \(F(1, 42) = 1.74, p = .19\) and the Group main effect \(F(1, 42) = 0.02, p = .90\) were not significant. Bonferroni-corrected post hoc t tests (independent- and paired-samples) were conducted to identify exercise intention differences between groups following CT angiography as well as exercise intention differences over time. There was no significant between-group difference in exercise intentions following CT angiography \(t(42) = −1.81, p = .08\) nor was there a significant change over time for patients receiving negative test results \(t(18) = 1.14, p = .27\).
However, patients receiving positive test results showed a significant rise in exercise intentions following testing \((t(24) = -2.86, \ p = .009)\). The findings thus support the hypothesis that patients with positive CT angiogram results would show a significant increase in exercise intentions in comparison to patients with negative CT angiogram results. Figure 18 shows the pre-testing to post-testing changes in exercise intention across the two diagnostic groups.

\[\begin{array}{c|c|c}
\text{Exercise Intention} & \text{Measurement Time Point} & \text{Patient Group} \\
\hline
\text{Before CT Angiogram} & \text{After CT Angiogram} & \text{Positive Test Result} \\
\text{Negative Test Result} & \text{Negative Test Result} & \\
\end{array}\]

*Figure 18. Mean exercise intention scores (with standard error bars shown) for before and after CT angiography for patients with negative and positive test results.*

**Hypothesis 11.** The first of the hypotheses that looked at health behaviour change predicted that, in comparison to patients with a negative CT angiogram test result, patients with positive CT angiogram results would show a significant increase in eating a heart-healthy diet at follow-up 6 weeks after receiving CT angiogram test results. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on dietary behaviour. The Group x Time interaction effect was significant \((F(1, 43) = 7.47, \ p\)
= .009), but both the Time main effect ($F(1, 43) = 0.05, p = .82$) and the Group main effect ($F(1, 43) = 0.89, p = .35$) did not reach the level of significance. Post hoc analysis using Bonferroni-corrected ($p = .05/3$) $t$ tests were conducted to identify the dietary behaviour differences between groups following CT angiography as well as differences over time. No significant between-group difference was found in dietary behaviour following CT angiography ($t(43) = -2.02, p = .05$) and no significant differences over time were found for either positive-testing ($t(24) = -1.66, p = .11$) or negative-testing ($t(19) = 2.49, p = .022$) patients. The results therefore failed to support the hypothesis that patients with positive CT angiogram results would show a significant increase in dietary behaviour.

**Hypothesis 12.** The final hypothesis regarding health behaviour change hypothesised that patients with positive CT angiogram results would show a significant increase in exercise behaviour at the 6-week follow-up compared to patients with a negative CT angiogram result. A two-way repeated-measures ANOVA was conducted to evaluate the effect of CT angiogram test results on exercise behaviour. Results showed a significant Group x Time interaction effect ($F(1, 43) = 8.02, p = .007$) and a non-significant Time main effect ($F(1, 43) = 0.03, p = .95$) and a non-significant Group main effect ($F(1, 43) = 0.24, p = .63$). A post hoc independent-samples $t$ test and paired-samples $t$ tests for each group were conducted to identify the exercise behaviour differences between groups following CT angiography as well as the exercise behaviour differences over time. Using Bonferroni-corrected significance levels ($p = .05/3$), results showed a non-significant between-group difference in exercise behaviour ($t(43) = -1.54, p = .13$). Differences across time for exercise behaviour were not significant for negative-testing patients ($t(19) = 1.55, p = .14$) but did change significantly for positive-testing patients ($t(24) = -2.79, p = .01$). The results thus support the hypothesis that patients with positive CT angiogram results would show a significant increase in exercise behaviour in comparison to patients with negative CT angiogram results (see Figure 19).
Further Explorations of Data

Further supplementary exploration of the data examined the association of health behaviours (i.e., dietary behaviour and exercise) at follow-up with the main predictor variables from the theory of planned behaviour. Other exploration of data involved examining medication beliefs and adherence to cardiac medicine.

The Theory of Planned Behaviour Predictor Variables and Cardiac Health Behaviours

The theory of planned behaviour (TPB) key predictors of health behaviour (i.e., behavioural attitude, subjective norms, perceived behavioural control, and behavioural intention) along with prior behaviour were examined on their relationship to health behaviours at follow-up among patients in the present study. To examine this, Pearson correlation coefficients were computed—using the Bonferroni approach ($p = .05/5 = .01$) to control for Type I error—for each of the diagnostic groups with health behaviours measured.
at follow-up (heart-healthy diet behaviour and exercise) and the associated predictor variables, which were measured immediately after they received their test results.

Correlations with heart-healthy diet behaviour were significant for three of the tested variables for positive-testing patients: prior heart-healthy diet behaviour ($r = .64, p = .001$), perceived behavioural control ($r = .52, p = .008$) and intention to eat healthy ($r = .63, p = .001$). For negative-testing patients, only prior behaviour was significantly associated with healthy diet behaviour at follow-up ($r = .67, p = .001$). The results show, then, that there is a positive relationship between positive-testing patients’ self-reported healthy diet behaviour at follow-up and prior dietary behaviour as well as post-testing perceived behavioural control and intentions to eat healthy. For negative-testing patients, only prior healthy diet behaviour produced a positive association with healthy diet behaviour at follow-up (see Table 16).

Table 16. Correlations Between Dietary Behaviour Predictor Variables and Heart-Healthy Diet Behaviour at Follow-Up For Patients With Positive and Negative CT Angiogram Results

<table>
<thead>
<tr>
<th>Predictor variables for heart-healthy diet</th>
<th>CT angiography diagnostic group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative-testing patients</td>
<td>Positive-testing patients</td>
<td></td>
</tr>
<tr>
<td>Prior health behaviour</td>
<td>.67*</td>
<td>.64*</td>
<td></td>
</tr>
<tr>
<td>Behavioural attitude</td>
<td>.11</td>
<td>.43</td>
<td></td>
</tr>
<tr>
<td>Subjective norms</td>
<td>.18</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>Perceived behavioural control</td>
<td>.43</td>
<td>.52*</td>
<td></td>
</tr>
<tr>
<td>Behavioural intentions</td>
<td>.49</td>
<td>.63*</td>
<td></td>
</tr>
</tbody>
</table>

*p < .01, 2-tailed.

In terms of exercise behaviour at follow-up, significant correlations were found for all predictor variables with the exception of subjective norms for positive testing patients: prior exercise behaviour ($r = .83, p < .001$), behavioural attitude ($r = .55, p = .006$), perceived
behavioural control ($r = .53, p = .007$), and behavioural intentions ($r = .65, p < .001$). Again, for negative-testing patients, only prior behaviour was significantly associated with exercise behaviour at follow-up ($r = .58, p = .007$). The results show that the majority of predictor variables—namely, prior exercise behaviour, behavioural attitude, perceived behavioural control, and behavioural intentions—are positively associated with patients’ self-reported exercise behaviour at follow-up among positive-testing patients. A similar pattern to diet behaviour was found for exercise behaviour among negative-testing patients, where prior behaviour showed the only significant relationship. Table 17 displays all correlation coefficients for exercise behaviour.

Table 17. Correlations Between Exercise Predictor Variables and Exercise Behaviour at Follow-Up For Patients With Positive and Negative CT Angiogram Results

<table>
<thead>
<tr>
<th>Predictor variables for exercise behaviour</th>
<th>CT angiography diagnostic group</th>
<th>Negative-testing patients</th>
<th>Positive-testing patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior health behaviour</td>
<td></td>
<td>.58*</td>
<td>.83**</td>
</tr>
<tr>
<td>Behavioural attitude</td>
<td></td>
<td>.35</td>
<td>.55*</td>
</tr>
<tr>
<td>Subjective norms</td>
<td></td>
<td>.01</td>
<td>.17</td>
</tr>
<tr>
<td>Perceived behavioural control</td>
<td></td>
<td>.49</td>
<td>.53*</td>
</tr>
<tr>
<td>Behavioural intentions</td>
<td></td>
<td>.48</td>
<td>.65**</td>
</tr>
</tbody>
</table>

* $p < .01$, 2-tailed. ** $p < .001$, 2-tailed.

Medication Beliefs and Adherence to Medication

Finally, adherence to medication and accompanying medication beliefs were explored for the 22 positive-testing participants who were prescribed cardiac medication at the time of follow-up (see Table 18). Of the 22 participants, six (27.3%) reported missing at least one pill
in the week leading up to the follow-up. To test medication belief differences between adhering participants and non-adhering participants, independent-samples *t* tests were conducted for necessity beliefs and concerns before testing as well as at follow-up. There were no between-group differences in necessity beliefs at baseline (*t*(17) = −1.05, *p* = .31), although at follow-up there was a non-significant trend for higher necessity beliefs among adhering participants (*t*(20) = 1.78, *p* = .09). Regarding concern about medication, there were no between-group differences both at baseline (*t*(16) = −1.35, *p* = .20) and at follow-up (*t*(20) = −0.35, *p* = .73). Overall, the results show that medication beliefs—namely, participants’ beliefs about the necessity of the medication as well as their medication concerns—did not differ between adhering and non-adhering participants.

*Table 18. Mean Values (with Standard Deviations in Parentheses) for Beliefs About Medication Before and After Testing For Adhering and Non-adhering Positive-Testing Patients*.  

<table>
<thead>
<tr>
<th>Medication beliefs</th>
<th>Before testing</th>
<th>At follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adhering patients</td>
<td>Non-adhering patients</td>
</tr>
<tr>
<td>Necessity</td>
<td>3.7 (3.5)</td>
<td>5.8 (3.3)</td>
</tr>
<tr>
<td>Concern</td>
<td>2.9 (3.0)</td>
<td>5.3 (3.3)</td>
</tr>
</tbody>
</table>

*Note.* Values show means of measured variables (with standard deviations in parentheses).
Prospective in design, the present study explored the psychological impact and value of coronary CT angiography among non-acute cardiac patients within a cardiac diagnostic setting. The study had two key aims: (1) to examine the effects of coronary CT angiogram test results on non-acute patients’ illness perceptions; and (2) to investigate testing effects on patients’ health behaviour intentions and subsequent cardiac health behaviour at follow-up 6 weeks after receiving test results from their cardiologist during a post-testing consultation. Supplementary exploration of the data comprised a look at the relationship between patients’ heart drawings, on the one hand, and illness worry and concern on the other. A brief examination of some of the predictor variables important for future health behaviours was also included in this section.

**Changes in Illness Perceptions**

The results from the present study showed significant changes for a number of illness perceptions in response to diagnosis from coronary CT angiography. For the illness perception variables that were hypothesised to change following diagnosis (i.e., identity, emotional effect, illness concern, and perception of illness consequences), three showed significant changes for patients with normal coronary angiograms: emotional effect, illness concern, and illness consequences all decreased significantly for negative-testing patients but remained unchanged for patients testing positive for coronary artery calcification. In this way, the negative findings reduced patients’ concern and emotion surrounding their heart condition and reduced the belief that the condition of their heart would have an effect on their life.

A number of noteworthy results were found for the remaining illness perceptions. Illness control variables—personal illness control and perceived illness control through
treatment—saw a change with the diagnostic results from the CT angiogram. However, the nature of the changes were dependent on the diagnosis itself: negative-testing patients reported a significant increase in perceived personal control, whereas positive-testing patients remained unchanged on this variable; conversely, positive-testing patients reported an increase in perceived control through treatment, in comparison to negative-testing patients, who showed no change on this illness perception variable. These results suggest that control beliefs can increase following testing, but the locus of these control beliefs shifts depending on the test result. Additionally, illness coherence increased for both diagnostic groups, which suggests an improvement in how patients felt they understood their heart following the testing procedure.

The results from the present study echo previous findings from a similar study that explored changes in illness perceptions among patients undergoing conventional coronary angiography (Devcich et al., 2008). Here, changes in perceived illness consequences, illness concern and emotional effect of the illness also decreased for negative-testing patients. The conventional coronary angiography study also found a similar testing-dependent effect on illness identity, although this finding was not mirrored in the results from the present study.

While cardiac testing itself can have a number of psychological benefits for individuals, such as reductions in anxiety and uncertainty (Mushlin et al., 2005), the present study suggests that changes towards more benign illness appraisals occur primarily in accordance with the nature of the diagnostic result. This illness perception change for negative-testing patients, but not for positive-testing patients, gives way to the conclusion that patients are cognitively preparing themselves for an unfavourable diagnosis. In other words, the fact that illness perceptions are comparable prior to testing and only decrease following normal diagnosis shows that, in a sense, patients are approaching the testing setting expecting the worst. The high level of perceived illness consequences prior to testing may point towards a coping strategy that is initiated at this stage in the testing process where the outcome is, to
all intents and purposes, unknown. That being said, the high level of pre-testing emotional effect and illness concern could also account for the high levels of state anxiety that are present prior to cardiac testing (De Jong-Watt & Arthur, 2004; Gallagher et al., 2010).

Control and coherence illness perception variables did not follow the above pattern. Changes in the locus of illness control most likely indicate a shift in patients’ beliefs about the ways that the condition of their heart needed to be addressed prescriptively. For positive-testing patients, an increase in treatment control not only indicates a belief in the degree to which their heart condition is amenable to treatment with cardiac medication, it may in addition point towards an acceptance of pharmaceutical treatment as the primary means for controlling illness. This could signify an underlying motivational approach to threat minimisation: when faced with the ensuing health threat—where the evidence in the form of scan images is difficult to deny—patients most likely found it more comforting to believe that the condition of their heart could be controlled through medication. Paradoxically, beliefs that the health threat can be minimised or controlled in the future may also allow patients to acknowledge fully its consequences (Croyle & Ditto, 1990). The combination of unchanged high levels of perceived illness consequences and high post-testing medication control beliefs for positive-testing patients at least appears to fit this cognitive pattern of responding to medical testing.

Conversely, the rise for negative-testing patients in their perceptions of personal control over the condition of their heart—a type of fundamental attribution error—could have positive implications for future behaviour change (Hirani & Newman, 2005; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000), although the present study’s results on behavioural intentions and behaviour change did not uphold this assumption, at least as a short-term pattern (see below). When performance feedback is ambiguous, as arguably is the case with future cardiac health behaviours, high control beliefs are particularly essential for thriving health outcomes, as shown by their relationship with lower levels of negative emotions and
higher levels of task persistence (Langens, 2007). This finding follows Taylor and Brown’s (1988) original hypothesis that illusions of control, along with a number of other so-called positive illusions, are hallmarks of healthy and productive lives. Indeed, high personal control beliefs have been shown to be important for psychosocial variables such as optimism, well-being and satisfaction with life among cardiac patients (Bohachick, Taylor, Sereika, Reeder, & Anton, 2002). However, whether these associations have significance for negative-testing coronary CT angiogram patients—essentially noncardiac patients—or, for that matter, positive-testing patients, who did not report an increase in personal control beliefs in the present study, remains to be explored in further research.

Also requiring further exploration is the positive effect that testing had on illness coherence, with both patient groups reporting increases in the extent to which they felt they understood the condition of their heart. Understanding could have been strengthened by a number of variables tied up with the testing procedure, including the consultation process, the use of images, the cardiologist’s communication skills, and so on. It is therefore not clear from the results which specific aspects of the testing procedure patients found most useful in increasing their understanding and to what degree each aspect plays in strengthening understanding overall. This feature of understanding, particularly with regard to the use of images from patients’ scans, was explored in the third study of this thesis.

Heart drawings were assessed in terms of their potential for gauging patients’ heart attack worry and concern about their cardiac illness. The results regarding drawing size failed to show any relationship between these variables either before testing or following diagnostic test results. The size of patients’ heart drawings, in other words, was related to neither heart attack worry nor illness concern. Likewise, the amount of detail in patients’ heart drawings was not related to heart attack worry following testing. Prior to testing, however, a relationship was apparent: patients who added more detail to their heart drawing were more likely to have higher heart attack worry prior to testing. Results, although not entirely
compelling, suggest that there might be some investigation-worthy relationship between the amount of detail of patients’ heart drawings and the level of heart-focussed anxiety prior to testing, and patient drawings could be an alternative or supplementary method for assessment of this dimension.

An interpretation of the present study’s drawing results can be made in context of previous research on patient drawings. Broadbent and colleagues’ (2004) study on myocardial infarct patients found that patients who drew damage on their heart during their time in hospital were more likely to have more negative illness perceptions—which included lower control beliefs and a longer timeline associated with their illness—and the amount of damage drawn was a better predictor of recovery beliefs than biomedical markers. Following this, the same research group explored drawing size as a predictor of recovery following myocardial infarction and found that increases in the size of patients’ drawing were indeed related to slower recovery as well as higher cardiac anxiety and heart attack worry (Broadbent, Ellis et al., 2006). The authors suggested that elements of patients’ drawings could reveal the extent to which patients are anxious about or focussed on their heart. Little support for this argument with regards to drawing size was found in the present study’s findings, a result which also differs from research carried out by Reynolds and colleagues (2007) involving heart failure patients.

The abovementioned studies, unlike the present study, were conducted on patients who had suffered a cardiac event. The systematic differences between the patient populations, therefore, may help to explain the incongruous findings. However, the pre-testing relationship between drawing detail and heart attack worry does make some sense considering that lower levels of illness coherence were found for all patients at this stage. The amount of detail in the images varied considerably, ranging from the simple (i.e., stylised Valentines-type heart drawings) to the more complex and sophisticated, characterised by anatomically accurate sketches of the heart and coronary vasculature. Given that patients do not appear to have a
particularly great understanding of human anatomy (Weinman, Yusuf, Berks, Rayner, & Petrie, 2009), a greater level of detail in drawings among early diagnosis patients could in fact reflect a greater focus on the heart and its condition among this particular patient population. This feature of patient drawings could therefore have greater measurement sensitivity for heart-focussed anxiety among early risk cardiac patients. This hypothesis deserves further scientific exploration.

