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**NEUROPSYCHOLOGICAL AND PSYCHOSOCIAL CONSEQUENCES OF  
MAJOR CARDIAC EVENTS:  
ARREST AND INFARCTION**

by

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A thesis submitted in conformity with the requirements  
for the degree of Doctor of Philosophy  
School of Psychology  
University of St Andrews

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## **Declaration**

I, Samantha O'Reilly, hereby certify that this thesis, which is approximately 59,000 words in length, has been written by me, that it is a record of work carried out by me and that it has not been submitted in any previous application for a higher degree.

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October 30, 2002

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## Abstract

The research reported here was an investigation of two important psychological consequences of in-hospital cardiac arrest and myocardial infarction (MI). Memory impairment is an important yet under-recognised neuropsychological consequence of out-of-hospital cardiac arrest. The issue in two studies was to establish the prevalence and degree of memory impairment in cases of *in-hospital* cardiac arrest and also to investigate potential routes for rehabilitation of impaired cardiac arrest patients. The results revealed that in-hospital cardiac arrest led to significant memory impairment for 26% of a group of in-hospital cardiac arrest patients. However, the widely used memory rehabilitation technique, errorless learning, did not appear to be particularly beneficial with these patients. Post-traumatic stress disorder as a consequence of medical events including MI, has been widely reported in recent years. In three further studies some issues surrounding post-traumatic stress disorder (PTSD) as a psychosocial consequence of cardiac arrest and MI were investigated. The results of the first of these studies showed that while PTSD was more widespread in cardiac arrest than MI patients, a significant minority of both were diagnosed with the disorder (19% and 7% respectively). The second study found that the personality disposition, Sense of Coherence, was a significant independent predictor of variance in PTSD symptoms in MI patients. Social support and negative affectivity were also important psychological predictors of PTSD symptoms. The results of the final study showed that the prevalence of PTSD in MI patients was not as widespread as previously reported. Structured clinical interviews with a further large sample of MI patients found just 3% of patients suffering from the disorder. The study also revealed that usage of negative emotion words when recollecting MI was predictive of PTSD symptoms.

## Papers

The following is a list of papers that have resulted from this thesis.

O'Carroll, R.E., Ayling, R., O'Reilly, S.M. & North, N.T. (2003) Alexithymia and sense of coherence in patients with total spinal cord transection, *Psychosomatic Medicine*, 65: 151-155.

O'Reilly, S.M., Grubb, N., & O'Carroll, R.E. (in press) Long-term emotional consequences of in-hospital cardiac arrest and myocardial infarction, *British Journal of Clinical Psychology*

O'Reilly, S.M., Grubb, N., & O'Carroll, R.E. (in press) In-hospital cardiac arrest leads to chronic memory impairment, *Resuscitation*

O'Reilly, S., Grubb, N., & O'Carroll, R. (in review) PTSD following MI is less widespread than previously reported, *British Medical Journal*

O'Reilly, S.M., Grubb, N., & O'Carroll, R.E. (in review) Errorless learning in memory-impaired survivors of in-hospital cardiac arrest, *Neuropsychological Rehabilitation*

O'Reilly, S.M., Grubb, N., & O'Carroll, R.E. (in preparation.) Sense of coherence predicts post-traumatic stress symptoms 6-months post-MI

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## **Chapter 1**

### **Introduction**

#### ***1.1 Outline of the thesis: the main goal***

Huge numbers of people in the UK and worldwide are affected by coronary heart disease. The odds of developing the disease and eventually dying as a result, are high. If you are male, the odds are higher still. But coronary heart disease is not just a physical disease. Like other chronic conditions, there are psychological factors associated with living with heart disease, but also with experiencing and surviving the acute coronary events which may punctuate its course. The goal of this thesis was to study some of these psychological aspects of surviving a major cardiac event, in the hope of achieving a better understanding of the challenges facing cardiac patients today. More specifically, the five studies in this thesis focused on some of the psychological consequences of surviving either a cardiac arrest or a myocardial infarction. The psychological consequences considered spanned from the neuropsychological to the psychosocial. The first two studies focused on memory impairment – a neuropsychological consequence. The remaining three studies were still concerned with an aspect of memory, i.e. traumatic memory of the event, but they considered memory from a more psychosocial perspective. The common theme in these three studies was their focus on features of post-traumatic stress disorder (PTSD) as a consequence of both cardiac arrest and myocardial infarction (MI). Another important concern, which also guided the direction of the studies, was that the work should have a discernible practical application as well as a more theoretical aspect. Thus Study I was an investigation of the prevalence of memory impairment in an in-hospital cardiac arrest

sample, and Study II assessed a potential memory rehabilitation technique with the same patient sample. Study III assessed the prevalence of PTSD in both a cardiac arrest and MI sample, while Studies IV and V investigated the contribution of a number of psychological factors to the development of PTSD following MI, with the aim of identifying factors that might be successfully targeted in out-patient rehabilitation programs for heart disease. Studies IV and V also addressed a number of important theoretical issues surrounding the Sense of Coherence which was the primary psychological variable of interest in both studies. The more specific aims of each study are identified in the following section, which is also a brief guide to the structure and content of the thesis.

## ***1.2 Outline of the thesis: the experimental studies***

Chapter 2 is an introductory review chapter on heart disease. This chapter covers a wide variety of facts about coronary heart disease and its consequences. There are two basic subdivisions in this chapter: the first subsection is concerned with the more medical aspects of the disease such as prevalence rates, risk factors and trends in mortality; the second section introduces the reader to some of the known psychological consequences of surviving a serious cardiac event.

Chapter 3 contains a description of the first experimental study of the thesis. The aim of Study I was to assess the prevalence and degree of memory impairment as a result of in-hospital cardiac, and to compare this with the prevalence and degree of memory impairment following both out-of-hospital cardiac arrest and MI.

Chapter 4 contains the second experimental study, which was the first of the studies in the thesis with a more practical focus. The emphasis in Study II was on the potential rehabilitation of individuals with memory impairment following cardiac arrest. The aim of the study was to assess the efficacy of a technique called ‘errorless learning’ with the memory impaired individuals identified in Study I.

Chapter 5 contains Study III, an investigation of a number of psychosocial consequences of both cardiac arrest and MI. The aims of this study were threefold: 1) to assess and compare the prevalence and degree of emotional distress (i.e. anxiety and depression) in cardiac arrest and MI patients; 2) to assess and compare the prevalence of PTSD in cardiac arrest and MI patients; and 3) to compare the prevalence rates of PTSD in both samples using a structured diagnostic clinical interview versus a self-report questionnaire.

Chapter 6 is the largest of the chapters in the thesis and contains a description of Study IV. Study IV had both practical and theoretical aims. The first aim was to establish the contribution of two psychological variables to the development of PTSD symptoms post-MI. From a practical perspective, it was considered that identification of psychological variables that contribute to the development or maintenance of traumatic reactions post-MI might ultimately lead to the inclusion of interventions targeting these variables in cardiac rehabilitation programs. The variables of interest were Negative Affectivity and Sense of Coherence. A second more theoretical aim of this study was to assess the extent to which these two variables are conceptually distinct. The final aim of this study was also theoretical: to assess the stability of the sense of coherence construct.

Chapter 7 contains the final study. Study V was a further investigation of the role of sense of coherence in the development of PTSD symptoms following MI. The first aim of this study was to assess the relationship between patients linguistic style during (written) free recollection of their cardiac event and features of the PTSD syndrome. As well as this more practical aim, the study also had a second aim which was further theoretical assessment of the sense of coherence.

Finally, Chapter 8 contains a discussion of the main findings of all five studies in terms of the main goal of the thesis, which was to contribute to our understanding of two major psychological consequences of surviving a serious cardiac event – memory impairment and post-traumatic stress disorder.

## **Chapter 2**

### **Psychology and Heart Disease**

#### ***2.1 Introduction***

This chapter is divided into two main sections. The first of these covers some basic facts about heart disease in order to familiarise the reader with its extent in the western world today. This section also presents basic information about the main forms of cardiovascular disease, trends in mortality, symptoms, and risk factors. All statistics in this section come from two sources: UK and European statistics are taken from the British Heart Foundation Coronary Heart Disease Statistics, 2002 edition (Petersen & Rayner, 2002); US statistics are taken from the American Heart Association, 2002 Heart and Stroke Statistical Update (American Heart Association, 2001). The second section focuses on morbidity as a consequence of serious cardiac events. In particular this section outlines some of the psychological consequences of cardiac arrest and myocardial infarction, which will be investigated in detail in the experimental chapters that follow.

#### ***2.2 Heart Disease***

Since the 1900s the incidence of heart disease in the western world has grown to epidemic proportions. Improvements in the treatment of heart disease continue to lead to increased numbers of people surviving serious cardiac events. In particular, since 1967 the use of transthoracic electrical shock to revive cardiac arrest victims outside of hospital has revolutionised cardiac medicine, quite literally allowing people who were

clinically dead to be returned to life. Nonetheless, the number of people still dying of heart disease today is alarming.

### ***2.2.1 Mortality following heart disease in the UK and US***

Diseases of the heart and circulatory system (cardiovascular disease or CVD) are currently the main cause of death in the UK. More than one in three people (over 235,000 deaths) died of CVD in 2000. CVD is also the leading cause of death in the United States. The latest American Heart Association figures indicate that one of every 2.5 people (over 950,000 deaths) in the US died of CVD in 1999. Indeed since 1900, CVD has been the leading cause of death in the United States every year except 1918.

Coronary heart disease (CHD) and stroke are the main forms of CVD. Stroke accounts for around a quarter of total deaths from CVD in the UK, and a sixth in the US. CHD accounts for around half of total deaths from CVD in both the UK and the US, making it the single most common cause of death in both countries. CHD accounted for around 125,000 deaths in the UK in 2000. Around one in four men and one in six women in the UK will die of the disease.

### ***2.2.2 Regional differences in mortality rates – UK, Europe and US***

Death rates from CHD in Scotland, Northern Ireland and the North of England are higher than in Wales and the South of England. The premature death rate (death before the age of 75) for men living in Scotland is over 50% higher than in East Anglia and over 80% higher for women. In the wider European context, there is a marked

difference between death rates in the more developed Western European countries than in the Eastern European countries, most notably those of the former USSR. For example, death rates from CHD in Kazakstan, Latvia, Lithuania, the Russian Federation, and Azerbaijan are more than triple those found in Denmark, Norway, Spain, Portugal, Germany and Italy. Differences in CHD death rates between states in the US are similar to regional differences found in the UK. The age-adjusted death rate in New York, the state with the highest death rate, is over 50% higher than in Hawaii, the lowest ranked state for CHD deaths.

### ***2.2.3 Recent trends in death rates***

Death rates from CVD have been falling in the UK since the early 1970s. In the last ten years, they have fallen by 31% for adults under 75 years of age. Death rates from CHD have also been falling since the late 1970's. In adults under 65 years, they have fallen by around 40% in the last ten years. Rates for younger men have been falling faster than rates for older male age groups. For example, there was a 45% drop in the death rate for men aged 45 – 54 in the UK between 1988 and 1998, but the corresponding drop for men aged 65 – 74 was only 34%. In the same period, death rates for women have fallen by a similar proportion in the 65 – 74 age group, and by 39% in the 45 – 54 age group. Death rates from CHD have also been falling in the United States. Between 1989 and 1999 the overall death rate from CHD (men and women) in the US fell by 24%.

While the death rate in the UK has been falling, it has not been falling as fast as in some other countries. For example, the death rate for men aged 35 – 74 fell by 37% between

1986 and 1996 in the UK, but it fell by 43% in Australia and 45% in Norway and Denmark. For women, the death rate fell by 36% in the UK but by 49%, 44% and 42% in Australia, Finland and France respectively.

#### **2.2.4 *Myocardial infarction v. cardiac arrest***

The current medical model of heart disease holds that it is largely the consequence of genetic factors combined with a maladaptive lifestyle, for example behaviours such as smoking, poor dietary habits, or lack of exercise. Cardiac risk factors are thought to combine in a multiplicative and generally unknown way to damage the coronary arteries. The body responds to these maladaptive behaviours by forming atheromatous plaques, which narrow the coronary blood vessels and restrict the bloodflow to the heart. The early stages of heart disease are unnoticeable and acute presentation usually takes one of three forms: angina, myocardial infarction (MI) or cardiac arrest.

Approximately 40% of new cases will present with angina (chest pain), usually brought about by increased demand on the heart (exercise or emotional arousal). For a further 40% of new cases the first symptom will be an MI or colloquially, a heart attack. This is caused when a thrombus or plaque detaches and permanently blocks a cardiac blood vessel. This causes the death of part of the heart and creates the infarction (MI). The dying tissue produces a strong electrical signal which can disrupt the rhythmic contractions of the heart chambers and lead to a cardiac arrest, also colloquially referred to as a heart attack. Cardiac arrest is the third form of acute presentation of CHD, occurring in about 30 – 50% of MIs. In around 13% of cases of CHD the first symptom will be sudden death, usually caused by cardiac arrest.

The difference between a cardiac arrest and an MI is not well understood by the general public. This is partly due to the fact that the medical profession refers to MI as 'heart attack', however when the layperson thinks 'heart attack' they imagine a cardiac arrest. The difference between these two types of 'heart attack' is significant and particularly so for this PhD. MI is identified medically by biological markers and in many cases will go largely unnoticed by the sufferer. Some infarcts are accompanied by considerable pain but in many the feeling is more like indigestion. The important thing to note about MI is that the heart *does not stop*. Cardiac arrest on the other hand, is when the heart abruptly stops, and oxygen to the brain is consequently shut off. Death can occur within minutes of arresting. However, if cardiac arrest victims receive immediate cardiopulmonary resuscitation (CPR), blood will be kept flowing to the heart and brain until definitive treatment is possible. Cardiac arrest can be reversed if the victim is treated with an electric shock to the heart that stops the abnormal rhythm, and allows a normal rhythm to resume. This process is referred to as defibrillation. The likelihood of surviving cardiac arrest is reduced by seven to ten percent with every minute that passes without treatment. Few resuscitation attempts succeed after ten minutes. In the US it is estimated that more than 95% of cardiac arrest victims die before reaching hospital.

### ***2.2.5 Factors contributing to the decline in CVD mortality***

Recognition of the massive health risk associated with and consequent economic costs of CHD, led to numerous factors all of which may have contributed to the decline in CVD mortality documented in section 2.2.3 above. These include a massive research effort into the epidemiology of the disease, improvements in resuscitation medicine,

more emphasis on reducing the major controllable cardiovascular risk factors (high blood pressure, smoking, high blood cholesterol, physical inactivity, overweight and obesity, and diabetes), massively increased funding for emergency services leading to dramatically reduced emergency service response times, and programs to raise public awareness of 'heart attack' symptoms and resuscitation skills. It is now known that early CPR and rapid defibrillation can dramatically improve long-term survival rates for witnessed out-of-hospital cardiac arrest (e.g. Cobbe, Dalziel, Ford, & Marsden, 1996; Davies, Colquhoun, Graham, Evans, & Chamberlain, 2002; Eisenberg, Horwood, Cummins, Reynolds-Haertle, & Hearne, 1990). In some US cities where ambulance response times have been improved to the extent that the first shock can be delivered within three to five minutes, reported survival rates are as high as 48 – 74%.

In the UK during the 1980's, the *Heartstart UK* program was specifically designed to reduce the number of mortalities as a result of cardiac arrest. Based on the findings of the large body of research on CVD, a three-pronged approach was developed comprising (1) the installation of an automatic defibrillator in all ambulances, (2) paramedic training in advanced life saving techniques, and (3) a public CPR program. The *Heartstart Scotland* program brought the initiative to Edinburgh, and in just over ten years, the program led to a four-fold increase in the numbers of people surviving to hospital discharge at the Royal Infirmary of Edinburgh following out-of-hospital cardiac arrest (Grubb, O'Carroll, Cobbe, Sirel, & Fox, 1996).

### **2.3 *Morbidity following cardiac arrest and MI***

One effect of this decrease in mortality as a result of CHD has been an increased focus on the part of researchers on morbidity following myocardial infarction and cardiac arrest. This section briefly outlines the main neuropsychological and psychosocial consequences of both, although more detailed discussion will follow in the relevant chapters.

#### **2.3.1 *Cardiac arrest***

A major factor contributing to post-resuscitation morbidity in survivors of cardiac arrest is brain injury as a result of global ischemia. There are a great many pathophysiological consequences of sudden cardiac arrest. Loss of brain oxygen stores and consciousness occurs within 10 to 20 seconds of arresting. Cellular glucose stores are depleted within 5 minutes and the membrane pump is inactivated. Furthermore, the occurrence of calcium shifts, tissue lactic acidosis, increases in free fatty acids, and extracellular amino acids creates a cellular environment that fosters reperfusion injuries<sup>1</sup> in vulnerable areas of the brain, such as the hippocampus and the neocortex (Safar, 1993). These pathophysiological changes have been associated with a wide variety of neurological sequelae ranging from mild intellectual impairments to brain death. Although the prevalence of severe brain damage in long-term survivors (>6 months) is low (1% to 3.9%: e.g. Gustafson, Edgren, & Hulting, 1992; Yarnell, 1976), estimates of full neurological recovery in these patients have ranged from a low of 25% to a high of 85%, depending on the methods used to assess cognitive function and the definition of

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<sup>1</sup> Reperfusion injuries refer to functional, metabolic, or structural changes in ischemic tissues following return of blood flow.

“full neurological recovery” employed (e.g. Earnest, Yarnell, Merrill, & Knapp, 1980; Grubb et al, 1996; Roine, Kajaste, & Kaste, 1993). Sauv e, Walker, Massa, Winkle, & Scheinman (1996) have noted that although there is a high probability that cardiac arrest survivors experience some degree of neurological impairment, neither neuropsychological testing nor neurological examination are part of routine hospital procedure for these patients.

Reports on the long-term psychological adjustment of cardiac arrest survivors appeared as early as the late 1960s (e.g. Dobson, Tattersfield, Adler, & McNicol, 1971; Druss & Kornfeld, 1967). Since then numerous studies have assessed psychological and psychosocial outcome following cardiac arrest. However, as with studies assessing neuropsychological outcomes, psychological and psychosocial outcome measures have varied widely and estimates of recovery have differed accordingly. In addition, long-term studies (i.e. follow-up periods of 6-months post-discharge or longer) are relatively rare. Nonetheless, a pattern of psychological recovery has emerged whereby many survivors experience high levels of anxiety, often accompanied by feelings of panic, while in hospital and in the weeks immediately following discharge. This anxiety gradually fades, and the majority of survivors recover well and report high levels of psychological and psychosocial adjustment (e.g. Bedell, Delbanco, Cook, & Epstein, 1983; Dougherty, 1994). Indeed some patients view their arrest as an opportunity to ‘start again’ and find that they can see life from a different perspective and are able to enjoy the time at their disposal more than ever before (Kliegel et al, 2002).

In recent years there has been increased attention to the possibility that survivors of serious illness may suffer from symptoms of post-traumatic stress disorder (PTSD).

Despite the fact that cardiac arrest is a very serious and life-threatening medical event, very few studies have assessed PTSD symptoms in cardiac arrest survivors. However, one study that assessed intrusive and avoidant behaviours, which are features of the PTSD syndrome, found that a small but significant number of cardiac arrest survivors were experiencing these types of symptoms (Ladwig et al, 1999).

### ***2.3.2 Myocardial infarction***

Unlike cardiac arrest, MI does not result in cerebral ischemia and consequently, it would not be expected that survivors of MI would be particularly at risk of neurological damage. Systematic studies of brain damage in cardiac arrest survivors were preceded by anecdotal reports of neuropsychological deficits, particularly memory impairment. Similar anecdotal reports are not found in the MI literature and consequently, there have not been studies to systematically assess neuropsychological outcome following MI. One study however, which assessed long- and short-term memory in a group of cardiac arrest survivors, also assessed a group of thirty-five MI survivors as a control group. The majority of the MI group displayed normal short- and long-term memory. A few had mild long-term memory impairment but none displayed memory deficit of a degree that was likely to interfere with everyday life (Grubb et al, 1996).

Studies on outcome following MI have tended to focus on more psychological and psychosocial aspects of recovery such as quality of life, resumption of employment, anxiety and depression. As with survivors of cardiac arrest, the majority of patients discharged from hospital post-MI tend to resume pre-event levels of functioning following a relatively short period of more pronounced anxiety and depression.

However, there is growing evidence that depression following MI may be severely under-diagnosed. A recent review of the evidence for depression following MI suggests that actual cases of depression may not be identified in as many as 90% of sufferers. The authors suggest a number of reasons for this extreme under-diagnosis including the atypical profile of depression post-MI and the tendency of physicians to interpret depressive symptoms as transient and normal reactions to a life-threatening event (Strik, Honig, & Maes, 2001). Again, estimates of the incidence of depression in patients post-MI vary considerably, but are usually between 15 – 30%.

Reports of high levels of depression in the first instance, and serious under-diagnosis of depression in the second instance, present a serious challenge for both cardiologists and psychologists working within cardiology. In recent years there have been a number of papers documenting a strong link between post-MI depression and subsequent mortality. For example, Johann Denollet and his colleagues in the Netherlands found that even mild depression led to significantly increased likelihood of mortality at 6-months post-MI. There is also growing evidence that significant numbers of MI survivors experience symptoms of PTSD after their event (Denollet & Brutsaert, 2001). Prevalence rates of around 10% are usually reported (e.g. Bennett & Brooke, 1999; Doerfler, Pbert, & DeCosimo, 1994).

## **2.4 Conclusion**

In summary, CVD is the leading cause of mortality in the Western world. Survival rates following cardiac arrest have improved enormously in the past decade but surviving an arrest is in many ways only the first hurdle. There is evidence that

significant numbers of cardiac arrest survivors suffer from lasting memory impairment after their arrest. Furthermore, cardiac arrest and MI survivors may also have to cope with depression, anxiety, and even PTSD following their cardiac event. In the chapters that follow, these neuropsychological and psychosocial consequences of cardiac arrest and MI are discussed and investigated in more detail.

## **Chapter 3**

### **Study I: Memory impairment following in-hospital cardiac arrest**

#### ***3.1 Introduction***

Anecdotal reports of memory impairment in survivors of sudden out-of-hospital cardiac arrest have existed for decades, and there are now a number of systematic studies that have assessed cognitive impairment in this population and have found evidence to support those early anecdotal reports. However, reported prevalence rates for memory impairment have varied widely between studies and some have even concluded that cognitive impairment is not a significant outcome of cardiac arrest. Generally speaking, early studies tended to judge that memory impairment was not a significant problem for cardiac arrest survivors, but more recent attempts to assess impairment have found that quite large numbers of post-anoxic patients have significant memory deficits. In this, the first of five experimental chapters, the literature on cognitive impairment as a result of cardiac arrest is reviewed as a background to the first study. The aim of the study was to assess the prevalence and degree of memory impairment in a group of surviving *in-hospital* cardiac arrest victims. The rationale for testing in-hospital rather than *out-of-hospital* survivors is presented in the review that precedes the experimental procedure.

#### ***3.2 The evidence for memory impairment after cardiac arrest***

An early report of neuropsychological damage following cardiac arrest, published in 1970, documents extensive cognitive deficits in two of twenty-five cardiac arrest

survivors (Willanger, Klee, Lindeneg, & Jorgensen, 1970). However, both of these impaired subjects experienced periods of unconsciousness lasting several weeks, which is not representative of the majority of cardiac arrests. In addition, although the paper makes no mention of the cause of cardiac arrest, both were of an age (18 and 19 years) suggestive of an arrest etiology (i.e. the origin or cause of the arrest) other than CHD. The authors note that while serious impairments were evident in these two cases, the elderly survivors who had experienced periods of unconsciousness lasting from a few minutes to a number of hours, displayed no evidence of intellectual impairment. In a few patients who had experienced several days of unconsciousness and amnesia at the time of arrest, there was evidence of moderately severe intellectual impairment, but in no patient was the impairment so severe that it was judged as a burden.

Hillis, Sinclair, Butler, & Cain (1993) assessed a wide range of cognitive abilities in 257 out-of-hospital cardiac arrest survivors using the Dementia Rating Scale (DRS). Total DRS scores for the cardiac arrest patients were not significantly different from those of a control group of patients who had coronary artery disease (CAD) but had not suffered a cardiac arrest. However, the cardiac arrest group did score significantly lower than controls on the portion of the DRS that assesses memory. They also reported more difficulties with memory and concentration than controls. However, as both groups' memory score fell within the range for normal healthy individuals, the researchers concluded that the effect of CAD and cardiac arrest on memory performances was not clinically significant.

These findings are similar to those reported in a study conducted by Bertini et al (1990). In this study out-of-hospital cardiac arrest patients completed a battery of

neuropsychological tests, which included tests from the Wechsler Memory Scale – Revised (WMS-R; Wechsler, 1987). While some neurological impairment was found in this sample, particularly in a sub-group who had post-anoxic coma on admission to hospital, the researchers concluded that the difficulties were not disabling. They did note however, that processing ability linked to memory was significantly worse in the sub-group admitted to hospital comatose, than in the sub-group who were admitted fully conscious.

Bertini et al's (1990) study also included an MI control group (i.e. a group of patients who had suffered acute MI uncomplicated by cardiac arrest). MI survivors provide an ideal natural control group for this type of study as they have the same underlying heart disease as cardiac arrest survivors, have also experienced a serious cardiac event, but the course of their disease has not been complicated by cardiac arrest. Thus, any difference in memory performances between the two groups can be attributed to the arrest event. No significant differences in neuropsychological performances between the cardiac arrest group and the MI controls were reported. The researchers' conclusion is that the "remarkably low incidence of neurologic sequelae in these resuscitated patients....is an encouraging result..." (p.410).

By the mid-nineties, reports of cognitive outcome after cardiac arrest had become less positive, as methodological weaknesses were ironed out and researchers began making systematic and more appropriate efforts to assess cognitive abilities.

For example, in 1994 Cynthia Dougherty reported the results of a longitudinal assessment of 15 survivors of sudden cardiac arrest. Neuropsychological recovery was

assessed five times over a one year period by means of the Neurobehavioral Cognitive Status Examination (NCSE; Kiernan, Mueller, Langston, & Van Dyke, 1987).

Survivors scored perfectly at all time periods on most of the NCSE subtests. However, they showed significant impairment on the subtests assessing memory and construction. The degree of impairment was reported as being substantial (“some participants did not answer any of the questions correctly”, p.151). Although there were improvements over the follow-up period, memory performances never reached normal levels. Furthermore, survivors reported finding the memory disturbances distressing, and that they interfered with work competency, daily functioning and complex reasoning. This study showed clearly how global cognitive functioning could be unimpaired following cardiac arrest, but specific abilities, such as memory, might still be substantially impaired.

A more recent study by Sunnerhagen, Johansson, Herlitz, & Grimby (1996) assessed neurological outcome in cardiac arrest survivors more than two years after their arrest. Cognitive functions were assessed using the Mini-mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975). The MMSE was originally used to help differentiate between dementia and depression in the elderly population. The authors note that it can be used as a screening instrument, but is not sensitive enough to detect all cognitive deficits that may cause problems in everyday activities, family relationships or employment situations. Nevertheless, because it was developed for use with a population in which some memory deficits can be expected, it is arguably a more appropriate test for assessing cardiac arrest survivors than tests such as the NCSE. Just over a third of the patients scored below the cut-off point for a normal population (less than 26), which indicates some type of cognitive deficit. Individuals who scored below

cut-off on the MMSE also tended to be more dependent in activities of daily living.

This study is a good example of how more recent studies have attempted to use more appropriate measures of cognitive ability than earlier studies did, and of how estimates of cognitive impairment are considerably higher when tests that have been designed to detect deficits in populations that are likely to be impaired are used, rather than tests that are designed for use with normal populations.

There have also been studies that assessed the pattern of cognitive deficits over time. For example, a group of researchers conducted a comprehensive study of cognitive recovery in 45 survivors of sudden cardiac arrest over a 25-week period post-arrest (Sauvé et al, 1996). Cognitive ability was assessed on four different occasions, using a variety of tests, including the NCSE. At initial assessment during hospitalisation, 84% of survivors had mild to severe deficits in at least one of nine cognitive outcome areas. The most frequent impairment was delayed memory recall; the most severe was recognition memory. Fifteen percent of survivors had deficits in at least 8 outcome areas. Over the next six months there were progressive improvements in survivors' cognitive performances. At the time of the final assessment 50% of survivors had impairments in one or more memory outcomes, and more than half of these also had deficits in at least one other cognitive area. There were significant improvements in performances over time, with the most marked improvement being between hospitalisation and assessment 3 – 6 weeks post-arrest.

Roine et al (1993) also assessed long-term cognitive outcome in survivors of out-of-hospital cardiac arrest and drew similar conclusions with regard to the type of memory impairment sustained, but a different conclusion with regard to improvements in

memory deficits over time. Survivors completed a battery of neuropsychological tests, including the WMS-R. Assessments were made whilst patients were still in hospital and also at 3- and 12-months post-arrest. Performances on most components of the WMS-R at both assessment points were within normal limits. However performance on the delayed recall component of the WMS-R was clearly sub-normal; 48% of patients were still experiencing difficulties on this subtest at 12-months post-arrest. Unlike Sauv e et al's (1996) study however, the difference between performance levels at three- and twelve-months post-arrest was not significant.