**Coronary CT Angiography and Cardiac Health Behaviour**

Changes in health behaviour intentions following testing were observed in the results from the present study, and these were dependent on the diagnostic result. Compared to negative-testing patients, patients with test results indicating the presence of coronary artery calcification reported positive changes in intentions to take cardiac medication and intentions to engage in exercise behaviour. These results therefore showed a testing-dependent change in aspiration towards engaging in healthy behaviours to combat cardiac risk. Furthermore, at follow-up 6 weeks after receiving their angiogram results, positive-testing patients reported an increase in exercise behaviour from pre-testing levels; negative-testing patients, on the other hand, showed no change on this variable. Changes in dietary intentions and dietary behaviour were not evident in either of the diagnostic groups.

These findings add further evidence to the growing literature that demonstrates the influence that cardiac imaging tests have on health behaviour change (Bovet et al., 2002; Kalia et al., 2006; Rodondi et al., 2008; Shahab et al., 2007). A previous study, involving statin-prescribed cardiac patients who underwent electron beam tomography, showed an association between the level of coronary calcium shown in the testing images and improvements in medication adherence (Kalia et al., 2006). Likewise, the present study’s results show a similar pattern among early risk cardiac patients receiving coronary CT angiography. While at this stage not all patients were taking cardiac medication, the results
nonetheless indicate a shift in patients’ reported intentions to take medication following test results showing the presence of coronary artery calcification. Adherence to statin therapy is problematically low (Frolkis, Pearce, Nambi, Minor, & Sprecher, 2002). Therefore, studies demonstrating changes in medication-taking intentions (and behaviours) could provide value in addressing this issue. Kalia and colleagues’ (2006) study highlighted the importance of patients viewing their scan images, and while the present study was not able to control for other factors involved in the rise in medication-taking intentions, by the same token, the influential effect of seeing the coronary CT angiogram images cannot be discounted.

The results showed not only a clear diagnosis-dependent effect on exercise intentions but also an impact on exercise behaviour at the point of follow-up. Much of the limited research on the use of patients’ images from their medical scans as a motivator for health behaviour change has primarily focussed on smoking cessation. Bovet and colleagues (2002) found that providing smokers with their scan images led to an increase in quit rates half a year later. However, other studies investigating the relationship between smoking behaviour and the use of patients’ medical images have only been able to demonstrate changes in intentions—with non-significant trends towards less smoking behaviour only evident at follow-up (Rodondi et al., 2008)—or have not been able to demonstrate changes in either smoking behaviour or intention (Shahab et al., 2007). Nonetheless, on the whole the research suggests that providing smokers with images of atherosclerosis in their arteries was a valuable adjunct to consultation to the extent that it has the potential to dissuade further smoking behaviour. The results from the present study suggest corresponding value for images in a coronary CT angiography setting regarding their potential to influence exercise behaviour. This topic merits further experimental investigation that is able to go beyond the limitations of the present descriptive study in order to isolate the contributing effect of using coronary CT angiogram images in the post-testing consultation.
On the contrary, some previous research exploring the effect of showing images from patients’ cardiac imaging tests has not demonstrated efficacy of using images in changing health behaviour. Lederman and colleagues (2007) found no effect of using CT images in conjunction with normal screening with regard to physical activity and medication use. Similarly, a study conducted by O’Malley et al. (2003) failed to show an effect on behavioural measures (i.e., physical activity, smoking cessation, BMI, blood pressure) for participants undergoing cardiovascular screening and electron beam tomography versus a non-testing control group. These findings contrast with the implications of the present study’s findings. However, the participants in the studies above—drawn from military and female (post-menopausal) populations—were not representative of typical clinical populations within cardiology, whereas the present study involved patients referred to a cardiac clinic specifically for diagnostic testing. Therefore, it could be argued that the images had more salience or relevance for the present study’s clinical sample, thus resulting in demonstrable effects on health behaviour intentions and later behaviour. Again, the results suggest that the use of images may be beneficial for patients undergoing coronary CT angiography. At the very least, the overall process of undergoing coronary CT angiography does appear to effect behavioural change for positive-testing patients, and there is a need to examine this effect further.

Supplementary exploration of the data focussed on examining key theory of planned behaviour (TPB) predictor variables—including behavioural attitude, subjective norms, perceived behavioural control, behavioural intentions, as well as past behaviour—and their relationship with the health behaviour outcomes of diet and exercise. For negative-testing patients, only past behaviour was significantly associated with either of the two behaviours, showing that prior engagement in healthy eating and physical activity were most important for predicting future engagement in these behaviours, respectively. For positive-testing patients, prior health behaviour was also significantly related to future health behaviours.
However, other additional variables came into the foreground as well: the TPB variables of perceived behavioural control and behavioural intention were significantly associated with heart-healthy dietary habits at follow-up; equally, these two variables were significantly associated with exercise behaviour at follow-up, as was behavioural attitude. These results suggest that key TPB variables may have particular significance for the prediction of future health behaviour in coronary CT angiogram patients who test positive for coronary artery calcification. These results suggest a potential moderating effect that diagnostic test results may have on psychological variables important for future health behaviour among cardiac patients, and this is a topic that could be investigated further.

Finally, medication beliefs at baseline and at follow-up were explored among the adherent and non-adherent patients who were prescribed cardiac medication at the time of follow-up. Although there was a trend for adherent patients to have had higher necessity beliefs at baseline, the results overall showed no detectable between-group differences in medication beliefs. Previous research has demonstrated the predictive power of medication beliefs for adherence among clinical patient populations (Horne & Weinman, 1999), but for patients undergoing coronary CT angiography, the present study failed to show this effect, at least with regards to short-term medication adherence.

**Clinical Relevance**

The study has relevance for clinical practice in a number of ways. First, the results show the significant role that the coronary CT angiography testing process can have on the way patients make appraisals of the condition of their heart. This involves an increase patients’ understanding of their illness as well as a change in the extent to which they believe the condition of their heart had consequences for their life. Moreover, illness concern and emotion can decrease for patients given a favourable diagnosis. On the flip side, for positive-testing patients, the unchanged levels of illness concern and emotion show that these patients
may still have a considerable level of anxiety about their heart health, and this should be kept in mind by clinicians throughout the testing process.

Although the present study was not able to isolate the effects of using patients’ heart images in the post-testing consultation, there is still a possibility that viewing these images contributed to the effects shown. It is plausible that viewing the scan images facilitated patients’ understanding of their heart or perhaps even contributed to changes in illness concern and emotion among patients with normal scans. Furthermore, it is possible that seeing the images (and consequently seeing the extent to which their arteries had developed calcified plaques) could have had a major effect on changing positive-testing patients’ health behaviour intentions and subsequent exercise behaviours. This is an important clinical consideration. Given that the patients that typically undergo coronary CT angiography are at early risk of heart disease, using images in consultation could greatly facilitate the change towards heart-healthy behaviours that impact significantly on cardiac risk reduction (Nusselder, Franco, Peeters, & Mackenbach, 2009).

The study has implications for addressing cardiac patients’ health behaviour intentions. Doctors are encouraged to advise patients on the merits of quitting smoking, and an opportune time to put across a persuasive message is around diagnosis—particularly when there is a diagnosis of heart disease—as the impetus for quitting is particular high around this time for patients (Graham et al., 2007). It appears from the present study’s results that a similar motivational effect may be seen for other health behaviours, particularly with regards to exercise. These results imply that emphasising the importance of engaging in physical activity—and possibly diet as well—could lead to beneficial health effects. It may also be important for clinicians to keep in mind patients’ beliefs around health behaviour, particularly with regards to self-efficacy beliefs, behavioural intentions and attitudes towards cardiac health behaviours and medication.
Strengths and Limitations

The major strength of the study is the clinical setting in which it was conducted and the patient sample that was recruited. A good deal of the previous research that has explored coronary CT angiography and its impact on health behaviour has been conducted on noncardiac patients or in noncardiac settings (e.g., Ashraf et al., 2009; Lederman et al., 2007). The nature of such studies makes it difficult to extrapolate findings to cardiac patients. The recruitment of clinic patients who were referred for diagnostic coronary CT angiography contributes greatly to the external validity of the present study. However, as the use of coronary CT angiography increases—with foreseeable expansion into the public health sector—interpretation of findings from research conducted in private clinic settings will need to be tempered with caution, and research on more representative samples will need to be conducted at that stage.

The study had several limitations. First, due to the study design, it was not possible to isolate the factors that led participants to a change in illness perceptions, health behaviour intentions and subsequent health behaviours. There could have been a number of specific factors important here, including the impact of seeing the images from the scan, discussion of the results with the patients’ cardiologist at follow-up consultation, or indeed the experience of going through the testing process itself. This issue could be remedied through using an experimental design. The additional benefit of using patients scan images during post-testing consultation, for example, could thus be examined through a randomised controlled trial with allocation to either a consultation with images group or a no-image control group. This would allow for the identification of causal factors leading to cardiac health behaviour intentions and subsequent cardiac health behaviours.

Limitations relating to the health behaviour variables include the short follow-up period and the items used to measure the health behaviours. A longer follow-up period would
have allowed for measurement of long-term behavioural effects of coronary CT angiography, and this would have provided greater clinical significance for the study, since long-term pattern of behaviour for diet and exercise are key to the prevention heart disease (Nusselder et al., 2009). As well as this, there may have been some limitations regarding how medication adherence was measured in the study. Measurement of adherence relied on self-reported recall, which may be subject to social desirability biases leading to potentially inaccurate assessment of the level of cardiac medication adherence. Although direct measures of adherence (e.g., blood tests) would have been highly impractical for the present study’s design, more effective indirect measures such as electronic monitoring devices or pill counts may have helped to strengthen measurements of adherence, although these are not without their administration difficulties and methodological issues (Lee et al., 2007).

Finally, a few statistical considerations need to be made. Although participant attrition was observed to some extent (e.g., dropout during the points of questionnaire administration and loss to follow-up) the proportion of participants used in the per-protocol analysis was still within an acceptable range and therefore concerns about a biased sample that may not be fully representative of an underlying clinical population may be somewhat speculative. However, more obvious limitations can be found regarding the number of participants used in the analysis of medication beliefs. With very few participants being prescribed medication at follow-up, it is likely that statistical analysis was underpowered, and this would have contributed to the absence of findings in this additional part of the study’s investigation.

**Suggestions for Further Research**

Based on the findings from the study, a clear direction for further research ought to focus on dissecting the coronary CT angiography process in order to find the effective elements that influence cardiac health behaviour intentions and health behaviours among cardiac patients. A logical place to start would be to investigate the use of patients’ scan...
images in consultation, as this would add to the burgeoning literature in this area, which at present is equivocal. The key to this research, however, most likely rests in the recruitment of genuine cardiac patients referred for diagnostic testing. Coronary CT angiogram images may have significance for a number of illness perception variables, ranging from understanding to perceived illness consequences, and experimental studies could unravel the specific value for patients that these images add to the testing procedure, particularly with regard to the post-testing consultation. Moreover, research of this kind could investigate any negative anxiety-inducing effects of seeing scanning images, particularly scans from tests demonstrating coronary artery calcification.

As discussed above, negative-testing patients showed decreasing shifts in perceived illness consequences following testing, and at follow-up their health behaviour remained unchanged from pre-testing levels. This combination of findings could represent a shift in patients’ perceptions of cardiac risk, and it is possible that lower risk perceptions had an influential role in shaping later behavioural patterns (Prentice-Dunn & Rogers, 1986). The nature of patients risk representations following normal test results could thus be investigated by further exploratory research. Furthermore, prospective research could examine what impact that perceptions of this nature have on cardiac health behaviours following medical testing. Research with this focus could explore the extent to which patients’ perceived risk of heart disease line up with actual risk and what consequences these risk perceptions have for future health behaviours (Gholizadeh, Davidson, Salamonson, & Worrall-Carter, 2010).

Finally, further studies could examine the influence that testing may have on medication adherence among patients prescribed cardiac medication following coronary CT angiography test—again, with the focus falling on the effects of scan images in relation to later treatment adherence. The demonstration of diagnosis-dependent effects on patients’ intentions to take cardiac medication suggests added value in exploring the effective elements of the testing process that have a positive impact on psychological variables. Such elements
could include medication and treatment representations (Horne, 1997) as well as TPB variables that have shown to be important for adherence (Bane, Hughes, & McElnay, 2006).

Conclusions

The present study provides good evidence for the positive effect that diagnostic test results from coronary CT angiography can have on patients’ appraisals of their heart condition as well as their health behaviour intentions and subsequent health behaviours. For the most part, these effects were clearly related to the nature of the test result, however, with negative-testing patients reporting a shift to more benign illness perceptions following testing, on the one hand, and positive-testing patients showing encouraging changes in their behavioural intentions and subsequent physical activity, on the other. Diagnostic-dependent changes in the locus of control beliefs for positive-testing and negative-testing patients may have reflected particular cognitive processes relating to threat minimisation and the fundamental attribution error, respectively, but further research is required to confirm these hypotheses.

Particular value of the present study can be found in the clinical setting in which it was conducted and the recruitment of a sample of bona fide cardiac patients. These features strengthen the study’s generalisability and ensure that it provides a valuable contribution to the literature that has examined the effects of using testing images to modify cardiac patients’ health behaviours. Furthermore, the findings from the study have a number of clinical implications with regard to cardiac testing, and further experimental and descriptive research could be informed by the demonstrated effects that coronary CT angiography can have on patients’ illness appraisals and health behaviour.

All up, the study shows that coronary CT angiography can be a significant experience for cardiac patients in many important ways. The ramifications of diagnosis, it would seem,
have far-reaching consequences, not only in terms of the way in which patients view their heart health, but also in terms of the actions they take in response. Further understanding of these effects is indeed warranted.
SECTION IV

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STUDY THREE
CHAPTER THIRTEEN

EXPLORING THE PSYCHOLOGICAL VALUE OF COMPUTED TOMOGRAPHY ANGIOGRAPHY TESTING AND IMAGES—A QUALITATIVE ANALYSIS

As a relatively new development in cardiac testing, coronary computed tomography (CT) angiography offers a technologically advanced, quick and non-invasive means of detecting early stages of ischaemic heart disease (IHD). The test has shown particular utility for examining the vascular health of asymptomatic patients who may be at greater risk of heart disease due to the presence of cardiac risk factors such as elevated cholesterol, family history and modifiable lifestyle factors (Moser et al., 2003). In many cases, coronary CT angiography may yield clear and well-defined images of the build-up of calcium deposits in the lumen of the heart vessels, perhaps even well before typical heart disease symptoms make an appearance. The test may thus potentially provide patients a tangible visible representation of burgeoning disease, in effect offering a window into a disease process otherwise concealed.

Although coronary CT angiography is used within cardiology as a diagnostic tool with increasing frequency, very little is known about the perceived value of the procedure for patients psychologically, particularly with regard to the images that are generated and their impact on patients’ cognitive representations of their illness and their attitudes towards cardiac health behaviours. Of the few studies that have looked at the impact of tomography images, findings have been mixed. Studies using electron beam tomography have shown modifications in patients’ dietary behaviour (Wong et al., 1996) and cardiac medication adherence (Kalia et al., 2006), perhaps as a result of being reinforced by the knowledge of a positive test result. A few other recent studies, on the other hand, were not able to show any behavioural effect relating to the use of coronary CT angiography images (Ashraf et al., 2009; Lederman et al., 2007; O’Malley et al., 2003).
One of the main issues with the abovementioned studies that failed to show an effect is that they were not conducted on typical clinical populations—in other words, higher-risk populations where there is a higher prevalence of coronary calcification. It is within this specific clinical context that coronary CT angiogram images could potentially be used effectively to promote change in poor cardiac health behaviours for patients particularly at risk of IHD. Furthermore, the lack of research in this area calls for an initiation of qualitative research to be conducted in order to explore patients’ impressions of the CT angiography procedure, its images and the diagnosis itself. If indeed viewing images may encourage patients’ motivation towards behaviour change, then a qualitative approach is likely to provide further understanding of this process.

The present qualitative study, therefore, looked at examining cardiac patients’ impressions of and reactions to the coronary CT angiography procedure within a typical private clinic setting. In a series of pre-diagnostic interviews, the study aimed to explore patients’ expectations of the procedure and their initial attitudes to cardiac health behaviours prior to receiving their coronary CT angiogram diagnostic results. Further, through post-diagnostic interviews, the present study aimed to investigate patients’ impressions of their coronary CT angiogram heart images as well as any potential effect these images may have had on their attitudes and intentions towards heart-healthy behaviours.
CHAPTER FOURTEEN

METHOD

The present study was a qualitative investigation into the psychological value of cardiac images for patients undergoing CT angiography. Conducted within a thematic analysis framework, the study involved semi-structured interviews of patients before and after receiving results from a diagnostic CT angiogram. Major themes prior to and following diagnosis were identified and explored using thematic analysis techniques.

Recruitment and Sample

The study comprised non-acute adult patients aged 18 years and over who were referred to a private heart clinic in Auckland for diagnostic CT angiography for assessment of coronary plaques. CT angiograms conducted for calcium scoring only were not included, as this procedure did not involve capturing detailed heart images. Participants were sampled sequentially, which yielded a mixture of positive-testing and negative-testing patients who were recruited and then followed up. Exclusion criteria included patients who had undergone CT angiography on a prior occasion and patients who did not speak English to a sufficient level. Thirteen mostly male (n = 11) CT angiogram patients took part in the present study, all from the Auckland metropolitan area. Ages ranged from 39 to 71 years old, with a mean of 56.6 years. Seven participants tested positive for coronary plaques with the remaining participants receiving negative CT angiogram test results.

Procedure

The study received ethical approval from The University of Auckland Human Participants Ethics Committee in September 2009. Participant recruitment began in May 2010 and final follow-up interviews were completed in September 2010.
In order to ensure patient confidentiality, potential participants were approached in the clinic waiting room at Mercy Hospital by nursing staff and were asked if they were interested in taking part in the study. Patients who were interested were then approached by the researcher and were provided with a participant information sheet and given a description of the study along with what was required from them. Following this, written consent was obtained from patients willing to take part in the study. Patients then underwent their CT angiogram, which on average took around 10 minutes to complete.

Initial interviews took place following patients’ CT angiogram and were conducted in a small interview room at the clinic. Patients were required to remain at the clinic for at least half an hour in order for clinical staff to monitor pulse and blood pressure and to ensure the absence of any allergic reactions to the contrast media used during the testing procedure. This was an ideal time to conduct interviews, as patients were typically relaxed post-procedure and were not as yet aware of the diagnostic findings from their CT angiogram. Interviews typically ran for around 5-10 minutes.

Follow-up interviews took place on the days patients received their results at clinic in the 2 to 3 weeks following their CT angiogram. Interviews were scheduled in a private room immediately following patients’ consultation with their cardiologist in order to best explore patients’ initial reactions to and impressions of the images seen in the consultation. Again, interviews typically ran for around 5-10 minutes in duration.

**Data Collection**

Data were collected in the form of audio-recorded, semi-structured interviews conducted before and after patients received their CT angiogram results—that is, before and after diagnosis. Interviews prior to diagnosis focused on patients’ current understanding of the condition of their heart as well as attitudes towards heart-healthy behaviour, including diet,
exercise and the possibility of needing to take cardiac medication. The purpose of the pre-
diagnostic interviews, then, was to elicit patients’ beliefs about their heart as well as treatment
beliefs, but also important was the exploration of patients’ expectations of what the test could
potentially offer them in terms of enhancing their understanding of the condition of their
heart. The open-ended questions that were used to explore the above areas (see Appendix G)
formed a basic framework for the interviews, although in many cases participants addressed
the questions of their own accord once discussion had been initiated.

Interviews following patients receiving their results focused on participants’
immediate impressions of the test results. Focal points here for the interviews were how
patients felt when they saw the images of their heart as well as the ways in which the results
(i.e., heart images) changed their perceptions of their heart. Also of interest was how patients
felt about engaging in heart-healthy behaviour—diet, exercise and taking cardiac
medication—in light of the test results. Open-ended questions were used (see Appendix G)
and again formed a framework for the interviews.

Data Analysis

Data analysis was conducted using a thematic analysis approach and made use of
procedures associated with the thematic analysis methodology (Boyatzis, 1998; Braun &
Clarke, 2006). While thematic analysis has been poorly demarcated in the past, it is
nonetheless a widely used analytic method within the domain of qualitative research; it is a
methodology that is not ostensibly associated with any one underlying theoretical stance but
rather is a foundational method for qualitative analysis per se and is seen as a tool to use
across different theoretical approaches (Boyatzis, 1998). One of the main advantages of
thematic analysis, then, is its resultant flexibility, and it has been argued that it is this feature
of flexibility that gives thematic analysis utility for the wide range of qualitative research
conducted within psychology (Braun & Clarke, 2006).
Thematic analysis is considered a useful qualitative methodology for exploratory health research, particularly where the research aim is to describe key issues among a given population and report the main elements of participants’ accounts (Green & Thorogood, 2004). In their review of thematic analysis, Braun and Clarke (2006) suggest that certain methodological considerations should be given precedence prior to undertaking qualitative analysis. First, consideration should be given to the type of analysis one wishes to undertake—namely, whether a rich description of the entire data set is to be undertaken or a more detailed account of certain aspects of the data set. The focus of the present study was to explore patients’ illness beliefs and reactions to the CT angiogram images, so the latter approach was taken focusing on these aspects of the interviews as opposed to a more generalised analysis of the patient interviews. A second consideration relates to how themes are identified—that is, whether an inductive or, alternatively, a theoretically driven approach is to be taken. As research into patients’ responses to CT angiography is very limited, the former approach was used when developing themes, which allowed for a more data-driven coding approach.

The process of data analysis began with transcribing the interviews into written form: the audio-recorded interviews were transcribed verbatim and transcripts were checked against the recordings for accuracy. Following this, initial codes—the most basic elements of the raw data from which meaningful assessment can be drawn (Boyatzis, 1998)—were generated through repeated reading of and familiarisation with the interview data. In practice this meant coding interviews with the main aims of the research in mind and identifying extracts in line with these aims.

Following the coding process, the next phase involved collating the coded data into overarching themes (Braun & Clarke, 2006). This was an iterative process involving the identification of ‘candidate themes’ and reviewing the coded data until significant individual themes and patterns became apparent in the data. The major themes were then reviewed by
the researcher before the dataset was subjected to further peer checking from an independent researcher who had completed postgraduate studies in health psychology and had experience in conducting health psychology research. The independent researcher examined a random sample of data (25% of the total scripts), checking the validity and content of the major themes. Overall, general agreement was very high, with consensus on the major themes evident and a high level of agreement on the coding of the content also apparent. In the few instances where there were issues with the content coding, further discussion was able to resolve these discrepancies until overall consensus was reached.
Interviews were analysed according to the time they were conducted in order to identify specific themes relating to the two fundamental stages of the diagnostic process—before diagnosis on the day of testing and following the consultation where patients were given their diagnostic results by their cardiologist. The following chapter is thus divided into two main sections, each exploring the themes associated with before and after diagnosis respectively.

Evidence is provided for each theme by using quotations from the interviews. The participant’s identification number follows each quotation, and the addition of brackets within quotations indicates the addition of information to enhance reader comprehension. Ellipses indicate an intentional omission of a section of the original quotation, again for the purpose of enhancing reader comprehension.

**Pre-Diagnostic Interviews**

Three themes were identified for interviews prior to diagnosis. The themes related to (1) the role, as identified by patients, that coronary CT angiography could play in facilitating more understanding of the condition of their heart; (2) the use of coronary CT angiography as a rationale for medical treatment; and (3) patient views on the importance of a heart-healthy lifestyle.

*Facilitating Understanding*

For the majority of participants, undergoing coronary CT angiography was a doctor-initiated preventative measure that was undertaken in light of the presence of heart disease risk factors such as high cholesterol levels or a family history of ischaemic heart disease. For
some participants, however, perhaps after having other family members experience heart disease, it was a chance to proactively address potential heart issues:

“I sought information on my heart and condition of my heart about 10 years ago, and I would say the main reason for that was that my father had had a heart attack. My mother had had some minor, very minor, strokes because of some blood pressure issue, so I thought I wouldn’t do what my father did—nothing [laughter] for years and years and wouldn’t go to the doctor when he was complaining of chest pain. So I thought I’d be on the front foot—may not be able to avoid it, but I thought, you know, the more information and more medical assessment, the better.” (Participant 7)

“My dad died of a heart attack at 51 and he had hardening of the arteries, and that was kind of the wake up call.” (Participant 11)

“I see this as preventative. I want to stop, if there’s something that’s going on, a build up of plaque or something, I want to be able to take measures.” (Participant 8)

The testing itself could be viewed in the light of worrying heart-related symptoms that patients had experienced. Symptoms considered by patients as being related to their heart ranged from the more commonly reported symptom of chest pain to other less obvious symptoms, such as dizziness and nausea, which were just as concerning for some patients. The following two quotes represent very different symptoms experienced, with each being met with what seems like very different levels of concern:

“I’ve been getting some pains in the chest here and at the top of abdomen, and basically I think this whole process is just making sure that the heart and the bits that go with it are in good nick, and trying to find out exactly what this thing is.” (Participant 9)

“I had a few incidences at the gym of after heavy exercise suddenly feeling nauseous and going white, two or three incidences of that. And that’s what made me go to my GP
about it...it was unusual for me because I’m a very healthy person and I never feel nauseous, and it was the nausea that was the most worrying because it’s just not something I’d relate to.” (Participant 1)

This follows on to the central aspect of the first theme—that patients saw the CT angiogram process as a means of facilitating understanding. This was noticeably verbalised when participants considered the prospect of seeing the images from their CT angiogram, which was seen to be of potential benefit for their understanding of their heart.

“I’d like to see some pretty pictures—I’m a visual sort of guy. If there’s a picture of something, that I can see what’s going on, and then getting walked through and stuff on what’s going on, that would be cool.” (Participant 11)

“Seeing my husband’s images was very sobering—you actually understood what it was all about.” (Participant 1)

“I guess really [laughter] what is happening on the inside, you know, we can see things on the outside but we can’t see things on the inside, so it’s good to know everything’s alright or not alright, or we can do something about it.” (Participant 3)

This last quote reflected a common sub-theme here: that understanding the condition of their heart—facilitated by undergoing coronary CT angiography—would lead patients to modifying their cardiac risk behaviours such as diet and exercise. As the above participant put it:

“Well I guess we don’t think about the heart particularly as an individual body organ, you know, we think of our body rather than a specific part of that. And I guess it’s whatever [the test is] going to tell us and then from there, you know, I can, if I need to make changes in lifestyle or eating and things, then I’ve got the information to actually
“go and do that. I guess in reality you tend to sit and wait for something to happen before we do anything.” (Participant 3)

And again, from two other participants:

“If the tests can demonstrate that [my symptoms] are purely typical of my behaviours, that it’s something that I need to manage, then I will make a much more strident effort rather than the, you know, we’re not going to do this or we’re not going to do that…I’d be a lot more fervent in the behaviours.” (Participant 12)

“I now am determined personally to perhaps embark on a slightly more stringent regime should these results show that [there is calcification]….They will modify my attitude…I mean, I have already modified my attitudes towards exercise…but they will cement those habits in place probably.” (Participant 4)

In sum, participants saw the process of undergoing CT angiography a way of making sense of their symptoms and the condition of their heart, and for many a better understanding of their heart had significant implications for the lifestyle and health behaviours.

**Testing as a Medical Treatment Rationale**

Another theme that emerged concerned the prospect of taking prescribed medication for ischaemic heart disease, and in many ways coronary CT angiography served as the sine qua non for medical treatment. While some patients expressed no concern about taking cardiac medication if the need arose, for the most part it was seen as a last resort for addressing potential risk of ischaemic heart disease. A number of participants at the outset expressed the desire for addressing cardiac risk, given the choice, through diet or exercise rather than via taking medication:
“I’d like to find out I don’t need to [and that] I can manage it with diet or something else…do it through natural means, then use drugs if I need to…that’s my ideal.”

(Participant 8)

“I don’t feel good about [taking cardiac medication], because I’ve never been a pill person. I bought vitamins and never taken them, [they] sit in the cupboard…I’m sceptical about a lot of pills. I have family in the drug company industry and, I would really, really like [my doctor] to tell me that I can do it with diet and exercise.” (Participant 1)

“I’d far rather do fitness and diet than having to rely on medication.” (Participant 6)

By and large, patients saw coronary CT angiography as a watershed point in terms of their need for taking cardiac medication. Interestingly, this theme was apparent for patients not currently taking any cardiac medication as well as for those who were taking medication for their heart at the time. The three quotations below demonstrate the potential the test had for bringing resolution to the prospect or reality of taking cardiac medication, which appeared to be an unfavourable consideration for most:

“I don’t want to have to take any drugs—it would be unnecessary. So I see [the test] as a sieve. It’s a filtering device for deciding what the next step is.” (Participant 8)

“My understanding is that this test is largely for [my cardiologist] and I to then haggle over whether I need to take statins and anything else he may discover.” (Participant 10)

“The medication that I’m on at the moment is [for] blood pressure—hypertension—and yeah, I hate having to do that…it would be great if that could be resolved. It probably won’t be—c’est la vie.” (Participant 9)

Patients at the other end of the spectrum, however, took a more matter-of-fact view on the possibility of taking cardiac medication, citing the long-term benefits and advantages of
taking medication. Even though there was a preference for other means of addressing heart issues (as shown above), a more pragmatic attitude was nonetheless expressed when considering the need to take cardiac medication:

“Well if that has to be done well that has to be done….If there’s a reason for it then you do it.” (Participant 9)

“I’m quite keen on living a long time, so if [taking medication] helps that and keeps me healthy…then it’s good. If it’s going to make life easier later, then it’s good….Someone said I need glasses so I went and bought some glasses. I’m not going to sit there worrying thinking I look funny cause I’ve got glasses on all of a sudden…[If you’ve] got a puncture, you gotta patch in it…if you’ve got a problem, fix it….There’s no point in stressing about it, you just move on.” (Participant 11)

“It would be irritating but that’s all I think, I’d get used to it, I have to take daily medicine anyway.” (Participant 5)

**The Importance of a Healthy Lifestyle**

Another theme that emerged from interviews prior to diagnosis revolved around an acknowledgement of the importance of living a heart-healthy lifestyle. Lifestyle factors mentioned included obvious ones such as diet and exercise, but also less obvious factors including stress and lack of sleep. The perceived connection between healthy behaviour and its implications for the heart and indeed mortality is exemplified by the following quote from a female participant who was asked what her ideas around her heart health were:

“To be as fit as I can [be], to continue to lose weight, because I think that you only get one heart, and one crack of it, and I think it’s the most important organ in your body—if that goes, it’s all over, Rover.” (Participant1)
The quotation highlights the cognitive representation of the heart as being fundamental or central to life, leading the participant in her motivation to be healthy. In fact, many participants acknowledged that exercise is positive health wise and good for the heart, even if perhaps they did not engage in it enough:

“I understand that the heart’s a muscle, so it needs to be exercised—the same as they all do really—so that’s probably one of the main things. And then dietary I think is another one, so eating, drinking, yeah….I think I exercise reasonably well, not as much as I’d like to, and the diet is something there again, I’m human. I think I eat reasonably well, I’m overweight I know that as well, and there again that’s a part of that whole management issue of things like exercise and the diet.” (Participant 12)

Some participants, then, also felt that they were not doing enough in terms of exercising and eating a healthy diet. The demand of work and its subsequent impact on time was a commonly identified barrier to getting adequate levels of exercise, which could be expected with the present patient population. Most participants were from a professional background, where work demands were arguably higher than average. For some, lack of exercise due to work demands was indeed seen as a problem that needed addressing:

“One of the biggest problems is that I don’t get enough exercise—it’s too much time sitting behind a desk and a computer and I deal with an awful lot of travelling overseas. I’m away probably three quarters of the time, and that doesn’t allow you to get involved in any regular process of exercise that a lot of people can do and, yeah, that’s a problem and something that I’ve got to deal with.” (Participant 9)

“My work became extremely busy and I allowed myself to get busier and busier...[with] less and less exercise and sport....All that’s been absolutely terrible for the last three years, but I’m determined that the next three years is going to be a lot better.” (Participant 7)
Most patients, then, are typically cognisant of the importance of lifestyle factors and displayed a positive attitude towards behaviours that are conducive to good heart health.

Post-Diagnostic Interviews

Analysis of the post-diagnostic interviews identified four key themes raised by participants: (1) reactions to the diagnostic result; (2) perceived value of seeing the images; (3) the impact of coronary CT angiography on patients’ behavioural intentions; and (4) patients’ general reflections on the procedure.

Reactions to Diagnosis

One of the main themes of the post-diagnostic interviews was the response to diagnosis—how patients reacted to a new diagnostic label as a result of going through coronary CT angiography testing. There were examples of negative and positive reactions from participants, as could be expected, but it was surprising that by far the most common type of reaction was that of the latter. Irrespective of the diagnosis, most participants communicated that they were happy with or had positive reactions to the results, and there were a number of instances where there was a sense of relief after receiving the results. The two quotations below, from two individual participants—the first with a negative test result and the second testing positive—illustrate this nicely, with both participants communicating their sense of relief for two very different reasons:

“Well, [the doctor] has explained that my heart is in very good shape, which is I guess an enormous relief. From that point of view it really has been worthwhile, because [it has] taken out any uncertainty. And, of course...anything that might suggest that [the heart] is a little bit flaky can be worrying. I mean, I was prepared for whatever [my doctor] was going to tell me, but it still came as an enormous relief to realise that I had minimal plaque.” (Participant 4)
“[I feel] probably pleased that something’s been discovered, because often you feel—particularly when you’re talking about something that happens and then it’s sort of gone—you feel as though, you begin to wonder if you imagined it. So did you imagine [it]? I mean, actually, I can feel that tightness there now, so I know that I haven’t. But you feel as though you imagined it. So...yeah, probably relieved that there is actually something there in a way.” (Participant 12)

Other points raised by participants when talking around feeling relieved included: relief due to prior expectations because of a family history of heart disease; relief that the test results were not as bad as they could have been; relief that their chest pain was not of a non-cardiac origin or that they were not “wasting everyone’s time”, as one participant put it; and the realisation that something could be done about their condition.

In fact, the last point—that something could be done about the disease process—was raised a number of times among the positive-testing participants, indicating a perceived value in detecting ischaemic heart disease early in the process:

“I think it’s totally positive, because it’s like insurance, really, isn’t it? Sort it out now instead of later when it’s a problem [and] it’s quite hard to fix. I’d like to be proactive about things instead of ’shit we’ve got a big problem!’ And there’s complications that can form later on and all sorts of stuff, so it’s easier to slow it down now than fix it later. So I think it’s good.” (Participant 11)

“I was hoping that I would be significantly different and better than my father, but the indication is that I’m in a very, very similar place to where he would have been at this age, in terms of the health of his heart and the risk. And he didn’t know ten years earlier what I now know. If he had known, if he’d been on the medication that’s being prescribed, he may have avoided the heart attack that he experienced.” (Participant 7)
Quotations such as these demonstrate the general positive attitudes displayed by participants, even in the face of an unfavourable diagnosis. And despite feelings of disappointment, which also appeared in some of the interviews among the positive-testing participants, many felt that it was nonetheless better to know than to not know. The above-quoted participant, after further reflection on his test results, went on to say:

“There’s sort of bitter sweetness there that, well, you know, you have got some issues. But at least you know about them…it could be a lot worse than it is.” (Participant 7)

The Value of Seeing the Images

Another theme that appeared in the post-diagnostic interviews related to the heart images per se. Many patients commented on how “real” it made it feel seeing the images of their heart, in a sense making their understanding of their heart more concrete. The images from the scan offered patients a view into the body, and in many ways gave them more understanding of their heart, and in some cases allowed for insight into the disease process. This was clear for both negative-testing and positive-testing patients, as the following two quotations demonstrate:

“It was very, very interesting and it made it very real....To actually see lovely clear pictures was very exciting.” (Participant 1)

“I was interested [in the images] as I am in a set of plans for a house, being a builder [laughter]. Yeah, interested in the details....The restricted area—the narrow area—it does appear to be a problem...and it looks sort of lumpy. I guess that calcification doesn’t form evenly along the artery; it deposits in clumps.” (Participant 5)

Moreover, upon further exploration in the interviews, it became apparent just how helpful it was for patients to see the images of their heart. Discussion around this also
reflected the idea that seeing the images offered an element of tangibility to participants. One participant, who had a positive coronary CT angiogram result, had this to say:

“It certainly was significant seeing the pictures, was certainly very significant. And I think it drives it home more if you actually see the images and actually see the calcium in places, so yeah I think it’s very helpful.” (Participant 7)

Another participant also reflected on this, also discussing the topic in light of the information he had received during the consultation:

“You know, the technology’s just amazing...to actually see the picture after having the scan is unreal [sic], but then from the pictures that I’ve seen, yes, I can see exactly the points that [the doctor] is actually focussing on.”