A study by Grubb et al (1996) was also designed to identify the nature, prevalence, and severity of long-term memory impairment in two distinct groups of cardiac patients: out-of-hospital cardiac arrest survivors and a control group of MI survivors. Long-term memory was assessed using the Rivermead Behavioural Memory Test (RBMT; Wilson, Cockburn, & Baddeley, 1985). The RBMT comprises several subtests that assess immediate and delayed spatial and verbal memory, as well as recognition and orientation. More than 6 months post-arrest, moderate or severe memory impairment was found in 38% of cardiac arrest cases, but none of the MI controls had this degree of impairment. This study also reported evidence that delayed recall is a significant problem for survivors of out-of-hospital cardiac arrest. Cardiac arrest survivors were significantly impaired compared with MI survivors on all the delayed components of the RBMT. However, they were also significantly more impaired on tests of immediate spatial and verbal memory.

The Grubb et al (1996) study is particularly significant in that the measure used to assess memory (the RBMT) was specifically developed for use with brain damaged

populations, and relies on tasks that are likely to resemble those that patients engage in during everyday life (e.g. learning a route, recognising faces, remembering a short news report). The RBMT thus provides a more ecologically valid and sensitive test of memory than previously used cognitive tests such as the DRS or MMSE. As impairments on the RBMT are likely to be indicative of difficulties in activities of daily living, Grubb et al (1996) concluded that memory impairment was common after cardiac arrest but more significantly, that the degree of impairment was *clinically significant*.

### **3.2.1 Duration of cardiac arrest**

The importance of establishing the effect, if any, of the duration of circulatory arrest on long-term cognitive outcome is considerable. A threshold above which cognitive impairment can reasonably be expected would be extremely useful in clinical practice as it would allow survivors and their families to be advised about the likelihood of neurological damage after surviving cardiac arrest. It also has implications for emergency services target response times. If neuropsychological damage becomes significantly more likely after a known time-period, then reducing ambulance response times below that cut-off becomes an important target. It is however, very difficult to assess precise durations for cardiac arrests, in particular for unwitnessed out-of-hospital arrests. Only a few studies have attempted to collect this data and a quick review of those will illustrate the difficulty inherent in answering this important question.

Willanger et al's (1970) report, referred to in section 3.2 above, notes that there was a close correlation between the duration of unconsciousness during cardiac arrest and

subsequent cognitive impairment. For three patients in this study of twenty-five cardiac arrest survivors, the period of unconsciousness following cardiac arrest lasted several weeks. In two of these three cases, the authors document severe and lasting cognitive sequelae. These two cases are likely to be driving this correlation. The other arrest durations are reported as lasting from a few minutes to three weeks. Apart from this statement and the information with respect to the three cases with lengthy unconsciousness, no further precise data regarding arrest duration is reported and it is unclear if more precise data was recorded. Furthermore, the duration of unconsciousness following arrest may not be correlated with the duration of cerebral hypoxia, which is the process behind any cognitive impairment that may be sustained. Nonetheless, this study provides some tentative support for the intuitive proposition that the lengthier the duration of cerebral hypoxia, the more significant will be the negative effect on the brain's later ability to function.

A team from the University of Florence have recently described an unusual case of complete neurological recovery after a cardiac arrest which lasted more than five hours (Fabbri et al, 2001). The arrest occurred during a urologic operation and there was no underlying CHD. The researchers do not describe how complete neurological recovery was determined<sup>2</sup>. Nonetheless, this case is worth mentioning as there was no apparent effect of such a long arrest duration on neurological recovery at three months. Whether this finding is the result of a failure to systematically assess cognitive functioning or the fact that the arrest etiology was not cardiac, is problematical for interpretation.

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<sup>2</sup> Neurological recovery may be different to neuropsychological recovery; however, many researchers in this area refer to 'neurological recovery' whilst making neuropsychological assessments.

Nonetheless this is an intriguing finding and runs completely counter to Willanger et al's (1970) findings, which also pertained to cardiac arrest of non-cardiac etiology.

Grubb et al's (1996) study also addressed whether the duration of cerebral hypoxia is a critical factor contributing to the degree of memory impairment post-arrest. Estimates of cardiac arrest duration in this study were based on the time the emergency call was logged until the time of the first successful defibrillation and the time of the last administered shock. The researchers reported a significant inverse correlation between memory performance and the latter estimate of circulatory arrest duration ( $r = -0.47$ ), which suggested that decreases in ambulance response times might result in improvements in cognitive outcomes for cardiac arrest survivors. However, there is a problem with estimates of this type. Although the estimates are based on electronically recorded data that are uniform for all patients, the length of time from the moment of collapse until the time the emergency call was received can vary and particularly in the case of unwitnessed arrests, this time-lapse may be significantly lengthy.

Sunnerhagen et al (1996) also made an attempt to assess whether the duration of circulatory arrest has an effect on subsequent cognitive impairment. However, the researchers method of assessing arrest duration was not a very reliable estimate of hypoxia. The time to arrival of the first and second (i.e. the mobile coronary care unit) ambulances was recorded, but there is no report of how these times were estimated. Statistical analysis revealed no difference in the time of ambulance arrival between survivors with normal, and those with lower than normal, memory (MMSE) scores.

A large study conducted in the US, aimed to identify a scheme using easily obtainable clinical variables that would allow identification of patients who were more likely to survive cardiac arrest with no neurological damage (Thompson, McCullough, Kahn, & O'Neill, 1998). Duration of cardiac arrest in this study was recorded as the time to return of spontaneous circulation (defined as the time from receipt of emergency call until the patient's systolic blood pressure was at least 90 mmHg). Estimates made in this way are uniform across patients but are subject to the same problem identified previously, i.e. the undetermined gap between the start of arrest and receipt of the emergency call. Neurologic survival was defined as the absence of moderate to severe neurologic deficits (i.e. being able to care for self) by clinical assessment at the time of discharge. Thomson et al (1998) found that duration of arrest was predictive of survival to discharge and neurological outcome at discharge.

Sauvé et al (1996) also made an estimate of arrest duration in their study. Duration was defined as the amount of time from the patient's collapse to the time when they had comprehensible speech, or if they were intubated, to the time when they were responding appropriately to verbal commands. Hierarchical regression analysis revealed that, of a number of predictor variables only 'time-to-awakening' made a significant unique contribution to the variance in the cognitive outcome variable 'delayed recall' (the area with the most prevalent and severe deficits).

On the whole then, the evidence to date suggests that despite the methodological difficulties discussed, there is a relationship between the duration of cerebral hypoxia and the degree of cognitive impairment sustained after survival.

### 3.2.2 *In-hospital v. out-of hospital cardiac arrest*

The previous studies have all concentrated on patients who have suffered their arrests outside hospital. At present, no study has attempted to establish the extent of memory difficulties (if any) suffered by those patients who have had a cardiac arrest *in hospital*. Separate investigation of the in-hospital cardiac arrest group is warranted due to an important difference between this and the out-of-hospital arrest population. Because all in-hospital arrest victims have already reached hospital when they arrest, it can reasonably be expected that the response times of emergency services are considerably quicker than in the case of an arrest outside hospital. Although response times have been dramatically reduced in recent years, it still necessarily takes time for the emergency call to be made and the ambulance service to respond. The situation where a person is already in the coronary care unit with their ECG being monitored is obviously more favourable for their survival and may also be more favourable for cognitive outcome. Once a person enters ventricular fibrillation, there is no oxygen reaching the brain until either the return of spontaneous circulation or defibrillation by electrical shock. It is this period of cerebral hypoxia that accounts for the cognitive impairment that has been noted following out-of-hospital cardiac arrest. As noted in section 3.2.1 above, Grubb et al (1996) reported a significant negative correlation between the time from emergency call to the last administered shock, and consequently suggested that a reduction in emergency services' response times might lead to better cognitive outcomes for cardiac arrest survivors.

### 3.2.3 *Aims and hypotheses*

The present study therefore built on findings regarding cognitive outcome following sudden cardiac arrest and continued collaborative work with Dr Neil Grubb and the cardiovascular team at the Royal Infirmary of Edinburgh, by examining the neuropsychological effects of in-hospital cardiac arrest. By assessing cognitive outcome in a group of in-hospital cardiac arrest survivors (IHCA) it was possible to address a number of important issues. First, the extent to which the cognitive profiles' of this group of cardiac patients differs from out-of-hospital arrest survivors or MI survivors is not known. One aim of the present study was therefore to establish the nature, prevalence, and severity of memory impairments in patients who have suffered a cardiac arrest in hospital, compared with those who have had their arrest out-of-hospital, and also compared with those who have had an MI uncomplicated by cardiac arrest. A second aim of the study was to address the issue of the effect of arrest duration on memory impairment following cardiac arrest. It was hypothesised that

1. patients who arrest whilst in hospital will be resuscitated more quickly and consequently suffer less severe memory impairment than out-of-hospital cardiac arrest (OHCA) survivors, but that,
2. IHCA survivors will sustain greater memory impairment than patients who sustained an MI but no arrest.

### 3.3 *Method*

The following section is divided into three sub-sections describing the study population, assessment of affective status and premorbid ability, and the memory assessments.

### ***3.3.1 Study population***

The Royal Infirmary of Edinburgh serves a principally urban population of 604, 070 in an area of 1291 km<sup>2</sup>. The hospital treats around 100 in-hospital cardiac arrests per year, of whom approximately 65 are discharged alive. Attempts were made to trace 191 consecutive in-hospital cardiac arrest patients identified from the Royal Infirmary of Edinburgh's Resuscitation Department audit. Thirty-six patients were deceased, 14 were untraceable (unknown GP, unknown address/telephone number), and 15 were not resident in the Lothian region. Two patients were excluded due to organic brain disease and twenty-six were excluded because their cardiac arrest had a non-cardiac etiology. Fifty-six patients did not meet the inclusion criteria with regard to age (18-75 years). Of the remaining 42 patients 33 (30 men and three women) agreed to be assessed.

In order to reach the target of 35 participants a further 28 patients were identified from another major teaching hospital in Edinburgh (Western General Hospital). One of these patients was deceased, four were untraceable, and four were not resident in the Lothian region. Two non-English speaking patients were excluded, and six were excluded because the etiology of cardiac arrest could not be established from their notes. Eight patients did not meet the inclusion criteria with regard to age. Of the remaining three patients two (one man and one woman) agreed to participate bringing the total number of participants to thirty-five. The overall response rate was 77.8%.

All potential participants' general practitioners were contacted initially to establish if their patient was still alive before direct telephone contact was made. Those who were still alive were contacted by the researcher and asked to attend the hospital for

assessment. If the patient agreed to participate, written consent was obtained at the time of assessment. Participant information sheets and consent forms can be seen in Appendix I. In-hospital arrest patients were assessed in the cardiology department of the Royal Infirmary of Edinburgh or in their homes. Patients were assessed at least two and no more than 18 months after their arrest. Ethical approval for the study was granted by the local health authority research ethics committee.

Comparison data was taken from a previous study conducted in the same setting (Grubb et al, 1996). There were thus two control groups: 1) survivors of out-of-hospital cardiac arrest (N = 35) and 2) survivors of acute myocardial infarction who had never experienced cardiac arrest (N = 35).

### ***3.3.2 Assessment of affective status and premorbid ability***

The Hospital anxiety and depression scale (HADS; Zigmond & Snaith, 1983) facilitates detection and management of anxiety and depression in patients being investigated and treated for medical disorders. It has been widely used in clinical and non-clinical populations, and has been found to provide valid and distinct measures of anxiety and depression without confounding by somatic symptoms of concurrent physical disorders. The HADS consists of 14 items of which two seven-item subscales cover anxiety and depressive symptoms respectively. Each item has four possible responses and a scoring range of 0-3 giving a potential global scoring range of 0-21 for each subscale. Clinically significant anxiety or depression is likely with scores in excess of 11 (maximum 21) on the relevant subscale. Scores of 8-10 are considered 'borderline significance' and scores below eight are defined as being in the normal range.

Memory performance is known to be related to general intellectual level. In order to determine whether the three groups were matched for premorbid intelligence the National adult reading test (NART; Nelson, 1982) was administered. The NART provides estimates of intelligence that are highly correlated with performance on full IQ tests. In the NART participants read aloud 50 irregular, non-phonetic words. The number of correctly pronounced words is highly correlated with general intelligence level. Performance on the NART is relatively unaffected by other forms of dementia such as Alzheimer's disease (O'Carroll, Blaikie, & Whittick, 1987) and was chosen as an estimate of pre-morbid intelligence for that reason. Appendix II contains copies of the HADS and the NART.

### ***3.3.3 Memory assessment***

#### *Short-term memory:*

The digit span subtests (forwards and backwards) of the Wechsler Memory Scale - Revised (WMS-R; Wechsler, 1987) were used as measures of short term working memory. In the forwards subtest the participant listens to and repeats aloud increasingly long strings of numbers until the task becomes impossible. In the backwards condition the participant is required to repeat the strings of numbers backwards.

#### *Long-term memory:*

Long-term episodic memory was assessed by means of the Rivermead Behavioural Memory Test (RBMT; Wilson et al, 1985). The test is specifically designed to identify memory difficulties in impaired populations and focuses on areas in which patients

might encounter difficulties during daily living. The RBMT is therefore an ecologically valid measure of memory ability in impaired populations. Scores on the RBMT have been found to correlate with observer ratings of memory impairment (Wilson, Cockburn, Baddeley, & Hiorns, 1989) and impairment on the test is an indication of genuine real-life difficulties for individuals. Memory function is measured with several subtests – remembering a name (after a 20 minute delay), the location of a hidden personal item (20 minute delay), an appointment (20 minute delay), a news report (immediate and delayed), objects and faces from picture cards (3-4 minute delay), a short route (immediate and delayed), and orientation questions. Each subtest is scored between 0 and 2 points, giving a maximum total score (“profile” score) of 24 points. Performance is divided into four categories according to the profile score – normal memory (22-24 points), mild impairment (17-21 points), moderate impairment (11-16 points), and severe impairment (<11 points).

### **3.4 Analysis and results**

#### **3.4.1 Statistics**

One-way analysis of variance was used to examine differences between the three groups’ psychosocial factors (age, time interval since the cardiac event, premorbid intelligence, and ratings of anxiety and depression), and memory functioning (RBMT and digit span). Between group differences in sex ratio and social deprivation categories for the three groups were tested using chi-square tests. The two main hypotheses were tested using one-way analysis of variance on the RBMT scores for the three groups. One-way analysis of variance was used to examine differences between

the three groups on the various subtests of the RBMT. RBMT scores were also treated as categorical data (normal memory, mild, moderate & severe impairment) to identify the number of individuals with clinically significant memory impairment (moderate and severe). Chi-square tests were used to compare this categorical data between cases (IHCA patients) and controls (OHCA and MI patients). Spearman's correlation coefficient was calculated for the estimated duration of arrest versus Rivermead scores. Two-tailed significance values were calculated in all cases. All analyses were performed using SPSS for Windows version 9.0.

#### **3.4.2 Patient characteristics**

Mean interval since arrest was 8.2 (4.5) months. Baseline characteristics for the three groups (IHCA; OHCA; MI) were similar (see *Table 3.1* for baseline information for the three groups). However, significant differences were observed for anxiety and time interval since the event, accounted for by the IHCA group. It is possible that anxiety levels and time since index event may affect memory test performance, therefore a test was conducted to see if these variables were correlated with RBMT scores. Interval since the event was not correlated with RBMT scores ( $r = -0.13$ ;  $p > 0.05$ ). However anxiety level was, and was thus entered as a covariate in all subsequent memory analyses ( $r = -.22$ ;  $p = 0.03$ ).

All participants were assigned to one of seven Carstairs & Morris (1991) social deprivation categories. Carstairs and Morris (1991) categories are determined according to postcode, based on unemployment, overcrowding, car ownership and percentage of residents in socioeconomic groups IV and V.

**Table 3.1** Baseline characteristics of 35 in-hospital cardiac arrest cases, 35 out-of-hospital cardiac arrest controls, and 35 myocardial infarction controls.

	<i>In-hospital</i>	<i>Out-of-hospital</i>	<i>MI</i>	<i>Test statistic</i>	<i>p</i>
<i>Age (years)</i>	60.5 (10.2)	65.0 (10.8)	66.1 (10.2)	F = 2.81	p>0.05
<i>Gender (male)</i>	29	28	29	$\chi^2 = 0.13$	p>0.05
<i>Interval from index event to assessment (months)</i>	9.2 (5.0)	6.7 (4.4)	8.6 (3.8)	F = 3.17	p<0.05
<i>NART (correct responses)</i>	25.2 (11.7)	30 (10.3)	29.9 (11.7)	F = 1.97	p>0.05
<i>HAD – anxiety</i>	7.3 (4.9)	5.2 (4.6)	3.6 (2.9)	F = 6.71	p<0.01
<i>HAD – depression</i>	5.0 (4.8)	4.2 (3.9)	3.2 (2.4)	F = 2.29	p>0.05

Note: Data for control groups taken from Grubb et al, 1996

For analysis purposes, the seven categories were combined to form three new categories (1-2, 3-5 and 6-7; see *Table 3.2* for number of participants in each category). The two arrest groups lived in areas with similar social deprivation ( $\chi^2=3.77$ ;  $df=2$ ;  $p>.05$ ). Both arrest groups lived in areas with significantly less social deprivation than the MI group (OHCA v. MI -  $\chi^2=9.18$ ;  $df=2$ ;  $p<.01$ ; IHCA v. MI -  $\chi^2=8.11$ ;  $df=2$ ;  $p<.02$ ). However, there was no relationship between social deprivation categories and RBMT scores

(Spearman's rho:  $r = .055$ ;  $p > 0.05$ ), therefore deprivation categories were not entered as covariates in subsequent analyses.

**Table 3. 2** *Number of in-hospital, out-of-hospital and MI patients in each Carstairs & Morris (1991) social deprivation category.*

<i>Deprivation Category</i>	<i>Study group</i>		
	In-hospital	Out-of-hospital	MI
1 - 2	3	4	13
3 - 5	25	29	17
6 - 7	7	2	5

### 3.4.3 *Short-term memory*

Performance on the backwards digit-span subscale of the WMS-R did not differ between the three groups ( $F = 0.44$ ;  $df = 2, 102$ ;  $p > .05$ ). However, there was a significant difference between the groups on the digits forwards subscale ( $F = 5.74$ ;  $df = 2, 102$ ;  $p < .04$ ). Scheffé post-hoc tests revealed that this difference was driven by the IHCA group who performed more poorly than both control groups did (IHCA v. MI:  $p < .01$ ; IHCA v. OHCA:  $p < .05$ ). A Scheffé post-hoc test revealed that there was no difference on the digits forwards test between the MI and OHCA groups (MI v. OHCA:  $p > .05$ ). However, all three groups scored in the range expected in unimpaired adults (see Table 3.3).

**Table 3. 3** Mean (s.d.) scores of in-hospital cardiac arrest patients and out-of-hospital arrest and MI control groups on short-term memory assessments.

	<i>In-hospital</i>	<i>Out-of-hospital</i>	<i>MI</i>
<i>Digits – forwards</i>	5.9 (1.2)	6.7 (1.3)	6.9 (1.3)
<i>Digits - backwards</i>	4.7 (1.2)	4.8 (1.5)	5.0 (1.3)

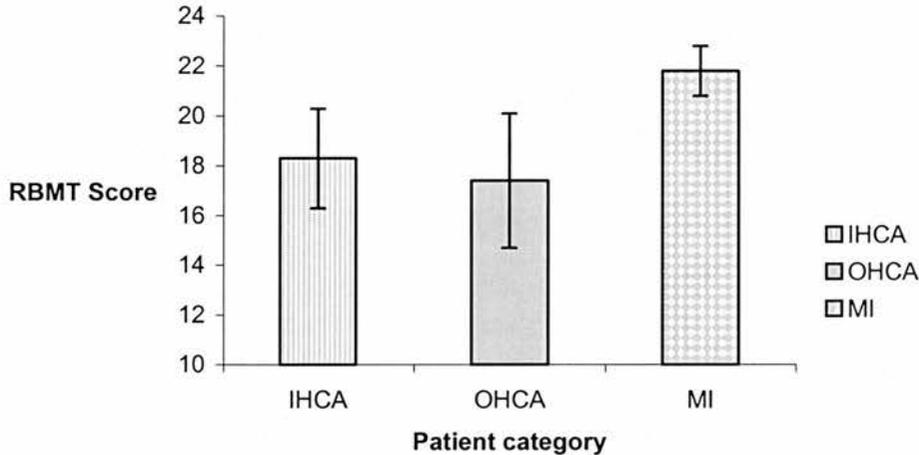
#### 3.4.4 Long-term memory

The main hypotheses regarding the relative degree of memory impairment in the three groups were tested by both quantitative and categorical methods. For the quantitative analysis the IHCA, OHCA and MI groups' mean RBMT profile scores were compared. The categorical analysis compared the overall numbers of patients scoring within the four impairment categories of the RBMT.

##### Quantitative analysis:

One-way analysis of variance on RBMT profile scores, with anxiety entered as a covariate, indicated that overall there was a significant difference in memory impairment between the three groups ( $F=9.45$ ;  $df = 2, 101$ ;  $p < .0001$ ). See *Fig. 3.1*. Three further one-way ANCOVAs were then conducted comparing the three pairs of groups separately. The IHCA survivors performed significantly worse than the MI patients ( $F = 11.89$ ;  $df = 1, 67$ ;  $p < .001$ ). While their performances on the RBMT were better than the OHCA survivors, they were not significantly so ( $F = 1.23$ ;  $df = 1, 67$ ;  $p > .05$ ). The difference between the OHCA group and the MI group was the most marked ( $F = 18.85$ ;  $df = 1, 67$ ;  $p < .0001$ ). This result therefore does not support the hypothesis

that IHCA survivors memory impairment would represent an intermediary point between the OHCA and MI survivors (see *Fig. 3.1*).



**Fig 3. 1** Mean RBMT scores for the three study groups: in-hospital arrest, out-of-hospital arrest and MI patients.

Categorical analysis:

The majority of IHCA patients assessed fell into the normal memory or mild impairment categories on the RBMT (nine (26%) and seventeen (48%) respectively). Eight people (23%) scored in the range for moderate impairment and one (3%) scored in the severely impaired range. Chi-square tests revealed no significant differences between the IHCA and OHCA groups on the number of individuals in each impairment category ( $\chi^2=1.60$ ;  $df=3$ ;  $p>0.05$ ). However, the IHCA and OHCA arrest groups were both significantly different from the MI group (OHCA v. MI -  $\chi^2=21.87$ ;  $df=3$ ;  $p<0.01$ ; IHCA v. MI -  $\chi^2=15.99$ ;  $df=3$ ;  $p<0.01$ ). See *Table 3.5* for performance breakdown of the three patient groups on the RBMT.

**Table 3.4** Results of performance on Rivermead behavioural memory test of 35 patients with in-hospital cardiac arrest, 35 patients with out-of-hospital cardiac arrest, and 35 controls who had myocardial infarction

	<i>Memory Impairment (Rivermead Profile Score)</i>			
	Normal (22-24)	Mild (17-21)	Moderate (12-16)	Severe (0-11)
<i>In-hospital</i>	9 (26%)	17 (48%)	8 (23%)	1 (3%)
<i>Out-of-hospital</i>	7 (20%)	15 (43%)	10 (29%)	3 (9%)
<i>Controls</i>	23 (66%)	12 (34%)	0	0

### 3.4.5 Profile of memory impairment

With significance levels adjusted (the Bonferoni correction was applied) there were differences between the groups in performance on six of the twelve RBMT subtests. Scheffé post-hoc tests showed that OHCA cases differed from the MI group on all six of these subtests – tests of spatial (route immediate and delayed) and verbal memory (news report immediate) and also subtests assessing delayed recall (appointment, message and belonging). The IHCA group also differed from the MI group, but on fewer subtests than the OHCA group did. IHCA patients performed more poorly on the delayed recall subtests (appointment, message and belonging) and on one test of verbal memory (news report immediate). Post-hoc Scheffé tests showed that spatial memory in the IHCA group was not impaired in comparison with the MI group but was significantly better than in the OHCA group (see *Table 3.4*).

**Table 3. 5 Comparison of 35 in-hospital cardiac arrest patients with 35 out-of-hospital arrest and 35 MI patients on RBMT sub-test scores.**

	<i>IHCA</i>	<i>OHCA</i>	<i>MI</i>	<i>F</i>	<i>p</i>
<i>Name</i>	0.97 (.98)	1.25 (.92)	1.37 (.84)	1.77	.176
<i>Belonging</i>	1.11 (.75)	1.06 (.91)	1.66 (.54)	6.83	** .002
<i>Appointment</i>	1.37 (.77)	1.46 (.78)	1.86 (.36)	5.32	** .006
<i>Pictures</i>	1.86 (.43)	1.80 (.53)	2.00 (.00)	2.39	.097
<i>Story – immediate</i>	1.40 (.85)	1.35 (.77)	1.89 (.32)	6.41	** .002
<i>Story – delayed</i>	1.66 (.68)	1.47 (.75)	1.91 (.28)	4.67	.012
<i>Faces</i>	1.83 (.38)	1.60 (.65)	1.63 (.60)	1.76	.178
<i>Route – immediate</i>	1.77 (.43)	1.34 (.94)	1.89 (.32)	7.38	* .001
<i>Route – delayed</i>	1.69 (.53)	1.29 (.96)	1.89 (.40)	7.21	* .001
<i>Message</i>	1.49 (.78)	1.54 (.74)	2.00 (.00)	7.19	** .001
<i>Orientation</i>	1.69 (.63)	1.63 (.69)	1.86 (.43)	1.40	.251
<i>Date</i>	1.57 (.74)	1.66 (.68)	1.86 (.36)	1.98	.143

\* OHCA ≠ MI, IHCA = MI, IHCA ≠ OHCA

\*\* OHCA ≠ MI, IHCA ≠ MI, IHCA = OHCA

### 3.4.6 Arrest duration

In order to address the question of whether longer periods of cerebral hypoxia are associated with greater degrees of cognitive impairment, data on estimated arrest durations was collected from the Department of Resuscitation Medicine's in-hospital cardiac arrest audit forms. However, this data was available for only fourteen (40%) of the IHCA patients. Mean duration of in-hospital arrests (recorded on the resuscitation audit forms) was 3.32 minutes. This was in comparison with a mean duration of out-of-hospital arrests (time from of the emergency call until the first successful shock) of 9.12 minutes. A Spearman's correlation on the available data for IHCA duration and RBMT

scores revealed no significant relationship between the duration of arrest and the degree of subsequent memory impairment (Spearman's rho:  $r=0.08$ ;  $p=.78$ ). A second estimate of arrest duration was taken from patient notes based on the number of shocks received prior to return of spontaneous circulation. For the shock-time estimates, it was assumed that the cardiac arrest team (a) attended the cardiac arrest rapidly, and (b) followed the UK Resuscitation Council guidelines for managing a cardiac arrest. These guidelines are based on a protocol in which, for a witnessed VF cardiac arrest, up to three shocks are given in relatively rapid succession at the start of resuscitation. These would normally be administered within 1-2 minutes. If these shocks fail to restore a normal rhythm then CPR is continued, drugs are given, and after a further 1-2 minutes further shocks are given. Thus, if protocols are correctly followed it is possible to estimate arrest duration from the number of shocks given. Estimates were made for 25 (71%) participants. According to these estimates arrests lasted on average 1.36 minutes. Using this second estimate of IHCA arrest, there was still no significant correlation between arrest duration and degree of subsequent memory impairment (Spearman's rho:  $r=.19$ ;  $p=0.37$ ).

### **3.5 Discussion**

The results of the study show that clinically significant i.e. moderate to severe, impairment to long-term episodic memory was observed in 26% of survivors of in-hospital cardiac arrest. Performance of these patients on the RBMT was significantly impaired when compared to the performance of 35 matched survivors of acute myocardial infarction. However long-term memory performances of IHCA survivors were not statistically different from those of cardiac arrest patients who had suffered

their arrest outside hospital. This finding remained the same using both quantitative and categorical methods to analyse the data. It is also important to note that the result cannot be attributed to the effect of anxiety, as anxiety levels were controlled for in the analysis of covariance. The result is consistent with the literature on cognitive impairment following out-of-hospital cardiac arrest, but also extends knowledge in the area by providing evidence that significant numbers of patients who suffer their arrests whilst in hospital are not protected from memory impairment.

However, before concluding that IHCA patients are no better off than OHCA patients in terms of memory impairment, a note of caution is warranted. Levels of impairment varied widely between patients in both arrest groups but not in the MI group. The standard deviations for the RBMT scores in the arrest groups were twice the magnitude of that shown by the MI group (see *Fig. 3.1*). This variation will have made it more difficult to detect small differences between the arrest groups. In-hospital cardiac arrest survivors' mean RBMT profile score fell between those of OHCA and MI survivors. Nonetheless, the findings of this study suggest that being in hospital before entering ventricular fibrillation may not confer any statistically significant advantage in terms of long-term cognitive outcome.

Grubb et al (2000) have shown that lack of oxygen to the brain during cardiac arrest resulted in cognitive impairment and global cerebral atrophy in OHCA survivors. The present findings indicate that cognitive impairment may also be a major problem for significant numbers of IHCA survivors. Twenty-six percent of the IHCA cases demonstrated a level of memory deficit that was likely to cause significant impairment

in daily functioning i.e. Rivermead test scores in the moderate or severe categories.

This compared with 38% of the OHCA control group, and none of the MI controls.

### ***3.5.1 The effect of arrest duration on memory impairment***

The hypothesis with regard to memory impairment was based on two assumptions: 1) that arrest duration is negatively correlated with cognitive outcome, and 2) that the duration of cerebral hypoxia in in-hospital arrests is shorter than that of out-of-hospital arrests. Based on the limited available data, mean duration of arrest for the IHCA group was estimated as being between 1.36 and 3.32 minutes. Average duration of arrest in the OHCA group (i.e. time emergency call was logged to time of the last administered shock) was just over nine minutes. Thus the second assumption was warranted.