After further prompting, he went on:

“It did [help] and I think that, you know, that’s actually clear—the potential for problems is actually clear. You can kind of see already, you know, where there could be an issue.”  

(Participant 3)

Overall, the patients who took part in the study communicated an appreciation of seeing the images of their heart, with most indicating that it was indeed helpful viewing them. This cannot, of course, be separated out of context from the consultation itself, where expert explanations of the condition of their heart were given to patients. It would seem, though, that seeing the images and receiving a good explanation from their cardiologist went a long way in helping participants in their understanding of their heart. As one participant reiterated:

“To get that sort of description and to have [the cardiologist] explain the pictures—extremely helpful and good.” (Participant 9)
Impact on Health Behaviour Intentions

“*It highlights things, and I guess where, you know, [before] you think about doing it and maybe you do and maybe you don’t...now you’re thinking about doing it, and yes you will.*” (Participant 3)

The above quotation was a participant’s response to a question about how he felt about diet and exercise following testing. Although framed somewhat bluntly, the participant’s statement nonetheless captures a common theme that was identified in the post-diagnostic interviews: that undergoing coronary CT angiography appeared to have an impact on patients’ health behaviour intentions. The finer details of this theme, however, depended on the diagnosis itself—that is, whether it was positive or negative.

Patients with a positive coronary CT angiogram result tended to report an increase in motivation to engage in healthy behaviours, as intimated in the quotation above. This came with an acknowledgement that perhaps in the past they had not done enough to stay healthy in order to lessen their risk of heart disease. For many positive-testing patients, this lead to resolutions, of various degrees of strength, to modify their behaviour. The following two quotes from patients who tested positive for calcium plaques illustrate this aspect for diet and exercise, respectively:

“*You hear a lot about the [food] pyramid—the healthy foods, the low fat foods, the low salt, no sugar, no carbohydrates—and I guess I’m aware of it. But...I like what I’m eating at the moment [laughter]. You know, my porridge has to have some salt in it, or I won’t eat it...Well, I guess I’m going to take it more seriously—diet—and, yeah...we’ll find out [laughter].*” (Participant 5)

“I’m definitely going to make more of an effort to look after myself...I will feel more justified in exercising more. I’m passionate about my golf but have struggled to find the
time to play [it], so I will feel justified to be a little bit more selfish, if you like, and say...for the sake of my health [and] to live a bit longer, I need to exercise more.”

(Participant 7)

The sub-theme that emerged for negative-testing patients, on the other hand, was one of reinforcement of prior behaviour: most participants with results showing clear arteries communicated that the test results, in a sense, reinforced the heart-healthy behaviours they had carried out in the past. In other words, the test result was an affirmation that the lifestyle that they had been living was indeed having a positive effect on their heart health. For example, when questioned on whether her views on diet and exercise had changed, one participant with high cholesterol but a negative test result for calcium plaques put it thus:

“...No, it’s made them stronger, because I know that what I have been doing is good....I’ve got that line in the sand and only want to get better. I certainly don’t want to ever have to come back here and go ‘ah, look your cholesterol’s gone through the roof and now you have got blocked arteries’. And so, I feel like, it’s almost like you’ve been given another chance.” (Participant 1)

Another participant with healthy arteries also echoed a similar lifestyle-affirming sentiment:

“It’s confirmed that the combination [of diet and exercise] seems to be working....I’ve always taken a view that exercise is good and, you know, lucky that I would have a healthy diet and I enjoy healthy food. And so the combination’s a good one. Like most people, I’ve got too much stress, but I cope with it by eating properly and exercising.”

(Participant 8)

In sum, the process of undergoing a coronary CT angiogram showed a positive effect on patients’ health behaviour intentions. The conversations around diet and exercise demonstrated intent to either maintain the heart-healthy behaviours or increase them.
Reflections on the Procedure and Staff

Finally, participants raised issues around the procedure itself and commented on how it was carried out from their perspective. There was a variety of data falling under this theme, with some of the more positive comments about the procedure relating particularly to the way in which the procedure was handled by staff. Some of the aspects of the procedure that were appreciated by participants included: consultation (i.e., staff consultation with patients and other health professionals); staff professionalism, competence and knowledge; and how easy and expeditious the testing process was overall. Also, some participants communicated that having confidence in the cardiologist, in particular, was important for them:

“Well, you know, I’ve got the results. I know why it was done and how it was done and how it was analysed—sort of how it was analysed. So I can accept that [the cardiologist] knows what he’s talking about, you know? I’m not being told something by somebody I have no confidence in.” (Participant 6)

“If popping a pill a day means that I keep my good health, then I won’t be averse to it, on [my cardiologist’s] recommendation—because I do feel very confident with him.” (Participant 1)

On the flipside, concerns mostly revolved around the risks of the procedure itself—for example, the level of radiation received, adverse reactions to the contrast dye, and so on. One participant reported some anxiety around the procedure itself, as he admittedly had not read the information sent out by the clinic that outlined coronary CT angiography and what it involves for patients, including the risks. His suggestion was that perhaps the clinic could follow up to ensure that patients understand the procedure or find out whether they have any questions prior to their scheduled appointment.
For the most part, however, the testing process was seen in a positive light and valued for the insight the procedure gave to patients regarding their heart and its condition. As one participant summed it up:

“This has been an excellent experience, I think. I’ve learnt a lot from it and...you got to know yourself a little bit more and know exactly what the hell’s going on. And to a degree, that’s very reassuring, you know, to have that knowledge rather than just having a big question mark. To actually have some knowledge is important.” (Participant 9)

Thus, even though the procedure itself was brief, the knowledge gained from undergoing it appeared to be of considerable value for patients.
CHAPTER SIXTEEN

DISCUSSION

The present study sought to understand cardiac patients’ experience of undergoing coronary CT angiography and to explore not only patients’ prior expectations of coronary CT angiography but also their reactions to the test following the administering of their test results by their cardiologist. Thematic analysis was used to examine the major themes patients communicated both before and after receiving diagnostic results from the test. The qualitative results of the present study will therefore be discussed for each set of interviews.

Pre-Diagnostic Findings

Results from the thematic analysis of the pre-diagnostic interviews revealed three major themes communicated by patients at this point in the testing process. First, patients held the expectation that the testing process could potentially help to better understand the condition of their heart, both in terms of understanding current symptoms and informing healthy lifestyle choices. Second, coronary CT angiography in many cases was perceived as a procedure that would rationalise the need for taking cardiac medication. This theme was apparent for patients not taking prescribed medication at the time as well as for those who were taking prescribed medication. Finally, patients communicated a perceived value in engaging in a lifestyle conducive to keeping a healthy heart and which incorporated exercise and heart-healthy dietary habits. For many patients, this came with an acknowledgement that perhaps they had not been doing as much as was perceived necessary for living an adequate heart-healthy lifestyle.

Inherent in patients’ expectations of the testing procedure is the perception that coronary CT angiography would be helpful in the facilitation of understanding their health. Kravitz and Callahan (2000) have discussed the so-called pragmatic dimension in relation to a
variety of tests conducted in the field of general internal medicine. They note that this dimension of testing reflects patients’ expectations of testing procedures in a number of ways: for patients, testing can, among other things, help define the basis of symptoms, detect subclinical disease and direct therapeutic decisions. This last aspect is also exemplified in the present study, where many patients felt that coronary CT angiography would help to justify pursuing a pharmacological approach to treating their heart health.

Even though research on patients’ expectations of coronary CT angiography is indeed meagre, studies conducted in other fields of medicine may serve as analogies for the present study. For example, van Bokhoven and colleagues (2006) explored patients’ expectations concerning blood testing in a Dutch general practice setting. Their qualitative analysis showed that many patients have high expectations for blood testing as a diagnostic tool: in the view of patients, such tests, it would seem, can enable the detection of serious diseases at an early stage without mistakes, on the one hand, and can provide proof of good health on the other. Such expectations are clearly at odds with the actual diagnostic value of blood tests. While comparisons between two very different tests need to be conducted tentatively, there were nonetheless similar ideas about the value of coronary CT angiography expressed by patients in the present study. Indeed, the perceived utility that blood tests have in providing insight into the body and disease processes described by patients in van Bokhoven and colleagues’ (2006) study was reflected in relation to coronary CT angiography in the present study, where patients felt the test would enable them to see the disease process—literally, as images are possible—and help guide treatment. Within cardiac settings, however, such expectations of coronary CT angiography from patients’ may be more closely aligned with cardiologists’ expectations of the test, although this remains to be seen.

Results showed that patients tended to defer to coronary CT angiography for defining the necessity to take cardiac medication. For the most part, patients expressed reluctance in taking cardiac medication, citing concerns about side effects and preferring instead to tackle
cardiac health and forestall heart disease through lifestyle factors such as diet and exercise. While this attitude was mostly found among patients who were not prescribed cardiac medication at the time, there was also some evidence of reluctance among those who were currently taking cardiac medication. This combination of high concern about cardiac medication and lower ratings of its necessity has implications for adherence (Horne & Weinman, 1999). Poor adherence to statins for primary prevention is common, and while external factors such as negative media attention can exacerbate the problem (van Hunsel, Passier, & van Grootheest, 2009), it has been shown that patient factors such as perception of risk, toxic effects of the medication, and expected treatment duration are central factors associated with non-adherence for patients on statin therapy (Mann, Allegrante, Natarajan, Halm, & Charlson, 2007). Indeed, some of these factors were cited by participants in the present study as reasons for their reluctance to take or continue cardiac medication. However, given that patients tended to place importance on their test results in defining their attitude to taking cardiac medication, the testing process itself could be an ideal intervention point for cardiologists to address patients’ existing medication beliefs in an attempt to encourage and potentially strengthen long-term adherence.

Nevertheless, many patients expressed a preference for addressing their heart health through health behaviours such as diet and exercise. Most participants reported positive attitudes towards diet and exercise, and an awareness of the importance of these modifiable risk factors in relation to heart health was evident in the interviews. Research has indicated that knowledge about behaviour-related risk factors for heart disease tends to be greater than knowledge about physiological factors such as cholesterol levels and weight (Potvin, Richard, & Edwards, 2000). Although the topic was not a central focus of the interviews, a few patients in any case mentioned the importance of monitoring their weight and cholesterol. Such an awareness of the significance of physiological factors may have stemmed from prior consultation and discussion with their GP and cardiologist—after all, hypercholesterolemia,
for example, is a common reason for referral for coronary CT angiogram testing (Johnson, Dowe, & Brink, 2009). Patients may thus have been aware of a wider range of factors and behaviours important for reducing the risk of heart disease, and this is an area that could have perhaps been explored further in the pre-diagnostic interviews.

**Post-Diagnostic Findings**

Analysis of the post-diagnostic interviews unveiled four major themes associated with patients’ conversations at that time. The first theme revolved around patients’ reactions to the diagnosis itself: mostly this was a sense of communicated relief, irrespective of whether the diagnosis was negative or positive. The results also showed a second theme relating to participants describing the value of seeing the images from the scan. Here, patients talked about how helpful it was seeing the images and how it contributed to their understanding of the condition of their heart. The impact of undergoing coronary CT angiography vis-à-vis patients’ health behaviour intentions was a third theme for the post-diagnostic interviews. For positive-testing patients, there was a reported increase in motivation to engage in more heart-healthy behaviours; for negative-testing patients, on the other hand, it appeared that the coronary CT angiogram test results reinforced the prior health behaviours that patients had been carrying out. A final theme encompassed patients’ general reflections on the testing procedure itself, with participants praising the professionalism and competence of staff involved. A few patients taking part in the study also revealed concerns about the risks of testing, including exposure to levels of radiation.

The finding that many patients expressed a sense of relief from the results of their coronary CT angiogram (despite the diagnosis), with most participants demonstrating positive reactions to their results, stands in contrast to findings of a study that looked at patients’ fears around conventional coronary angiography (Heikkilä, Paunonen, Laippala et al., 1999). In that study, over three quarters of the participants reported fears of uncertainty about illness
after receiving results from their angiogram. The authors speculated that a possible cause of this fear might have been patients’ lack of a deeper understanding of the implications a diagnosis may have had for their lives. While the reasons for patients’ positive reactions to diagnosis in the present study can only be speculated on as well, at the same time it cannot be ruled out that the coronary CT angiography consultation procedure as a whole, which incorporates how information is fed back to the patient, in contrast to result feedback processes in a catheterisation lab setting, may play an important role in these observed patient reactions. The influences of the clinical environment, time taken by the cardiologist to explain results and their implications could have helped in preventing the escalation of potential related fears. Indeed, a part of this major theme in the present study related to patients’ understanding that something could be done about the condition of their heart and arteries at that point in time.

Another key theme of the post-diagnostic interviews was the reported value of seeing images from the scan. Part of this theme was the strengthening of patients’ understanding of their heart through the use of images during consultation. Many participants commented that the images made the experience “feel more real” for them, and it appeared from patients’ interview conversations that the use of images was a valuable adjunct to the information received when reviewing findings from the diagnostic test with their cardiologist. The use of images, then, may have helped patients develop tangible or concrete representations of the condition of their heart and underlying disease processes. In other words, testing may have seen an improvement in illness coherence (Weinman et al., 1996). Recent research by Karamanidou et al. (2008) has looked at the use of imagery in enhancing medical understanding in renal patients. Using a psycho-educational intervention that incorporated the use of a plastic model of a human stomach showing the action of phosphate-binding medication, the study showed positive intervention effects at 4-month follow-up, where significant differences for general understanding, understanding problems of high-phosphate
levels, and medication outcome efficacy where observed between the intervention group and the care-as-usual control group. Results from the present study also allude to an improvement in understanding via the use of imagery, and although the present study did not examine the effects of imagery on understanding the use of cardiac medication, the suggested effects on illness coherence have implications for interventions aiming to improve the fit between patients’ models of their illness and the recommended treatment (Hall, Weinman, & Marteau, 2004; Karamanidou et al., 2008).

Most participants reported an influence on their behavioural intentions following testing—a third post-testing theme that was uncovered in the present study. The impact of coronary CT angiography on health behaviour has been examined in only a few studies, which in general have concentrated on a narrow set of cardiac risk behaviours (see Hollands et al., 2010). The results from the present study regarding the identification of effects on behavioural intentions, particularly among positive-testing patients, provide a valuable contribution to research in this area, as they suggest that testing-related effects on intentions in relation to important cardiac health behaviours may be taking place. The results from the present study can provide an interesting discussion point when contrasted with randomised controlled trials that have examined the impact of cardiac testing (augmented with the use of heart images) on dietary behaviour (Lederman et al., 2007) and physical activity (O'Malley et al., 2003). Both of these studies—which involved non-clinical samples—failed to show any testing-related effects on health behaviours. The present study, however, suggests that among a clinical sample of patients undergoing coronary CT angiography, some testing-related effects on behaviour may be present. While it cannot be assumed that the intentions reported by patients would actually lead to the implementation of related health behaviours, the salience of the third theme in the post-diagnostic interviews perhaps has some consequence for behavioural patterns, inasmuch as intentions hold important predictive value for health behaviour (Ajzen, 1988; Ajzen & Fishbein, 1980).
A final theme that emerged comprised patients’ reflections on the procedure itself. Whereas most of the comments in this theme revolved around praise of the staff involved in the testing procedure, some participants also voiced concern over perceived risks of undergoing a test that involves exposure to radiation. Such concerns, however, may be unfounded. Hendee (1983) has observed that the perceived risks of radiation exposure from medical tests using X-ray technology does not show consistency with the reality of risk as predicted by radiation risk models. Be that as it may, an increased awareness around patients’ fears concerning coronary CT angiography could in any case help patients through the overall testing process. To this extent, providing information and support based on patients’ needs may be required to address patient fears and concerns (Heikkilä, Paunonen, Laippala et al., 1999).

**Clinical Relevance**

The present study provides a closer look at patients’ experiences of undergoing a coronary CT angiogram. Some of the themes uncovered have direct relevance to clinical practice. For example, the apparent value of seeing images from the scan may be used for educational purposes when explaining test results and perhaps when explaining the need for medication. Ensuring an adequate fit between patients’ models of their illness and the required treatment is an important clinical consideration when taking into account the issues around medical adherence (Karamanidou et al., 2008). But more generally, augmenting consultation with tangible images of the heart may help to set in place more accurate illness perceptions, which can have many positive consequences for a variety of health outcomes for patients with medical conditions (Petrie, Jago et al., 2007).

The study also has relevance for encouraging patients in their health behaviours. Along with smoking, health behaviours including poor diet and sedentary lifestyle are among the major modifiable risk factors associated with atherosclerosis and ischaemic heart disease.
(Blane et al., 1996). The clinical encounter—and in particular the time around diagnosis of heart disease—offers an ideal opportunity to encourage behaviour change such as smoking (Graham et al., 2007). Behaviours around diet and exercise may also be encouraged at this point, and the results from the present study suggest that there may be added value in supplementing the consultation following coronary CT angiography with the use of images from the patients’ scan.