However, the first assumption may not be correct. Grubb et al (1996) have previously reported a significant negative correlation between RBMT scores and the time from emergency call to the last shock in this OHCA group (Spearman correlation:  $r = -0.47$ ) and a number of other studies using various estimates of cerebral hypoxia have provided some evidence of a relationship between arrest duration and the degree of subsequent memory-impairment sustained. However, the present study found no correlation between RBMT test scores and the estimates of arrest duration.

Although resuscitation times were appreciably longer in the OHCA group, this group are generally individuals who arrest with relatively little warning. In comparison, IHCA victims are, by definition, individuals who are already ill and in hospital before their cardiac arrest occurs. It is possible that brain injury is compounded in the IHCA group by their underlying illness, thus worsening this group's cognitive outcome. It

may also be that instead of a continuous relationship between brain injury and duration of cardiac arrest, hypoxic brain injury occurs after a finite time interval has elapsed. There is a considerable literature documenting a sharp fall-off in survival rates after approximately 8 minutes (Cummins, Ornato, Thies, & Pepe, 1991) and it is possible that there is a similar threshold effect for lasting memory impairment. The underlying illness of the IHCA group could perhaps alter this threshold in some way. In the literature review that introduced this study, a case of cardiac arrest lasting more than five hours (which occurred during a urologic operation) was briefly mentioned. The 60-year-old patient had no prior history of CHD and despite suffering an unprecedentedly long cardiac arrest, he not only survived the arrest but also made a complete neurological recovery. The morning following his arrest, the patient was described as regaining consciousness, being able to respond to simple commands, and being free from sensory motor deficits. Three months later, event related potentials (ERPs) and electroencephalograms (EEGs) were completely normal and no abnormal neurological sequelae were present. However, the authors do not describe how neurologic performance was assessed. Many earlier studies that assessed global cognitive functioning drew similarly positive conclusions but may have missed more subtle deficits or failed to assess the specific areas, such as delayed memory recall, that cardiac arrest survivors have difficulties with. However, if this patient indeed made a full neurological recovery after an arrest of five hours but of non-cardiac etiology, this strengthens the possibility that the underlying CHD of the IHCA group in some way reduces their threshold for sustaining cognitive (and specifically memory) deficits. An alternative explanation for the widespread prevalence and significant degree of memory-impairment found in IHCA patients, is that the shorter arrest durations of the IHCA group may be insufficiently long for any relationship between arrest duration and

memory-impairment to emerge. This explanation is in keeping with the findings of Grubb et al's (1996) previous study of out-of-hospital cardiac arrest survivors. The moderate negative correlation reported in that study between arrest duration and memory outcome, was largely accounted for by arrests with longer periods of cerebral hypoxia.

### ***3.5.2 The effect of time-interval from arrest to assessment***

The mean interval between cardiac event and assessment for the IHCA cases was significantly longer than for the OHCA control group (10.9 v. 6.7 months). However, the interval between cardiac event and neuropsychological assessment was not correlated with RBMT scores and is therefore unlikely to have altered the main findings of the study. Many cardiac arrest survivors initially experience difficulty with concentration and memory but the difficulties fade with time. In one study, 40% of patients had recovered normal functioning in these areas three months after the arrest, and by six months, 52% had recovered (Roine et al, 1993). However, a follow-up of the original Grubb et al (1996) OHCA group three years post cardiac arrest found no improvement in memory performance, and in fact found further age associated deterioration (Drysdale, Grubb, Fox, & O'Carroll, 2000).

### ***3.5.3 The effect of anxiety levels***

In the present study, the IHCA group reported higher anxiety levels than either of the other two groups. In the original 1996 study, more of the OHCA arrest group than MI controls were experiencing high levels of anxiety (Grubb et al, 1996). Given that

cardiac arrest is a more serious medical situation than MI this finding is understandable. It was not expected that IHCA survivors would report greater anxiety than OHCA survivors. However, the IHCA sample is a more diverse group than the OHCA group. A number of these patients have been hospitalised for some time prior to their arrest, sometimes for a condition other than heart disease. Some individuals have recognised the symptoms of an MI or cardiac arrest in sufficient time to make it to hospital and were in the coronary care unit (CCU) before their arrest took place. Some patients collapsed as they arrived at Accident & Emergency. In each scenario IHCA survivors have experienced the stress of being in hospital as well as the stress of a cardiac arrest. In addition, they may have the stress associated with knowing they have a serious illness, whether it is coronary artery disease or otherwise. In contrast, OHCA survivors have frequently had no indications of ill health prior to their arrest and may consequently be at reduced risk for developing anxiety post-arrest. The issue of psychological outcome following cardiac arrest and MI, in particular traumatic memory of the event, was explored in greater detail in the third study and is reported in Chapter 5 of this thesis.

#### ***3.5.4 Limitations of the study***

It was not possible to be blind to the cardiac history of the study participants prior to their assessment. It is therefore possible that there was an effect of this on the memory assessments in particular. The memory assessments were however, objective, standardised, presented at a fixed rate with a predefined mode of verbal delivery, and scored using a marking key. Observer bias was therefore unlikely to have substantially altered the results. Furthermore, the study focused on memory deficits, and did not

attempt to identify any perceptual deficits which can accompany memory deficit in brain injured patients and which might affect memory. A separate study by the cardiovascular research team at the hospital is currently assessing perceptual functioning in survivors of cardiac arrest. Another limitation of the study is that the two estimates of arrest duration were subjective, and may be unreliable. They were also not available for all participants. Finally, the OHCA and MI control groups were recruited around five years prior to the recruitment of the IHCA patients. It is possible that patient management had changed in the intervening time period. However, professional guidelines for the management of cardiac patients have not significantly altered in that time and thus are not likely to have significantly altered the results (Grubb, personal communication, Aug. 2002).

### ***3.5.5 Implications of the study***

Despite relatively short estimated arrest durations, clinically important memory deficits were observed in one in four survivors of in-hospital cardiac arrest. In general, cognitive impairment remains a serious, under-diagnosed effect of cerebral hypoxia for numerous surviving cardiac arrest victims. In a report on quality of survival following out-of-hospital cardiac arrest clinicians identified cognitive deficits in just 10% of survivors at discharge (Cobbe et al, 1996). However, when systematic efforts are made to identify deficits, 26% of in-hospital and 38% of out-of-hospital arrest survivors, have moderate to severe memory impairment assessed using an ecologically valid tool, and their degree of impairment is comparable to other groups with brain injury e.g. stroke victims (Wilson et al, 1989). This degree of impairment means that patients' functional capacity is compromised in real life settings and may lead to difficulties in the work

place and in social interactions. Greater attention should be made to assessing cognitive outcomes following in- and out-of-hospital cardiac arrest. Successful participation in cardiac rehabilitation programs could also be compromised in memory impaired survivors of cardiac arrest. In the next experimental chapter the findings of the second study, which assessed the efficacy of a memory rehabilitation technique with this sample of memory-impaired and memory-unimpaired IHCA patients, are reported.

## **Chapter 4**

### **Study II: The effect of errorless learning on memory performances of memory-impaired survivors of in-hospital cardiac arrest**

#### ***4.1 Introduction***

Increasing numbers of cardiac arrest victims are now surviving this life-threatening event, and an increasing body of evidence suggests that memory impairment is a lasting and significant problem for large numbers of these survivors. As a consequence, it is certain that more and more patients are being discharged from hospital with memory deficits which are certain to pose difficulties for daily functioning. It is now imperative that ways of helping such patients are evaluated. This chapter reports the findings of a novel study in which such an evaluation was conducted. Using the same group of cardiac patients identified in the previous chapter, the study examined the efficacy of a well-known and previously successful method of neuropsychological rehabilitation. The introduction to this study contains a review of the literature on errorless learning in diverse memory-impaired populations, and explains the rationale behind using this technique with a cardiac population.

#### ***4.2 Errorless learning***

Memory impairment, or amnesia, is one of the most common and debilitating consequences of brain injury and disease, which can affect many aspects of daily living and seriously disrupt an individual's ability to function independently. Amnesia is associated with a wide variety of neurological conditions, including stroke, closed-head

injury, encephalitis, aneurysm, Korsakoff's syndrome, cerebral tumour, and anoxia. Attempts to help memory-impaired individuals have a long history, however, years of research have shown that memory deficits are largely resistant to remediation. Nonetheless, it is evident that even severely amnesic patients retain the capacity for some kinds of learning. In particular, some studies have shown that memory-impaired patients are capable of acquiring new knowledge within very specific domains. For instance, studies have shown that memory-impaired patients can acquire perceptual, motor and cognitive skills, such as mirror reading (Cohen & Squire, 1980), rotary pursuit (Milner, Corkin, & Teuber, 1968), and puzzle solving (Brooks & Baddeley, 1976). Numerous studies have also revealed that memory-disordered patients can perform at near normal levels on priming tasks which depend on preserved implicit memory functioning. For example, when given the letter fragment CHA\_\_ they are as likely to produce the recently exposed word CHAIR as normal controls (e.g. Cermak, Talbot, Chandler, & Wolbarst, 1985). One practical implication of studies that demonstrated preserved learning abilities in memory-impaired individuals, was that memory losses might therefore be compensated for, not only by the use of external memory aids, but by learning new techniques for tackling problems that access preserved abilities (e.g. implicit memory) or skills (e.g. mnemonic strategies such as visual imagery).

One influential method in memory rehabilitation that is thought to tap into preserved abilities, is errorless learning. The technique was originally developed by animal behaviourists and was used to teach pigeons to distinguish between different coloured keys (Terrace, 1963). Since its initial development in animal behaviour research, errorless learning has been successfully used with human populations. The basic

principle of the technique is to prevent people from making mistakes while they learn new information (or a new skill), because some people, in particular those with memory or learning difficulties, learn better in this way than they do with more traditional ‘trial and error’ methods of learning. There are several ways in which errors can be prevented or minimised during the learning process. These include physically prompting a response, giving people the correct information immediately prior to them giving a response, or asking people to follow written instructions. Since the 1970s researchers have used these types of errorless techniques to teach people with learning difficulties concepts of weight, shape and colour (Cullen, 1976), coin recognition (Llorente & Gaffan, 1989), and age and gender discrimination (Reading & Ager, 1990). More recently, Barbara Wilson and her colleagues introduced errorless learning methods to the field of memory rehabilitation of brain injured people. A substantial body of research now supports the efficacy of errorless learning with memory impaired individuals, and as a result the once revolutionary techniques are now widely accepted.

#### ***4.2.1 Errorless learning and the classic amnesic syndrome***

Memory deficits do not often occur in isolation from other problems. Indeed most patients with memory impairments generally have deficits that extend beyond memory. These could be problems with perception or attention, or with the patient’s mood. However, some patients have a very pure form of memory deficit, isolated from the many other problems that can affect memory-impaired patients. This relatively isolated but dense form of memory deficit is typically referred to as the amnesic syndrome and has been extensively studied. Cases of the classic amnesic syndrome do not all show lesions to one specific area of the brain. However, they are typically associated with

lesions in the circuit linking the temporal lobes, the hippocampus, the mamillary bodies and the frontal lobes (Baddeley, 1990).

One important feature of the classic amnesic syndrome that is particularly relevant to this study, is the dissociation between implicit and explicit memory. Amnesic patients demonstrate a pattern of memory deficit that is consistent with impaired explicit memory but intact implicit memory. Explicit memory refers to the capacity to recall particular episodes from one's past. Explicit learning is facilitated by giving full attention to the material to be remembered and by encoding it as elaborately as possible. In contrast, implicit memory refers to more covert knowledge. Implicit learning is relatively unaffected by the richness (or otherwise) of initial encoding, and retrieval of a memory can occur in the absence of any conscious recollection of the initial learning experience. An early description of implicit memory comes from Claparade in 1911. Claparade described how he pricked an amnesic patient's hand with a needle one day; the following day the patient refused to shake hands with him although he could not say why.

In 1994 Baddeley & Wilson published the results of a study conducted with a group of amnesic patients, which they believe to be the first of its kind. Inspiration for the study came from two sources. Firstly, the researchers' previous attempts to teach amnesic individuals to enter the date and time into an electronic memory aid proved that the task was extremely difficult for the patients to master. Baddeley & Wilson (1994) speculated that the steps necessary to complete the task exceeded the memory capacity of the individuals, with the result that errors were made on the first trial. These errors then appeared to persist in amnesic subjects, and interfered with their acquisition of the

necessary skills to complete the task. They further hypothesised that the intact implicit memory of amnesic patients led to persistent recollection of the incorrect responses, while their impaired explicit memory did not allow them to discriminate between correct and incorrect responses made during learning. Knowing from previous studies that memory-impaired individuals are as susceptible to priming as normal controls (see section 4.2), Baddeley and Wilson (1994) used a word-stem completion task with a group of amnesic individuals to test whether the errors that they made while learning were reducing their ability to learn. The results of the study demonstrated a clear advantage of errorless learning over errorful learning (in which errors are encouraged) for all amnesic patients. Two unimpaired control groups also performed better under errorless conditions, but the amnesic group was more affected by learning method than the other two groups. Amnesic patients recalled less than 60% of new information under traditional trial-and-error learning conditions, but remembered almost 80% of new information when it was presented in a way that eliminated errors.

Wilson, Baddeley, Evans, & Shiel (1994) also report six case studies in which severely amnesic patients successfully mastered a variety of tasks using errorless learning techniques. For example, RM was a 35-year-old man diagnosed with Korsakoff's syndrome. RM was trained on two tasks, both of which required programming an electronic memory aid. One task was taught under errorful conditions and the other under errorless conditions. RM failed completely to master the task taught under errorful conditions. However, using the errorless technique he was able to complete the task with 100% accuracy and no prompting. Another subject, ED, sustained a very severe head injury which left him severely memory impaired. ED was taught rehabilitation staff-members names under errorful and errorless conditions. He

eventually learned all the staff-members names in the errorful condition (although he required several days training to learn the names in this way). However, he immediately performed at ceiling levels under errorless conditions. Wilson et al (1994) concluded that errorless learning appeared to be effective for most of the people with memory impairments that they tested.

Squires, Hunkin, & Parkin (1997) reported the results of two experiments which compared the effectiveness of errorless and errorful learning in memory-impaired individuals. In both experiments the researchers did not include an unimpaired control group because of the difficulty in creating a task that is possible for memory-impaired subjects but which is sufficiently difficult for unimpaired controls. Squires et al (1997) found that while patients did learn under errorful conditions, they learned significantly more quickly under errorless conditions. However, when the researchers re-tested subjects after a delay of one hour, the advantage for items learned under errorless conditions had disappeared. Learning was more stable over the 1-hour delay following errorful learning. Further analysis revealed that the improvement in the errorful condition was due to greater numbers of recovered responses in this condition. Recovered responses were defined as those responses that were correctly recalled at delayed cued recall, but which had not been recalled at immediate testing. Squires et al (1997) report identical results for their second study: initial retention is better under errorless than errorful conditions; performance following a 1 hour delay is equal in both conditions due to greater numbers of 'recovered' responses in the errorful condition.

A more recent study investigated the role of effort as well as error in learning for memory-impaired individuals (Komatsu, Mimura, Kato, Wakamatsu, & Kashima,

2000). Wilson et al (1994) have previously acknowledged that the active participation of patients is required for successful rehabilitation and that simply reducing or eliminating errors is not sufficient to ensure adequate learning. Squires et al (1997) have also suggested that while errorless learning facilitates recall by eliminating errors, it may lose some effectiveness as a learning strategy because it does not require significant cognitive effort. In the Komatsu et al (2000) study, error and effort were studied as separate independent variables. Errorless and effortful conditions were expected to produce superior learning, and a combination of errorless and effortful learning was expected to produce the best results. The study findings revealed an advantage of errorless over errorful learning for memory-impaired individuals. However, contrary to expectation, the amount of effort required in the learning phase of the experiment was not found to have a significant effect on individuals' recall performances.

#### ***4.2.2 Errorless learning and other memory-impaired populations***

Errorless learning techniques have not only been used with patients suffering from the classic amnesic syndrome; they have also been used to teach individuals with memory-impairment associated with schizophrenia. O'Carroll, Russell, Lawrie & Johnstone (1999) reported a similar pattern of results as those reviewed in section 4.2.1: when memory-impaired schizophrenic patients are prevented from making errors during the learning process, their recollection of new material is significantly improved in comparison with when they are allowed to make errors. Two unimpaired control groups included in the study demonstrated no particular advantage of errorless over errorful learning.

Linda Clare and her colleagues have recently used errorless learning principles with people suffering from Alzheimer's disease with considerable success. They describe the case of VJ, a severely memory-impaired man with Alzheimer's disease. VJ received intense memory training, comprising mnemonic strategies and an errorless vanishing cues method. Following training VJ was able to perform at near perfect levels and furthermore, still recalled the material at testing 9 months later (Clare, Wilson, Breen, & Hodges, 1998). Since reporting this finding, Clare and her colleagues have replicated the result using a multiple single case experimental design (Clare et al, 2000). These results demonstrated that participants with early stage Alzheimer's disease can make significant improvement on specific everyday memory tasks when training is based on errorless learning principles. A further notable finding was that for two individuals, improvements made during training sessions generalised to real-life settings.

A recent MRI (magnetic resonance imaging) study of memory-impaired cardiac arrest survivors revealed that the pattern of brain damage in these patients is one of global cerebral atrophy (Grubb et al, 2000). This pattern more closely resembles that found in patients with Alzheimer's disease, rather than the more localised hippocampal and frontal lobe injury associated with the amnesic syndrome (see section 4.2.1). Clare et al's (1998; 2000) results therefore suggest that errorless principles may also be of benefit for memory-impaired cardiac arrest patients.

### 4.2.3 *The mechanism of errorless learning: implicit v. explicit memory*

Baddeley & Wilson (1994) initially proposed that errorless learning works because it facilitates the unimpaired implicit memory of memory-impaired individuals. As mentioned above in section 4.2.1, implicit memory often remains intact in amnesic patients despite poorly functioning explicit memory. However, evidence suggests that implicit memory is poorly equipped to deal with errors because this form of memory is particularly sensitive to interference (Baddeley, 1992). Baddeley & Wilson (1994) therefore proposed that the errors made in traditional trial-and-error (i.e. errorful) approaches to learning are remembered implicitly and interfere with explicit retrieval of correct responses. Put simply, they proposed that when memory-impaired patients try and learn material under traditional (errorful) conditions, they implicitly remember their correct answers and incorrect guesses. However, when they are subsequently asked to recall the correct answer, their impaired explicit memory system makes it difficult for them to distinguish between the correct response and incorrect guesses generated during errorful learning. Since there is no interference from errors during cued recall in the errorless condition, performance is significantly better in this condition.

This interpretation of the beneficial effects of errorless learning has been challenged by Hunkin and her colleagues who proposed that the benefits of errorless learning might be due to benefits of error prevention on residual explicit memory (Hunkin, Squires, Parkin, & Tidy, 1998). Studies such as those reviewed above have shown that errorless learning leads to better free recall of learned information than does traditional errorful learning. Noting that free recall is well established as a test of explicit memory, Hunkin et al (1998) observe that in order to accommodate Baddeley & Wilson's (1994) view

that memory-impaired individuals rely more heavily on implicit memory, you must either assume that explicit responses (i.e. responses made during free recall) depend to some extent on implicit memory, or that information acquired by implicit memory is somehow transferable for subsequent access by explicit memory. With this in mind, Hunkin et al (1998) conducted an experiment designed to elucidate the involvement of implicit memory in errorless learning. The results of this experiment found the usual benefits of errorless learning with memory-impaired individuals, but no evidence to support the view that these benefits were dependent on implicit memory. Instead, Hunkin et al (1998) proposed that the improved performance under errorless conditions must reflect the benefits of errorless learning on residual explicit memory.

In fact, both explanations would appear to have some validity. It is possible of course that different people with differing pathologies may employ either implicit or explicit memory systems to learn tasks, depending on the severity of the memory impairment. Whatever the mechanism behind the efficacy of errorless learning, the principle remains the same: patients begin by learning very small amounts of information, are prevented from making any errors (i.e. guesses), and gradually, the task difficulty is increased.

#### ***4.2.4 Aims and hypotheses***

The aim of the present study was to assess whether errorless learning may be of benefit to patients who are experiencing significant memory difficulties following cardiac arrest. To do this, patients' acquisition of novel information was compared under both errorless and errorful learning methods.

The experimental hypotheses were that

1. errorless learning would result in significantly better retention than traditional trial and error (errorful) learning in memory-impaired cardiac arrest survivors,
2. memory-unimpaired survivors would show equivalent retention under both methods of learning, and
3. there would be a differential effect of errorless learning in the memory-impaired and unimpaired survivors, evidenced by a significant group by learning method by performance interaction.

### **4.3 *Methods***

#### **4.3.1 *Study population***

Thirty-four of the 35 IHCA patients described in the previous chapter completed the errorless learning procedure. See section 3.3.1 for patient and recruitment details. The participant information and consent form can be found in Appendix I. (One patient who had difficulty with the task did not complete the procedure and their data was not included in the analysis)

#### **4.3.2 *Definition of memory impairment***

Participants were divided into two groups according to their performance on the RBMT. (See section 3.3.3 for a detailed description of the RBMT.) There are four possible performance categories on the RBMT – normal memory, mild, moderate and severe memory impairment. For the purposes of this study, patients with scores in the moderate and severe impairment categories were defined as the memory-impaired

group (N = 9) and patients performing in the normal and mild impairment ranges formed an unimpaired control group (N = 25).

### **4.3.3 Procedure**

Following the protocol described by Baddeley & Wilson (1994), participants' ability to learn two lists of five-letter words under two different learning conditions was compared. One was an errorless method in which participants were prevented from making any errors during learning, and the second was an errorful method where errors were encouraged by asking participants to guess the correct answer prior to giving it to them. Each participant completed both errorless and errorful learning methods in the same session, with each condition separated by a ten-minute break. The two learning methods were counterbalanced across participants. Each list consisted of 10 words to be learned in order to avoid ceiling effects.

In the errorless learning condition, for a given target word e.g. ANGER, each participant was told 'I am thinking of a five letter word beginning with AN and the word is ANGER, please write that down now'. The same procedure was repeated for each word on the list, and was then repeated a further two times using the same instructions for a total of three learning trials. In the errorful learning condition, participants were told 'I am thinking of a five letter word beginning with AN, can you guess what it might be?' The correct word was provided following four incorrect guesses, or after 25 seconds had elapsed if four guesses had not been forthcoming. Participants were asked to write down each correct word at this point. A list of 10 substitute words was available in the unlikely event that subjects guessed the target

word the first time in order to ensure that there was at least one error for each word in the first trial of the errorful condition. Again, the same procedure was repeated for each of the 10 words on the list. Thus, in this condition, subjects are generating guesses, whereas in the errorless condition only the correct responses are produced.

The first three trials, described above, constituted the learning phase. This was followed immediately by the first of three blocks of recall trials. Each recall block consisted of three test trials, and each block was separated by five minutes. Thus, there were a total of nine recall trials. On all test trials, the first two letters of each word was supplied and subjects were asked to guess the correct word. The tester would say ‘One of the words you wrote down earlier began with AN, can you remember it?’ If the subject did not respond, they were encouraged to give any appropriate word, even if they felt it was incorrect. If the subject provided a wrong answer the tester immediately corrected them by providing the target word. If after 25s the subject had not supplied any word, they were deemed to have forgotten it, and marked as having given an incorrect response.

#### ***4.3.4 Other Measures***

All participants also completed a battery of neuropsychological tests during the breaks between trials on the errorless and errorful procedures. Participants completed the NART, the HADS, and the digit span subtests – forwards and backwards – of the WMS-R. All tests are described in detail in sections 3.3.2 and 3.3.3. These tests were part of the first experimental study, and are not referred to in the analysis of the present study. However, they were administered during the errorless and errorful learning

procedures in order to create uniformity across the discussions between trials for each participant, and critically, in order to prevent rehearsal of material between trials.

#### **4.4 Analysis and Results**

##### **4.4.1 Statistics**

Potential confounding variables were compared using t-tests (age, IQ, anxiety and depression) or chi-square (gender). The errorless and errorful data was analysed using a 3 way ANCOVA (2\*2\*9) with memory-impairment as a between-subject factor, learning method and memory-test trial number as within-subject factors, and NART scores as a covariate. The relationship between performance on errorful learning trials and memory recall was analysed using Pearson's correlational analyses. Improvement over the course of errorless learning trials and memory-impairment was tested using Pearson's correlational analysis. All statistical analyses were performed using SPSS for Windows version. 9.0.

##### **4.4.2 Baseline characteristics**

There were no significant differences between the memory-impaired and unimpaired survivors on the potential confounding variables of sex, age, anxiety and depression (see *Table 4.1*). There was however a difference between the two groups on NART scores (i.e. IQ estimates). The unimpaired group scored significantly better on the NART and NART scores were therefore entered as a covariate in the subsequent analysis of memory performance under errorless and errorful conditions.

**Table 4.1** Baseline characteristics of 9 memory impaired and 24 memory unimpaired in-hospital cardiac arrest survivors.

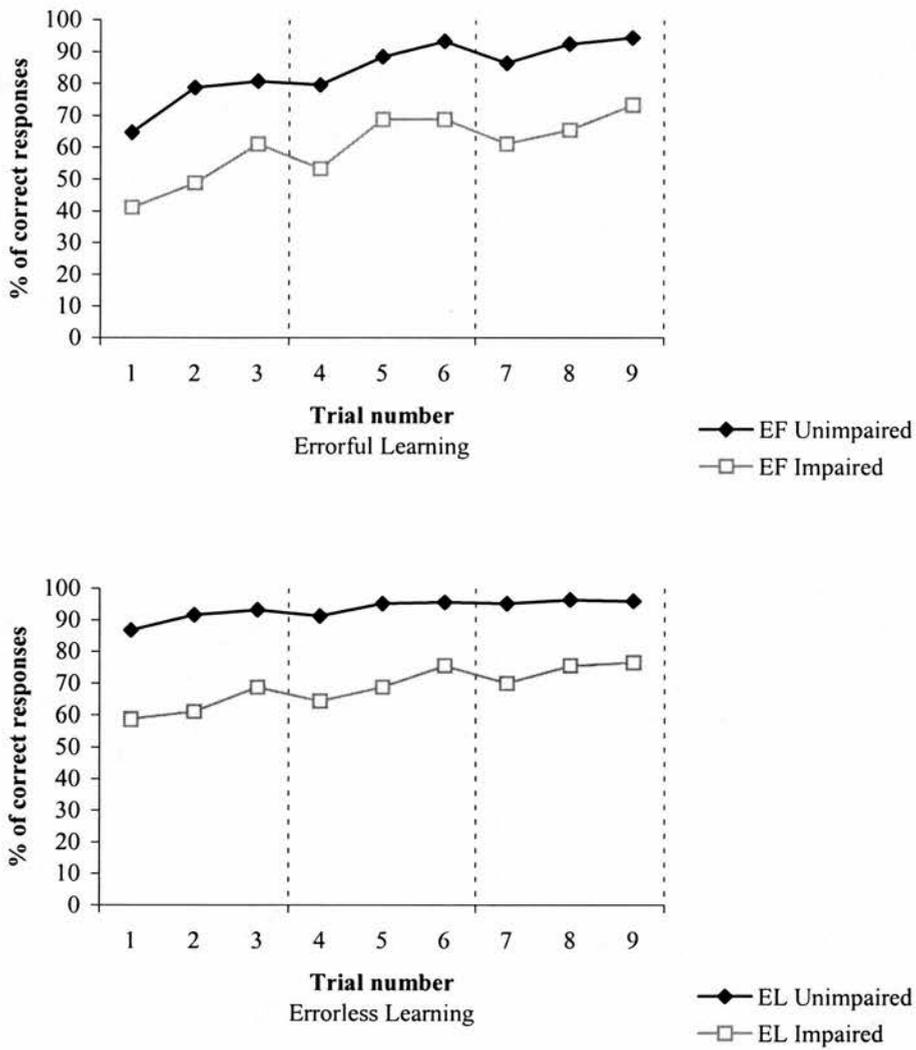
	<i>Impaired</i>	<i>Unimpaired</i>	<i>Test statistic</i>	<i>p value</i>
<i>Age</i>	61.7 (12.4)	60.2 (9.8)	t = -0.35	p > 0.05
<i>Sex (male)</i>	82%	88%	$\chi^2 = 2.07$	p > 0.05
<i>NART (errors)</i>	37.0 (8.4)	21.0 (9.8)	t = -4.33	p < 0.001
<i>Anxiety</i>	9.3 (5.8)	6.8 (4.6)	t = -1.34	p > 0.05
<i>Depression</i>	7.8 (6.7)	4.4 (4.1)	t = -1.84	p > 0.05

#### 4.4.3 Errorless v. errorful learning analysis

Figure 4.1 shows the results of the memory testing following errorless and errorful learning. The results of the 3-way ANCOVA, controlling for NART scores, show that there was a clear effect of impairment (group) ( $F = 4.15$ ;  $df = 1,31$ ;  $p < 0.05$ ), trial ( $F = 2.08$ ;  $df = 8,31$ ;  $p < 0.05$ ), and learning method ( $F = 7.62$ ;  $df = 1,31$ ;  $p < 0.01$ ).