**Strengths and Limitations**

One of the strengths of the present study is its use of a clinical sample to explore patient responses to the process of undergoing a coronary CT angiogram. While research has begun to look at the impact of coronary CT angiogram images on cardiac health behaviours, much of it has not been conducted on cardiac patients in typical cardiac diagnostic settings (e.g., Lederman et al., 2007; O'Malley et al., 2003). The present study has shown a variety of responses to the testing procedure among a small cohort of non-acute diagnostic patients in an authentic cardiac setting.

Another of the study’s strengths is that it takes an in-depth look at the reactions to testing. This is particularly pertinent considering that coronary CT angiography is a relatively new innovation, and considering its increasing use as a cardiac diagnostic test and its implications for patient management and treatment, thus far it has received disproportionately little attention in the form of psychological research. The present study demonstrates that the procedure, though non-invasive and brief, nonetheless carries with it many considerations for patients, ranging from expectations of the procedure through to the impact of diagnosis and viewing heart images and consequent evaluations of behavioural intentions.

A possible limitation of the present study may be that the sample does not capture a fully representative range of patients who undergo diagnostic testing involving coronary CT
angiography. Although this can be a general limitation to qualitative research itself, particularly where small sample sizes are used, it relates more specifically to the nature of the sample in the present study, where a disproportionately high proportion were male. As well as this, all participants were patients of only one cardiologist and interacted with virtually the same nursing and radiology staff. Some care therefore should be maintained when considering transferability of the study to other settings with different patient populations and staff with differing interpersonal and professional skills.

**Suggestions for Further Research**

As the subject of patients’ impressions of and responses to the testing involving coronary CT angiography is relatively unexplored, possible topics of further research are multiple and diverse. Research in three particular areas, however, could follow on from the findings of the present study. First, research could further explore the added value that heart images have in coronary CT angiography, particularly in diagnostic settings with typical clinical populations. The findings from the current study suggest the existence of image-induced effects on patients’ understanding of their heart, and further prospective research could explore cognitive understanding in this context using quantitative methodologies. Experimental research could examine the added value of using patients’ heart images during consultation following testing. By randomising patients to receive either post-diagnostic consultation with images or consultation without, the effects of using heart images may well be further teased out. Such methodologies could test the effects that using images during consultation may have on illness perceptions, for example. As well as this, further research could explore patients’ concerns around the procedure in general and perceived implications the results could have for them (e.g., Heikkilä, Paunonen, Laippala et al., 1999).

Second, following the findings of the present study regarding reported strengthening of patients’ health behaviour intentions, further research could examine the impact that
coronary CT angiography has on long-term health behaviours such as diet and exercise. Again, randomised controlled trials examining the influence of viewing heart images in the testing context are ideal here. While a start has been made on conducting experimental research in this area (e.g., Lederman et al., 2007; O'Malley et al., 2003), there is still a need to conduct research using representative clinical samples. The findings from the present study point towards the potential influence that the process of undergoing coronary CT angiography and viewing heart images may have on future behaviours that are central to heart health. The results in this study have at least been encouraging enough to merit further investigation into the topic among clinical populations.

Finally, patients’ medication beliefs and adherence to prescribed cardiac medication is also suggested as a topic for further investigation. Findings of the present study could inform further research into the use of CT angiogram images as a means of enhancing patients’ understanding of their heart as well as the recommended pharmaceutical treatment (cf., Karamanidou et al., 2008). Research that combines the enhancement of understanding through the use of images and the targeting of associated treatment beliefs and concerns could be developed to enhance patients’ motivation around adhering to treatment (Horne & Weinman, 1999). Findings from the current study at least suggest a link between the coronary CT angiography testing process and motivation towards taking recommended cardiac medication.

Conclusions

Coronary CT angiography is a significant event for patients in many ways. The present study shows that, prior to testing, patients bring with them expectations of gaining knowledge and understanding of their heart condition through the testing process, which appears to have consequences for their attitudes towards taking cardiac medication. Following testing, patients reported many positive aspects of undergoing coronary CT angiography, with
a common sub-theme being a sense of relief after the disclosure of test results. Even for positive-testing patients, the value of catching heart disease was clearly expressed in the post-diagnostic interviews.

Perhaps the most important findings relate to the impact of scan images on patients’ understanding of the condition of their heart and the potential influence the testing procedure had on health behaviour intentions. These findings have implications for clinical practice and provide a starting point for further investigation on the value of coronary CT angiography as a testing process and, moreover, the additional value that might be gained through using cardiac images in post-diagnostic consultations. Such research would ideally take the form of randomised controlled trials conducted on representative clinical samples.

As a qualitative study, much of the worth of the present study can be found in its in-depth look at the experience of undergoing a commonly used and relatively new cardiac testing procedure. The findings show that there are a number of important aspects of coronary CT angiography for patients and a number of significant issues at the forefront of patients’ minds. Along with this study, then, further research in this area could well pave the way for an improved experience for patients and could provide a guide for more effective consultations following diagnosis.
SECTION V

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GENERAL DISCUSSION
CHAPTER SEVENTEEN

GENERAL DISCUSSION

The present thesis was an exploration into cardiac patients’ experiences of undergoing advanced diagnostic testing procedures. For patients, the psychological implications of these tests were related to fundamental responses that were dependent on two divergent test outcomes: first, responses to a negative diagnostic test result, in which no significant evidence of organic disease is found; and second, responses to a positive test result, where early disease is established through the examination of cardiac images from the test.

The following general discussion looks at some of the clinical and theoretical implications of the studies from this thesis. From an overview of the research as a whole, directions for future research are proposed. This research could explore some of the questions and issues that were raised from all three studies and may well have significant bearing on future clinical practice.

Implications for Clinical Practice

The studies of this thesis have a number of implications for clinical practice. These relate to the enhancement of reassurance in cardiac settings, the effect of cardiac testing on illness perceptions as well as health behaviour intentions and health behaviour, and the clinical value of using cardiac testing images during the post-diagnostic consultation.

Enhancing Reassurance

The first study in this thesis raises issues around providing reassurance for noncardiac chest pain patients undergoing coronary angiography. These issues can be divided into two particular areas: environment-based issues and issues that revolve around the psychological
characteristics of NCCP patients. Attention was drawn to environment-based issues through the recognition of pragmatic demands of conducting a reassurance intervention in an angiogram ward setting. The challenges posed by the environment, particularly with regards to the numerous pre-testing protocols that are typically set in place to prepare patients for their angiogram, are considerable obstacles to providing even a relatively brief psychological intervention. Moreover, the uncontrolled nature of information flow to patients following the procedure, while probably given by medical staff in response to patients’ needs, most likely had a hand in rendering the intervention ineffective. Reassurance in angiogram settings can come from a number of potential sources at many points during patients’ half-day stay in hospital, including nursing staff, house surgeons, cardiologists, or even from viewing normal angiogram images during the procedure. For these reasons, the effects of priming patients for negative test results was therefore not as effective as shown in a treadmill testing environment (Petrie, Müller et al., 2007), where less elaborate pre-testing protocols are involved and more standardised feedback processes are set in place due to the shorter time spent in hospital.

Patient-based issues that were raised relate to the potential psychiatric comorbidities and characteristic psychological traits associated with NCCP patients. Coronary angiogram patients are typically further along in the diagnostic pathway than treadmill patients, as non-acute angiogram patients invariably undergo exercise tolerance testing prior to conventional coronary angiography. Given that this is the case, it is plausible that angiogram patients may have more negative illness perceptions that are more deeply entrenched due to previous diagnostic uncertainty and ongoing investigation (Howard & Wessely, 1996). Key reassurance-related illness perceptions identified by the first study in this thesis and previous research (Donkin et al., 2006) may deserve more focus in addressing the problem of poor reassurance among some patients, and interventions could start to address these important illness appraisals made by NCCP patients. Researching the possible long-term significance of maladaptive illness identity beliefs would be an ideal place to start.
The high levels of testing-related anxiety shown before (De Jong-Watt & Arthur, 2004) and during (Heikkilä et al., 1998) the coronary angiography testing process suggest that this should also be focussed on among NCCP patients, who already have high levels of anxiety and are highly likely to have elevated levels of anxiety following testing as well (Robertson et al., 2008). Patients with high trait anxiety or specific heart-focussed anxiety most likely would benefit from a reassurance approach that takes emotional factors into consideration. Interventions for reassurance may thus need to be individualised and customised according to patients’ needs in order achieve maximisation of patient health outcomes (Coia & Morley, 1998). Such an approach would address reassurance via targeted cognitive and emotional intervention strategies that directly address high anxiety, on the one hand, and erroneous illness representations on the other on a case-by-case basis.

The results from this thesis raise the need for a truly multidisciplinary approach to be taken in order to enhance reassurance in coronary angiogram settings, and this relates to the two domains mentioned above. First, interventions in conventional coronary angiogram settings need to be more integral with the procedures set in place prior to and following coronary angiography. The highlighted difficulties of applying the reassurance intervention in this environment calls for more integrated care rather than a discrete approach that is isolated from the rest of the testing process and environment. An ideal solution would be to involve both nursing staff and cardiologists to work in concert in addressing reassurance among patients with noncardiac chest pain. Secondly, the message itself should address relevant fears and concerns specific to individuals, and immediate post-angiogram care ideally needs to address relevant aetiological factors, if known. This approach is necessary to encourage a better fit between individuals’ illness appraisals and the newly formed diagnostic label (Petrie & Weinman, 2006).
Cardiac Testing and Illness Perceptions

Immediate changes in illness perceptions were observed among non-acute patients referred for coronary CT angiography following testing, with the results showing that patients tend to modify their perceptions according to the outcome of the diagnostic test result. For negative-testing patients, this saw a decrease in illness concern and emotional effect due to the illness, as well as a shift towards fewer perceived cardiac-related illness consequences. Patient interviews also revealed a feeling of relief among patients with normal test results. All of these findings suggest that the process of undergoing coronary CT angiography reassured patients, but the long-term pattern of this reassurance remains unclear. The diagnostic feedback process of coronary CT angiography differs considerably from that of conventional angiography, and there may be elements in the testing process that patients find particularly reassuring (Howard & Wessely, 1996). The use of CT images does indeed seem to be highly valued by patients, and this could be an important variable in providing effective reassurance in this setting. Reassurance for patients seemingly at early risk of heart disease has notable bearing on clinical practice, since the delivery of an effective reassurance message via a ‘definitive test’ at this stage has the potential to minimise ongoing medical testing and patient concern (Howard & Wessely, 2004).

A previous study that examined the effects of diagnostic testing among multiple sclerosis patients found that positive-testing patients became less anxious following their results and felt positive about the diagnostic workup, despite the fact that they were faced with coping with a chronic disease (Mushlin et al., 1994). Patient interviews in the third study of this thesis also showed a philosophical and pragmatic approach to a diagnosis of early heart disease, with patients expressing the value of catching the disease early so that steps could be taken to address it—patients expressed, in other words, the feeling that it is better to know than to not know. Nevertheless, illness concern and emotion was still high among positive-testing patients, as shown in the results of the second study of this thesis, and clinicians
should be aware that although a stoical attitude about the ramifications of results may be expressed by patients, there are obvious issues of underlying concern that require attention as well. In clinical practice, this could mean taking steps to instil confidence in treatment recommendations and the prognostic outlook in order to allay patients’ fears and concerns in an approach that is at once informative and therapeutic (Thorne, Oglov, Armstrong, & Hislop, 2007). For patients this process rests, to some extent, on their faith in the cardiologist, as demonstrated in the third study’s post-testing interviews, but additional care is advised concerning the communication of such test results and the consequences of treatment approaches for patients.

**Cardiac Testing and Behaviour Change**

One of pioneers of research into cardiac testing early on showed the impact that a medical test can have on health behaviour intentions, illustrating the potentially important role that treadmill testing may play in the modification of coronary risk factors (Bruce et al., 1980). Likewise, the two studies in this thesis conducted in a coronary CT angiogram setting brought into focus the prominent role that test results from a modern cardiac imaging test can play in modifying health-protective behavioural intentions and subsequent behaviours. The demonstrated shift towards more positive intentions to take cardiac medication and intentions to engage in exercise following test results is a finding that bears particular clinical significance, particularly as this tendency was found in patients who tested positive for early signs of heart disease.

More importantly, however, was the finding that positive-testing patients at follow-up were more likely to have higher levels of physical activity than at baseline, which indicates less of a gulf in the intention–behaviour gap compared with normal-testing patients. As shown in the qualitative analysis, most patients prior to testing had an appreciation of the importance of health-protective behaviours and recognised the merit in engaging in, for example,
exercise. Some felt they could do more, but it is encouraging to find an effect from testing on actual health behaviour. Whether this behaviour continues as a long-term pattern remains to be seen and should be the focus of further research.

Medication beliefs were also affected by diagnostic results from the test. It was apparent from the interviews that a majority of patients had a clear preference for addressing their heart condition with health behaviours such as diet and exercise rather than through cardiac medication, around which there was some reluctance and even scepticism. Following testing, however, there was a shift in patients’ intentions to take medication, which perhaps indicates a resignation to the necessity of taking cardiac medication to treat the condition of their heart. The finding that positive-testing patients were more likely to have higher treatment control beliefs following testing also underscores this apparent shift. Given the many issues around medication non-adherence and its salience as a problem in health care (Lehane & McCarthy, 2007), the results from this thesis have significance for clinical practice: The period following the diagnosis of early heart disease appears to be an ideal point in time to encourage patients to form more positive medication beliefs in the hope of fostering later adherence to their medication, as at this point patients are already modifying their intentions towards taking medication. Further prospective research is necessary, of course, in order to better understand this relationship and map out causal mechanisms and adherence patterns. Nonetheless, evidence from the research in this thesis is encouraging and suggests that such research would be worthwhile in the attempt to address intentional aspects of non-adherence.

The Value of Cardiac Testing Images

Both coronary CT angiography and conventional angiography are modern cardiac tests that use advanced medical imaging technology as their means for diagnosis. During conventional angiography, patients are able to view real-time images of their heart, and in
many cases, with guidance from the cardiologist, patients are able to see the presence or absence of artery narrowing indicative of ischaemic heart disease. It is possible, therefore, that the images may provide additional reassurance value for patients with normal arteries. This feature of coronary angiography needs to be studied in the clinical context, perhaps initially through exploratory qualitative research that examines patients’ impressions of the procedure and how helpful they felt the angiogram images were for their reassurance. Indeed, it may well be that processing of a ‘peripheral route’ nature may be operating, where images add perceived credibility to the diagnostic message in an analogous manner to the way that brain scan images can add persuasive power to findings in cognitive neuroscience (McCabe & Castel, 2008).

In the second study of this thesis, both patient groups (i.e., positive-testing and negative-testing patients) saw an increase in illness coherence, suggesting an improvement in the extent to which patients felt they understood the condition of their heart. The central issue here for clinical practice is uncovering the key elements of the coronary CT angiography procedure that contribute to increased understanding. The influences are potentially many, but the patient interviews conducted following testing clearly showed that patients had an appreciation of seeing the images, with many communicating that viewing the images made their illness feel “more real” for them. This knowledge-bearing aspect of medical images should be kept in mind during the coronary CT angiography post-testing consultation, where explanation of disease or medical treatment may need to be supplemented with the use of concrete images (cf. Karamanidou et al., 2008).

Overall, the results from this thesis point to the inherent value in using images during consultation following diagnostic results from conventional coronary angiography and coronary CT angiography. The presence of medical images may have contributory effects on diagnostic process outcomes for patients, from increasing understanding to enhancing
reassurance. The further study of these potential effects has much clinical importance, as both have the potential to lead to improved health outcomes.

**Implications for Theory**

The results from this thesis demonstrate the applicability of the common-sense model of self-regulation (Leventhal et al., 1984) in explaining the way that patients prepare for diagnostic test results. Prior to testing, patients appear to bring with them seemingly pessimistic expectations of what the test results might show. However, this phenomenon may reflect the initiation of a coping strategy designed to deal with the uncertainty of diagnosis at this stage in the testing process. In this sense, patients are cognitively preparing themselves for the possibility that the cardiac test could indicate the presence of underlying heart disease (Devchich et al., 2008). Furthermore, the high levels of emotional illness representations (e.g., illness concern and emotional effect) among negative-testing patients prior to testing likely points to the presence of underlying emotion-focused coping reactions in response to a potential health threat. Such coping reactions can include proactive strategies such as seeking testing in the first place and may reflect underlying cognitive change related to symptom reappraisal processes (Gross, 1999).

The finding that test results can lead to beneficial changes in behaviour for positive-testing patients points to initiation of further coping strategies in response to a health threat. The view held by the self-regulatory model is that patients are active processors of information regarding their health, as opposed to passive objects upon which adverse health conditions operate (Leventhal & Diefenbach, 1991). This can be observed in the results of the second and third studies of this thesis. While the coronary CT angiography patients saw the importance of engaging in protective health behaviours such as eating a heart-healthy diet and engaging in exercise, it was only in the face of receiving an unfavourable diagnosis that there was a noticeable change in their health behaviour intentions and subsequent health behaviour.
This implies that coping responses were set in place in response to new information that provided definitive information about the presence of early forming heart disease. The motivational elements of medical testing can thus be incorporated into self-regulatory models of health and illness, and further research on responses to cardiac diagnosis could be guided by an application of such theoretical approaches.

Part of this thesis explored the challenge of enhancing medical reassurance in a cardiac testing environment. The results, however, showed that this can be a difficult task for a variety of environmental and patient-related reasons. With regards to patient variables, it was apparent that psychological and psychiatric factors—including symptom appraisal, symptom concern and trait anxiety—were associated with low reassurance following testing. In particular, the persistence of high illness identity in its association with low reassurance at follow-up indicates that erroneous illness appraisals, wherein individuals evaluate experienced symptoms to be indicative of the presence of heart disease, may have particular relevance for addressing reassurance among NCCP patients. Nevertheless, the contributing factors associated with noncardiac chest pain are wide and varied (Chambers & Bass, 1990; Fang & Bjorkman, 2001; Sheps et al., 2004) and should be considered when addressing reassurance among NCCP patients. The integrated aetiological model proposed by Bass and Mayou (2002) provides a useful paradigm for guiding reassurance interventions for NCCP patients (see Figure 7). Such a model incorporates a wide range of causal and maintaining factors into a biopsychosocial approach to noncardiac chest pain and subsequent disability. The results from this thesis support the use of such an approach when considering methods of providing reassurance.

Finally, this thesis raises some wider philosophical considerations around the use of medical images in cardiac testing environments. The qualitative interviews showed that patients appreciated seeing images of their heart and felt that these images contributed to their understanding. Indeed, the results from the quantitative CT angiography study backed this up.
to some extent, showing significant increases in perceived illness coherence for both diagnostic groups. Since conventional coronary angiography makes use of detailed cardiac images as well, it is conceivable that, for patients, viewing these images during the procedure contributed to the reassuring message that there was no underlying cardiac pathology causing their chest pain. These issues raise the premise that medical images hold considerable epistemological value for patients’ knowledge, since they reflect underlying cultural assumptions that value seeing into the body as a legitimising process for unseen symptoms (Rhodes et al., 1999). Moreover, perceived heart-related symptoms carry with them an intrinsic threat of mortality (Fitzsimons et al., 2000), so it is not surprising that there is a considerable level of fear and anxiety associated with their weighty presence. Medical images may therefore work through more visceral means by allaying fears of heart disease or providing emotive cues resulting in increased motivation to address the health threat. This assumption has implications for providing reassurance as well as encouraging behaviour change through the use of patients’ heart images.

**Future Directions**

This thesis raises potential directions for future clinical and applied research. The second study found that illness concern and the emotional effect of the illness for positive-testing patients remained high following testing, which shows that these patients may display a significant level of anxiety about their heart health following diagnosis. Further research could look at the clinical implications of this finding and whether intervention is necessary to address levels of health anxiety following the post-diagnostic consultation. For patients, the application of cognitive threat minimisation strategies may go some way towards coping with the burdening diagnosis of underlying heart disease, but it is likely that emotional based interventions could assist further with the implementation of more successful coping strategies (Cameron & Jago, 2008). But even prior to that, the time between testing and
receiving test results has its own issues that require further exploration. For patients, this period can be up to a fortnight, and it is likely that patients may continue to feel concerned about the outcome of their test results while effectively waiting in limbo. The nature and level of such anxiety during this time could also become the focus of further applied research with the aim of informing future clinical practice strategies that allay patients’ anxiety and worry.

In addition, there may be value in providing brief interventions for NCCP patients who have particularly high maladaptive illness beliefs. High levels of illness identity, for example, were shown to have a strong association with poor reassurance, both immediately following testing and at follow-up in the first study. Providing interventions that target key illness beliefs could form the basis for addressing continuing disability among certain patients with noncardiac chest pain. However, if such an intervention were to be applied in a conventional coronary angiography setting, some guidance could be provided from the lessons learnt from the first study in this thesis as well as from other reassurance intervention studies conducted in angiogram settings (e.g., Sanders et al., 1997). In sum, attention needs to be paid to integrating the intervention and therapist with existing clinical protocols in order to maximise their chance of working effectively in a particularly busy clinical testing environment—an environment that also carries with it an evident amount of fear and worry for patients. Future research should bear this in mind.

Further research could examine the practical value of using images from tests such as coronary CT angiography and conventional coronary angiography for the improvement of patient understanding. Taken together as proof-of-principle studies, the coronary CT angiography studies from this thesis provide persuasive evidence for the effectiveness of using scan images for explaining to patients the condition of their heart. It is clear from the patient interviews that additional illness coherence can be gained from viewing medical images, and further experimental research would do well to aim to capture this aspect. The potential effects of conducting experimental research on using patients’ scan images as an
adjunct to the post-testing consultation are twofold: such research could lead to, first, an improvement in the communication of medical findings to patients, and second, the provision of additional methods of explaining treatment recommendations.

The study of the use of images for enhancing reassurance also merits further attention. What remains unclear from the intervention study of this thesis is the degree to which images from the angiogram procedure contributed to patients’ levels of reassurance. The use of scan images may help to underpin the delivery of a reassuring message by doctors and cardiologists, and conducting research into this hypothesis would be worthwhile, as would be the exploration into patients’ responses to seeing their normal angiogram scans and how this relates to later reassurance. Initially this could be investigated via simple qualitative methodologies as those used in the interview study in this thesis, but additional prospective designs might be able to further untangle the effects of using patients’ scan images to enhance reassurance and measure their impact on reducing potentially ongoing symptom worry among patients with noncardiac chest pain.

Finally, the findings from this thesis call for further research on the impact of testing on health behaviours and health behaviour intentions. There are a number of issues that could be explored in this area, including the level of influence that showing patients scan images has on health behaviours, the impact that testing has on patterns of long-term adherence to treatment, and the relationships between perceptions of risk following testing and future health behaviour. While the testing procedure can offer an ideal opportunity to motivate patients to engage in healthy behaviour, the evidence in this thesis suggests that negative-testing patients were not as motivated to engage in health-protective behaviours as positive-testing patients following coronary CT angiography. Furthermore, patients who tested negative for early heart disease had higher levels of illness control following testing, which begs the question of whether such beliefs are indicative of future behaviour change among healthy individuals (cf. Taylor et al., 2000). The negative test result would have led to a
reduction of perceived risk of heart disease, and the intriguing relationships between perceived risk, personal control beliefs, and future health behaviours following testing needs to be explored further in continuing research.

**General Conclusions**

The testing procedures examined in this thesis are valued by cardiologists not only for their high diagnostic accuracy but also for the positive effects they can potentially have on patients. Coronary CT angiography, for example, has been touted as a powerful tool for reassurance as well an instrument that has the ability to encourage health-protective behavioural changes, including compliance with medical therapy (Schussler & Grayburn, 2007). These claims are made despite the fact that, at present, research on these influential aspects is in short supply and demonstration of these effects is patently lacking. This thesis takes steady steps towards measuring such effects and understanding their clinical significance, and as it was conducted in authentic cardiac settings with genuine clinical samples, the results are all the more pertinent.

The first study of this thesis tested the effectiveness of a pre-testing psychological intervention aimed at enhancing reassurance among a cohort of non-acute coronary angiography patients. However, previous success at using this type of reassurance intervention in another cardiac testing setting (exercise tolerance testing) were not able to be replicated in the present coronary angiography environment, with results showing no difference between the intervention group and controls in self-reported reassurance levels. The study shows that the task of enhancing reassurance can provide many challenges and complications, particularly in environments where limited time and resources are available. Consequently, for experimental studies conducted in conventional coronary angiography settings, a more integral approach is likely to be necessary to assist in intervention implementation. Furthermore, the results showed that anxiety and specific illness
perceptions—particularly illness identity—have consequences for reassurance, and it is plausible that focussing intervention efforts on such factors could help in improving reassurance. All up, with the issues that were uncovered kept in mind, the study has the potential to inform further reassurance interventional research in conventional coronary angiography settings that involve patients with noncardiac chest pain.

The second and third studies of this thesis explored patients’ experience of coronary CT angiography using quantitative and qualitative methodologies, respectively. Taken together, the studies show that coronary CT angiography had many positive effects on patients. For the most part, these effects were related to the outcome of the test, with negative-testing patients reporting decreases in illness concern and illness emotion, as well as perceiving fewer illness consequences following testing. Both patient groups showed an increase in illness coherence following testing, and the interviews indicated that much value was gained in this regard from seeing the heart images from their scan.

In addition, the studies showed that testing had effects on patients’ behavioural intentions and subsequent health behaviour. Again, the effects were dependent on the test results, with positive-testing patients showing increases in their intentions to take cardiac medication as well as increases in their intentions to engage in physical activity. More importantly, these patients reported an increase in exercise behaviour at follow-up, showing that diagnosis from coronary CT angiography has a measurable impact on later health behaviour. What additional role patients’ scan images have on this phenomenon is unclear, but the results from these studies suggest that further experimental research on this topic is needed and would be valuable for uncovering possible motivational effects that viewing images may have on health behaviours.

The two coronary CT angiography studies have the ability to inform future clinical practice in a number of ways. First, the results suggest that the testing procedure indeed has
the ability to act as a catalyst for behaviour change. Early findings from Bruce and colleagues (1980) suggested that this was the case for more fundamental cardiac testing techniques, but with the advent of modern cardiac tests that have powerful imagery at their disposal, harnessing test-related motivational effects on health behaviours could prove to be a worthwhile endeavour in the face of increasing heart disease. Second, illness concern and emotional effect remained at pre-testing levels for patients diagnosed with calcified arteries, which indicates that although further research is needed to better understand the nature of patients’ anxiety at this stage, there may be inherent value in providing support for such patients in their attempts to cope with a diagnosis that has many significant life consequences. Finally, the use of patients’ scan images has the distinct capacity to assist clinicians in the communication of diagnostic findings and perhaps also to help explain treatment recommendations. Additionally, it is possible that patients’ images could be used more effectively for enhancing reassurance where normal test results are yielded.

In conclusion, medical testing in cardiac settings can have many significant consequences for patients, with diagnosis leading to treatment for underlying disease, on the one hand, or reassurance that no organic disease is present on the other. In the same way, testing can have an impact on patients' cognitive representations of their illness, at once having profound implications for the way patients construct illness models, make symptom appraisals, and regulate their emotional responses to diagnosed health or illness. While the studies in this thesis have identified important considerations in medical testing, the results and issues raised highlight the fact that it is merely a start for further research to continue on in the exploration of the effects of diagnostic testing. In many ways, the conclusions drawn from the studies of this thesis point to an exciting area of research that has the potential to understand cardiac patients’ experience of undergoing diagnostic testing more comprehensively. In this respect, the land of diagnosis holds further adventures for researchers, with the prospect of even further discoveries on the horizon that have the
potential to make meaningful clinical contributions to the improvement of diagnostic testing outcomes for cardiac patients.
SECTION VI

§

REFERENCES AND APPENDICES
REFERENCES


O'Malley, P. G., Feuerstein, I. M., & Taylor, A. J. (2003). Impact of electron beam tomography, with or without case management, on motivation, behavioral change, and


APPENDIX A

STUDY ONE: PARTICIPANT INFORMATION SHEET
AND CONSENT FORM
You are invited to take part in a study about people’s views about their heart condition and the process of undergoing an angiogram. We are particularly interested in looking at later reassurance following the procedure and ways in which it can be improved. This research will be conducted as part of the Principal Investigator’s PhD thesis. Your participation is entirely voluntary (your choice). You do not have to take part in this study, and if you choose not to take part this will not affect any future care or treatment. If you do agree to take part, you are free to withdraw from the study at any time, without having to give a good reason, and this will in no way affect your continuing health care.

**About the study**

The main aim of this study is to test whether a brief psychological intervention can improve reassurance following a coronary angiogram. The study also aims to explore how patients view their symptoms following their angiogram and how reassured they are after the procedure. Participants were selected for this study by their cardiac consultant if they have been scheduled to undergo an angiogram. We aim to recruit 60 participants with normal angiograms to ensure that a wide range of ethnic groups is represented. A sample size of 60 is also sufficient to conduct statistical tests related to the study’s aims.

The study involves three assessment times where you will be given a brief questionnaire to fill out, which takes about 5-15 minutes to complete. Questions will cover topics such as how you feel about your health, as well as your impressions of the procedure. The first
assessment time will be in the hospital while awaiting your angiogram. The second assessment time will be after your angiogram when you are back on the ward. Finally, 6 weeks after your angiogram, a third brief questionnaire will be administered over the telephone. The inclusion of this follow-up questionnaire allows us to measure patterns of reassurance over time.

Please note that your responses at these assessment times are strictly confidential. Only the researchers involved in this study will have access to your information, which will be kept in a locked filing cabinet. After 10 years, all questionnaires will be destroyed (shredded). The information collected from this study will be written up for the principal investigator’s doctoral thesis and a scientific article, but your identity will never be revealed or associated with the data. If you would like a summary of the results at the end of the study, please contact the principal investigator, Daniel Devcich (contact details provided above).

If you choose to participate, there will not be any personal benefit to you. However, you will be assisting the researchers to have a better understanding of how patients view their health following an angiogram, and this may help to improve outcomes and the quality of care for future patients. The inconveniences of the study are the time taken to fill out the questionnaires. You may have a friend or whanau/family support to help you understand the risks and/or benefits of this study and any other explanations you may need.

In the unlikely event of a physical injury as a result of your participation 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 2002 Injury Prevention Rehabilitation and Compensation Act. If your claim is accepted by ACC, you still might not get any 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 no lump sum compensation payable. There is no cover for mental injury unless it is a result of 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.

If you have any other questions about this study, please contact Daniel Devcich. If you have any queries or concerns regarding your rights as a participant in this study, you can contact an independent Health and Disability Advocate. This is a free service provided under the Health and Disability Commissioner Act:

Telephone (NZ wide): 0800-555-050
Free Fax (NZ wide): 0800-2787-7678 (0800 2 SUPPORT)
Email: advocacy@hdc.org.nz

For Maori health support, or to discuss any concerns or issues regarding this study, please contact Mata Forbes RGON, Maori Health Services Co-ordinator / Advisor, 5th Level, GM Suite, Auckland City Hospital. Tel 307 4949 ext. 23939 or Mobile 021-348-432

This study has received ethical approval from the Northern X Regional Ethics Committee.
I have read and I understand the information sheet dated 26 November 2007 for volunteers taking part in the study designed to improve reassurance following angiography.

I have had the opportunity to discuss this study and I am satisfied with the answers I have been given.

I have had the opportunity to use whanau support or a friend to help me ask questions and understand the study.

I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time and this will in no way affect my future health care.

I understand that my participation in this study is confidential and that no material which could identify me will be used in any reports on this study.

I have had time to consider whether to take part and I understand the compensation provisions for this study.

I consent to the researchers accessing my medical notes

YES / NO

I ___________________________(full name) hereby consent to take part in this study

Signature: ___________________________ Date: ___________________________

Project explained by: ___________________________ Project role: ___________________________

Signature: ___________________________ Date: ___________________________
APPENDIX B

STUDY ONE: QUESTIONNAIRES
ANGIOGRAPHY QUESTIONNAIRE
(PRE-DIAGNOSTIC)

This questionnaire is designed to gather some background information on your current health and views of your symptoms and illness. All of the information you give us is in confidence to the researchers and will be used only for the purposes of the study.

Some of the questions ask about your attitudes towards your health. Others are about emotional aspects.

For all these questions there are no right or wrong answers—an answer is correct if it is true for you. We are most interested in your own opinion. Please choose the response that best fits with your circumstances.

If you have any concerns about a question or the study, please do not hesitate to ask the researcher.

Thank you for your participation in the study
## BACKGROUND INFORMATION

1. What is your gender?

| MALE | FEMALE |

2. What is your marital status?

| Single (never married) | Married/ de facto relationship | Divorced or Separated | Widowed |

3. How old are you?

| YEARS |

4. Which ethnic group do you identify with?

| European | Maori | Pacific Islander | Asian | Other (please specify) |

5. What is your employment status?

| Employed – full time | Employed – part time | Unemployed | Retired | Work at home | Student | Beneficiary |

6. What are your usual living arrangements?

| Living with partner or spouse and children | Living with partner or spouse and no children | Sole adult with children | Living alone | Living with other adults (e.g. relatives, friends) | Other (please specify) |

7. At what level did you complete your formal education?

| Primary school | Secondary school (including 5th Form) | Secondary school (including 6th or 7th Form) | Technical or Trade Certificate | University or Polytechnic Diploma | University degree | Postgraduate degree |
8. Have you ever had any of the following tests for your heart condition?

<table>
<thead>
<tr>
<th>Test</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous angiogram</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous exercise tolerance test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous Electrocardiogram (ECG)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CURRENT HEALTH

Compared to the person in excellent health, how would you rate your own health at the present time? (Tick one)

<table>
<thead>
<tr>
<th>Health Rating</th>
<th>Terrible</th>
<th>Very Poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Listed below are a number of symptoms that you may or may not have experienced since over the past year. Please indicate, by ticking Yes or No, whether you have experienced any of these symptoms and whether you believe that these symptoms are related to your heart.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>I have experienced this symptom in the past 12 months</th>
<th>This symptom is related to my heart</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Chest pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathlessness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dizziness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheeziness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irregular heartbeat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upset stomach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep difficulties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stiff joints</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**YOUR VIEWS ABOUT YOUR ILLNESS**

*Please circle the number that best corresponds to your views:*

<table>
<thead>
<tr>
<th>How much do you think your heart problem will affect your life?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much control do you feel you have over your heart problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much do you think your treatment (pills etc) can help your heart problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much do you presently experience symptoms from your heart problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How concerned are you about your heart problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How well do you understand your heart problem?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How much does your heart problem affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How long do you think your heart problem will last?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>
People vary in how strong heart disease runs in their family. Please rate how strongly heart disease runs in your family.

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Very strong</td>
</tr>
</tbody>
</table>

Overall, how worried are you that you will have a heart attack?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Extremely worried</td>
</tr>
</tbody>
</table>

To what extent do you believe you need further testing (more than the angiogram) to determine the cause of your illness?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not further testing required</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Much more testing required</td>
</tr>
</tbody>
</table>

How distressed are you about your symptoms?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all distressed</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Extremely distressed</td>
</tr>
</tbody>
</table>

How worried are you about your health?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Extremely</td>
</tr>
</tbody>
</table>

How much do you think your heart can physically recover from your heart problem?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Completely</td>
</tr>
</tbody>
</table>

How much do you think you will have to restrict your activities in the long term because of your heart problem?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>Enormously</td>
</tr>
</tbody>
</table>

How much do you feel you can help reduce your risk of having a heart attack?

<table>
<thead>
<tr>
<th>Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning</td>
<td>Not at all</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>A great deal</td>
</tr>
</tbody>
</table>
# CHEST PAIN

Have you experienced chest pain over the past month?