Therefore, in both learning conditions the memory impaired group performed more poorly than did the unimpaired group, both groups showed improvement over time, and performances following errorless learning were better than following errorful learning for both groups. Thus the first hypothesis that memory-impaired survivors of cardiac arrest would perform better under errorless learning conditions than under errorful learning conditions was supported. However, none of the interactions reached significance. There was no interaction between learning method and impairment ( $F = 3.05$ ;  $df = 1,31$ ;  $p > 0.05$ ), learning method and trial ( $F = 1.08$ ;  $df = 8,31$ ;  $p > 0.05$ ), and between learning method, trial and impairment ( $F = 1.03$ ;  $df = 8,31$ ;  $p > 0.05$ ).

Therefore, the evidence did not support the second hypothesis that memory-unimpaired survivors would perform equivalently under both errorless and errorful conditions. The unimpaired group also displayed improved memory performance following errorless learning.



**Fig 4. 1** Recall performances for the two groups following errorful and errorless learning techniques.

Finally, the insignificant interaction between learning method, trial and impairment does not support a differential effect of errorless learning for memory-impaired and unimpaired survivors of cardiac arrest, and the third hypothesis was therefore unsupported.

It appeared as though a number of patients were benefiting from the errorless learning procedure. In order to test this observation, an 'improvement' score for each participant was calculated by subtracting the number of errors made on errorless learning trial 9 from the number of errors made on the first errorless learning trial. This improvement score was significantly negatively correlated with RBMT profile scores ( $r = -0.41$ ;  $p < 0.02$ ). There was no significant correlation between improvement on errorful trials calculated in the same way ( $r = -0.19$ ;  $p > 0.05$ ).

#### ***4.4.4 Types of errors analysis***

Examining the data revealed that our participants generated guesses on the first errorful learning trial, but tended not to do so on the two subsequent learning trials. Mean number of guesses (i.e. errors) generated on the first errorful learning trial was 28, compared with eight and six respectively on the 2<sup>nd</sup> and 3<sup>rd</sup> learning trials. Statistical analysis of this data revealed an important relationship between the number of errors made on errorful learning trials two and three, and performance on later memory recall. Significant negative correlations were found between mean number of errors generated during errorful training and mean number of correctly recalled words in subsequent memory testing (learning trial 2:  $r = -0.49$ ;  $p < .01$ ; learning trial 3:  $r = -0.68$ ;  $p < .0001$ ). Thus, participants who continued making errors throughout the errorful learning trials recalled fewer correct words during memory testing. To explore this

finding further, types of response made on learning trials two and three were recorded . There were three possible responses: 1) a correct response (no error made), 2) an incorrect response (i.e. generating at least one error), and 3) no response (i.e. silent for 25 seconds and experimenter provides correct word, thus no error made).

On learning trial two, only 14 of 28 (50%) participants produced errors on five or more of the target words. In trial three only 7 of 28 participants (25%) produced incorrect responses on five or more target words. If an errorful condition is considered to have been met when a participant generates errors on at least 50% of the items to be remembered, then these results indicate that a true errorful condition was not created.

#### **4.5 Discussion**

Memory performances were significantly better following errorless than errorful learning, for both memory-impaired and memory-unimpaired survivors of cardiac arrest. Thus the first, but not the second experimental hypothesis was supported. While it was hypothesised that memory-impaired subjects would benefit from an errorless learning technique, it was expected that unimpaired participants' performances would be equivalent following both learning methods. The pattern of results is therefore consistent with those of numerous previous studies that reported an advantage of errorless learning with various memory-impaired groups. However, the results also differ from those of previous studies insofar as previous studies have not generally reported an advantage of errorless over errorful learning with unimpaired control groups. The results of the study provide no evidence to support the third hypothesis: there was no differential effect of errorless learning in the two groups of patients. In

other words, memory-impaired cardiac arrest patients learned better under errorless than errorful conditions, but not significantly more so than memory-unimpaired cardiac arrest patients did. This was a surprising finding and is also contrary to the findings of other studies that have reported a clear advantage of errorless learning with various memory-impaired populations, that is not apparent in individuals with intact memory ability (e.g. Baddeley & Wilson, 1994; Wilson et al, 1994; O'Carroll et al, 1999).

It is unfortunate that this attempt to utilise a previously beneficial and widely used memory rehabilitation technique was unsuccessful with this population of memory-impaired in-hospital cardiac arrest survivors. There are a number of potential explanations for the findings, which are now discussed in turn.

#### ***4.5.1 Degree of impairment***

The degree of memory impairment sustained by these cardiac arrest patients was less severe than that found in populations with whom the method has previously been successful, e.g. patients with the classic amnesic syndrome (e.g. Baddeley et al, 1994; Wilson et al, 1994). This milder degree of impairment may have resulted in the dilution of the method's benefits. Grubb et al (1996) originally reported a degree of memory impairment in out-of-hospital cardiac arrest survivors (i.e. mean scores on the RBMT) that was comparable to degrees of impairment found in other brain-injured populations. In the first experimental study of this thesis, reported in Chapter 3, there was no evidence of a statistically significant difference between memory performances of out-of-hospital and in-hospital cardiac arrest survivors. However, RBMT total scores for the IHCA group were slightly higher than RBMT total scores for the OHCA group. It

is possible that the higher RBMT total scores of the IHCA patients in this study, which reflect better memory ability, were sufficient to eliminate the usual advantage of the technique with memory impaired individuals. Furthermore, in previous studies of errorless learning techniques that have also assessed participants with the RBMT, memory-impaired participants usually received RBMT screening scores of 3 or less (i.e. moderately or severely impaired;  $< 3 =$  severe impairment). None of the participants in the present study was this impaired: the mean RBMT screening score for our memory-impaired patients was 5.1 (2.2) which corresponds to memory function profile in the moderately impaired range (moderate impairment: 3 – 6).

There is also the possibility that the results were affected by the relative impairment of the impaired and unimpaired groups. The mean RBMT screening score of the unimpaired controls in the present study was 8.9 (1.9). Scores in the range from 7 – 9 indicate poor memory function. This was in comparison with the memory-impaired groups' mean screening score of 5.1. Normal memory is indicated by an RBMT screening score of 10 – 12. Previous studies have generally compared severely impaired individuals with control groups who score in the normal range. It is therefore possible that the relative difference in memory function between our groups was insufficiently large to lead to a statistically significant difference in performance between the groups. If the study was repeated using a healthy control group with normal memory function the usual advantage of errorless learning for memory-impaired individuals might become apparent.

#### 4.5.2 *Creating errors*

The relative impairment of this population in comparison with other memory-impaired populations who have shown markedly improved learning following errorless learning raises another important consideration. Other researchers have previously acknowledged the difficulty in creating a true errorful condition in unimpaired control groups. In creating a task on which it is possible for memory-impaired individuals to show learning, learning conditions which are very easy for controls are necessarily created. Therefore the all important error generation of the errorful condition may not occur to a sufficient extent. In other words, after the first errorful trial unimpaired participants may already have learned the material and hence, generate no further errors. In a number of studies where the question at issue has been the mechanisms behind the success of errorless learning, and which have therefore not necessitated inclusion of an unimpaired control group, researchers have not tested unimpaired controls because of this difficulty (e.g. Squires et al, 1997; Hunkin & Parkin, 1995).

It appeared during the present study that in addition to this problem (many unimpaired participants performing at ceiling levels), it was difficult to encourage the unimpaired, but also the impaired group, to generate guesses (i.e. make errors) on errorful learning trials when they *did not know the correct response*. Participants usually generated numerous errors on learning trial one (mean errors = 28) but failed to do so on subsequent learning trials (trial two = 8; trial three = 6). Failure to generate errors was found to be negatively correlated with later memory-performance, thus participants who generated more errors during the learning trials remembered fewer correct words in the recall phase of the errorful condition. Examination of the types of responses made by

participants during errorful training revealed that 50% of participants were producing errors on 5 or more of the target words during errorful learning trial 2, but just 25% of participants produced errors on 5 or more words in errorful learning trial 3. Therefore, in learning trials two and three, 50% and 75% of the sample respectively, had already memorised half of the word list, or refused to produce guesses, or some combination of these responses. Thus it seems reasonable to state that some participants effectively received two errorless conditions rather than one errorless and one errorful condition, and the results of the study may be due to this rather than the ineffectiveness of errorless learning with these patients.

#### ***4.5.3 Intensity of training***

There is another notable difference between this study and a number of the studies on errorless learning reviewed earlier in the chapter. In this study individuals were tested on a word-stem completion task using an almost identical methodological procedure to that used by Baddeley & Wilson (1994) and others (e.g. O'Carroll et al, 1999).

However, other studies have incorporated numerous errorless learning methods (e.g. vanishing cues, forwards prompting) as well as mnemonic techniques into individuals' memory training (Clare et al, 1998; Clare et al, 2000). In one study memory-impaired individuals were trained on face-name associations over five separate training sessions (Komatsu et al, 2000). Thus the intensity of training in these studies was far greater than in the original Baddeley & Wilson (1994) study, and also greater than in the present study. It is possible that the intensive training that individuals in these studies received contributed to the benefits that were attributed by the researchers to errorless learning alone. Furthermore, the Clare et al studies (1998; 2000) found an advantage of

errorless learning for memory-impaired Alzheimer's patients but did not test unimpaired controls. Therefore it is unknown whether the group by method interaction reported by Baddeley & Wilson (1994) and O'Carroll et al (1999) would have been evident between Alzheimer's patients and healthy controls. However, it was Clare et al's studies (1998; 2000) in which errorless learning was of benefit to Alzheimer's patients, that suggested to the present researcher that errorless learning might be beneficial with memory-impaired cardiac arrest patients due to the greater similarity (global cerebral atrophy) of Alzheimer's and cardiac arrest patients, than between the classic amnesic syndrome and cardiac arrest patients.

#### ***4.5.4 Conclusions and implications of the study***

This chapter reports the first study to evaluate errorless learning in patients who suffer lasting memory impairment following cardiac arrest. Despite the successful use of errorless learning with other memory-impaired populations, the technique did not appear to be particularly beneficial for this group of memory-impaired patients. This is particularly unfortunate as the number of patients surviving cardiac arrest is high and as many as one third of these are left with significant memory impairment. However, issues such as the relative degree of impairment between the memory-impaired and unimpaired control group, are likely to have contributed to the failure to find a differential effect of errorless learning. Thus replicating the study using a control group with normal memory might reveal a statistical advantage of errorless learning for the memory-impaired patients. It is also plausible that the relatively mild degree of impairment found in cardiac arrest patients (in comparison with memory-impaired patients in other errorless learning studies) makes errorless learning approaches less

suitable for them than for other more severely impaired individuals. Nonetheless, the overall results of this study in no way suggest that errorless learning approaches should be abandoned with memory-impaired cardiac arrest patients. Indeed, the correlation between improvement on the errorless learning procedure and RBMT profile scores, supports the experimenter's observation that there were a number of severely impaired individuals in this study who showed the usual marked improvement in recall performance following errorless training. Identification of such patients, who are highly likely to benefit from errorless learning training, is very accurate using a test like the RBMT. Patients thus identified as severely impaired could have memory-rehabilitation included as part of their ongoing cardiac rehabilitation.

While the results of the study were unexpected on one level, it became evident as testing continued that there was another unexpected and positive effect taking place. The study was carried out on average 8 months after participants' cardiac arrests. Memory difficulties are usually experienced immediately following arrest and then may improve somewhat over the initial few months post-arrest. Thereafter, deficits appear to remain relatively stable. Thus, by the time of assessment, individuals who were identified as having memory deficits were already aware that they were having memory difficulties. Anecdotally, many of these patients reported that the memory difficulties were a source of anxiety and embarrassment for them. Some patients even reported that they thought they were "going senile". Often patients did not connect the difficulties to their cardiac arrest but rather attributed it to increasing age. In general, patients reported that they were glad to have participated in the study, and to have confirmed what they had already suspected, namely that their memory had deteriorated. They commonly thought that now that the memory impairment due to cardiac arrest was

confirmed, they would be able to compensate by using appointment notebooks or similar techniques.

To conclude, the results of the study did not support the efficacy of errorless learning approaches in the rehabilitation of cardiac arrest survivors. Nonetheless, abandonment of the technique would be premature, as it did appear to be beneficial for the severely impaired patients. For other less impaired patients, external memory aids such as diaries may be of more benefit.

## **Chapter 5**

### **Study III: Psychological adjustment following in-hospital cardiac arrest and myocardial infarction: The prevalence of post-traumatic stress disorder**

#### ***5.1 Introduction***

Thus far the main topic of investigation has been neuropsychological outcome, and more specifically, memory impairment, following serious cardiac events, in particular cardiac arrest. However, cardiac arrest and myocardial infarction (MI) survivors also have to deal with the memory of surviving a life-threatening event. An investigation of the major consequences of CHD from a psychological perspective would not be complete without consideration of these psychosocial sequelae. Therefore, the following study took as its focus some of the serious psychosocial consequences facing survivors after major cardiac events. The body of literature on psychosocial adjustment following cardiac arrest and MI is extensive and growing. The introduction to this chapter reviews a cross-section of this literature, in order to equip the reader with the main findings of the larger body of research. This section also introduces the reader to some general facts about post-traumatic stress disorder (PTSD) as well as reviewing some of the evidence suggesting that PTSD is a potential consequence of medical events. In particular, the evidence that PTSD is a problem for some patients following cardiac arrest and MI is assessed.

## 5.2 *Psychological consequences of cardiac arrest and MI*

Short-term outcome of cardiac arrest and MI is usually measured by physical parameters, notably by mortality. Patients who survive a “heart attack” have already had a good short-term outcome: in Chapter 2 it was noted that the vast majority of patients experiencing a cardiac arrest will not survive the attack (see section 2.2.4). However, for the surviving patients it is long-term outcome that is of more significance. Traditional measures of long-term outcome such as mortality and continuing organic morbidity (e.g. angina) are now seen as insufficient. It is now widely regarded that long-term outcome is best gauged in terms of the extent to which survivors adjust to the physical, emotional, and social implications of having had a “heart attack”. It has therefore become increasingly common in recent years to speak of “psychosocial outcome” or “quality of life” following serious cardiac events. The most commonly used psychosocial indicators of recovery are return to work, social activities, domestic harmony, and individual emotional state (Philip, 1988). This chapter is concerned with the latter of these four, although some reference will be made to other aspects of recovery. Numerous studies have suggested that high levels of psychological distress, in particular anxiety and panic symptoms, are common in the early stages of recovery from MI and cardiac arrest. However, studies on long-term adjustment following serious cardiac events are relatively rare and have provided conflicting evidence about the degree and severity of emotional disability. The following overview of the literature on psychosocial adjustment following cardiac arrest and MI assesses the evidence that anxiety and depression are serious lasting consequences of these events for numerous survivors.

### *5.2.1 Psychological consequences of cardiac arrest*

More than thirty years ago Dobson et al (1971) conducted a study of patient attitudes and adjustment six months following in- and out-of-hospital cardiac arrest. It is interesting to note that usual medical practice at the time was to inform the relatives but not the patients about any episodes of cardiac arrest they had suffered. In general it was assumed that most patients were unaware of the true nature of cardiac resuscitation. In this study, all patients were asked direct questions about their return to work, changes in physical and social activity since their illness, and mood and affective symptoms. If it became apparent that the patient was aware of having had a cardiac arrest, they were asked direct questions about their recollection of it. The predominant feelings expressed by patients towards having had a cardiac arrest were disbelief, insecurity, bewilderment, painlessness and closeness to death. Most patients experienced an initial increase in anxiety in the first few weeks after returning home. In patients who later made only a moderate or unsatisfactory adjustment this anxiety tended to be greater, and also tended to be associated with feelings of panic. Twenty percent of patients were deemed to be suffering from depression and 60% from anxiety. Overall, 25% of patients were not deemed to have achieved successful rehabilitation. They showed pronounced disturbance in mood, insomnia, irritability, loss of self-esteem and reduced energy. Their social and physical activities were curtailed and return to work was considerably delayed.

Some studies have reported a remission in depressive symptoms in the months following discharge from hospital. For example, Bedell, Delbanco, Cook & Epstein (1983) evaluated patients 3 days prior to their discharge from hospital following in-

hospital cardiac arrest. A follow-up assessment took place in their homes 6-months post-discharge. Depression was assessed both times using a self-report scale: the Center for Epidemiologic Studies' Depression Scale (CESD; Weissman, 1977). Patients are reported as being "severely depressed" at the time of discharge. Patients' mean depression scores were comparable to mean scores for acutely and chronically depressed populations. Six months later their depression scores had fallen significantly and were reported as being within the range of scores expected in a normal population. However, no information about the proportion of patients scoring in the severely depressed range at either time point is reported and the researchers' assertion of "nearly uniform alleviation" of depressive symptoms (p. 309) may have been over-optimistic. An interesting note is made with regard to ten patients who became housebound following their arrest and four patients who were housebound beforehand and remained so afterwards. Half of these patients were reportedly incapacitated by fear "to a degree well beyond the limitations imposed by organic disease" (p.574). This profile seems inconsistent with the claim for "nearly uniform alleviation" of depression.

Roine et al (1993) assessed sixty-eight survivors of sudden cardiac arrest for depression three and twelve months after their arrests. Patients completed the CESD at both assessments. Twenty-four (35%) patients had symptoms of depression at three months and 17 (31%) had symptoms at twelve months. While CESD scores improved slightly from three to twelve month follow-up, the researchers do not report that there was any statistically significant reduction in either mean depression scores or the number of patients with depressive symptoms.

Another longitudinal study of fifteen cardiac arrest survivors' psychological reactions to their arrest, carried out assessments at discharge, as well as at 1, 3, 6 and 12 months post-discharge (Dougherty, 1994). Psychological reactions were assessed using the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1981). Cardiac arrest survivors reported the highest levels of anxiety at hospital discharge, and anxiety levels gradually decreased throughout the year. However, the difference between anxiety level at discharge and one-year post-arrest was non-significant. Furthermore, the researchers do not report whether patients' anxiety levels were significantly higher than would be expected in the normal population. Survivors also reported the highest levels of depression at hospital discharge. Depression scores fell from a high of 14.8 at discharge to 10.2 at one year but this decrease was not significant. However, in comparison with normative values of 14.0 for college students and 27.8 in individuals with personality disorders, this sample of cardiac arrest survivors were not deemed as clinically depressed. This finding is not consistent with the majority of research in this area. While the evidence for the prevalence of depression more than one-year post-arrest is conflicting, researchers are generally in agreement that immediately following cardiac arrest significant numbers of patients suffer from clinically significant levels of depression.

Hsu, Madsen & Callahan (1996) assessed thirty-five cardiac arrest survivors for quality-of-life and functional status 12 – 24 months after hospital discharge. Participants completed a quality of life measure: the Beth Israel/UCLA Functional Status Questionnaire (FSQ; Jette & Deniston, 1978). A “warning zone” for each of six FSQ categories, representing a threshold below which clinically significant impairment is present, was devised by the developers. The patients in the study are reported to have

performed well on the FSQ overall. Fifty-four percent of patients had no scores in warning zones, while the remaining 46% had an average of two warning zones.

Participants were also asked a single question about their perception of their current quality-of-life. Thirty-four percent of patients rated their quality-of-life as worse than before their cardiac arrest, 38% thought it was the same, and 28% thought it was better. Hsu et al (1996) report that these results seem positive. However, 31% of patients still scored in the warning zone on the mental health category up to two years after cardiac arrest.

Some studies that have primarily focused on neuropsychological recovery following cardiac arrest, have also assessed psychological and psychosocial consequences. For example, Sauvé et al (1996) administered the POMS to their cardiac arrest patients at four time points over the first six months of recovery. Mean scores for both male and female subjects were substantially lower than POMS normative data for patients with personality disorders. However, male cardiac arrest survivors reported less distress than male college students did, and there was no difference between female cardiac arrest survivors' and female college students' levels of reported distress. There was evidence of a gender difference in reports of distress: female survivors reported higher levels of tension and depression than male survivors. The results of the study revealed significant decreases in tension and depression over time. There were no associations found between the psychological variables and any cardiac arrest variables at the first two assessments. A small association was found between time to awakening and depression at the third assessment (longer awakening times were associated with greater depression). A similarly small relationship was found between lower ejection fraction and depression at the final assessment. In general then, this study found low levels of

distress in survivors of cardiac arrest. Interpreting their findings, Sauvé et al (1996) cite a study of patients with heart disease, in which depression rates on self-report measures were compared with rates obtained by clinical interviews (Carney et al, 1987). The finding of that study suggested that patients with CAD had a tendency to underreport depression.

*Summary: Psychological consequences of cardiac arrest*

To summarise briefly, the findings of studies on psychological adjustment following cardiac arrest have been inconclusive. On the one hand, researchers have reported diminishing levels of anxiety and depression in the first six months following cardiac arrest to the extent that cardiac arrest survivors are no more anxious or depressed than the normal population after the initial stages of recovery. On the other hand, other researchers have found evidence of persisting high levels of psychological distress up to two years following hospital discharge.

**5.2.2 Psychological consequences of MI**

A very early study of emotional state in 203 men who survived either an MI or myocardial ischemia, was conducted at the same site as the present research: the Royal Infirmary of Edinburgh (Cay, Vetter, Philip, & Dugard, 1972). Psychological information was collected during the men's hospital stay and at 4 and 12 months post-discharge from hospital. Follow-up data was reported in a later paper (Philip, 1988). Detailed interviews were conducted by a psychiatrist and a formulation of psychiatric disorder was made based on the psychiatrist's evaluation of the patient's present mental state and history. In addition, a wide range of neurotic psychopathology was measured

using the Personal Disturbance Scale of the Symptom Sign Inventory (SSI; Foulds, 1968). On the basis of the psychiatrist's assessments while patients were still in hospital, 65% showed evidence of emotional disturbance, although no attempt was made to estimate the severity of their symptoms. Scores on the SSI revealed that 40% of patients fell into the 'borderline' disturbance category and a further 37% had scores in the psychiatric category. Thus the proportions of men who were deemed to have an emotional disturbance while in hospital were comparable according to both self-report and psychiatric assessment. The researchers also recorded the severity of all heart attacks according to the Peel (PPI; Peel, 1962) and Norris (Crider, Shapiro, & Turskey, 1966) indices. This is one of the earliest studies to report no evidence of a link between the physical severity of the MI and subsequent emotional disturbance in survivors. Instead, emotional upset appeared to be linked to certain environmental difficulties prior to the attack (e.g. difficulties at work, financial hardship). The proportion of men deemed to have a psychiatric disorder did not change significantly during the course of the follow-up period. The paper concludes that in the absence of specific rehabilitation to target emotional upset, survivors of acute coronary episodes continue to experience high levels of anxiety and depression following discharge.

Trelawny-Ross & Russell (1987) also reported no significant change in levels of psychological symptoms over a six-month follow-up period of MI patients. The percentages of men experiencing moderate to severe levels of anxiety at 10 days, 2 and 6 months post-discharge were 39%, 52%, and 33% respectively. For depression, the figures were 20%, 26%, and 26% respectively. Somatic symptoms (pain, breathlessness, and fatigue) emerged as the single best predictor of outcome in a regression analysis. Depression explained just 1.3% of the variance in leisure activity

outcome and less than 1% of the other three outcome variables. Anxiety does not appear in the regression analysis, which suggests that it may not have been a useful predictor of outcome. However, the results of this regression analysis should be treated with caution as there were just 31 interviewees and 8 predictor variables. Having somatic symptoms was significantly correlated with depression, and negatively correlated with perception of good support from the family general practitioner. Cardiac damage assessed at the time of discharge was not significantly correlated with any aspect of outcome. The researchers do not report whether cardiac damage was related to depression.

A cross-sectional study conducted in Taiwan assessed the prevalence of anxiety, depression and coping style in survivors of MI (Chiou, Potempa, & Buschmann, 1997). Participants (N = 40) completed a Chinese translation of the HADS during their initial hospital convalescence. The majority of participants were in the normal range on the HADS anxiety and depression subscales (65% and 70% respectively). However, 25% of patients had clinically significant levels of anxiety and 15% had clinically significant levels of depression. Chiou et al (1997) also took measures of both actual and perceived severity of MI. Actual MI severity was determined by the PPI and perceived severity was determined using a self-rating scale developed by Webster (1983) and translated into Chinese. A positive correlation between the actual severity of MI and depression was found. This finding is contrary to the findings of previous studies that have reported no relationship between objective measures of MI severity and subsequent negative affect (e.g. Cay et al, 1972). There was a moderate positive relationship between actual and perceived severity of MI. Chiou et al (1997) also report a positive relationship between perceived severity of MI and subsequent anxiety.

Schleifer and his colleagues (Schleifer et al, 1989) also documented the course of depression in MI patients in the first 3 – 4 months following their MI using both a structured clinical interview (the Schedule for Affective Disorders and Schizophrenia; Endicott & Spitzer, 1978) and a self-report measure (the Hamilton Depression Rating Scale: HDRS; Hamilton, 1967). Based on the clinical interviews at follow-up, 45% of the sample met diagnostic criteria for minor or major depressive disorder, with 18% meeting criteria for probable or definite major depressive disorder. The data also revealed a gender difference in the prevalence of depression following MI, with women having a significantly increased risk of meeting diagnostic criteria for major depressive disorder. The results of the study also indicated that the degree of cardiac impairment was not significantly associated with depression 8 – 10 days after MI. However, Schleifer et al (1989) do not report whether the degree of cardiac impairment was associated with depression at follow-up. Finally, the authors report that patients who were diagnosed with major depression post-MI, and who were also medically symptomatic at follow-up, were less likely to return to work.

Another study collected psychological data from 560 male survivors of acute MI in the third week following infarction (Ladwig, Kieser, König, Breithardt, & Borggrefe, 1991). The aim of the study was to determine the prognostic significance of maladaptive emotional states post-MI for different forms of negative cardiac events. Psychological assessments were conducted using a questionnaire containing 37 items taken from standardised instruments to measure depressive disorders. The psychological inventory was divided into five subscales on the basis of a factor analysis and a combination factor of extreme depressive behaviour was created by combining three of the scales. Fourteen and half percent of patients exhibited evidence of extreme

depression (defined as scores in excess of either 75% (two scales) or 90% (one scale) on at least two of the scales). There was no association between the degree of depression and any of the cardiovascular function variables examined (e.g. more complicated arrhythmias, presence of angina pectoris). At the end of the follow-up period there were 17 arrhythmic events and 12 cardiac deaths. The frequency of arrhythmic events and cardiac deaths was significantly higher in the sub-group of patients with major depressive disorders, and the effect was stronger for cardiac deaths.

Lloyd & Cawley (1983) also reported that emotional distress tends to remit in the year following MI. In this study the researchers differentiated between MI patients who had psychiatric diagnoses pre-and post-MI. Thirty-five percent of MI survivors received diagnoses of psychiatric disturbance one-week post-MI. However, 16% of the sample had a history of psychiatric disturbance prior to hospitalisation (Group 1). Thus 19% of patients developed an affective disturbance (depressed mood with or without anxiety) as a result of MI (Group 2). Twelve months later the majority patients in Group 1 were still psychiatrically ill. Group 2 patients had significantly improved by 4-month follow-up: only 23.5% of the groups now received diagnoses of psychiatric illness. However, there was no further significant improvement in Group 2 over the next 8 months. Patients who had no symptoms at one-week assessment were also followed up (Group 3). There was a significant increase in the number of patients in this group with clinically significant symptoms at four month follow-up. While there was a reduction in the scores of Group 3 between 4- and 12-month follow-up it was not significant. On the whole, there was an improvement in depressive and/or anxiety symptoms over the study period but most of this occurred within the first four months. This improvement

notwithstanding, 12% of patients were still suffering from clinically significant symptoms of depression and/or anxiety 12-months post-MI.

A recent large-scale, longitudinal study conducted in England, assessed 344 male and female (27%) MI survivors for psychological adjustment prior to discharge from hospital, with follow-up assessments at 3 and 12 months post-discharge (Mayou et al, 2000). The study is a rare example of a study on psychological adjustment to MI that included significant numbers of women in the sample. The researchers used the HADS to assess anxiety and depression. During their initial hospital admission 18.5% of patients scored as “probably clinically significant” cases of anxiety, and a further 19.1% were borderline cases. In addition, 7.6% of patients were probable cases of depression, and another 9.9% were borderline cases of depression. There were no significant differences between men and women on either depression or anxiety scores. Taking anxiety and depression scores combined 14.8% of patients were probable cases of emotional disorder. Distress in hospital was associated with a longer stay in hospital, and a prior history of psychological and social difficulties. For the majority of non-depressed patients, there were no changes in their anxiety and depression scores in the course of the one-year follow-up period and their scores remained comparable with those reported for the general population. On the other hand, Mayou et al (2000) assert that distress tended to persist in patients who were initially distressed. However, this assertion requires some comment. The proportion of patients experiencing distress dropped from 14% at baseline, to 10% at one year but this difference was not significant. However, over two thirds of patients who were initially distressed experienced improvement in their affective status. Thus the patients who were distressed at 12-months were a different group of patients than those who were

distressed at baseline. Emotional distress in hospital was strongly predictive of poor social outcome, as well as psychological outcome at 3- and 12-months. Patients who were distressed were more likely to be constrained in their daily routine, to be constrained in leisure and social activities, to be doing less exercise, and to have made less effort to change their diet. Furthermore, distressed patients who were smokers before their MI were much less likely than non-distressed smokers to have stopped smoking at 1-year follow-up. These results therefore provide further evidence that patients who experience anxiety and depression in the early stages of recovery post-MI have an increased risk of poor long-term outcome.