- Yes [ ]
- No [ ]

On average, how frequent was your chest pain over the past month?

<p>| | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Did not occur at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extremely highly frequency</td>
</tr>
</tbody>
</table>

On average, how much was your day-to-day activity limited by your chest pain over the past month?

<p>| | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extremely limited</td>
</tr>
</tbody>
</table>

On average, how severe was your chest pain over the past month?

<p>| | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>No pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extremely severe pain</td>
</tr>
</tbody>
</table>

# EMOTIONS

Please read each of the following statements and tick the one which best indicates how you feel MOST OF THE TIME:

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Somewhat</th>
<th>Moderately</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have been feeling calm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling tense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling upset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling relaxed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling worried</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

THANK YOU VERY MUCH FOR YOUR TIME
ANGIOGRAPHY QUESTIONNAIRE
(POST-DIAGNOSTIC)

This questionnaire is designed to gather some information about your impressions of your angiogram as well as your views on your health and symptoms.

Again, all of the information you give us is in confidence to the researchers and will be used only for the purposes of the study.

Thank you for your participation in the study
During your hospital stay you would have received information concerning your heart condition. We are interested in how satisfied you were with the information that you received and your overall views about the procedure.

For the following, please circle the number that best corresponds to your views.

<table>
<thead>
<tr>
<th>How well was the procedure explained by the cardiologist?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not well explained</td>
</tr>
<tr>
<td>Very well explained</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How well were your angiogram results explained to you by the cardiologist?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not well explained</td>
</tr>
<tr>
<td>Very well explained</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To what extent do you still have questions about your condition?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>I have no questions at all</td>
</tr>
<tr>
<td>I have a lot of questions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall, how satisfied were you with the information you received today?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not at all</td>
</tr>
<tr>
<td>Completely</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How distressed are you about your symptoms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not at all distressed</td>
</tr>
<tr>
<td>Extremely distressed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall, how concerned are you that you will have a heart attack?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not at all concerned</td>
</tr>
<tr>
<td>Extremely concerned</td>
</tr>
<tr>
<td>Question</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>How much do you think your heart problem will affect your life?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How much control do you feel you have over your heart problem?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How much do you think your treatment (pills etc) can help your heart problem?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How much do you presently experience symptoms from your heart problem?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How concerned are you about your heart problem?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How well do you understand your heart problem?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How much does your heart problem affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How long do you think your heart problem will last?</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
How worried are you about your health?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not at all</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>extremely</td>
</tr>
</tbody>
</table>

To what extent do you believe that there is something seriously wrong with your heart?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not at all</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>strongly believe</td>
</tr>
</tbody>
</table>

How reassured were you by the angiogram?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not at all</td>
<td>reassured</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

To what extent do you believe you need further testing to determine the cause of your illness?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no further testing required</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>much more testing required</td>
</tr>
</tbody>
</table>

How accurate do you believe the angiogram is for identifying heart problems?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not at all accurate</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>highly accurate</td>
</tr>
</tbody>
</table>

Do you have any other comments about the angiogram testing procedure?

THANK YOU VERY MUCH FOR YOUR TIME
Hi my name is __________________ from the department of Psychological Medicine at The University of Auckland. As you may recall, 6 weeks ago you completed two brief questionnaires while you were undergoing an angiogram at Auckland Hospital. I am now ringing up with the final follow-up of these questionnaires. This will take approximately five minutes—is now a convenient time?

First of all, I just have a few questions regarding your chest pain:

Do you still experience chest pain?

YES  NO
On average, how frequent was your chest pain over the past month?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not occur at all</td>
<td>Extremely highly frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On average, how much was your day-to-day activity limited by your chest pain over the past month?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>Extremely limited</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On average, how severe was your chest pain over the past month?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pain</td>
<td>Extremely severe pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I am now going to ask you five questions all ranked on a one to ten scale. Do you know what a one to ten scale is? After each question I will explain the scale to you so that you can answer the question in the appropriate manner.

| How worried are you about your health? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | extremely |
| not at all | |

| To what extent do you believe that there is something seriously wrong with your heart? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | strongly believe |
| no at all | |

| How reassured were you by the angiogram? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | completely reassured |
| not at all | |

| To what extent to do you believe you need further testing to determine the cause of your illness? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | much more testing required |
| no further testing | |

| How accurate do you believe the angiogram is for identifying heart problems? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | highly accurate |
| not at all | |

265
Compared to a person in excellent health how would you rate your health at the present time?

<table>
<thead>
<tr>
<th>Terrible</th>
<th>Very poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

Thank you. I just have 4 final questions.

1. How often have you visited your GP for chest pain over the past month?

2. Have you made any phone calls to any health professionals (GP, nurse, cardiologist) regarding your heart or symptoms?

   YES   NO

3. How many times have you been to a hospital emergency department or emergency medical care for chest pain the last month?

4. Over the last month have you taken any medication for your heart?

   YES   NO

Thank you very much for your time
Clinical Data Sheet

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHI Number:</td>
</tr>
<tr>
<td>DOB:</td>
</tr>
<tr>
<td>Gender:</td>
</tr>
<tr>
<td>Telephone:</td>
</tr>
<tr>
<td>Address:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lipids:</th>
<th>TC</th>
<th>HDL</th>
<th>LDL</th>
<th>TG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior MI:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior heart failure:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior CVA:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior PCI:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior CABG:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior cardiac rehabilitation:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History smoking:</td>
<td>Yes / No</td>
<td>Current smoking:</td>
<td>Yes / No</td>
<td></td>
</tr>
<tr>
<td>History of high blood pressure (on treatment):</td>
<td>Yes / No</td>
<td>Family history of IHD (M&lt;55, F&lt;65, 1st degree relatives):</td>
<td>Yes / No</td>
<td></td>
</tr>
<tr>
<td>Diabetes Mellitus:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs on arrival:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occlusion level:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C

STUDY ONE: INTERVENTION PAMPHLET
The most common worry for patients with chest pain and similar symptoms concerns their risk of heart disease and especially a heart attack. To find out whether your symptoms are related to heart disease you will shortly undergo a coronary angiogram.

What is a coronary angiogram?
A coronary angiogram is a special X-ray of your heart that is commonly used as a diagnostic test for coronary artery disease. The test allows doctors to view the blood vessels surrounding the heart, and from the images that are shown, your doctor is able to determine whether or not there are any significant blockages in or narrowing of these vessels.

At the present time, coronary angiography is the most accurate means of diagnosing coronary artery disease. The results allow you and your doctor to make important decisions about managing your heart health.

What happens during the procedure?
During the procedure, a small tube called a catheter will be passed through the aorta, the largest artery in your body, until it reaches the coronary arteries surrounding the heart. Once in place, a contrast dye will be gently injected into the vessels. This allows X-ray images to be taken of the blood vessels surrounding the heart. Your doctor will take a number of images of your heart from many angles in order to get an accurate picture of your coronary arteries.

What could the test results mean?
Results could show that you either have normal arteries or significant narrowings or blockages (heart disease). If this is the case, there are several possible treatments that may be recommended by your doctor. Depending on the severity of the blockages in your arteries, treatments may include angioplasty (inserting a small balloon to widen the narrowed part of the artery), stenting, or other surgical options including coronary artery bypass grafting.

When will I be given the results of the test?
Your cardiologist may give you the results of the angiogram after the procedure. Usually you will also be seen in the cardiology clinic within 1 to 3 weeks to fully discuss the results of the angiogram with your cardiologist or cardiology registrar.

If my test is normal, could there be other causes for my symptoms?
Just because your chest pain is not from the heart does not mean that it is not real pain. There are many causes of non-cardiac chest pain which are not as medically serious, including:

- Pain in the muscles between the ribs caused by tension in these muscles.
- Pain in the chest wall caused by strains or tears in the muscles or ligaments.
- Spleen, tightening or mild inflammation of the esophagus – the food pipe from the throat to the stomach
- Pain coming from pinched nerves in the neck or back.

What if my symptoms continue but my angiogram is normal?
If you experience chest pain, you may still feel concerned or worried about what is causing the pain. This is natural, since whenever there seems to be something wrong with us we want to know why. Concern or worry will often have other effects which contribute to the chest pain. These include muscle tension and breathing incorrectly. Sometimes people who worry about their chest pain focus more on their body and can over time become oversensitive to any pain in the chest area.

If your angiogram is normal but you have ongoing chest pain that still worries you, a good person to talk to about this is your GP.
APPENDIX D

STUDY TWO: PARTICIPANT INFORMATION SHEET

AND CONSENT FORM
PARTICIPANT INFORMATION SHEET  
(Clinic Patient)

*Examining the Effects of CT Angiography Test Results on Patients Illness and Risk Perceptions: A Qualitative and Quantitative Analysis*

**Daniel Devcich, Professor Keith Petrie, Dr Liz Broadbent, Dr Chris Ellis**

My name is Daniel Devcich. I am a PhD student at The University of Auckland, currently conducting my doctoral research in the Department of Psychological Medicine. The present research project is part of the requirements for completing my doctoral degree.

**Project Description**

You are invited to take part in a study about people’s views about their heart-related symptoms and about the process of undergoing a CT angiogram. You have been selected because you are scheduled for a diagnostic CT angiogram.

The main aims of the project are, first, to explore patients’ perceptions of their heart condition prior to and following CT angiography. Secondly, we aim to measure changes in illness perceptions and perceptions of heart risk following CT angiography test results.

**Project Procedures**

The study involves two assessment times where you will be given a brief questionnaire to fill out. Participation is voluntary, and if you decide to take part, each questionnaire should take no more than 10 minutes to complete. Questionnaires will cover topics such as your thoughts about your health, symptoms and medication, as well as your impressions of the procedure. The first assessment time will be in clinic while awaiting your CT angiogram; the second will be at follow-up clinic after you have received your results from your cardiologist. There will also be a brief follow-up via telephone 6 weeks after your clinic visit. This will take no more than 5 minutes.

We are also conducting a small number of brief tape-recorded interviews to explore patients’ thoughts about the above in more depth, and you may be asked if you would like to take part in one of these instead of filling out a questionnaire (if you choose to take part in the interview you will not be required to complete the questionnaires). These interviews will take around 30 minutes each and will be conducted before your CT angiogram and at follow-up. Again, participation is entirely voluntary, and all information gathered will be held in strict confidence by the researchers.
Data storage/retention/destruction/future use

All data will be kept in the Principal Investigator’s office, either in a locked filing cabinet or securely on computer. Data will be kept for up to 6 years, upon which it will be destroyed (shredded/deleted). Recorded interviews will be transcribed by a professional transcribing service, but participants’ identity will be kept anonymous. A summary of the results of the study will be made available to participants upon request.

Right to Withdraw from Participation

You have the right to withdraw from participation in the study at any time up until 01/06/10. If you agree to take part, you are free to withdraw from the study at any time, without having to give a reason, and this will in no way affect your continuing health care. If you are being interviewed and you decide to withdraw, recording will be switched off.

Anonymity and Confidentiality

Anonymity and confidentiality of all participants is of high priority. The data gathered will be written up for the Principal Investigator’s doctoral thesis and for potential publication in a peer-reviewed journal. In either case, confidentiality and anonymity is assured through the entire process from writing up to publication.

Contact Details

If you would like more information or have any further questions, please feel free to contact any of the people below:

Principal Investigator: Daniel Devcich (Doctoral Student)  
Department of Psychological Medicine  
Faculty of Medical and Health Sciences  
University of Auckland  
Private Bag 92019, Auckland  
Phone: 373-7599 extn 82891  
d.devcich@auckland.ac.nz

Supervisor: Professor Keith Petrie  
Department of Psychological Medicine  
Faculty of Medical and Health Sciences  
University of Auckland  
Private Bag 92019, Auckland  
Phone: 373-7599 extn 82891  
kj.petrie@auckland.ac.nz

Head of Department: Professor Rob Kydd  
Department of Psychological Medicine  
Faculty of Medical and Health Sciences  
University of Auckland  
Private Bag 92019, Auckland  
Phone: 373-7599 extn 82891  
r.kydd@auckland.ac.nz

For any queries regarding ethical concerns you may contact the Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Office of the Vice Chancellor, Private Bag 92019, Auckland 1142. Telephone 09 373-7599 extn 83711.

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 16 September 2009 for (3) years, Reference Number 2009 / 348

272
CONSENT FORM FOR QUESTIONNAIRE
(Clinic Patient)

THIS FORM WILL BE HELD FOR A PERIOD OF 6 YEARS

Examining the Effects of CT Angiography Test Results on Patients Illness and Risk Perceptions: A Qualitative and Quantitative Analysis

Daniel Devcich, Professor Keith Petrie, Dr Liz Broadbent, Dr Chris Ellis

I have read the Participant Information Sheet and have understood the nature of the research and why I have been selected. I have had the opportunity to ask questions and have them answered to my satisfaction.

- I agree to take part in this research.
- I understand that participation is voluntary.
- I understand that my participation will involve filling out two questionnaires (10 minutes each) as well as a brief 5-minute follow-up via telephone.
- I understand that I am free to withdraw participation at any time and to withdraw any data traceable to me up until 01/06/10.
- I wish / do not wish to receive the summary of findings.
- I understand that data will be kept for 6 years, after which they will be destroyed.
- I understand that all information will be held in strict confidence by the researchers.

Name ___________________________

Signature ___________________________  Date _______________

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 16 SEPTEMBER, 2009 FOR (3) YEARS. REFERENCE NUMBER: 2009 / 348
APPENDIX E

STUDY TWO: QUESTIONNAIRES
This questionnaire is designed to gather some background information on your current health and views of your symptoms and illness. All of the information you give us is in confidence to the researchers and will be used only for the purposes of the study.

Some of the questions ask about your attitudes towards your health and health behaviours. Others are about emotional aspects.

For all these questions there are no right or wrong answers—an answer is correct if it is true for you. We are most interested in your own opinion. Please choose the response that best fits with your circumstances.

If you have any concerns about a question or the study, please do not hesitate to ask the researcher.

Thank you for your participation in the study
1. What is your gender?  

| Male | Female |

2. How old are you?  

| _____ Years |

3. Which ethnic group do you identify with?  

| European | Maori | Pacific Islander | Asian | Other (please specify) |

4. What is your employment status?  

| Employed – full time | Employed – part time | Unemployed | Retired | Work at home | Student | Beneficiary |

5. At what level did you complete your formal education?  

| Primary school | Secondary school (including 5th Form) | Secondary school (including 6th or 7th Form) | Technical or Trade Certificate | University or Polytechnic Diploma | University degree | Postgraduate degree |

6. Have you ever had any of the following tests for your heart condition?  

| Yes | No |

| Previous CT angiogram | Previous exercise tolerance test | Previous Electrocardiogram (ECG) |
**CURRENT HEALTH**

Compared to the *person in excellent health*, how would you rate your own health at the present time? (Tick one)

<table>
<thead>
<tr>
<th>Terrible</th>
<th>Very Poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

Listed below are a number of symptoms that you may or may not have experienced since over the past year. Please indicate, by ticking *Yes* or *No*, whether you have experienced any of these symptoms and whether you believe that these symptoms are related to your heart.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>I have experienced this symptom in the past 12 months</th>
<th>This symptom is related to my heart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathlessness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dizziness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheeziness</td>
<td></td>
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</tr>
<tr>
<td>Nausea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irregular heartbeat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upset stomach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sleep difficulties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stiff joints</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### YOUR VIEWS ABOUT YOUR ILLNESS

*Please circle the number that best corresponds to your views:*

<table>
<thead>
<tr>
<th>Question</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you think a heart problem will affect your life in the future?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No effect at all</td>
</tr>
<tr>
<td>How much control do you feel you have over preventing a heart problem?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Absolutely no control</td>
</tr>
<tr>
<td>How much do you think your treatment (pills etc) can help your heart?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not at all</td>
</tr>
<tr>
<td>How much do you presently experience symptoms related to your heart?</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No symptoms at all</td>
</tr>
<tr>
<td>How concerned are you about your heart?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not at all concerned</td>
</tr>
<tr>
<td>How well do you understand your heart problem?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Don't understand at all</td>
</tr>
<tr>
<td>How much does your heart problem affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not at all affected emotionally</td>
</tr>
<tr>
<td>How long do you think your heart problem will last?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A very short time</td>
</tr>
</tbody>
</table>
### Overall, how worried are you that you will have a heart attack?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
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<th>6</th>
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<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all worried</td>
<td>Extremely worried</td>
<td></td>
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<td></td>
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</table>

How distressed are you about any current heart symptoms?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all distressed</td>
<td>Extremely distressed</td>
<td></td>
<td></td>
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<td></td>
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</table>

To what extent do you believe there is something seriously wrong with your heart?

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<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td>Strongly believe</td>
<td></td>
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</tbody>
</table>

How worried are you about your health?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td>Extremely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

How much do you feel you can help reduce your risk of having a heart attack?

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<tr>
<th></th>
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<th>6</th>
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<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td>A great deal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### EMOTIONS

Please read each of the following statements and tick the one which best indicates how you feel MOST OF THE TIME:

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Somewhat</th>
<th>Moderately</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have been feeling calm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling tense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling upset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling relaxed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have been feeling worried</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Are you currently taking any medication for your heart?

YES  NO

If so, what are you taking?

For the following questions, please circle the number that best corresponds to your views:

How much do you feel you need medication prescribed for your heart?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t need it at all</td>
<td>It is absolutely essential for me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How concerned are you about medication prescribed for your heart?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all concerned</td>
<td>Extremely concerned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
For the following questions, please circle the number that best corresponds to your views on your current attitude towards taking cardiac medication over the next 6 months:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beneficial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foolish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wise</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Most people who are important to me think I should take cardiac medication:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely unlikely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely likely</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

How much control do you feel you have over taking cardiac medication over the next 6 months?

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total control</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

For me to take regular cardiac medication over the next 6 months is:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I intend to take regular cardiac medication during the next 6 months:

<table>
<thead>
<tr>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Definitely</td>
</tr>
</tbody>
</table>

How strictly do you follow a heart-healthy diet?

<table>
<thead>
<tr>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Very strictly</td>
</tr>
</tbody>
</table>

How often do you follow a heart-healthy diet?

<table>
<thead>
<tr>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Every day</td>
</tr>
</tbody>
</table>

*For the following questions, please circle the number that best corresponds to your views on your current attitude towards undertaking a heart-healthy diet over the next 6 months:*
Most people who are important to me think I should eat healthy:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Harmful</th>
<th>Beneficial</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>+1</td>
<td>+2</td>
</tr>
<tr>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
</tbody>
</table>

Foolish and Wise:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Foolish</th>
<th>Wise</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>+1</td>
<td>+2</td>
</tr>
<tr>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
</tbody>
</table>

How much control do you feel you have over eating healthy over the next 6 months?

<table>
<thead>
<tr>
<th>Control</th>
<th>No control</th>
<th>Total control</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>+1</td>
<td>+2</td>
</tr>
<tr>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
</tbody>
</table>

For me to eat healthy over the next 6 months is:

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Difficult</th>
<th>Easy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>+1</td>
<td>+2</td>
</tr>
<tr>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
</tbody>
</table>

I intend to eat healthy during the next 6 months:

<table>
<thead>
<tr>
<th>Intention</th>
<th>Not at all</th>
<th>Definitely</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>+1</td>
<td>+2</td>
</tr>
<tr>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
</tbody>
</table>
Please indicate how frequently, if at all, you engage in exercise (which can include activities such as aerobics, badminton, jogging, walking etc., but not activities which would form part of your everyday life, such as walking to the bus stop). Circle the number that best corresponds:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Every day</td>
</tr>
</tbody>
</table>

For the following questions, please circle the number that best corresponds to your views on your current attitude towards taking exercise over the next 6 months:

**Bad**

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Beneficial**

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
</table>

**Foolish**

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
</table>

**Wise**

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
</table>
Most people who are important to me think I should exercise:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely unlikely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extremely likely</td>
</tr>
</tbody>
</table>

How much control do you feel you have over exercising over the next 6 months?

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total control</td>
</tr>
</tbody>
</table>

For me to exercise over the next 6 months is:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Easy</td>
</tr>
</tbody>
</table>

I intend to exercise during the next 6 months:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Definitely</td>
</tr>
</tbody>
</table>
Please draw a picture of what you think your heart looks like now. We are not interested in your drawing ability – a simple sketch is fine.

We are interested in your ideas about how you see the condition of your heart.

**Picture of my heart:**

THANK YOU VERY MUCH FOR YOUR TIME
CT ANGIOGRAPHY QUESTIONNAIRE  
(POST-DIAGNOSTIC)

This questionnaire is designed to gather some information on your current health and views of your symptoms and illness. All of the information you give us is in confidence to the researchers and will be used only for the purposes of the study.

Some of the questions ask about your attitudes towards your health and health behaviours. Others are about emotional aspects.

For all these questions there are no right or wrong answers—an answer is correct if it is true for you. We are most interested in your own opinion. Please choose the response that best fits with your circumstances.

If you have any concerns about a question or the study, please do not hesitate to ask the researcher.

Thank you for your participation in the study
## YOUR VIEWS ABOUT YOUR ILLNESS

For the following questions, please circle the number that best corresponds to your views:

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you think a heart problem will affect your life in the future?</td>
<td>0-10</td>
<td>No effect at all - Severely affect my life</td>
</tr>
<tr>
<td>How much control do you feel you have over preventing a heart problem?</td>
<td>0-10</td>
<td>Absolutely amount no control - Extreme amount of control</td>
</tr>
<tr>
<td>How much do you think your treatment (pills etc) can help your heart?</td>
<td>0-10</td>
<td>Not at all - Extremely helpful</td>
</tr>
<tr>
<td>How much do you presently experience symptoms related to your heart?</td>
<td>0-10</td>
<td>No symptoms at all - Many severe symptoms</td>
</tr>
<tr>
<td>How concerned are you about your heart?</td>
<td>0-10</td>
<td>Not at all concerned - Extremely concerned</td>
</tr>
<tr>
<td>How well do you understand your heart problem?</td>
<td>0-10</td>
<td>Don't understand at all - Understand very clearly</td>
</tr>
<tr>
<td>How much does your heart problem affect you emotionally? (e.g. does it make you angry, scared, upset or depressed?)</td>
<td>0-10</td>
<td>Not at all affected emotionally - Extremely affected emotionally</td>
</tr>
<tr>
<td>Question</td>
<td>Scale</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>How long do you think your heart problem will last?</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>A very short time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall, how worried are you that you will have a heart attack?</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely worried</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How distressed are you about any current heart symptoms?</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Not at all distressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely distressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To what extent do you believe there is something seriously wrong with your heart?</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly believe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How worried are you about your health?</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely worried</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much do you feel you can help reduce your risk of having a heart attack?</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A great deal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
For the following questions, please circle the number that best corresponds to your views on your current attitude towards taking cardiac medication over the next 6 months:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>+2</td>
</tr>
<tr>
<td>Good</td>
<td>+3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmful</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>+2</td>
</tr>
<tr>
<td>Beneficial</td>
<td>+3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foolish</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>+2</td>
</tr>
<tr>
<td>Wise</td>
<td>+3</td>
</tr>
</tbody>
</table>

Most people who are important to me think I should take cardiac medication:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely unlikely</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>+2</td>
</tr>
<tr>
<td>Extremely likely</td>
<td>+3</td>
</tr>
</tbody>
</table>

How much control do you feel you have over taking cardiac medication over the next 6 months?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>No control</td>
<td>-3</td>
</tr>
<tr>
<td></td>
<td>-2</td>
</tr>
<tr>
<td></td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>+1</td>
</tr>
<tr>
<td></td>
<td>+2</td>
</tr>
<tr>
<td>Total control</td>
<td>+3</td>
</tr>
</tbody>
</table>
For me to take regular cardiac medication over the next 6 months is:

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td>+3</td>
</tr>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Easy</td>
</tr>
</tbody>
</table>

I intend to take regular cardiac medication during the next 6 months:

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td>+3</td>
</tr>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Definitely</td>
</tr>
</tbody>
</table>

**DIET**

For the following questions, please circle the number that best corresponds to your views on your current attitude towards undertaking a heart-healthy diet over the next 6 months:

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td>+3</td>
</tr>
<tr>
<td>Bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good</td>
</tr>
</tbody>
</table>

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td>+3</td>
</tr>
<tr>
<td>Harmful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Beneficial</td>
</tr>
</tbody>
</table>

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td>+3</td>
</tr>
<tr>
<td>Foolish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wise</td>
</tr>
</tbody>
</table>
Most people who are important to me think I should eat healthy:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely unlikely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much control do you feel you have over eating healthy over the next 6 months?

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For me to eat healthy over the next 6 months is:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I intend to eat healthy during the next 6 months:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definitely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**EXERCISE**

For the following questions, please circle the number that best corresponds to your views on your current attitude towards taking exercise over the next 6 months:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>Good</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmful</td>
<td>Beneficial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foolish</td>
<td>Wise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Most people who are important to me think I should exercise:

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely unlikely</td>
<td>Extremely likely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much control do you feel you have over exercising over the next 6 months?

<table>
<thead>
<tr>
<th></th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No control</td>
<td>Total control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
For me to exercise over the next 6 months is:

<table>
<thead>
<tr>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Easy</td>
</tr>
</tbody>
</table>

I intend to exercise during the next 6 months:

<table>
<thead>
<tr>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Definitely</td>
</tr>
</tbody>
</table>
DRAWING

Please draw a picture of what you think your heart looks like now. We are not interested in your drawing ability – a simple sketch is fine.

We are interested in your ideas about how you see the condition of your heart after the information you have received today.

Picture of my heart:

THANK YOU VERY MUCH FOR YOUR TIME
CT ANGIOGRAPHY QUESTIONNAIRE
(SIX-WEEK FOLLOW-UP)

Script: Hi my name is __________________ from the department of Psychological Medicine at The University of Auckland. As you may recall, 6 weeks ago you completed two brief questionnaires while you were undergoing a CT Angiogram at The Auckland Heart Group. I am now ringing up with the final follow-up of these questionnaires. This will take approximately five minutes—is now a convenient time?

First I have some questions about your personal ideas concerning your heart. Please indicate the number on the scale that best corresponds to your views:

<table>
<thead>
<tr>
<th>Overall, how worried are you that you will have a heart attack?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not at all</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How distressed are you about any current heart symptoms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not at all distressed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To what extent do you believe there is something seriously wrong with your heart?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>Not at all</td>
</tr>
</tbody>
</table>
How worried are you about your health?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extremely</td>
</tr>
</tbody>
</table>

How much do you feel you can help reduce your risk of having a heart attack?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A great deal</td>
</tr>
</tbody>
</table>

I am now going to ask you a few questions about your medication diet and exercise habits.

Are you currently taking any medication for your heart?

[YES] [NO]

If so, what are you taking?

For the following questions, please indicate the number that best corresponds to your views:

How much do you feel you need medication prescribed for your heart?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t need it at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>It is absolutely essential for me</td>
</tr>
</tbody>
</table>

How concerned are you about medication prescribed for your heart?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all concerned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Extremely concerned</td>
</tr>
<tr>
<td>Question</td>
<td>Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many cardiac medication pills are you prescribed to take each day?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During the last 7 days how many times did you miss taking one of your pills?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How strictly do you follow a heart-healthy diet?</td>
<td>-3 -2 -1 0 +1 +2 +3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all Very strictly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often do you follow a heart-healthy diet?</td>
<td>-3 -2 -1 0 +1 +2 +3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never Every day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please indicate how frequently, if at all, you engage in exercise (which can include activities such as aerobics, badminton, jogging, walking etc., but not activities which would form part of your everyday life, such as walking to the bus stop) by circling the number that best corresponds:

<table>
<thead>
<tr>
<th>Number</th>
<th>Never</th>
<th>Every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2 3 4 5 6 7 8 9 10 11</td>
</tr>
</tbody>
</table>
Thank you. I just have a couple of final questions.

Have you talked to family and friends about your heart?  

YES  NO

Compared to a person in excellent health how would you rate your health at the present time?

<table>
<thead>
<tr>
<th>Terrible</th>
<th>Very poor</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very good</th>
<th>Excellent</th>
</tr>
</thead>
</table>

THANK YOU VERY MUCH FOR YOUR TIME
### Clinical Data Sheet

**Name:**

**NHI Number:**

**DOB:**

**Gender:**

**Telephone:**

**Address:**

<table>
<thead>
<tr>
<th>Lipids:</th>
<th>TC</th>
<th>HDL</th>
<th>LDL</th>
<th>TG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior MI:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior heart failure:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior CVA</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior PCI:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior CABG:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior cardiac rehabilitation:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>History smoking:</td>
<td>Yes / No</td>
<td>Current smoking:</td>
<td>Yes / No</td>
<td></td>
</tr>
<tr>
<td>History of high blood pressure (on treatment):</td>
<td>Yes / No</td>
<td>Family history of IHD (M&lt;55, F&lt;65, 1st degree relatives):</td>
<td>Yes / No</td>
<td></td>
</tr>
<tr>
<td>Diabetes Mellitus:</td>
<td>Yes / No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs on arrival:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test results:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

STUDY THREE: PARTICIPANT INFORMATION SHEET

AND CONSENT FORM
PARTICIPANT INFORMATION SHEET  
(Clinic Patient)

Examining the Effects of CT Angiography Test Results on Patients Illness and Risk Perceptions: A Qualitative and Quantitative Analysis

Daniel Devcich, Professor Keith Petrie, Dr Liz Broadbent, Dr Chris Ellis

My name is Daniel Devcich. I am a PhD student at The University of Auckland, currently conducting my doctoral research in the Department of Psychological Medicine. The present research project is part of the requirements for completing my doctoral degree.

Project Description

You are invited to take part in a study about people’s views about their heart-related symptoms and about the process of undergoing a CT angiogram. You have been selected because you are scheduled for a diagnostic CT angiogram.

The main aims of the project are, first, to explore patients’ perceptions of their heart condition prior to and following CT angiography. Secondly, we aim to measure changes in illness perceptions and perceptions of heart risk following CT angiography test results.

Project Procedures

The study involves two assessment times where you will be given a brief questionnaire to fill out. Participation is voluntary, and if you decide to take part, each questionnaire should take no more than 10 minutes to complete. Questionnaires will cover topics such as your thoughts about your health, symptoms and medication, as well as your impressions of the procedure. The first assessment time will be in clinic while awaiting your CT angiogram; the second will be at follow-up clinic after you have received your results from your cardiologist. There will also be a brief follow-up via telephone 6 weeks after your clinic visit. This will take no more than 5 minutes.

We are also conducting a small number of brief tape-recorded interviews to explore patients’ thoughts about the above in more depth, and you may be asked if you would like to take part in one of these instead of filling out a questionnaire (if you choose to take part in the interview you will not be required to complete the questionnaires). These interviews will take around 30 minutes each and will be conducted before your CT angiogram and at follow-up. Again, participation is entirely voluntary, and all information gathered will be held in strict confidence by the researchers.
Data storage/retention/destruction/future use

All data will be kept in the Principal Investigator’s office, either in a locked filing cabinet or securely on computer. Data will be kept for up to 6 years, upon which it will be destroyed (shredded/deleted). Recorded interviews will be transcribed by a professional transcribing service, but participants’ identity will be kept anonymous. A summary of the results of the study will be made available to participants upon request.

Right to Withdraw from Participation

You have the right to withdraw from participation in the study at any time up until 01/06/10. If you agree to take part, you are free to withdraw from the study at any time, without having to give a reason, and this will in no way affect your continuing health care. If you are being interviewed and you decide to withdraw, recording will be switched off.

Anonymity and Confidentiality

Anonymity and confidentiality of all participants is of high priority. The data gathered will be written up for the Principal Investigator’s doctoral thesis and for potential publication in a peer-reviewed journal. In either case, confidentiality and anonymity is assured through the entire process from writing up to publication.

Contact Details

If you would like more information or have any further questions, please feel free to contact any of the people below:

Principal Investigator: Daniel Devcich (Doctoral Student)
Department of Psychological Medicine
Faculty of Medical and Health Sciences
University of Auckland
Private Bag 92019, Auckland
Phone: 373-7599 extn 82891
d.devcich@auckland.ac.nz

Supervisor: Professor Keith Petrie
Department of Psychological Medicine
Faculty of Medical and Health Sciences
University of Auckland
Private Bag 92019, Auckland
Phone: 373-7599 extn 82891
kj.petrie@auckland.ac.nz

Head of Department: Professor Rob Kydd
Department of Psychological Medicine
Faculty of Medical and Health Sciences
University of Auckland
Private Bag 92019, Auckland
Phone: 373-7599 extn 82891
r.kydd@auckland.ac.nz

For any queries regarding ethical concerns you may contact the Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Office of the Vice Chancellor, Private Bag 92019, Auckland 1142. Telephone 09 373-7599 extn 83711.

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 16 September 2009 for (3) years, Reference Number 2009 / 348
CONSENT FORM FOR INTERVIEW
(Clinic Patient)

THIS FORM WILL BE HELD FOR A PERIOD OF 6 YEARS

Examining the Effects of CT Angiography Test Results on Patients Illness and Risk Perceptions: A Qualitative and Quantitative Analysis

Daniel Devcich, Professor Keith Petrie, Dr Liz Broadbent, Dr Chris Ellis

I have read the Participant Information Sheet and have understood the nature of the research and why I have been selected. I have had the opportunity to ask questions and have them answered to my satisfaction.

- I agree to take part in this research.
- I understand that participation is voluntary.
- I understand that my participation will involve taking part in two 30-minute interviews.
- I understand that I am free to withdraw participation at any time and to withdraw any data traceable to me up until 01/06/10.
- I understand that the interview is going to be audio-taped and that I can request for the recording to be stopped at any time.
- I agree / disagree to be audio taped.
- I wish / do not wish to receive the summary of findings.
- I understand that a third party who has signed a confidentiality agreement will transcribe the tapes.
- I understand that data will be kept for 6 years, after which they will be destroyed.
- I understand that all information will be held in strict confidence by the researchers.

Name ____________________________

Signature ____________________________ Date ____________________

APPROVED BY THE UNIVERSITY OF AUCKLAND HUMAN PARTICIPANTS ETHICS COMMITTEE ON 16 SEPTEMBER, 2009 FOR (3) YEARS. REFERENCE NUMBER 2009 / 348
APPENDIX G

STUDY THREE: INTERVIEW SCHEDULES
Thanks very much for agreeing to take part in this study. My name is Daniel Devcich, and I am a doctoral researcher at The University of Auckland. I am interested in finding out about your views and impressions of coronary CT angiography and how your views of your health are affected by the procedure. By understanding how patients view their illness and the process of undergoing an angiogram, we hope to work towards improving health outcomes and the quality of care for future patients.

**Interview Questions**

1. Based on the tests that you have had before your coronary CT angiogram and on what doctors have said also, what is your understanding of the condition of your heart?

2. Why do you think you are having the CT angiogram?

3. What do you think the test will tell you?

4. What would you like to know from the test?

5. What are your ideas around looking after your heart?

6. How do you feel about taking medication for your heart?

7. How do you feel about diet and exercise in relation to your heart health?

8. Do you have any other comments?
POST-DIAGNOSTIC INTERVIEW SCHEDULE

Thank you for agreeing to take part in this interview session. As you may recall from the last interview session, part of my research is focused on looking at how your views of your health are affected by the CT angiogram procedure. The following questions will therefore look at your impressions of coronary CT angiography.

Interview Questions

1. What are your impressions of the health of your heart after going over your CT angiogram results?

2. How did you feel when you saw the images of your heart?

3. In what ways do the results of your CT angiogram change your own perception of your heart?

4. How do you feel about taking medication for your heart?

5. How do you feel about diet and exercise in relation to your heart health?

6. Do you think there are any negative aspects of going through a CT angiogram?

7. Do you have any other comments?