*Summary: Psychological consequences of MI*

In summary then, the vast majority of studies have found that numerous patients experience emotional distress in the immediate aftermath of MI. Anxiety is more widespread than depression and is usually reported by around 20% - 30% of patients. Depression tends to occur in around 10% - 15% of MI patients immediately following infarction. The development of depression following serious cardiac events does not appear to be related to the severity of cardiac disease. It is however, associated with psychosocial factors such as family support and personality characteristics such as neuroticism. Previous psychiatric illness is a particular risk factor for the development of depression post-MI and cardiac arrest. Whether or not emotional distress remits over time has been widely investigated. The majority of studies have followed patients over periods of around one year. Some studies have assessed emotional status in survivors as many as five times in the course of the first year post-MI although two assessment points are more common. The findings of these studies have been inconclusive. Some researchers have reported no remit in distress and others have reported diminishing

distress on the basis of very similar findings. On the whole the evidence suggests that levels of distress remit considerably in the initial months of recovery, but not much thereafter. However, it appears as though the proportion of distressed patients may remain relatively stable over the course of long-term recovery, but the actual patients who are distressed may change.

Studies assessing anxiety and depression over periods longer than 12 months are rare. However, a number of studies have followed patients for up to five years and found an association between poor psychological adjustment post-infarction and subsequent mortality. Furthermore, initial research suggests that psychological interventions included in cardiac rehabilitation courses are successful in reducing emotional distress and in turn, lead to a reduction in later mortality. A selection of these studies is reviewed in the following section.

### ***5.2.3 Emotional distress and mortality post-MI***

As this overview of the research has shown, the link between MI and subsequent emotional distress has been well established. Furthermore, the negative effects of this distress on social aspects of outcome have also been well documented. However, what is the evidence that emotional distress has an even more serious impact on the lives of MI survivors than curtailing psychosocial recovery and reducing quality-of-life? One study already reviewed found evidence of a link between post-MI depression and negative cardiac events and mortality (Ladwig et al, 1991), and over the course of the past decade further studies have been published that provide evidence of a link between emotional distress following MI and mortality. For example, in 1993 Frasure-Smith

and her colleagues published the results of a study that investigated whether diagnosis of major depression in patients following MI would have an impact on cardiac mortality in the first 6 months post-discharge. Two hundred and twenty two MI patients were evaluated prospectively using the module for major depressive episode of the National Institute of Mental Health Diagnostic Interview Schedule – Version III-R (DIS; Robins, Helzer, Croughan, & Ratcliff, 1981). Sixteen percent of patients met modified<sup>3</sup> DSM-III-R criteria for major depressive disorder at the time of their hospitalisation. Six months later 12 patients had died, including 17% of depressed and 3% of nondepressed patients. All deaths were due to cardiac causes and the difference in mortality rates between the depressed and nondepressed groups was highly significant. There were no significant differences between the depressed and non-depressed groups in left ventricular ejection fraction, Killip class<sup>4</sup>, whether they had a previous MI, or whether they had been smokers at the time of MI. Women however, were marginally more likely to be depressed than men. In a step-wise regression analysis Killip class, previous MI and depression all had independent prognostic impact on mortality.

Another more recent study evaluated 271 MI survivors for mood disorder syndrome in the days following their MI and again four months later (Bush et al, 2001). Women were well represented in the sample (41.8%). Patients were assessed for symptoms using both a structured clinical interview (Spitzer, Williams, Gibbon, & First, 1992) and the Beck Depression Inventory (BDI; Beck & Beamesderfer, 1974). Four months post-

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<sup>3</sup> Because a diagnosis of major depression requires that symptoms be present almost every day for two weeks, and DIS assessments took place an average of one week post-infarct, the DIS was modified slightly and patients were simply asked whether each symptom had occurred every day since admission.

<sup>4</sup> Killip class is a widely used 4-level measure of infarction severity named after the doctor that devised it.

MI, major depression was diagnosed in 9.5% and dysthymia in 9.9% of patients. None had bipolar disorder. BDI scores indicative of mild depression were present in 19.9% of patients. Mood disorder and/or high BDI scores were present in 27.3%. The large numbers of women included in the study may have contributed to the high proportion of patients experiencing mood disorders. Women have previously been shown to be at greater risk of poor psychological adjustment following MI. Despite having a large proportion of female participants, the researchers did not report any analysis of the contribution of gender to emotional distress. More patients who had a mood disorder had died at the four month follow-up than those who did not (10.9% v. 5.4%) but this difference was not significant. However, significantly more patients with high BDI scores than with low BDI scores had died: 13.2% v. 5.1%. Patients with a current mood disorder and/or high BDI scores had a 4-month mortality rate of 13.6% compared with 3.8% for those with neither mood disorder nor high BDI scores. This difference was highly significant. Interestingly, past history of depression was not associated with increased mortality risk. The most important implication of this study is that the results provide evidence of a link between even very mild symptoms of depression and mortality risk after MI.

#### ***5.2.4 Cardiac rehabilitation and emotional distress***

Cardiac rehabilitation aims at promoting both optimal physical and psychological functioning, with the ultimate goal of improving prognosis in terms of mortality and quality of life. Whether or not rehabilitation programmes are successful in either or both of these aims is unclear. Some reviews have suggested that rehabilitation incorporating exercise following MI reduces mortality by as much as 20% to 25%

(O'Connor et al, 1989; Oldridge, Guyatt, Fisher, & Rimm, 1988). On the other hand, the results of a more recent large scale study that followed 634 MI survivors over 19 years (or until death), who had been assigned to cardiac rehabilitation either with or without exercise, did not confirm these findings (Dorn, Naughton, Imamura, & Trevisan, 1999). But what about rehabilitation programs that address the emotional distress which has been shown to have a powerful effect on subsequent mortality? Denollet & Brutsaert (2001) carried out a study that aimed to measure whether the reduction of emotional distress in patients with CHD would lead to a beneficial effect of rehabilitation on prognosis. The hypothesis was based on cognitive models of behaviour which propose that enhancing an individual's sense of control decreases negative affect, which in turn promotes maintenance of changes in lifestyle that may enhance prognosis (Denollet & Brutsaert, 2001). Immediately following their coronary event (MI or coronary artery bypass grafting - CABG) study participants received either standard care or a specially designed rehabilitation program. The duration of the rehabilitation program was 3 months and it included both group and individual interventions. In addition, 48% of patients received individual cognitive/behavioural therapy. The Global Mood Scale (GMS; Denollet, 1993) was used to assess the effectiveness of the intervention at reducing emotional distress. Patients filled in the GMS at two points: 3 – 6 weeks post-MI or CABG and 3 months later (which corresponded to the end of the rehabilitation program). Forty-three percent of patients who participated in the rehabilitation program reported an improvement in negative affect, and 15% reported deterioration. The follow-up interval varied between 9 and 10 years and the main endpoint of the study was death from all causes. The initial changes in negative affect were significantly associated with prognosis: survivors tended to report more improvement and less deterioration than non-survivors. The rate of death

also differed between the rehabilitation and control group: 4% versus 17% respectively. Thus, the researchers conclude that participation in the program was effective in reducing emotional distress, and furthermore that this reduction in emotional distress was responsible for the changes in affect that were predictive of enhanced prognosis.

### **5.2.5 *Post-traumatic stress disorder***

Post-traumatic stress disorder (PTSD) is an anxiety disorder that can develop after exposure to a terrifying event in which grave physical harm occurred or was threatened. It was first introduced in DSM-III (American Psychiatric Association, 1980) but similar reactions, such as “shell shock” and “combat trauma” have been known since the early 1900s. Traumatic events that can trigger PTSD are outside the range of normal human experience and include violent personal assaults such as rape or mugging, natural or human-caused disasters, accidents, or military combat. PTSD can be extremely disabling for the individuals affected, but also for their family members. In fact, family members of people who experience a trauma can also develop PTSD. For example, the parents of childhood survivors of cancer have been found to be at risk of developing the disorder (Kazak et al, 1998). Many people with PTSD repeatedly re-experience their ordeal in the form of flashbacks, memories, nightmares, or frightening thoughts. These symptoms can occur in particular when an individual is exposed to events or objects reminiscent of the trauma. Anniversaries of the event can also trigger symptoms. People with PTSD often experience emotional numbness and sleep disturbances, depression, anxiety, and irritability or outbursts of anger. Feelings of intense guilt are also common. Most people with PTSD consciously try to avoid any reminders or thoughts of the ordeal. PTSD is diagnosed when at least 6 symptoms have occurred for

more than 1 month and cause clinically significant distress or impairment (exact DSM-IV criteria for diagnosis of the disorder can be found in section 5.3.3). About 3.6% of US adults aged 18 to 54 (5.2 million people) have PTSD during the course of a given year (Narrow, Rae, & Regier, 2002). About 30% of the men and women who have spent time in war zones experience PTSD. It is estimated that one million war veterans developed PTSD after serving in Vietnam (Kulka, Schlenger, Fairbank, & al, 1988). PTSD can develop at any age, including in childhood. Symptoms typically begin within 3 months of a traumatic event, although occasionally they do not begin until years later. Once PTSD occurs, the severity and duration of the illness varies. Some people recover within 6 months, while others suffer much longer.

Research has demonstrated the effectiveness of cognitive-behavioural therapy, group therapy, and exposure therapy (in which the patient gradually and repeatedly relives the frightening experience under controlled conditions to help him or her work through the trauma) in treating PTSD (e.g. Lubin, 1998; Marks, 1998). Studies also have found that several types of medication, particularly the selective serotonin reuptake inhibitors (SSRIs) and other antidepressants, can help relieve the symptoms of PTSD (for a review see Davidson, 1992). Researchers are attempting to determine which treatments work best for which type of trauma. Some studies have shown that giving people an opportunity to talk about their experiences very soon after a catastrophic event may reduce some of the symptoms of PTSD. For example, a study of 12,000 schoolchildren who lived through a hurricane in Hawaii found that those who got counselling early on were better adjusted two years later than those who did not (Chemtob, Tomas, Law, & Cremniter, 1997). However, a recent Cochrane review of 11 studies concluded that debriefing was not effective in preventing the occurrence of PTSD and recommended

that compulsory debriefing of victims post-trauma should cease (Rose, Bisson, & Wessely, 2002). Depression, alcohol or other substance abuse, or other anxiety disorders frequently co-occur with PTSD (Breslau, Davis, Andreski, & Peterson, 1991) and the likelihood of successful treatment is increased when these other conditions are appropriately identified and treated also. Headaches, gastrointestinal complaints, immune system problems, dizziness, chest pain, or discomfort in other parts of the body are also common. It has been found that people who have suffered abuse as children or who have had other previous traumatic experiences are more likely to develop the disorder (Widom, 1999). Research is continuing to identify other factors that may lead to PTSD. For example, it used to be believed that people who tend to be emotionally numb after a trauma were showing a healthy response, but recently some researchers have found evidence supporting the idea that people who experience this emotional distancing may be more prone to PTSD (Feeny, Zoellner, Fitzgibbons, & Foa, 2000).

Studies in animals and humans have focused on pinpointing the specific brain areas and circuits involved in anxiety and fear, which are important for understanding anxiety disorders such as PTSD. Fear, an emotion that evolved to deal with danger, causes an automatic, rapid protective response in many systems of the body. The body's fear response is coordinated by the amygdala. Recent research suggests that different anxiety disorders may be associated with abnormal activation of the amygdala (Adamec & Shallow, 2000; De Bellis et al, 2000; Driessen et al, 2000). In brain imaging studies, researchers have found that the hippocampus, part of the brain critical to memory and emotion, may be smaller in cases of PTSD (Bonne, 2001). People with PTSD also tend to have abnormal levels of key hormones involved in response to stress. Some studies have shown that cortisol levels are lower than normal and epinephrine and

norepinephrine are higher than normal in people with PTSD (Yehuda, 1998).

Norepinephrine is a neurotransmitter released during stress, and one of its functions is to modulate encoding via the amygdala. This action of norepinephrine is thought to be one reason why people generally can remember emotionally arousing events better than other situations. Under the extreme stress of trauma, norepinephrine may be released leading to the formation of abnormally strong memories that are then experienced as flashbacks or intrusions. Since cortisol normally limits norepinephrine activation, low cortisol levels may represent a significant risk factor for developing PTSD. Finally, when people are in danger, they produce high levels of natural opiates, which can temporarily mask pain. Research has shown that people with PTSD continue to produce those higher levels even after the danger has passed (Yehuda, 1998) and this may lead to the blunted emotions associated with the condition. Ultimately, research which facilitates understanding of the systems involved in memories of emotionally charged events may lead to discovery of medications or psychosocial interventions that, if given early, could block the development of PTSD symptoms. For example, recent evidence suggests that beta-blockers may block the effects of norepinephrine and thus reduce the likelihood of PTSD developing (Pitman et al, 2002).

#### ***5.2.6 PTSD and medical illness***

Experiencing an event that is far outside the range of normal human experience constitutes one of the core criteria for development of PTSD. However, life-threatening illnesses were specifically excluded from the list of potentially traumatic events that might precipitate PTSD until the publication of the fourth edition of the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV; American Psychiatric Association,

1994). The year prior to the publication of DSM-IV, Shalev and his colleagues proposed that PTSD may be more common than generally recognised in medical patients (Shalev, Schreiber, Galai, & Melmed, 1993). In support of this assertion they pointed out that specific psychological symptoms relating to the cancer experience, such as re-experiencing, avoidance and heightened arousal, are also typical of PTSD and have been frequently reported by cancer survivors (e.g. Kornblith et al, 1992; Lesko et al, 1992; Morris, Greer, & White, 1977).

### Breast cancer

Of the medical illnesses that have been studied in relation to PTSD, cancer and particularly breast cancer, is one of the most often investigated. The majority of studies have taken place since the inclusion of life-threatening illnesses in Criterion A for PTSD in DSM-IV. To date there have been at least 13 published studies that investigated the incidence of PTSD in adult cancer patients, and of these 10 focused on breast cancer patients. Only one of these studies used a longitudinal design (Andrykowski, Cordova, McGrath, Sloan, & Kenady, 2000); the remainder used cross-sectional designs. Samples sizes ranged from a low of  $N = 31$  (Kazak et al, 1998; Naidich & Motta, 2000) to  $N = 160$  (Green et al, 1998). The majority of studies used either or both the PTSD module of the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1997) and the PTSD Checklist Civilian Version (PCL-C; Weathers, Litz, Herman, Huska, & Keane, 1993). There have in addition been some 21 studies that assessed the prevalence of intrusive and avoidance symptoms in cancer patients using the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979). The IES is a 15-item questionnaire that assesses intrusive and avoidance behaviours. It is not a direct measure of PTSD but has been widely used in

research on post-traumatic stress. However, the constraints of this thesis demand that this discussion is restricted to a brief presentation of the findings of those 13 studies that specifically assessed PTSD symptoms.

The incidence of cancer-related PTSD in studies that used the SCID ranged from 0% (Mundy et al, 2000) to 6% (Andrykowski, Cordova, Studts, & Miller, 1998).

Participants were assessed on average at least 6.5 months post-treatment. Higher rates were reported in studies using the PCL-C. There are two methods used to determine diagnosis of PTSD using the PCL-C: (a) the cut-off method that focuses on symptom intensity and is based on a cut-off score of at least 50 and (b) the symptom cluster method that uses the number of requisite PTSD symptoms that are present. In the eight studies which used the PCL-C, the incidence of PTSD ranged from 5% (Andrykowski & Cordova, 1998; Andrykowski et al, 1998; Cordova et al, 1995; Smith, Redd, DuHamel, Vickberg, & Ricketts, 1999) to 12% (Jacobsen et al, 1998) using the cut-off method, and from 6% (Andrykowski & Cordova, 1998; Andrykowski et al, 1998) to 19% (Jacobsen et al, 1998) using the symptom cluster method. The two studies that used the Clinician Administered PTSD Scale - Structured Interview (CAPS-I; Blake et al, 1995) reported a relatively higher incidence of PTSD ranging from 14% (Pitman et al, 2001) to 32% (Naidich & Motta, 2000). Apart from the study by Smith et al (1999) which reported subclinical PTSD in 60% of their sample, other studies have reported subclinical PTSD in 5-13% of their samples (Andrykowski et al, 1998; Andrykowski et al, 1998b). A number of studies have also reported "lifetime" cancer-related PTSD rates. Lifetime rates are calculated by retrospectively asking patients if they have experienced PTSD symptoms at any time since their cancer diagnosis. Mundy et al (2000) reported the highest incidence for lifetime cancer-related PTSD within their

sample (35%), despite finding no patient who met PTSD criteria at least 3 months following treatment completion. The incidence of lifetime cancer-related PTSD in the other five studies ranged from 3% (Green et al, 1998) to 22% (Alter & Pelcovitz, 1996).

### HIV

Post-traumatic stress disorder has also been observed in response to diagnosis with the HIV virus. In one study the researchers interviewed 61 HIV-positive homosexual/bisexual men an average of 47.8 months since diagnosis of HIV infection (Kelly et al, 1998). The PTSD module of the DIS was used to establish the presence of PTSD symptoms. Thirty percent fulfilled DSM-III-R diagnostic criteria for PTSD. However, this figure refers to the presence of all criteria for PTSD at any time following HIV diagnosis *i.e.* 30% met lifetime criteria for PTSD. The researchers report that some cases of PTSD were resolved but do not report how many participants met criteria for current PTSD. Interestingly, in 37% of cases the onset of PTSD symptoms was delayed for at least 6 months after diagnosis of HIV infection. Significantly more PTSD-cases reported previous trauma than did non-cases (26% *v.* 7.5%) which is consistent with previous evidence that experience of prior trauma constitutes a risk for the development of PTSD following a subsequent traumatic event (Widom, 1999). Also consistent with previous research, development of PTSD was significantly related to the presence of psychiatric morbidity prior to diagnosis of HIV-infection, most notably, major depression and anxiety disorder (21% *v.* 7%). Of the numerous disease factors measured none was significantly related to the development of PTSD. This finding is reminiscent of previous research that has found no relationship between the objective severity of cardiac illness and the development of symptoms of psychological distress following MI and cardiac arrest.

### Variceal haemorrhage

A key element of any event which can be included as a precipitating trauma for PTSD rather than just being an adverse event in a person's life, is the threat of death. Cancer and HIV certainly fulfil this key criterion. Nonetheless, by no means all or even a majority of individuals will develop PTSD in response to this type of death threat. However, in the case of chronic illnesses such as HIV or cancer, the threat of death is often not as immediate as it would be in traumatic situations such as road traffic accidents or physical assault. Certain acute medical conditions also bring with them the threat of immediate death. One such condition is variceal haemorrhage. This is a distressing medical condition in which about 30% of individuals who experience their first haemorrhage, vomit litres of blood prior to death via exsanguination. Such deaths are horrific experiences and anecdotally, many nursing and medical personnel have vivid recollections of their first such death. One recent study assessed the extent to which survivors of variceal haemorrhage suffered from symptoms of PTSD. The researchers hypothesised that due to the horrific and life-threatening nature of the condition, the prevalence rate for PTSD in this population would be high. Thirty individuals who had survived a variceal haemorrhage were assessed for PTSD an average of 21.1 months afterwards. Symptoms were assessed using a "gold standard" clinical interview: the Structured Clinical Interview for DSM-III-R (SCID; Spitzer et al, 1992). Intrusive and avoidance symptoms were also assessed with the IES. Somewhat surprisingly, the results of the study indicated that just one (3%) of the participants fulfilled criteria for a diagnosis of PTSD (O'Carroll et al, 1999). This prevalence rate is lower than those generally reported for cancer survivors and considerably lower than those reported for HIV-infected patients. Therefore, it appears as though what might

appear to be extremely traumatic to an onlooker may not be experienced or remembered as such by the victims.

### ***5.2.7 PTSD following MI***

Coronary heart disease (CHD) is an example of a chronic illness interspersed with acute episodes such as MI or cardiac arrest. Both cardiac arrest and MI are extremely life-threatening events and thus meet core criteria for diagnosis of PTSD. Furthermore, even if one survives a “heart attack” the chronic nature of CHD means that the threat of a further acute episode still exists. While cardiac arrest and MI clearly may not evoke symptoms of post-traumatic stress in all patients it seems plausible that such serious cardiac events might leave some individuals at risk of developing PTSD. While there appears to have been only one study that assessed the likelihood of developing the disorder post-cardiac arrest, there have been at least 12 studies that have investigated the issue of whether people are at risk of developing PTSD following MI. These studies are described below in chronological order and are summarised in *Table 5.1*.

**Table 5. 1** Summary of the main findings of previous studies of PTSD in MI and cardiac arrest survivors

Study	CAD endpoints	Sample	Selection procedure	Interval since event	Controls	Assessment of PTSD	Outcome
Kutz <i>et al</i> (1988)	MI	4 male case studies	None	2 weeks – 11 months	No	Non-defined clinical interview	All cases were diagnosed with PTSD
Neumann (1991)	MI	21 male veterans	Volunteers from medical centre	6 months	Yes	IES (self-report)	Higher levels of PTSD in MI group
Doerfler <i>et al</i> (1994)	MI & CABG	50 men	Selected from medical records	6-12 months	No	RI (self-report) & IES	4 (8%) cases of PTSD; 9 (18%) according to RI
Kutz <i>et al</i> (1994)	MI	88 men & 12 women	Consecutively admitted patients	6-18 months	No	PTSD Inventory (self-report)	9 (9%) cases of acute and 16 (16%) further cases of life-time PTSD
Van Driel <i>et al</i> (1995)	MI	14 men & 9 women	Consecutively admitted patients	22-26 months	No	SCID (interview)	No diagnoses of PTSD among 18 survivors
Lukach (1996)	MI	48 men & 22 women	Patients receiving post-MI treatment	1-15 months	No	IES & SCID	No diagnoses of PTSD
Mcphearson (1999)	MI	20 male veterans	Selected from medical records	3-12 months	Yes	PCL-M (self-report)	6 (30%) diagnosed with PTSD
Ladwig <i>et al</i> (1999)	Cardiac arrest	17 men & 4 women	Consecutively admitted patients	22-64 months	Yes	IES	8 (38%) cases of PTSD
Bennett <i>et al</i> (1999)	MI	30 men & 14 women	Random sample	6-12 months	No	PDS (self-report)	4 (9%) cases of PTSD
Bennett <i>et al</i> (2001)	MI	39 men & 7 women	Consecutively admitted patients	3 months	No	PDS & IES	3 (7.6%) cases of PTSD
Shemesh (2001)	MI	81 men & 21 women	MI patients requiring Captopril	6 months	No	IES	10 (9.8%) cases of PTSD
Bennett <i>et al</i> (2002)	MI	75 men and women	Consecutively admitted patients	3 months	No	PDS and IES	12 (16%) cases of PTSD
Pedersen (submitted)	MI	112 men & women	Consecutively admitted patients	4-6 weeks	Yes	PDS	25 (22.3%) diagnosed with PTSD

Kutz, Garb, & David (1988) describe four cases of severe PTSD in patients following acute MI, prior to the inclusion of life-threatening illness in the DSM-IV definition of PTSD. The first patient to attract the authors' attention to the possibility of PTSD following MI was a 40-year old male who was referred for psychiatric consultation by his family physician because of "a total change of personality with severe psychological distress" (p. 169) four months following an acute MI. With the exception of survivor's guilt, there was no major or associated DSM-III criterion for PTSD that the patient did not meet. The other three case studies describe a similar pattern of symptoms and all except one patient benefited from psychotherapeutic techniques. The authors also report that preliminary unpublished epidemiological data indicated that 15% of their post-MI patients suffer from symptoms of PTSD within the first year following the infarction.

A few years later but still prior to the publication of DSM-IV, Neumann (1991) assessed PTSD symptoms in a group of veterans who had experienced an MI and a control group of colonoscopy patients. All participants completed the IES and a checklist for PTSD developed from DSM-III (Spitzer, 1989). MI patients reported significantly more distress than the control group. Mean total IES scores for the MI group was 21.38 but Neumann (1991) does not report percentages of patients with likely diagnoses of PTSD. The developer of the IES (Horowitz, 1982) advised that scores in excess of 19 represent a high level of symptoms, corresponding to a high degree of clinical concern; thus the mean IES score of 21.38 indicates that this group of veterans was suffering from significant levels of PTSD symptoms. However, as combat experience is a significant risk factor for PTSD, this group of veterans with MI is not representative of general MI patients.

Doerfler et al (1994) reported the results of a study that assessed the prevalence of PTSD symptoms in a group of men who had either survived an MI or who underwent CABG surgery 6 – 12 months prior. Assessments were conducted via self-report questionnaires mailed to potential participants. The Reaction Index (RI; Frederick, 1985) and the IES were used to measure PTSD symptomatology. The RI includes symptoms of PTSD listed in DSM-III but not all PTSD symptoms are assessed by the RI or IES. In general low levels of distress were reported. Scores on the RI of >7 are suggested as indicative of a likelihood of PTSD. Eighteen percent of men reported high levels of PTSD symptoms using this cut-off point. Using an algorithm and including some items from the IES as well as the RI, the authors estimated that 8% of the sample would meet criteria for PTSD.

One group of researchers assessed PTSD symptoms in a relatively large sample of MI survivors using a self-report measure that was adapted for use with MI patients (Kutz, Shabatai, Solomon, Neumann, & David, 1994). Participants attended hospital for assessment between 6 and 18 months post-MI. The PTSD Inventory is based on DSM-III criteria for PTSD and was originally developed for use with combat veterans (Solomon, Mikulincer, & Jacob, 1987). The study findings indicated that 16% of MI survivors were suffering from PTSD when symptoms were assessed with this modified self-report questionnaire. The authors also wished to examine the relationship between PTSD symptoms and a number of potential risk factors for the development of PTSD. The factors associated with increased risk of PTSD were country of origin, prior MI and cardiac hospitalisation, prior PTSD of non-cardiac origin, and anticipation of permanent injury. There was no relationship between the intensity of fear or pain during the MI and PTSD symptoms afterwards. Finally, no relationship between objective medical information about the MI and the severity of subsequent PTSD symptoms was observed.

Van Driel & Op Den Velde (1995) conducted a longitudinal study on a small sample of MI survivors. Participants were assessed one to two weeks after admission to hospital, and again 22 to 26 months later. Around half of the patients did not report life-threat, anxiety or helplessness at the time of their MI. PTSD symptoms were assessed using the SCID (based on DSM-III-R). According to SCID scores at hospitalisation one subject was exhibiting several symptoms of PTSD and was suffering from a DSM-IV acute stress disorder but none were suffering from full-blown PTSD. At follow-up, a number of subjects had died, further reducing the sample size. Of the remaining survivors none met diagnostic criteria for PTSD. One male patient reported sufficient symptoms during the first year post-MI to warrant a partial diagnosis for PTSD. This was the same individual who had been suffering from an acute stress disorder at hospitalisation. The authors conclude that while the development of PTSD following MI is possible, it is the exception rather than the rule.

Lukach (1996) examined the prevalence of PTSD in first time MI patients approximately 6 months after the index MI. PTSD symptoms were assessed by both self-report (IES) and clinical interview (SCID). Clinical interviews were conducted by telephone and all other questionnaires were mailed to participants. Severity of MI was established using the Ischemic Heart Disease Index (IHDI; Gustafson et al, 1983). None of the patients qualified for a diagnosis of PTSD, and no relationship was found between disease severity and any of the psychological measures. The author notes that time since MI may have affected the prevalence of PTSD symptoms. However, symptoms of psychological distress tend to be strongest immediately following cardiac events and up to six months post-event. In a regression analysis, time since MI only predicted total scores on the IES where it accounted for 6% of the variance.

Mcphearson's (1998) study was particularly interested in the responses of war veterans to PTSD and MI. Prevalence of PTSD was assessed in a group of 56 male veterans, 20 of whom had suffered an MI. Of these 20 veterans six (30%) reported significant above-threshold levels of PTSD symptoms on the PTSD Checklist - Military Version (PCL-M; Weathers, Huska, & Keane, 1991). This prevalence rate is considerably higher than those reported in the majority of other studies reviewed here. However, Mcphearson's (1998) finding is understandable in the light of prior evidence that experience of a prior trauma increases the risk of developing PTSD following another traumatic event. In this case all MI survivors had also survived a combat situation which would leave them vulnerable to developing PTSD following MI.

Bennett & Brook (1999) investigated the associations between personality variables, social support, awareness of MI and PTSD symptom severity in first time MI survivors.

Questionnaires were mailed to potential participants. PTSD symptoms were assessed using Part 3 of the Post-traumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997) and also the IES. The authors reported that 9% of patients qualified for a diagnosis of PTSD according to DSM-IV criteria, 6 – 12 months post-MI. Scores in excess of 23 on Part 3 of the PDS were taken as indicative of PTSD. However, as this part of the PDS only assesses Criterion B for PTSD it is inaccurate to conclude that these four individuals fulfilled diagnostic criteria for the disorder. They may not have experienced fear or terror at the time of the event, or their symptoms may not have been causing clinically significant impairment in their lives, both of which would be essential for a diagnosis of PTSD. Multiple step-wise regression analyses were used to examine the relationships between the predictor variables and PTSD symptoms. Alexithymia, age, social support, and awareness of having an MI at the time emerged as predictive of one or more measures of PTSD symptoms.

A second paper by Paul Bennett and his colleagues reported the findings of a 3-month follow-up of their original sample of MI survivors (Bennett, Conway, Clatworthy, Brooke, & Owen, 2001). Just over 7% of respondents were deemed to fulfil criteria for diagnosis of PTSD according to part 3 of the PDS. The same criticism with regard to drawing conclusions about diagnosis of PTSD on the basis of a partial self-report questionnaire is also applicable here. It is interesting that the estimated prevalence rate of PTSD in this sample of MI patients was lower at the 3-month follow-up than at the 6 – 12 month follow-up.

Another recently published study of PTSD in survivors of MI was particularly interested in the possible relationship between PTSD symptoms and nonadherence to medical treatment in MI patients (Shemesh et al. 2001). The authors hypothesised that as part of the avoidance dimension of PTSD, patients who are traumatised may avoid taking their medication because it serves as a recurrent reminder of their MI. PTSD symptoms were assessed using the IES. As previously mentioned in section 5.2.6, the IES is not a specific measure of PTSD; it only measures intrusions and avoidance behaviours and does not tackle important features such as hyperarousal. Patients were assessed for PTSD symptoms at 6 months post-discharge and adherence to medical treatment was measured every three months for 6 months to 1 year post-discharge from hospital. Just under 10% of patients were found to have above-threshold scores on the IES. The number of serious adverse medical events that patients experienced in the year was also recorded. Nonadherence was significantly associated with serious adverse events and mortality. Intrusion and avoidance symptoms were not related to adverse events but they were significantly associated with decreased adherence and this association could not be fully explained by comorbid psychiatric symptoms.

The most recently published study of PTSD in MI patients by Bennett, Owen, Koutsakis, & Bisson (2002) reported a further exploration of the role of personality, social context and cognitive predictors of PTSD in MI patients, more specifically, alexithymia and negative affect. MI patients completed part 3 of the PDS and the IES whilst in hospital and again three months later. Sixteen percent of patients were considered to have clinically significant symptom levels of PTSD. Anxiety and depression scores according to the HADS were strongly correlated with PDS scores (7% and 13% of patients reported significant levels of depression and anxiety at 3-month follow-up). Hierarchical regression analysis was used to examine potential predictors of PDS scores. The independent variables were entered in two blocks: Block 1 – PANAS, depression, social support and dissociation, and surprise at the time of MI; Block 2 – thought intrusion and avoidance. The overall explained variance was modest (42%, 65% and 39% on the PDS avoidance, re-experiencing and arousal subscales respectively). Of the variables of interest (i.e. Block 1), lack of confidant support, negative affect, and dissociation were predictive of one or more PDS scales. Baseline IES intrusion but not avoidance also contributed significantly to PDS scores.

Finally, Pederson, Middel, & Larsen (submitted) investigated the prevalence of PTSD symptoms in a large sample of MI survivors four to six weeks post-MI. This sample size is the largest to date in studies that have assessed PTSD in MI patients. The researchers also included a healthy control group (N = 115). Participants completed the PDS self-report questionnaire at home and returned the questionnaires by post. In its complete format the PDS assesses all criteria for PTSD and therefore diagnoses are theoretically possible on the basis of responses to this questionnaire. Twenty-two percent of patients qualified for diagnosis of PTSD compared with 7% of controls. This prevalence rate is high in comparison to other studies that have used smaller sample sizes but equivalent to the study

with the previously largest sample size ( $N = 100$ ; Kutz et al, 1994). Objective clinical variables were obtained for the patients from their medical records and the personality traits neuroticism and extroversion were assessed by means of the short version of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1991). Patients scored higher on depression and neuroticism than did controls. In a multivariate regression analysis, depression and neuroticism were associated with a diagnosis of PTSD, and MI approached significance. On a separate analysis of MI patients, none of the clinical variables were related to a diagnosis of PTSD; anxiety was associated with PTSD but depression only approached significance.

#### **5.2.8 PTSD following cardiac arrest**

The only study to assess symptoms of PTSD in cardiac arrest survivors used the German version of the IES. Survivors were assessed on average 29 months after discharge from hospital (Ladwig et al, 1999). A comparison group of 35 patients with chest pain of cardiac origin but no cardiac arrest were also assessed for symptoms of PTSD and general psychological status. Because the IES does not have norms in the German version the researchers defined patients who scored 50% or higher on the IES and who also labelled themselves as troubled by the event as having PTSD. According to this criterion 38% of cardiac arrest survivors were suffering from PTSD. However, it is important to restate that the IES is not a specific measure of PTSD: the items do not correspond to current or previous DSM criteria for the disorder, as other self-report PTSD questionnaires do. In fact, the entire hyperarousal symptom cluster is not assessed by the IES, which is strictly speaking a measure of intrusive and avoidance phenomena. Nonetheless, the 'PTSD' group in this study reported significantly more symptoms of depression and anxiety according to the HADS than the non-PTSD group. One quarter of patients qualified for moderate to

severe forms of depression. However, anxiety levels were low in the cardiac arrest patients. In fact, they were even lower in this group than in the reference angina pectoris group. The researchers also examined whether age, sex, and other selected factors of the resuscitation procedures on the scene of the collapse contributed to the risk of developing PTSD symptoms. The only factor that significantly predicted outcome in terms of PTSD symptoms was prolonged sedation. Patients who experienced prolonged sedation at the time of arrest were five times less likely than their non-sedated counterparts to develop PTSD. This is an interesting finding which adds to the recent debate on the role of explicit (conscious) versus implicit (unconscious) memory in the development of PTSD. Ladwig et al's (1999) finding suggests that being unconscious affords considerable protection from the development of PTSD. However, many head-injury patients have allegedly developed PTSD without conscious recollection of the event and as early as 1911 there was a report of an avoidance reaction in a patient with impaired explicit memory (see section 4.2.1).

*Summary: PTSD following MI and cardiac arrest*

There is growing evidence that PTSD is a significant problem for some individuals following MI, cardiac arrest and other serious cardiac events. The majority of studies have been conducted with MI patients and prevalence rates of between 0 – 22% have been reported. The only study of PTSD in cardiac arrest patients reported an estimated prevalence rate of 38% but this was based on responses to the IES which is not a direct measure of PTSD symptoms according to current DSM-IV criteria. The way in which PTSD is assessed and the timing of assessment may account for the large variation in prevalence rates. Of the 13 studies reviewed, ten used self-report measures and just three used clinical interviews to assess PTSD symptomatology. Self-report measures are easier and less time consuming to administer but prevalence rates obtained with these measures

cannot be regarded as conclusive. The interval between the index event and psychological assessment has also varied from as little as two weeks up to more than 5 years. This is likely to have a significant effect on the prevalence of PTSD symptoms reported. Also, sample sizes have ranged from a low of  $N = 21$  to a high of  $N = 112$ . These differences make it difficult to draw comparisons between studies. However, it is interesting to note that in two of the three studies which had sample sizes of one hundred or more, reported prevalence rates that were higher than usual (Kutz et al, 1994 – 16%; Pederson, submitted – 22%). On the whole though, the results of these studies have shown that at least some patients are at risk of developing PTSD post-MI. There is also some evidence that cardiac arrest survivors might be more prone to developing PTSD than MI patients. As cardiac arrest is a more life-threatening event than MI it might be expected that symptoms of psychological distress would be greater post-arrest. However, the only study to date that investigated PTSD in survivors of cardiac arrest, used a self-report measure of intrusive and avoidance behaviours (Ladwig et al, 1999). In order to more accurately assess the risk of developing PTSD following cardiac arrest, assessments need to be carried out using clinical interviews. This notwithstanding, the use of self-administered questionnaires in PTSD research is likely to remain widespread. If self-report measures are to be used with cardiac populations, who have suffered an internal rather than the more usual external stressors, they must accurately identify patients who are experiencing high levels of post-traumatic stress. Therefore, the degree of correspondence between PTSD diagnoses by self-report questionnaire and the “gold-standard” of structured clinical interview is an important consideration.

### **5.2.9 Aims and hypotheses**

The aims of the present study were 1) to compare the prevalence and severity of emotional distress in survivors of cardiac arrest with that of cardiac patients who had suffered an MI but whose course was not complicated by cardiac arrest; 2) to ascertain to what extent these patients suffer from the symptoms of PTSD, and 3) to assess the validity of a self-report measure for PTSD with a cardiac population.

It was hypothesised that survivors of cardiac arrest would experience significantly greater levels of emotional distress and PTSD symptoms than myocardial infarction controls, due to the more life-threatening nature of cardiac arrest.

## **5.3 Method**

### **5.3.1 Study population**

Cardiac arrest patients were included in the study if they had been successfully resuscitated from in-hospital cardiac arrest, 3-18 months prior to assessment and were aged between 18 and 75 years. Only patients who had a first time cardiac arrest were included. Potential participants were drawn from the resuscitation audit forms of two major Edinburgh hospitals. Of 213 identified IHCA survivors, 37 were deceased at follow-up and 18 were untraceable. Nineteen were living outwith the Lothian region and two had an insufficient command of English to participate. Two were excluded due to organic brain disease and 32 because their arrest was of a non-cardiac aetiology. A further 64 patients did not meet age-limit criteria. Of the 39 patients alive and eligible for inclusion in the study 27 agreed to participate, giving an overall response rate of 69%. Reasons given for non-participation

were poor health (N = 4), primary caregiver for disabled spouse (N = 3), minding grandchildren (N = 1), and not wishing to discuss illness (N = 4).

The control group (N = 28) for the study was identified from the discharge notes of a cardiac ward at the hospital. All controls had survived an acute myocardial infarction uncomplicated by cardiac arrest and were individually matched for age, sex and time since index event to the cardiac arrest group. One control patient had had a previous MI. All other controls were first-time MIs. Cardiac arrest and MI patients were not excluded on the basis of psychiatric history but all patients were asked to provide details of any previous psychiatric diagnoses if they had any.

Potential participants' GPs were contacted initially to establish if their patient was still alive before direct telephone contact was made. Those who were still alive were contacted by the researcher and asked to attend hospital for assessment. If the patient agreed to participate, written consent was obtained. Consent forms and patient information sheets can be seen in Appendix I. Ethical approval for the study was granted by the local health authority research ethics committee. All patients were assessed in the cardiology department of the Royal Infirmary of Edinburgh or in their homes if they were unable to attend the hospital for assessment.

### ***5.3.2 Assessment of affective adaptation***

Current affective status was evaluated with the 14-item Hospital anxiety and depression scale (HADS; Zigmond & Snaith, 1983). The HADS was developed especially for use in general medical settings and has been found to provide valid and distinct measures of

anxiety and depression without confounding by somatic symptoms of concurrent physical disorders. It was thus considered to be an appropriate measure for use with the study population. The HADS comprises two seven-item subscales which cover anxiety and depressive symptoms respectively. Each item has four possible responses and a scoring range of 0-3 giving a potential global scoring range of 0-21 for each subscale. Clinically significant anxiety or depression is likely with scores in excess of 11 on the relevant subscale. Scores of 8-10 are considered 'borderline significance' and scores below eight are defined as being in the normal range.

### ***5.3.3 Assessment of post-traumatic stress symptoms***

Post-traumatic stress symptoms, according to the current operational diagnosis of PTSD in DSM-IV (American Psychiatric Association, 1994), were assessed using both a self-report questionnaire and a structured clinical interview.

#### *Self-report:*

The Post-traumatic Diagnostic Scale (PDS; Foa et al, 1997) assesses all diagnostic criteria for PTSD in DSM-IV and provides information about the severity of PTSD symptoms. The questionnaire comprises four sections that together assess the entire PTSD syndrome. Parts 1) and 2) assess Criterion A (traumatic situations): Part 1) assesses if the life-threatening event occurred and Part 2) assesses whether extreme fear or terror was experienced; Part 3) assesses Criteria B, C, & D (the 17 symptoms - 5 re-experiencing, 7 avoidance, 5 arousal) and Criterion E (duration of the symptoms); Part 4) assesses Criterion F (impairment in daily functioning). In order to fulfil diagnostic criteria for PTSD an individual has to have experienced an event that caused themselves or someone else injury or put their own or

someone else's life in danger; they have to have experienced extreme fear or terror during the event; and they must report at least 1 re-experiencing, 3 avoidance, and 2 hyperarousal symptoms, causing significant impairment in their daily life for at least one month. The PDS has been validated against the Structured clinical interview for the Diagnostic and Statistical Manual (4<sup>th</sup> Edition) – PTSD section (SCID; First et al, 1997).

*Clinical interview:*

The Structured clinical interview for the Diagnostic and Statistical Manual (4<sup>th</sup> Edition) – PTSD section (SCID, First et al, 1997) is the most widely used criterion against which other measures have been validated and was the chosen interview measure. It comprises four main sections: 1) experiencing a traumatic life-threatening event; 2) persistent re-experiencing of the event (e.g. nightmares and flashbacks); 3) persistent avoidance of associated stimuli; and 4) persistent symptoms of increased arousal.

The dimensions of intrusion and avoidance were also assessed using the Impact of Event Scale (IES; Horowitz et al, 1979). This instrument is a 15-item questionnaire with four response options for each item (0, 1, 3 or 5) and has two subscales measuring intrusion (7 items) and avoidance (8 items). The potential global scoring ranges are 0-35 and 0-40 respectively. The IES is not a direct measure of PTSD but has been widely used in research on post-traumatic stress. A review of research using the IES concluded that the scale still had considerable value as an instrument for measuring subjective distress following trauma (Joseph, 2000).

Data on participants' occupation, level of social deprivation, and smoking status was also collected.

### **5.3.4 Procedure**

All participants completed the assessment in the following order: IES, PDS, HADS, SCID and sociodemographic data not available in case notes. The order of administration was not counterbalanced in order to reduce potential contamination of the PDS by discussion of the event during the SCID interviews. Structured clinical interviews were audiotaped with the patient's consent and positive diagnoses were confirmed by a second independent rater. For one MI subject where a positive diagnosis of PTSD was made, the interview was not recorded because consent was not given. In all other cases inter-rater agreement was 100%.

## **5.4 Analysis and results**

### **5.4.1 Statistics**

The groups' baseline characteristics were compared with t-tests and chi-square tests to ensure comparability. The relationships between previous and present depression and previous depression and PTSD symptoms were tested using independent samples t-tests. Numbers of positive diagnoses of PTSD in the two groups were compared with chi-square tests. Differences between the cardiac arrest and MI patients on affective adjustment, experience of intrusion, avoidance and hyperarousal symptoms, as well as overall symptom severity were examined with independent samples t-tests. Agreement on "caseness" between the two measures of PTSD (clinical interview and self-report) were compared using Cohen's kappa statistic. Agreements between symptom-cluster scores were examined with Pearson's correlations. All statistical analyses were performed using SPSS for Windows version 9.0.

### 5.4.2 Patient characteristics

The two study groups were well matched for age, sex and time since index event. Mean time since event for both groups combined was 9.8 (5.2) months. All participants were assigned to one of seven Carstairs & Morris (1991) social deprivation categories (see section 3.4.2). The two groups lived in areas with similar social deprivation. The groups were also well matched for occupational background and current smoking habit. Analyses of age and social deprivation indices of those who participated and those who did not revealed no significant differences. However, there were more females among the group who declined to participate than in the two participating groups (15% v. 44%;  $\chi^2=36.71$ ;  $df=1$ ;  $p<0.001$ ). Two participants (one case and one control) had previous diagnoses of depression. See *Table 5.2* for baseline data for the two study groups.

**Table 5.2** *Baseline characteristics of the 27 in-hospital cardiac arrest (CA) cases and matched myocardial infarction (MI) controls (N = 28).*

	CA	MI	Test statistic	Significance level
Age (years)	59.7 (10.1)	58.3 (9.6)	$t=0.56$	$p>0.05$
Interval from index event to assessment (months)	8.5 (4.9)	11.1 (5.2)	$t=-1.89$	$p>0.05$
Social deprivation index (% 3-5)	49%	51%	$\chi^2=4.28$	$p>0.05$
Sex (% male)	81%	89%	$\chi^2=0.67$	$p>0.05$
Occupation (% manual)	59%	41%	$\chi^2=2.86$	$p>0.05$
Smoking status (% smokers)	49%	55%	$\chi^2=0.04$	$p>0.05$

### 5.4.3 Affective adjustment

According to Zigmond & Snaith (1983) individuals who score less than 8 on the HADS subscales are non-cases of anxiety and depression; individuals scoring between 8 – 10 are possible cases; individuals scoring over 11 are suspected cases of anxiety and depression. The majority of patients reported levels of emotional adjustment that fell within the normal range (see *Table 5.3*). Mean scores on the HADS anxiety and depression subscales were higher for the CA survivors than MI patients (mean anxiety score: 7.3 (5.7) v. 4.7 (3.6);  $t = 2.11$ ;  $df = 43.6$ ;  $p < 0.05$ ; mean depression score: 5.1 (5.1) v. 2.2 (2.2);  $t = 2.65$ ;  $df = 35.7$ ;  $p < 0.05$ ). Patients with previous diagnoses of depression had higher scores on the HADS depression subscale than those with no previous diagnosis of depression (10.5 (10.6) v. 3.3 (3.7);  $t = 2.53$ ;  $df = 1$ ;  $p < 0.02$ ).

**Table 5.3 Comparison of CA patients and MI control group by HADS category on HADS anxiety and depression subscale scores.**

HADS scale		HADS Category			Pearson's $\chi^2$
		Low (<8)	Borderline (8-10)	Clinical ( $\geq 11$ )	
Anxiety	CA	17 (63%)	2 (7%)	8 (30%)	4.89; $p < 0.05$
	MI	22 (79%)	4 (14%)	2 (7%)	
Depression	CA	21 (78%)	2 (7%)	4 (15%)	4.52; $p < 0.05$
	MI	26 (93%)	2 (7%)	0	

### 5.4.4 Post-traumatic stress symptoms

First, to assess if there was any relationship between previous psychiatric diagnosis and severity of PTSD, an independent samples t-test was conducted on PDS severity scores.

The results indicated no significant relationship between previous psychiatric diagnosis and

present PTSD symptoms ( $t = 0.95$ ;  $df = 53$ ;  $p > 0.05$ ). Therefore data from the two participants who had previous depression was included in the analyses.

The hypothesis that CA cases would have significantly more PTSD symptoms than MI controls was tested by 1) quantitative analysis of PTSD symptom-cluster scores, according to both structured interview and self-report (i.e. the number of symptoms reported by participants on the re-experiencing, avoidance and arousal clusters), and also of IES scores; and 2) categorical analysis of the number of patients in both groups with positive diagnoses for PTSD, and also scoring within high, medium or low symptom categories on the IES.

Quantitative analysis:

With significance levels adjusted using Bonferoni's correction there were no differences between the groups on the three PDS symptom-cluster scores (re-experiencing, avoidance, arousal) and PDS severity scores. The groups also did not differ on the three SCID symptom-cluster scores (re-experiencing, avoidance and hyperarousal). Mean scores on the IES were higher for the CA cases than MI controls but not significantly so. The results of the various analyses are shown in *Table 5.4*.

**Table 5. 4** Comparison of cardiac arrest patients and MI control group the IES, the PDS, and the SCID.

	CA	MI	t-value	df	p-value
IES – total	17.0 (20.9)	11.3 (12.2)	1.24	41.5	$p > 0.05$
IES – intrusion	7.6 (10.0)	6.2 (7.5)	0.58	53	$p > 0.05$
IES – avoidance	9.4 (11.5)	5.1 (6.1)	1.74	39.5	$p > 0.05$
PDS – re-experiencing	1.4 (1.7)	1.1 (1.6)	0.75	53	$p > 0.05$
PDS – avoidance	1.8 (2.6)	1.4 (1.7)	0.67	44.4	$p > 0.05$
PDS – arousal	2.2 (1.7)	1.6 (1.4)	1.36	53	$p > 0.05$
SPDS – severity	10.7 (13.7)	6.6 (7.8)	1.37	40.7	$p > 0.05$
SCID – B (re-exp.)	1.0 (1.2)	0.6 (1.0)	1.53	53	$p > 0.05$
SCID – C (avoid.)	1.9 (2.4)	0.5 (1.2)	2.68	38.8	$p > 0.05$
SCID – D (arousal)	1.5 (1.6)	1.0 (1.2)	1.24	53	$p > 0.05$

Note: Equal variances not always assumed; adjusted degrees of freedom shown where appropriate

*Categorical analysis:*

Five (19%) cardiac arrest patients and two (7%) MI patients were diagnosed as meeting full criteria for PTSD according to the SCID structured clinical interview. This difference was non-significant ( $\chi^2=1.6$ ;  $df=1$ ;  $p>0.05$ ). When PTSD symptoms were assessed by self-report questionnaire there was still no significant difference in “caseness” between cardiac arrest cases and MI controls: four (15%) cardiac arrest survivors and two (7%) MI survivors reported symptom levels serious enough to warrant diagnosis of the PTSD syndrome ( $\chi^2=0.83$ ;  $df=1$ ;  $p>0.05$ ). Horowitz (1982) has identified three cut off points describing low, medium and high symptom levels on the IES (using the total score) and corresponding to levels of clinical concern: low,  $<8.5$ ; medium,  $8.6 - 19.0$ ; and high,  $>19$ . Using this classification the cardiac arrest group had 17 (63%) individuals in the low symptom category and 10 (37%) in the high category. No one in this group scored in the medium symptom range. The MI control group had 15 (54%) in the low, 8 (28%) in the medium, and 5 (18%) in the high symptom categories. Chi-square analysis showed a significant difference between the two groups on IES categorisation (see *Table 5.5*).

**5.4.5 Comparison of PDS and SCID**

The validity of PTSD diagnoses obtained using the PDS self-report questionnaire was assessed by comparing the diagnoses made using the questionnaire with the “gold standard” diagnoses obtained by structured clinical interview (SCID). Overall numbers of patients meeting full diagnostic criteria for PTSD were very similar using both methods (SCID – 7 v. PDS – 6). A kappa statistic of .39 was obtained with 87% agreement between the two measures. However, of the 7 identified cases of PTSD with the SCID and 6 cases identified by PDS, only 3 cases were identified in common (see *Table 5.6*).

Scores on the three symptom-clusters of the PDS were significantly correlated with scores when symptom-clusters were assessed by the SCID (Pearson's product moment correlations: re-experiencing –  $r = 0.59$ ;  $p < 0.01$ ; avoidance –  $r = 0.58$ ;  $p < 0.01$ ; arousal –  $r = 0.70$ ;  $p < 0.01$ ).

**Table 5. 5 Comparison of cardiac arrest patients and MI control group on Impact of Events scale (IES) categorisation.**

Study group	IES Category			Pearson's $\chi^2$
	Low (< 8.5)	Medium (8.6-19)	High (>19)	
Cardiac arrest	17 (63%)	0	10 (27%)	
MI	15 (53%)	8 (29%)	5 (18%)	9.78; $p < 0.01$

**Table 5. 6 Comparison of structured clinical interview (SCID) and Post-traumatic Diagnostic Scale (PDS) diagnoses of post-traumatic stress disorder.**

		SCID	
		PTSD +ve	PTSD -ve
PDS	PTSD +ve	3	3
	PTSD -ve	4	45

## 5.5 Discussion

### 5.5.1 General psychological adjustment

The majority of participants in the study had adjusted well to their cardiac arrest or MI. Nonetheless, more than 6 months after the event 30% of cardiac arrest survivors reported clinical levels of anxiety, and 15% reported clinical levels of depression. This was in comparison with 7% (anxiety) and 0% (depression) of the MI group. Thus, significantly

more cardiac arrest survivors than MI survivors were experiencing psychological distress following their index event. Mean scores on the anxiety and depression subscales of the HADS were also significantly higher in the cardiac arrest group, indicating that as well as being problematic for a greater number of patients, cardiac arrest also leads to higher levels of emotional maladjustment than MI does. The results therefore support the hypothesis that in-hospital cardiac arrest survivors would experience greater difficulty with long-term emotional adjustment to their event than MI controls. Previous research has reported that up to 30% of cardiac arrest survivors suffer from depression as much as twelve months post-arrest (Roine et al, 1993), and prevalence rates for anxiety as high as 60% have been reported (Dobson et al, 1971). On the other hand, some researchers have reported that although depression and anxiety are widely prevalent in cardiac arrest survivors in the early weeks and months following arrest, psychological distress tends to remit so that by six months post-event, levels of depression are equivalent to those found in the normal population (Bedell et al, 1983; Dougherty, 1994).

In contrast to the cardiac arrest group, none of the MI group reported clinically significant levels of depression and just 7% reported significant levels of anxiety. This finding, particularly in relation to depression, is surprising as studies on psychological adjustment following MI have more consistently reported high levels of depression and anxiety in patients, than studies that have investigated cardiac arrest survivors. Debate has tended to focus on whether psychological distress remits to any great extent post-MI rather than whether it remits completely, with some studies reporting that distress tends to remit, and others finding that it persists. In general however, previous studies have reported that around 10% of MI patients suffer from depression between six and twelve months after their

infarction. The present findings do not confirm this and instead suggest that depression is not a significant problem for MI patients 6-months after discharge.

One possible reason for the low prevalence of depression in these MI patients is that women comprised just 11% of the sample. While the ratio of men to women in studies of CHD is usually not equal due to the fact that more men than women suffer from the disease, 11% is nonetheless a relatively low proportion of women for this type of study. Women have been found to be at greater risk of psychological distress post-MI than men (Schleifer et al, 1989; Sauvé et al, 1996), and the low rate of depression found in this study could be accounted for by the low number of women that participated. However, a study that investigated depressive symptoms in an exclusively male sample found that 14.5% of male MI survivors were suffering from extreme forms of depression 6-months post-event (Ladwig et al, 1991). As an alternative explanation, evidence from a study that assessed depressive symptoms in a sample of cardiac patients with both structured clinical interviews and self-report measures found that the estimates of depression according to the clinical interviews were higher than those reported by patients themselves on a self-report questionnaire (Carney et al, 1987). If cardiac patients have a tendency to under-report depressive symptoms then the estimates of self-reported depression in the present samples of cardiac patients may underestimate the true incidence of depression. Finally, as noted before, the findings in relation to psychological distress following serious cardiac events such as cardiac arrest and MI have been quite inconclusive. While many studies have reported considerable levels of psychological maladjustment, there have also been studies which have reported that surviving such an event can lead to positive changes for many patients. For example, Laerum, Johnsen, Smith, & Larsen (1988) reported that almost one third of their sample of male MI survivors reported a considerable improvement in their life situation between 12

and 24 weeks post-infarction. Sixty percent of the group had quit smoking and 19% had reduced their alcohol consumption. Fifty percent reported increased gratitude at being alive, more feelings of joy in life, and a greater appreciation of family, friends, hobbies and health. Nonetheless, the finding that none of the present MI group reported clinically significant levels of depression and only seven percent reported significant levels of anxiety, was a more positive outcome than expected.

### **5.5.2 Prevalence of PTSD**

Nineteen percent (N = 5) of the cardiac arrest sample fulfilled diagnostic criteria for post-traumatic stress disorder when assessed using the SCID, compared with 7% (N = 2) of the MI sample. Therefore, MI patients were statistically as likely to suffer from PTSD as cardiac arrest patients, despite cardiac arrest being a more life-threatening medical event. This main finding remained the same when PTSD symptoms were assessed using the PDS self-report questionnaire. This result was surprising and also contrary to the study hypothesis. It is important to consider that the finding may be the result of insufficient statistical power to detect a difference between the two prevalence rates. There were only 27 and 28 cardiac arrest and MI participants respectively; therefore, both the prevalence rates and the finding of no statistical difference between the two groups with respect to PTSD, must be considered preliminary. Previous studies of MI patients have reported prevalence rates for PTSD of up to 22% (Pederson et al, submitted) although rates in the region of 10% are more common (Bennett et al, 1999; Shemesh et al, 2001; Kutz et al, 1994).

Only one previous study has investigated PTSD in cardiac arrest survivors and found a prevalence rate of 38% among a group of 21 out-of-hospital cardiac arrest survivors (Ladwig et al, 1999). There are a number of potential explanations for the difference between Ladwig et al's (1999) high estimate of PTSD and the present rate of 19%. Firstly, the present study was conducted on in-hospital cardiac arrest survivors rather than out-of-hospital cardiac arrest victims. The experience of arresting whilst in hospital may be less traumatic than arresting in a public place or at home. Arresting in hospital, patients may take some comfort from the fact that appropriate medical care is instantly accessible. They may also be more prepared psychologically for the event, as they are aware of their illness to the extent that they have at least come to hospital before arresting. An alternative explanation is that the different methods of assessing PTSD symptoms could have accounted for the widely different prevalence rates. Ladwig et al (1999) used a German version of the IES to assess PTSD symptoms. Patients who scored in excess of 50% on the IES were defined as the PTSD group. While the IES is widely used in PTSD research, it is a measure of intrusive and avoidant phenomena associated with a particular event and *was not* designed to diagnose PTSD. However, the IES has been shown to distinguish between people who have PTSD and those who do not (Bryant & Harvey, 1996). The IES has also been shown to predict later PTSD symptoms (Perry, Difede, Musngi, Frances, & Jacobsberg, 1992). Nonetheless it cannot be considered as reliable as clinical interviews in assessing PTSD, and furthermore it is not possible to make definitive diagnoses of PTSD without a clinical assessment. While Ladwig et al (1999) used a cautiously high cut-off point, it is possible that it was still not high enough and consequently some of the 38% of patients with PTSD in their study may not actually be PTSD-positive. It is in fact impossible to tell who had PTSD in Ladwig et al's (1999) study. Using a cut-off point of 50% the prevalence rate of PTSD in the present sample of cardiac arrest patients rises to

22%. However, the version of the IES used in this study was different to the one used in the Ladwig et al's (1999) study and drawing comparisons between the studies is therefore problematic. Finally, depressed individuals have a known tendency to endorse more negative items on self-report questionnaires than normal controls (e.g. Ingram, 1984; Matthews & Harley, 1996). While this would not account for the large difference in prevalence rates between the studies on IES scores, it suggests nonetheless that researchers and clinicians should be wary of using self-report measures to assess PTSD in populations that are likely to suffer from some degree of depression.

### ***5.5.3 Prevalence rates according to self-report and clinical interview***

Overall there was 87% agreement between diagnoses made with the SCID and the PDS, however the kappa value was low. In fact only three individuals with PTSD were identified in common, and the high percentage of agreement between the measures was largely accounted for by the majority of patients who were PTSD-negative. In order to receive a positive diagnosis on the PDS, respondents must indicate that they were physically injured, or that their life was in danger (Criterion A). Of the four individuals diagnosed as having PTSD by structured clinical interview but not by self-report, three (two cardiac arrest cases; one MI control) did not meet Criterion A on the PDS. The PDS assesses whether a traumatic event meets Criterion A with a number of questions including: "During this traumatic event were you physically injured?" The three unidentified patients responded 'No' to this question. Due to the internal nature of injury concomitant with cardiac arrest or MI, these patients did not recognise or report that they had been injured. Furthermore, the two cardiac arrest patients did not believe their lives to be in danger during their event (i.e. they answered negatively to the question "During this traumatic event was your life in

danger?") despite reporting that they were both frightened and terrified during it. Often people are unaware that they are having a cardiac arrest and that their life is therefore seriously threatened. Bennett & Brooke (1999) have reported that awareness of experiencing an MI during the event is associated with greater numbers of intrusive thoughts afterwards. Not recognising the serious nature of their event at the time may have inadvertently protected these two PTSD cases from experiencing even greater levels of intrusive thoughts post-event. However, by definition, failure to endorse either of these two items precluded all three cases from receiving positive diagnoses of PTSD by self-report. These findings suggest that some generic self-report measures for PTSD may be unsuitable for use with cardiac patients. In particular, diagnoses of PTSD in cardiac samples obtained with the PDS should be treated with caution. Overall symptom severity scores might be more useful than diagnoses in identifying individuals at risk for the disorder. Strong correlations between the interview and self-report measure assessments on the three symptom-clusters of the disorder were found. However, structured clinical interview remains the "gold standard" for assessment of PTSD.

#### ***5.5.4 Limitations of the study***

It is possible that patients who refused to participate in the study may have been experiencing more problems with affective adjustment and PTSD than those who participated and this could have contributed to the relatively low levels of psychological distress that were reported. A number of patients cited not wanting to discuss their illness as a reason for non-participation. Some also mentioned during the recruitment phone-call that they had experienced a difficult time adjusting, were only just coming to terms with their event, and felt that they would not be helped by returning to the hospital. Alternatively, the

selection bias could have operated in the opposite direction and patients who were experiencing distress may have been particularly keen to participate. Participants and non-participants did not differ in terms of age or social deprivation indices, however, no further information about psychological adjustment was available for patients who did not participate. It is therefore impossible to gauge whether or not there was a selection bias in operation. However, ethically these potential selection biases are unavoidable due to a requirement of having voluntary, informed participants.

Another limitation of the study concerns the small sample sizes. Caution is advisable when interpreting the finding that the prevalence rate for PTSD of 7% in MI patients was not significantly different from that of 19% for cardiac arrest patients. This finding may be a result of low statistical power to detect differences due to the fact that the actual number of people with confirmed PTSD was relatively small (cardiac arrest - 5 v. MI - 2). This issue will be dealt with again in section 8.2. Nonetheless, the sample size is comparable with those of other studies in this field (Ladwig et al, 1999; Neumann, 1991; Van Driel & Op den Velde, 1995).

Finally, we have no measure of cardiac arrest or MI severity for our sample. However, it is well established that there is no significant association between severity of infarct and psychological adjustment to MI (e.g. Cay et al, 1972; Lloyd & Cawley, 1983; Laerum et al, 1988) and it was not expected that PTSD would be associated with MI or cardiac arrest severity.

### 5.5.5 *Implications of the study*

The study shows that a PTSD perspective can be productive in conceptualising the process of adjustment to serious cardiac events. The results confirm that such events, particularly cardiac arrest, are perceived as traumatic by many patients, and a significant minority of patients experience levels of emotional distress serious enough to warrant diagnoses of PTSD more than 6-months post-event. Identifying patients who experience emotional disability following cardiac arrest and MI is an important step towards improving the health outcomes of these patients. Identification of patients at risk for PTSD may have implications for their prognosis given the evidence suggesting that MI patients with PTSD and depression may be at increased risk of recurrent coronary events and mortality. Diagnosis of PTSD following heart transplantation has been found to be associated with a 15-fold risk of mortality 1 – 3 years post transplant (Dew et al, 1999). In addition, PTSD has been associated with substance abuse, such as smoking and the use of alcohol (Breslau et al, 1991). Smoking in particular is a serious risk factor for CHD. Furthermore, studies have also shown a direct association between PTSD and an increased risk of cardiovascular diseases (Boscarino, 1997; Boscarino & Chang, 1999).

PTSD in medical patients in a general hospital setting can be associated with marked distress and disability, resulting in avoidance of care and poor adherence with treatment (Shalev et al, 1993). Recognition of PTSD symptoms is crucial if effective treatment is to be given. Appropriate treatment can lead to a reduction in symptoms as well as patients' improved ability to make use of medical care (Kutz et al, 1988; Alter & Pelcovitz, 1996; Mayou & Smith, 1997). For example, Shalev et al (1993) previously reported case histories of two individuals who survived serious cardiac events but were suffering from PTSD

afterwards. Both were engaging in physically exerting activities, which dangerously challenged their hearts. Following identification of the PTSD syndrome both were offered psychotherapy which helped them overcome their symptoms and cease their heart-challenging behaviour.

Finally, self-report measures for PTSD are easy for patients to complete and quick to administer. However, they should be used cautiously with cardiac samples. Specifically adapted scales for use with cardiac patients may be more accurate and appropriate. Structured clinical interview remains the preferable method for identification of PTSD. On the basis of the findings from Study III, the use of self-report PTSD questionnaires for large scale screening of MI patients, followed by structured clinical interview of those found to be PTSD-positive by self-report, is advocated.

## **Chapter 6**

### **Study IV: The contribution of Sense of Coherence to the development of PTSD symptoms following myocardial infarction**

#### ***6.1 Introduction***

The results of the last study confirmed that PTSD is a potential consequence of surviving cardiac arrest for as many as one in five survivors. The results also confirmed the findings of other studies that have reported PTSD symptoms in approximately 10% of MI survivors. Identification of psychological variables that contribute to the development of PTSD post-MI and cardiac arrest would be beneficial, as these variables might be more amenable to intervention in cardiac rehabilitation programs than sociodemographic or psychosocial variables. Study IV therefore investigated the role of two psychological variables in the development of PTSD symptoms in a large group of MI survivors. The introduction to this chapter is divided into two sections. The first of these presents a brief overview of the literature on the contribution of psychological variables to the development of psychological distress and PTSD post-MI, with a particular focus on Negative Affectivity. The second introduces the reader to the Sense of Coherence construct, which was the main variable of interest in this fourth experimental study. This section also contains a review of the literature on the contribution of sense of coherence to general well-being and recovery following negative life events.

## **6.2 *Psychological variables and the development of emotional distress post-MI***

It is common to find raised levels of anxiety and depression in the first weeks after discharge following an acute MI but for the majority of patients these problems remit within the first six to eight weeks. However, there is widespread evidence that as many as one third of patients will report clinical levels of anxiety and up to one quarter of patients will report clinical levels of depression at 1 year post-infarction (e.g. Trelawney-Ross & Russell, 1987; Chiou et al, 1997), notwithstanding the results of the third study in this thesis where no patients reported clinical levels of depression and just seven percent reported clinical levels of anxiety, six months post-MI. Furthermore, it has been reported that around 10% of MI survivors suffer from symptoms of anxiety serious enough to warrant a diagnosis of PTSD in the year following MI (e.g. Bennett & Brook, 1999; Doerfler et al, 1994; Shemesh et al, 2001). The relationship between a patient's psychological reaction to MI and the severity of their infarction is equivocal. However, the results of the majority of studies in this area suggest that there is no significant association between the two (e.g. Schleifer et al, 1989; Frasure-Smith et al, 1993; Ladwig et al, 1999). There is also some evidence that being female is a risk factor for the development of depression post-MI (e.g. Schleifer et al, 1989; Frasure-Smith et al, 1993). So although the outlook for most patients is relatively optimistic, a substantial minority of patients fail to make a successful adjustment and recovery.

Research on what differentiates those who successfully incorporate the event, and even draw strength from it, suggests that psychological variables rather than physiological aspects of the disease or illness, are critical determinants of psychological recovery following illness. A patient's thoughts, beliefs and attitudes may play a central role in determining

psychological outcome. For example, there is evidence to suggest that, at least in some MI patients, poor adjustment may be related to misperceptions about heart disease (Mæland & Havik, 1989). In this case, undue illness behaviour can be seen as a rational response to misconceptions about CHD and its long-term prognosis, rather than as a failure to make a successful adjustment. A number of studies have examined the relationship between different coping strategies and outcome among cardiac patients. For example, Bennett, Lowe, Mayfield, Norman, & Morgan (1999) examined the prospective associations between coping strategies and emotional and behavioural outcomes in first-time MI patients. They found that seeking emotional support whilst in hospital (negative relationship) and the use of distraction predicted anxiety three months post-MI. Depression at three months was not predicted by coping strategies in hospital. On the whole, better adjustment is associated with the use of problem-focused coping strategies, while poorer adjustment tends to be associated with avoidant strategies (Lowe, Norman, & Bennett, 2000).

Perceived social support has also been found to moderate the effects of trauma on diverse populations (e.g. Andrykowski et al, 1998; Carlier, Lamberts & Gersons, 1997), as well as moderating levels of anxiety in post-MI samples (Bennett et al, 1999; Waltz, 1986). Of particular relevance here is a study reviewed in Chapter 5 in which perceived social support significantly contributed to explained variance in PTSD symptoms following MI (Bennett & Brooke, 1999). In this study, the affective support subscale of the Duke-UNC Social Support Scale (Broadhead, Gehlbach, DeGruy, & Kaplan, 1988) explained 4% of the variance in post-traumatic stress symptoms assessed using a self-report questionnaire. Bennett & Brooke (1999) also investigated the contribution of the personality variable alexithymia to the development of PTSD symptoms. Alexithymia is a syndrome that comprises a marked deficit in the ability to describe feelings, a very limited fantasy life, and

a cognitive style that is excessively focused on external details (Sifneos, 1973). In Bennett & Brooke's (1999) sample of 69 MI patients, the alexithymic dimension of 'difficulty in identifying feelings' explained 21% of the variance in IES intrusion symptoms. However, it did not significantly contribute to variance in PTSD symptoms when they were assessed using a specific measure of the disorder (the PDS). Furthermore, in a similar study of psychological predictors of PTSD (Bennett et al, 2002) alexithymia was not predictive of either PDS or IES scores.

Johan Denollet and his colleagues have recently aroused interest in a personality type that they refer to as Type-D personality and its role in mortality and distress following MI. Type-D personalities tend to experience negative emotions but are not likely to express them openly to others. They consciously avoid interpersonal conflict through extensive control over self-expression and thus, may suppress substantial emotional distress in maladaptive ways (Denollet, Sys, & Brutsaert, 1995). There is now evidence from a number of studies that Type-D personality is predictive of both emotional distress (Denollet, Vaes, & Brutsaert, 2000) and mortality (e.g. Denollet et al, 1995) following MI. Finally, there is some evidence that the degree to which individuals are aware that they are having a 'heart attack' at the time of the event may contribute to having intrusive thoughts afterwards (Bennett & Brooke, 1999). This finding is consistent with evidence from other trauma populations that the subjective appraisal of an event as being more serious (e.g. a car crash) tends to lead to higher levels of PTSD symptomatology after the event (e.g. Mayou, Ehlers, & Bryant, 2002).

In the spectrum of psychosocial variables that contribute to psychological recovery post-MI, alexithymia, Type-D personality and illness beliefs are psychological predictors, whereas

social support lies towards the social end of the spectrum, and the various coping mechanisms may fall somewhere between the two poles. The next variable considered here, negative affectivity, is a psychological variable which was central to the present study and is discussed in some detail in the following section.

### **6.2.1 *Negative affectivity***

The term 'negative affectivity' describes a stable and pervasive personality trait in which an individual has a tendency to experience various negative emotional states. Negative affectivity includes feelings of anger, fear, scorn, revulsion, guilt, self-dissatisfaction, worry, nervousness, tension, a sense of rejection and to a certain extent, sadness (Watson & Clark, 1984). Individuals who are high on the dimension tend to be distressed, and to have a negative self-perception. On the other hand, low negative affectivity individuals are relatively content and secure and have a positive self-image. Different researchers have referred to this tendency to experience aversive emotional states by different labels, such as 'neuroticism' (e.g. Eysenck & Eysenck, 1968), 'trait-anxiety' (e.g. Spielberger, Gorsuch, & Lushene, 1970), and 'general maladjustment' (e.g. Kimble & Posnick, 1967). However, all are so closely related that they are widely regarded to refer to the same personality dimension. For simplicity's sake, the term negative affectivity (NA) will be used here. According to Watson & Clark (1984) NA is not simply reactive in nature and can manifest itself in the absence of a notable external stressor. That is not to say that high NA individuals consistently report negative emotional states but that such individuals are more likely to experience a significant level of distress in any situation.

In contrast to NA, 'positive affectivity' (PA) reflects an individual's level of pleasurable engagement with the environment. High PA is best described by terms reflecting enthusiasm, energy level, mental alertness, interest, joy and determination. Descriptors reflecting lethargy and fatigue on the other hand, best define low PA. High PA individuals lead a full, happy, and interesting life, and maintain a generally high activity life (Watson & Clark, 1984). Although the terms positive and negative affectivity suggest that these are opposite poles on the one dimension, they are in fact highly distinctive dimensions that are best represented as orthogonal (i.e. uncorrelated) factors.

Negative affectivity has been extensively explored in health research, and specifically in relation to CHD. For example, Costa, Fleg, McCrae & Lakatta (1982) found that NA was not only related to concurrent chest pain, but it also predicted the development of angina 5 – 20 years later in patients who were initially asymptomatic. However, NA appears to be unrelated to actual cardiac pathology. Prospective studies with follow-up periods from 4.5 to 20 years, have found that premorbid levels of NA do not predict the occurrence of CHD (Costa et al, 1982), or myocardial infarction (Ostfeld, Lobowits, Shekelle, & Paul, 1964). Of particular interest here however, is research that has shown NA to be associated with symptoms and diagnoses of both depression and anxiety, and also of other psychiatric disorders. For example, Watson, Clark & Carey (1988) collected data on NA, PA and psychiatric status from 150 in- and outpatients at various psychiatric units. The results of the study indicated that NA was consistently correlated with a broad range of depressive and anxious symptoms and diagnoses. Positive affectivity was consistently correlated with depressive symptoms and diagnoses only, suggesting that PA may be a critical factor in distinguishing depression from anxiety. The symptoms of panic disorder in particular, were almost all significantly correlated with NA. This was found even though none of the items

measuring NA referred to somatic complaints and almost all of the symptoms of panic disorder involved physical manifestations of extreme anxiety.

Similar results regarding the association of NA with general health complaints in normal samples have also been reported. For example, Watson & Pennebaker (1989) collected data from employees and students of a US university, as well as from individuals not affiliated with the university, as part of a comprehensive project to encourage better physical fitness, dietary habits, stress-management and psychological well-being in people. They also drew on other relevant studies in their analyses and discussion. The data revealed a clear and consistent convergent/discriminant pattern between NA and PA: trait NA reliably correlated with measures of symptom reporting, whereas trait PA was largely independent of them. In all but one sample, PA scores were unrelated to physical complaints. However, NA was significantly related to a wide variety of health complaints including chest and back pains, toothaches, headaches, cold hands or feet, swollen joints, itchy or painful eyes, sinus congestion, severe stomach pains or cramps, and nausea.

Anxiety then is essentially a state of high NA and has no significant relation to PA, whereas depression is a mixed state of high NA and low PA (Watson et al, 1988). It follows from this that NA would be associated with anxiety disorders such as PTSD. This has been confirmed by recent research. For example, Breslau, Davis, Andreski & Peterson (Breslau et al, 1991) found that NA was strongly associated with levels of PTSD in a sample of young urban adults. Of particular relevance for the present study is a report by Bennett & Brook (1999) in which NA was predictive of PTSD symptoms in a sample of 44 MI survivors. Post-traumatic stress symptoms were measured using the PDS self-report scale and also the IES. Negative affectivity was measured using the Positive and Negative Affect

Schedule (PANAS; Watson, Clark, & Tellegen, 1988). PANAS-total scores were highly correlated with both PDS and IES scores and contributed a significant amount to the variance in all the outcome measures. In a stepwise regression analysis PANAS-total scores independently contributed 56% to the explained variance in PDS scores. However, it should be noted here that PANAS-total scores reflect both PA and NA. Although it has been reported that PA is not significantly associated with anxiety (see above), if NA scores only had been included in the regression analysis, the findings would better reflect the contribution of NA to the development of PTSD symptoms post-MI. A more recent study by Bennett et al (2002) has confirmed this association between PTSD symptoms and NA.

In summary, there are numerous psychological and psychosocial factors that play an important role in both the development of and recovery from CHD. This introductory section has so far introduced the reader to a number of these and has focused particularly on NA. In the next section the focus will be on the primary variable of interest in the fourth study – Sense of Coherence.

### **6.3 *Sense of Coherence***

Conventional medicine, like all sciences, operates within a paradigm that has a number of key assumptions at its core. One of the key assumptions of the pathogenic paradigm within which medicine operates, is that the normal state of affairs for any organism is one of equilibrium and that illness is a deviation from the normal state of balance. Therefore, within a pathogenic orientation, the basic question must be “Why do people become ill?” There is however another fundamentally different way to view the world, which leads to a rather different question. The presence of stressors in this world – from the microbiological

to the sociocultural levels – is ubiquitous. So much so that one could wonder not why people become ill, but rather how anyone manages to remain healthy? It was this very different outlook on life, whereby the organism is understood to be constantly moving towards entropy, which caused medical sociologist Aaron Antonovsky, to become interested in what he referred to as the salutogenic question. The salutogenic question and the salutogenic model<sup>5</sup>, emphasise why the majority of people stay healthy in the face of life's considerable stressors. Antonovsky's tentative answer to this question was expressed in the concept of generalised resistance resources (GRRs), things such as ego strength, cultural stability, money, and social support. In other words, a GRR is anything that is effective in combating a wide variety of stressors. In his first book on the salutogenic paradigm, *Health, Stress and Coping* (Antonovsky, 1979), Antonovsky outlined a wide range of GRRs, from immunopotentiators to religion. But he still needed a rule by which one could identify a phenomenon as a GRR without having to see whether or how it served as one. The 'sense of coherence' concept provided this rule. What was common to all GRRs Antonovsky argued, was that they facilitated making sense out of the numerous stressors to which we are constantly exposed. Over time, as one repeatedly experiences the availability of GRRs, a strong sense of coherence will be generated within the individual. The sense of coherence was the central concept of *Health, Stress and Coping* (1979). It is defined in the book as

*“a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli deriving from one's internal and external environments in the course of living are structured, predictable, and explicable; (2) the resources are available to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement” (Antonovsky, 1987) p.19).*

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<sup>5</sup> Salutogenic and salutogenesis are terms coined by Antonovsky; Latin 'salus' = health; Greek 'genesis' = origins.

To paraphrase this definition, people who have a strong sense of coherence are confident in their ability to understand and to manage both their internal and external environments, they possess the capacity (or know other people who possess the capacity) to cope effectively with life's stressors, and fundamentally, they see life's events and stressors as challenges rather than hindrances. Indeed, according to Antonovsky an individual with a strong sense of coherence may not just survive and do well in circumstances of extreme stress, but may even draw strength from their experience. The sense of coherence construct is composed of three theoretically distinct components: comprehensibility, manageability and meaningfulness. These three components relate respectively to the three components of Antonovsky's (1979; 1983; 1993) definition of the sense of coherence (SOC).

*Comprehensibility* refers to the extent to which a person regards the stimuli that they encounter as making cognitive sense. The person high on the comprehensibility component of the SOC lives in a world that is ordered, consistent, structured, and clear rather than one which is random, chaotic, accidental, and inexplicable. Note that this component implies nothing about the desirability of stimuli – merely that they are comprehensible.

Comprehensibility is thus the cognitive component of the SOC.

The second component of the SOC is manageability. *Manageability* refers to the extent to which a person perceives that they are capable of mobilising resources that will enable them to deal with the demands placed on them in life. These resources may be under their own control or they may be controlled by others to whom they have access, for example, family, friends, God, priest, colleagues, doctor, or anyone whom an individual feels they can trust and rely upon. The person with a high sense of manageability, does not feel victimised by

events, or believe that life treats them unfairly. Manageability is the behavioural component of the SOC.

The third and final component of the SOC, is meaningfulness. *Meaningfulness* refers to the extent to which a person feels that life “makes sense”, not just in a cognitive sense, but also in an emotional sense. A sense of meaningfulness allows a person to care about life, to engage with it, and to invest time and energy in it. When negative events arise, the person high on meaningfulness will be determined to seek meaning in them and do their best to overcome them with dignity. Meaningfulness thus represents the motivational aspect of the SOC.

One important theoretical assumption about the SOC is that after young adulthood it remains a relatively stable personality disposition. According to Antonovsky (1979; 1987) the foundation of a strong SOC in adulthood is created by consistency in life experiences, load balance (i.e. an appropriate balance in daily life between under- and over-load), and the opportunity to participate in decision-making in childhood and adolescence. These three elements contribute to the development of the three components of the SOC respectively; consistency leads to comprehensibility, load balance to manageability, and participation leads to a sense of meaningfulness. During early adulthood an individual’s location along the SOC continuum becomes more or less fixed depending on the experiences they encounter and their resolution of those experiences. Antonovsky has suggested the age of 30 as a critical point in the development of the SOC; after that a person with a strong SOC will be able to cope with the subsequent demands and challenges of life. In contrast, the person with a weak SOC has not developed the skills and outlook on life that are necessary for managing stress and staying well. This view of stability however, does not mean that the

SOC is rigidly fixed. Some temporary changes, what Antonovsky refers to as “fluctuations around a mean” (1987, p. 124), may occur in response to radical environmental events, for example, the threat of unemployment, death of a family member, or serious illness. Sooner or later however, a person returns to his or her mean level of SOC. Thus Antonovsky did not anticipate that the SOC would be easily amenable to change via for example, rehabilitation programs or counselling.

Sense of coherence is then essentially a measure of a person’s resistance in the face of stress and as such resembles other measures of coping. However, conventional coping measures tend to assess individual’s preferences for particular coping strategies, whereas the SOC is a measure of an individual’s capacity to respond to stressors by the appropriate application of a variety of coping and other strategies (Antonovsky, 1993). Overall, the SOC concept has many similarities with other theories of stress resistance such as health locus of control, self-efficacy, hardiness, and dispositional optimism. In his second book on SOC, *Unraveling the Mystery of Health: How People Manage Stress And Stay Well* (Antonovsky, 1987)

Antonovsky devoted an entire chapter to discussing the similarities and differences between his theory and those of numerous researchers, including Kobasa’s theory of the hardy personality (e.g. Kobasa, 1979), Boyce’s sense of permanence (e.g. Boyce, 1985), and Bandura’s theory of self-efficacy (e.g. Bandura, 1977).

### ***6.3.1 Measuring Sense of Coherence***

To operationalise the SOC, fifty-one people who had experienced a severe trauma with inescapable major consequences for his or her life were interviewed and a questionnaire, the Orientation to Life Questionnaire (SOC-29; Antonovsky, 1987 – see Appendix II) was

developed on the basis of the data collected during these interviews. The interviewees were rated as having a weak, moderate or strong sense of coherence, on the basis of the interview transcriptions by four individual raters. There was a reasonable degree of agreement between raters in classification – 62% of interviews were placed in the same category by three raters. A further 23% were placed in either the moderate or strong categories after discussion between the raters. Fifteen percent (seven interviews) were discarded due to insufficient inter-rater agreement. The interview schedules of the strong and weak SOC individuals were then examined for common themes and elements in the way life was viewed by the former group (i.e. strong SOC), but absent in the other (i.e. weak SOC), and vice versa. In this way, the language that people use to express the concepts of the SOC was identified.

The questionnaire to measure SOC was developed using facet design. In facet design the researcher specifies facets of what is to be measured and the important elements of each facet. A mapping sentence is thus created, which contains the entire potential for questionnaire items. Thirty-six items were generated using the SOC mapping sentence as well as language and concepts from the interview data. This 36-item questionnaire was extensively pre-tested. On the basis of response distributions for each item, correlation matrices, discriminant power testing and smallest-space analysis, certain items were discarded, others were reworded and a few new items were created. The end result of this process was the Orientation to Life Questionnaire (SOC-29; Antonovsky, 1987), a 29-item self-report questionnaire comprising eleven comprehensibility, ten manageability, and eight meaningfulness items.

### 6.3.2 *Psychometric properties of the Orientation to Life Questionnaire*

Following its appearance in 1979 the SOC construct received a lot of attention. However, for some time its measurement received considerably less attention and it was only following its publication in *Unraveling the Mystery of Health* (Antonovsky, 1987) that the SOC-29 became widely available. By the early 1990's the SOC-29 had been translated into at least 12 languages, but little data had been published regarding its factor structure, reliability and validity. There was evidence from three studies that the three theoretical components of the scale were not separable (Antonovsky, 1983; Dana, Hoffman, Armstrong, & Wilson, 1985; Holm, Ehde, Lamberty, Dix, & Thompson, 1988). However, none of these studies was published in peer-reviewed journals and the results were therefore tentative. Then in 1993, Frenz, Carey & Jorgensen published the first comprehensive psychometric evaluation of the SOC-29. Using a large, heterogeneous sample that included both clinical and non-clinical subjects, Frenz et al (1993) evaluated the stability and internal consistency of the scale as well as providing known-groups, discriminant, convergent, and factorial evidence for its validity. Six other measures as well as the SOC-29 were administered to 374 men and women, aged between 17 and 60 years of age. A principal components analysis of responses for the full sample data produced five factors which were substantially intercorrelated. A secondary principal components analysis was conducted to see if these five factors would further reduce to three, in keeping with Antonovsky's theory (1979; 1987). One core factor emerged from this analysis, which Frenz et al (1993) labelled 'sense of coherence'. Internal consistency was assessed by Cronbach's alpha and the value reflected a high level of internal consistency. One-week test-retest reliability was also high. A small sub-sample (N = 36) had a longer retest interval of 7 – 30 days and the analysis of this data indicated a high level of test-retest reliability also. The known-groups analysis,

which was designed to determine whether SOC scores differed among groups known to vary with respect to psychological adjustment, revealed that the patient group obtained significantly lower SOC scores than the non-patient group. Convergent evidence for the validity of the SOC was obtained by examining the relationship between SOC total scores and (a) alcohol consumption, (b) perceived stress, (c) trait anxiety, and (d) depression. SOC was not related to alcohol consumption, it was inversely related to perceived stress and trait-anxiety, and it was also inversely related to depression. Indeed it was so strongly related to trait-anxiety that Frenz et al (1993) speculated that both questionnaires (i.e. the SOC-29 and the anxiety measure) might in fact be measuring the same thing. Divergent evidence was obtained from an analysis of the relationship of SOC to social desirability. The analysis indicated that SOC was associated with social desirability. On the whole, Frenz et al's (1993) findings provided evidence that the SOC-29 scale is a reliable and valid measure of the SOC construct. However, the long-term stability of the construct was as yet undemonstrated, and further investigation of its relationship with negative affectivity was warranted.

By the time Antonovsky wrote *Unraveling the Mystery of Health* in 1987, he had developed the SOC-29 and conducted a small number studies of investigating the SOC. Since then, the number of studies investigating the concept has grown and there are now well over 300 published studies on the subject. Because Antonovsky himself was interested in health as an outcome, by far the majority of research on SOC has focused on health as an outcome variable. In the sections that follow the main findings of this body of research will be discussed.

### 6.3.3 *Sense of coherence and life stress*

Jorgensen, Frankowski, & Carey (1999) examined the stress-buffering effects of SOC in undergraduate students. Sense of coherence scores were negatively correlated with negative life events and reported psychological symptoms. Negative life events correlated positively with assessments of psychological distress. Negative life events and physical ailments were positively correlated only for those students with low SOC. This result suggests that medium and high levels of SOC attenuated the impact of negative life events on physical symptoms. Undergraduates with a high SOC experienced few psychological symptoms and showed no tendency to link physical symptoms with negative life events.

Studies such as Jorgensen et al's (1999) provide tentative evidence in support of the theory that a strong SOC allows people to manage stress. However, because the SOC is not supposed to be fully formed and stable until the late 20's, it is also necessary to assess the role of SOC in coping with adversity in older adults. Gana (2001) carried out a study to assess the potential mediating role of SOC in the relationship between adversity and psychological well being in a large sample of adults with a mean age of 54.2 years. Adversity was assessed by three indicators: anxiety, worry and stress. All three were negatively correlated with SOC and life satisfaction. The results of structural equation modelling indicated that adversity and stressful experiences do not affect psychological well being directly, but rather do so indirectly via the SOC. The structural path from adversity to well being was significant in the weak SOC group and nonsignificant in the strong SOC group. Thus adversity affected well being only in individuals with a weak SOC, which suggests a moderating role for SOC. Gana's (2001) results are therefore consistent with

Jorgensen et al's (1999) in showing that adults with a weak SOC are more vulnerable to stressful experiences than those with a strong SOC.

Another study investigated the relationship between SOC and burnout in health social workers (Gilbar, 1998b). Burnout was measured using the Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981), which is a 22-item scale that comprises three subscales: (a) emotional exhaustion; (b) depersonalisation; (c) personal accomplishment. Correlations between the subscales of the SOC-29 and the subscales of the MBI were generally high. The results of a stepwise regression analysis indicated that total SOC scores contributed to the emotional exhaustion subscale (9%), and the personal accomplishment subscale (28%), but not the depersonalisation subscale. When the regression analysis was performed using SOC subscale scores, the subscales manageability and meaningfulness were found to be responsible for these contributions to explained variance. Although no analysis according to SOC category (i.e. weak or strong) was conducted, the findings on the whole confirm the assumption that social workers with a strong SOC experienced less burnout than their colleagues with a weak SOC.

One problem with the studies reviewed so far is that they were either cross-sectional in nature (Gana, 2001; Gilbar, 1988) or retrospectively assessed their outcome variables using self-report measures (Gana, 2001; Gilbar, 1988; Jorgensen et al, 1999). A longitudinal, prospective study that investigated SOC as a potential mediator between hostility and health in women, used a behavioural marker of health in addition to self-reported health ratings as outcome variables (Kivimäki et al, 2002). Data was collected at five points over a seven-year period from 433 female municipal employees. Sense of coherence was assessed using six-items drawn from the SOC-29. Hostility was correlated with both SOC and depression,

and using structural equation modelling, was also found to predict health. When SOC and depressive symptoms were entered separately into the model as mediators, both were found to fit the data. However, the fit of the models revealed that SOC mediated between hostility and sickness absence more strongly than depressive symptoms did. The relationships between hostility, SOC, depressive symptoms and self-rated health were the same; both were mediators of the relationship between hostility and self-rated health but SOC was the more powerful. This study is powerful support for the health buffering theory of SOC. It was prospectively conducted over a long period and furthermore, used a behavioural measure of health as well as subjective reports of health.

The majority of studies that have investigated the relationship between SOC and stress, have relied upon self-report or behavioural measures of health. However, there have been a few studies that have used biological markers of health and stress as outcome variables. For example, Zhang, Vitaliano, Lutgendorf, Scanlan & Savage (2001) examined SOC as a potential buffer of the relationship between stress and fasting glucose and insulin levels in non-diabetic spouses of individuals with Alzheimer's disease and a matched control group (i.e. people not under chronic stress). It has been shown previously that negative psychological factors, such as life stress and anger, are positively associated with glucose levels (e.g. Schwabergger, 1987). Insulin and glucose levels, as well as SOC were measured twice, separated by 15 – 18 months. Caregivers had lower SOC scores, especially female caregivers, than controls. Among caregivers, men had higher glucose levels than women did, but only if their SOC score was low. If SOC was high, there was no difference in glucose levels between men and women suggesting that SOC acted as buffer between stress and glucose levels. In the control group there was no differential relationship between SOC and glucose levels in men and women. In caregivers, higher SOC at first assessment was

significantly predictive of lower glucose levels 15 – 18 months later but this difference was not found in controls. These relationships were not found for SOC and insulin. Caregivers with a high SOC also tended to experience fewer hassles and more uplifts than those with a low SOC. Furthermore, the relationship between SOC at the first assessment and glucose levels at the second assessment was mediated by hassles/uplifts. The pattern of results suggests that higher levels of SOC may make it possible for caregivers to appraise daily activities as less negative and more positive and that this in turn may lead to less glucose dysregulation. This evidence of a moderating role of SOC between stress and a known physiological marker of health, is strong support of Antonovsky's theory that individuals with a strong SOC are better equipped than those with a weak SOC to deal with stressors, and therefore experience better health.

Another study that used a biological marker of health in an investigation of SOC and life stress (Lutgendorf, Vitaliano, Reimer, Harvey, & Lubaroff, 1999) assessed a group of healthy older adults who were voluntarily relocating to congregational living facilities, and a non-relocating control group. Blood sampling and assessment of SOC took place one month prior to relocation. Natural killer (NK) cell activity was the outcome variable of interest. NK cell activity is commonly examined as an outcome measure in studies examining behaviour-immune relationships because NK cells are thought to be an important factor in resistance to viruses and tumours (Whiteside, Bryant, Day, & Herberman, 1990). Compared to the control group, relocators reported decreased positive mood and NK activity as well as elevated thought intrusion. Positive mood mediated the relationship of moving with NK activity, whereas SOC moderated this relationship. Low SOC relocators had the poorest NK activity; that of high SOC relocators was less compromised.

Many other studies on the SOC construct and its relationship with stress and health have been conducted with various populations. Consequently theoretical knowledge about the construct, for example its development and maintenance, is growing. Wolff & Ratner (1999) have extended investigation of SOC to children and adolescents. They found that traumatic events encountered in childhood were stronger predictors of adults' SOC than traumatic life events in adulthood. Research has also been carried out to establish if SOC affects individuals' perceptions of task characteristics. Shiu (1998) found that SOC was positively correlated with perceived goal progress and perceived task control in public health nurses. Furthermore, when nurses experienced interruptions and had to juggle tasks, those with a strong SOC reported more positive affect and less negative affect than nurses with a weak SOC. Findings such as these provide evidence to support Antonovsky's proposal that SOC is formed in childhood, adolescence and early adulthood. They also provide evidence about the potential mechanisms of SOC's beneficial effects on health. More longitudinal studies, as well as studies with large sample sizes, are confirming the findings of earlier studies that a strong SOC is predictive of various aspects of perceived health. For example, the results of a four-year Finnish study with a sample size of 1,976 found that a strong SOC predicted good health in men and women, and the association was not attributable to underlying associations of SOC with other variables such as level of education. Finally, the same health promoting effects of SOC have now also been confirmed in adolescents. Torsheim, Aaroe, & Wold (2001) have found that SOC scores account for between 39% and 54% of the variance in subjective health complaints in adolescents.

The studies mentioned so far have focused on health in generally healthy populations. Their results have supported Antonovsky's theory that a strong SOC allows a person to cope more

effectively with stress and to stay both physically and mentally healthy. However, Antonovsky's theory would also predict that once a person has contracted a serious illness or is subjected to a trauma over and above the ordinary hassles of daily life, the degree to which they have a strong SOC will enable them to cope with the demands of their illness. There has been extensive research on SOC in populations suffering from various chronic illnesses and diseases. The main findings of this research are discussed in the following section.

#### ***6.3.4 Sense of coherence and coping with illness***

A study of depression in patients with rheumatoid arthritis (RA) assessed the relationships between sociodemographic factors, disease activity, impairment, pain, depression, and SOC (Büchi et al, 1998). Depression scores were significantly correlated with SOC scores. Increased prevalence of depression was associated with low SOC and high self-rated pain, but not with the other factors. The combination of low SOC and high pain was associated with the highest frequency of depression. Sense of coherence made an independent contribution to the variance in depression scores of 23%, and SOC and pain combined explained 47% of the variance in depression.

Another study investigated SOC in relation to outcome after orthopaedic injuries (Ristner, Andersson, Johansson, Johansson, & Ponzer, 2000). One year after injury patients were tested for physical results and somatic complaints, as well as for quality of life, disability and depression. At a minimum of two years post-injury participants were asked to rate their

quality of life and to fill out a questionnaire to assess their SOC<sup>6</sup>. In patients belonging to the low SOC group, the risk of having a less good outcome varied between two and nine times greater than in the high SOC group depending on the outcome variable. A larger proportion of the low SOC group had a significantly worse disability outcome and reported poorer quality of life at both follow-ups than did the high SOC group. However, there is a problem associated with retrospective assessment of SOC: it is possible that if you have a poor physical outcome following injury, you may score lower on all psychological measures. Thus, low SOC in this patient group may be a consequence rather than a cause of poor outcome.

The studies reviewed so far in this section have used self-report measures of well-being to assess the role of SOC in recovery from illness. Newton (1999) however, used the objective outcome measure of return to work in her study of SOC and hardiness in liver transplant patients. This retrospective survey found a statistically significant difference in SOC and hardiness scores between participants who had returned to work and those who had not. Mean SOC and hardiness scores were higher for working than for non-working participants. Sense of coherence and hardiness scores were correlated with each other. However, a hierarchical regression analysis, entering SOC first and hardiness second, indicated that SOC was a significant independent predictor of return to work but hardiness was not. Thus SOC was an important factor in determining whether people returned to work following liver transplants.

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<sup>6</sup> The researchers used a modified SOC questionnaire, which comprised three questions where each one assessed a different component of the SOC.

Sense of coherence has also been studied in patients with irritable bowel syndrome with and without coexisting chronic pain syndrome (Sperber et al, 1999), women with breast cancer (Gilbar, 1998a) and their daughters (Gilbar & Borovik, 1998), patients with type-II diabetes (Sanden-Eriksson, 2000), elderly patients with hip fractures (Johansson, Larsson, & Hamrin, 1998), and patients and their spouses on home-dialysis for end-stage renal disease (Horsburgh & Rice, 1997). All of these studies as well as numerous others, have found a positive relationship between SOC and successful adaptation to various illnesses. There is also some evidence of a moderating role for SOC in non-healthy populations. Soderberg, Lundman, & Norberg (1997) found that SOC moderated feelings of well being in women with chronic pain syndrome.

### ***6.3.5 Sense of coherence and coronary heart disease***

As we have seen, SOC has been widely studied in relation to various illnesses and more generally, in relation to life stress. It has also been studied in relation to heart disease. For example, Dantas, Motzer, & Ciol (2002) have recently published the results of a study which assessed the contribution of SOC to variance in quality of life in 84 patients who had undergone CABG. Participants completed questionnaires related to perceived social support, self-esteem, CHD, quality of life, and SOC. There was a strong positive correlation between SOC scores and quality of life. A linear regression analysis was also conducted in four steps. The first step included demographic and illness measures and explained 48.7% of the variance in quality of life. Adding perceived social support, self-esteem and sense of coherence increased the explained variance to 64.5%, 69.4% and 75.1% respectively. Thus, SOC made an independent contribution of around 5% to the observed variance in quality of life.

Motzer & Stewart (1996) investigated the contribution of SOC to quality of life in 149 male and female patients who had survived a cardiac arrest. A total of 16 other predictor variables were also investigated. The 17 variables were entered into a multiple regression analysis in six steps. On the first step social status variables did not contribute significantly to explained variance in quality of life. The first significant contribution to the variance of 5% was attained with the inclusion of social support in the model. On step three, self-esteem contributed 24% to explained variance. Predictors reflecting instability and work of the chronic illness contributed 17% to the explained variance on steps four and five. On last step, the inclusion of SOC contributed a further 15% to the explained variance, for a total explained variance of 64%. The overall level of SOC in the study sample was reported as being quite high. Because Motzer & Stewart (1996) used the 13-item SOC questionnaire, a direct comparison of scores between this and other studies is not possible. Instead Motzer & Stewart (1996) reported that their cardiac arrest survivors mean SOC score was just 0.2 of a standard deviation below mean SOC scores for samples reported to have a strong sense of coherence, and around half to three-quarters of a standard deviation higher than mean SOC scores of samples reported to have a relatively weak sense of coherence. The relatively high mean SOC found in the sample suggested to Motzer & Stewart (1996) that something about the situation of these cardiac arrest survivors might have increased their overall level of SOC. The implication of this is that, contrary to Antonovsky's prediction that SOC is not likely to change once it stabilises in the late 20's, it might in fact be affected as a result of surviving serious adversity. A further implication is that if SOC was enhanced without intervention, then specific interventions might be successful in increasing SOC in people with chronic illnesses and consequently lead to improved quality of life. While Motzer & Stewart's (1996) study appears to provide evidence of a strong role for SOC in quality of life post-cardiac arrest (an independent contribution of 15%), an important criticism of the

study is that 17 variables were used in a regression analysis with a sample size of 149. Using the rule of thumb of  $N > 50 + 8.m$  where  $m$  is the number of predictor variables, a regression analysis with 17 predictor variables would require a sample size of 186 (Tabachnik & Fidell, 2001). This criticism also applies to Dantas et al's (2002) study. Therefore the results of these two studies should be regarded as tentative.

SOC has also been investigated in relation to recovery from first-time MI. Drory, Kravertz, & Florian (1999) were interested in the contribution of a number of variables to patients' psychosocial adjustment following MI. Sociodemographic data, as well as medical information, was collected from patient records and interviews. Depression, SOC and social support were also assessed. Information on psychosocial adjustment was collected between 3 and 6 months post-MI; all other information was collected prior to discharge. Overall, participants reported a reasonable degree of psychosocial adjustment to their cardiac illness and MI. Hierarchical regression analysis was used to investigate the contribution of 10 variables to psychosocial adjustment. Psychological and sociodemographic variables predicted the largest amount of variance across a variety of life domains. Sense of coherence was positively related at a significant level to four of seven assessed psychosocial life domains, thus patients with higher levels of SOC at discharge reported more positive psychosocial adjustment 3 – 6 months later. Perceived social support was negatively related to three life domains. Therefore, patients with greater social support reported better psychosocial adjustment. Of the medical variables, only Killip class at discharge (i.e. infarction severity) contributed a significant amount to the variance in three of the seven psychosocial adjustment categories.

It has been argued that the achievement of long-term adherence to rehabilitation programs is related to an individual's desire to maintain health rather than to cure disease (Sluijs & Knibbe, 1991). As the SOC concept was developed to "predict and explain movement toward the health end of the health ease/disease continuum" (Antonovsky, 1993; p. 730) it could be very relevant in understanding the problem of adherence. Accordingly Kamwendo, Hansson, & Hjerpe (1998) invited patients who took part in a comprehensive cardiac rehabilitation program to participate in a study that investigated the possible relationships amongst adherence, SOC and knowledge of lifestyle recommendations. Adherence was gauged by asking participants to rate the extent to which they followed the lifestyle changes recommended by the cardiac rehabilitation team. Eighty-nine percent of individuals changed at least one behaviour following the rehabilitation team's recommendations. SOC was not significantly correlated with either the adherence scale score or the number of changes carried out. There was a positive correlation between SOC and cardiac knowledge but no relationship between cardiac knowledge and adherence. On the whole then, the study found no evidence to suggest that the SOC concept might be useful in identifying patients who are at risk of not adhering to a cardiac rehabilitation program.

Karlsson, Berglin, & Larsson (2000) conducted a longitudinal study to investigate SOC and emotional state before and after CABG, and also to examine the relationships between SOC outcome and both emotional state and experience of chest pain one year after CABG. The participants completed a number of questionnaires at five time-points: the week before coronary angiography; the day before CABG surgery; and 3, 6 and 12 months post-operatively. Test-retest reliability of SOC scores for the whole sample was high. However, when the researchers compared individual participant's pre- and 1-year post-operative SOC scores, they found that almost half the participants' SOC scores had changed. Karlsson et al

(2000) divided the sample into 3 groups: one which included patients (14.7%) who had increased their SOC by 10% or more; one which included patients (26.6%) who had decreased SOC scores of 10% or more; and a third group of patients (58.7%) who reported stable SOC. Change in SOC was not related to pre-operative level of SOC. This finding does not support Antonovsky's assertion that individuals with a strong SOC are better equipped to deal favourably with significant life stressors. It also suggests that SOC is not as stable in adulthood as Antonovsky believed. Loneliness was unchanged at 1-year follow-up, but depression, anxiety and stress all decreased from pre- to post-CABG. Patients with a strong SOC reported better outcomes in terms of loneliness, stress, anxiety and depression than did patients with a moderate or weak SOC. Furthermore, significantly more patients in the moderate/weak SOC group than in the strong SOC group reported chest pain post-operatively (21% v. 42%). The findings of this study therefore provide mixed evidence for Antonovsky's salutogenic theory.

Despite the importance of carrying out prospective studies in order to test Antonovsky's assumptions about the health-protective benefits of a strong SOC, the majority of studies on SOC and the salutogenic model have been cross-sectional and retrospective in nature. There are however examples of prospective, longitudinal studies of SOC. For example, Poppius, Tenkanen, Kalimo, & Heinsalmi (1999) carried out a very large scale, prospective study of the risk of CHD according to SOC in 4405 Finnish men. The follow-up period was eight years. There were differences in clinical findings for blue and white collar workers relating to total cholesterol, blood pressure, body-mass index and smoking, i.e. risk factors for CHD. However, only leisure time physical activity varied according to SOC. With regard to actual incidence of CHD, in the white collar work group those with a weak SOC had almost double the rate of CHD than those with either a moderate or strong SOC. A similar effect was not

observed in the blue collar workers; contrary to theoretical expectations, blue collar workers with a low SOC had a lower incidence of CHD than blue collar workers in the medium or high SOC categories. This mixed pattern of results is difficult to explain in terms of Antonovsky's salutogenic theory and the researchers have no alternative explanation of their results.

### ***6.3.6 Sense of coherence and post-traumatic stress disorder***

Antonovsky's hypothesis that SOC is a personality variable that may directly affect or modify the course of the stress process has now been validated by numerous studies. Having a strong SOC significantly contributes to a person's ability to cope with stressful situations. A strong SOC has also been shown to lead to better quality of life following serious cardiac events such as cardiac arrest and MI. Previous research, including the study reported in Chapter 5 of this thesis, has shown that PTSD can develop in a significant minority of cardiac arrest and MI survivors. The hypothesis to be tested in Study IV is that SOC will affect the development of PTSD and the severity of PTSD symptoms. A number of studies have recently investigated this potential relationship between SOC and PTSD. The first of these was reported by Ulrich Frommberger and his colleagues (Frommberger et al, 1999). Frommberger et al (1999) assessed road traffic accident victims for symptoms of PTSD according to DSM-III-R criteria, for general psychopathology, and for a number of personality traits and attributional style. Patients were assessed shortly after their accident and again six months later. At the six-month assessment participants were assessed again for PTSD and a sub-group also completed the SOC-29. The researchers report that SOC was only measured at the follow-up assessment because according to Antonovsky, the SOC is a stable trait and therefore, they did not expect any change in SOC scores over the follow-

up period. Patients who fulfilled criteria for PTSD or subsyndromal PTSD after their accident had significantly lower SOC scores than patients without any psychiatric diagnoses. Sense of coherence scores correlated negatively with the duration of in-patient rehabilitation after the accident. Sense of coherence was also negatively correlated with expected negative health consequences of the accident, and positively correlated with an optimistic outlook for the future. At both assessments, SOC total scores were negatively correlated with all the self-rating scales for psychopathological symptoms including PTSD. The results of this study are interesting not only because they show an association between PTSD symptoms and sense of coherence, but also because of the association found between SOC and an objective physical health marker, i.e. the amount of physical rehabilitation required by road traffic accident victims.

A second study investigated the prevalence of PTSD, SOC, and coping patterns in road traffic accident victims (Schnyder, Buchi, Morgeli, & Sensky, 1999). Patients were assessed for PTSD in the weeks after the accident. Post-traumatic stress symptomatology did not correlate with objective injury criteria, but rather with pre-trauma variables (female gender, biographical risk, life events), victims' subjective appraisal of the severity of the accident, their current coping strategies, and their SOC. As one would expect, SOC was negatively correlated with PTSD symptoms. This study also provides further evidence that there is no relationship between injury severity and subsequent PTSD, but that there is a significant effect of the victims' subjective appraisal of threat during the event.

Dudek & Koniarek (2000) went one step further and asked what is the relationship between particular components of the SOC and PTSD symptoms? Although previous empirical

evidence suggested that SOC scores should not be broken down into its constituent parts<sup>7</sup>, the authors of this paper cite evidence which indicated that components of the SOC correlate to a varying extent with variables such as anxiety, hostility and somatisation (Mroziak, Czabala, & Wójtowicz, 1997). Dudek & Koniarek (2000) assessed 464 fire-fighters for PTSD symptoms and for SOC. Total scores and three subscale scores for both PTSD and SOC were calculated. Sense of coherence scores were significantly lower in the sub-group of fire-fighters with PTSD than in the sub-group without PTSD. The significant differences were between the two groups' scores on the comprehensibility and meaningfulness components, but not on the manageability component of the SOC. Correlational analyses of the components of PTSD (re-experiencing, avoidance, arousal) and SOC indicate an overall trend for individuals with lower SOC scores to report more severe PTSD symptomatology. The comprehensibility component of the SOC was the most strongly correlated with all PTSD dimensions, with the strongest relationship between comprehensibility and avoidance symptoms. The only non-significant correlation was between meaningfulness and trauma re-experiencing. The findings of this study provide interesting evidence about the relationship of the various components of the SOC to pathological reactions to trauma.

Finally, Ortlepp & Friedman (2001) report the results of a study that investigated the relationship of SOC to the incidence of indicators of secondary traumatic stress in a sample of non-professional trauma counsellors. Secondary traumatic stress (STS) refers to the experience of traumatic stress reactions in people who are not the primary victim of the trauma but perhaps family members, work colleagues, friends and neighbours, or people who assist the primary victim. This study is also one of a growing number that have focused

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<sup>7</sup> This is based on the fact that factor analysis of SOC data has tended to identify one rather than three separate factors.

on the relevance of the three sub-components of the SOC to the outcome variable/s of interest, in this case, the development of STS reactions. Data was collected from trauma counsellors six weeks after they had been involved in a trauma counselling incident. The results of the study indicate a statistically significant and strong relationship between the SOC construct and the various indicators of STS. Global SOC scores contributed to between 12% and 35% of the variance in the scores on the STS indicators. Stepwise regression analysis on four indicators of STS using the three components of SOC as predictor variables indicated that between 14% and 35% of the variance in these indicators may be explained by combinations of two SOC sub-components. For example, SOC manageability explained 29% of the variance in compassion fatigue scores, and SOC comprehensibility contributed a further 6%, for a total of 35% explained variance. Overall, this study showed that strong inverse relationships exist between SOC - and its subscales - and indicators of secondary traumatic stress. Consistent with the findings of Dudek & Koniarek (2000) who reported the strongest association between manageability and comprehensibility and PTSD symptoms, Ortlepp & Friedman (2001) also report the strongest associations between STS symptoms and these two components of SOC.

### ***6.3.7 Sense of coherence v. negative affectivity***

According to Antonovsky, SOC is a dispositional orientation that engenders, sustains and enhances health, as well as other positive outcomes. The SOC-29 and the abbreviated SOC-13 were developed for the purpose of measuring individual SOC scores. However, there has been concern in the literature that the SOC-29 scale simply measures negative affectivity (NA). (NA is described in detail in section 6.2.1) The studies reviewed in this chapter have provided consistent evidence of an association between SOC and recovery from illness as

well as general health. They have also provided evidence that SOC is correlated with measures of anxiety, which is a component of trait NA. NA is associated with high levels of reporting or complaining of physical illness (see section 6.2.1), as is SOC. However, NA does not generally predict the development of serious physical illnesses such as CHD (for a comprehensive review of this subject see (Costa & McCrae, 1987), whereas initial evidence suggests that SOC does predict the development of CHD at least in some men (Poppius et al, 1999).

There have been a small number of studies that have attempted to determine the degree to which the SOC and NA represent two distinct, though conceptually related constructs. For example, Kravetz, Drory, & Florian (1993) assessed SOC, NA and Kobasa's health proneness construct of hardiness (Kobasa, 1979), in a sample of male CHD patients. Correlational analyses indicated that the health proneness construct was generally distinguishable from the negative affectivity construct. However, there appeared to be considerable overlap between SOC and the measures of NA. The largest correlation with SOC and another measure of health proneness was 0.48. This was equal to the correlation between SOC and depression and smaller than the correlation between SOC and anxiety (-0.53). In order to explore this further, the researchers selected three factor models that reflected the central issues in the controversy surrounding measures of health proneness and measures of negative affect. If Antonovsky's theory of SOC and Kobasa's theory of hardiness are correct, and SOC and hardiness are conceptually distinct from NA, then an oblique two-factor model where the five indices of health proneness used in this study would load on one factor, and the three indices of NA would load on the second, and where these two factors would also be correlated, should be the most appropriate fit. A unifactor model where health proneness measures and NA measures load on the same factor should be

a better fit if the critics of SOC and hardiness are correct, and SOC and hardiness are actually positively phrased negative affect. The third model tested was a two-factor orthogonal model in which the assumption was that the health proneness and negative affect indices would load on two separate factors but would not be significantly correlated with each other. The results of the model testing revealed that the best fitting model was the oblique two-factor model. Therefore the results of this study support Antonovsky's and Kobasa's views that SOC and hardiness are related to, though distinct from, NA.

In addition to writing extensively on the salutogenic paradigm, Strümpfer and his colleagues have conducted numerous studies on the SOC construct and its relation to health. They have also paid considerable attention to the question of whether the SOC questionnaires measure the absence of NA rather than the SOC construct. In his first reported study of SOC and NA, Strümpfer (1997) reported a negative correlation between scores on the SOC-13 scale and the NA subscale of the PANAS of  $-0.30$ . Corrected for unreliability of the SOC-13 the correlation rose to  $-0.42$ . Scores on the NA scale were not correlated with health ratings 9 months later but SOC scores were ( $0.32$ ). Partialling out the effect of NA the correlation dropped to  $0.25$ . Hierarchical multiple regression analysis, with age, education, NA and SOC-13 regressed onto health ratings revealed that SOC-13 was the only significant predictor of health ratings.

Strümpfer, Viviers, & Gouws (1998) reported the combined findings from three diverse samples in which SOC and NA were assessed. All samples completed the SOC-29 and the researchers also created separate scores for the negatively (12 items) and neutrally (15 items) phrased items of the questionnaire. It has been suggested that the 12 negatively phrased items of the SOC, by virtue of being phrased negatively could be accounting for the

high correlations of SOC with NA (Antonovsky, 1994). However, the pattern of results from the three studies suggested that item phrasing is not solely responsible for variation in the SOC-29 questionnaire. The patterns of correlation of the two subscales (neutral and negative) with the full SOC-29 and with the different trait scales were all so similar that the authors suggest that they are not likely to contribute differently to the SOC total score. Stepwise multiple regression analyses showed that between 39 – 50% of the variance in the two subscales could not be explained in terms of variance in common with the NA and PA measures.

Finally, Mlonzi & Strümpfer (1998) carried out an investigation of potential personality correlates of the SOC-29, by administering the Sixteen Personality Factor Questionnaire (16PF; Cattell, Eber, & Tatsuoka, 1970) and the SOC-29 to undergraduate psychology students. In the total sample, three of the five second-order factor scores correlated significantly with the SOC scale scores and in the female sub-sample a further two more did. Anxiety was negatively correlated with SOC ( $r = -0.52$ ) but explained only 27% of the variance in SOC scores. Sense of coherence scores were also correlated with the factors Extraversion and Control. For the female sub-sample only, SOC scores were correlated with Tough Poise and Independence. The authors conclude that as SOC was significantly correlated with three of five second-order personality factors, and in the female sub-sample with the other two, it must be a highly complex personality disposition which is indirectly related to a wide variety of primary personality traits. On the negative correlation between the SOC scale and the anxiety factor, Mlonzi & Strümpfer (1998) comment that it seems inappropriate to define the factor only in terms of the pathological pole (i.e. anxiety). The positive end of the continuum could be used just as well to define it. Furthermore, as anxiety explained just 27% of the variance in SOC scores, the researchers conclude that with

so much variance remaining unexplained, SOC cannot be interpreted as merely the inverse of anxiety.

Carmel & Bernstein (1990) conducted a longitudinal assessment of both SOC and trait anxiety in a group of medical students. The perception of stressors, trait anxiety and SOC were assessed at three time-points during medical training. Stressor scores were highest in the second year of training, and significantly higher in second year than in both the orientation program and first year. Individual trait-anxiety scores increased systematically over time, and SOC scores decreased over time. The correlations between trait-anxiety and SOC were high at each of the three stages (-0.69 to -0.76) and considerably higher than the correlations generally reported by Strümpfer and his colleagues. This study shows clearly that SOC can decrease in the face of increasing stressors. However, this group of students is well below the age at which Antonovsky hypothesised that the SOC would stabilise. Thus, Carmel & Bernstein's (1990) study findings do not weaken Antonovsky's argument about the stability of the SOC. The researchers do not make any comments about the strong negative correlation between trait-anxiety and SOC and whether this indicates that the two scales have measured the same underlying personality dimension.

### **6.3.8 Conclusion and hypotheses**

Antonovsky's SOC concept has been widely adopted by researchers, particularly those working in health related domains. Part of its appeal is likely to be attributable to the more positive focus of the salutogenic approach to health, in comparison with the traditional pathogenic approach. It is important to note that Antonovsky never proposed salutogenesis to be a rival on the pathogenic stage. Rather he proposed that it should be a complement to

traditional medical approaches and a means of generating new research hypotheses. A large body of research now supports the assumption that SOC is an important contributing factor to resiliency and effective coping following serious illnesses, including CHD. It has also been shown to be an important factor in the management of general life stress. Numerous studies have found that individuals with a weak SOC<sup>8</sup>, whether they are generally healthy or living with serious illness, report more physical symptoms of poor health, take more sick-leave from work, and experience more psychological symptoms of depression and anxiety than individuals with a strong SOC. Studies have found evidence that SOC moderates the relationship between stress and health, and between illness and well-being. There is also evidence that SOC is a protective factor in the development of PTSD following traumatic events, including medical events such as MI. Study results have shown that SOC is normally distributed, and that individuals with chronic illness and/or disease have SOC scores comparable to the general population. However, despite the fact that people with chronic diseases such as fibromyalgia, rheumatism, or CHD, may not differ in SOC from the general population at a group level, it is still important to identify those individuals who have a weak SOC as they may need more support to cope with the demands of their illness. In the previous study, reported in Chapter 5, it was shown that a significant minority of MI patients suffered from PTSD after their MI. However, PTSD is not an all or nothing reaction and significant numbers of individuals suffer from stress reactions whilst not fulfilling DSM-IV criteria for the disorder. Similarly, in the salutogenic paradigm, health is conceived of as a continuum from ease to disease and individuals move along the continuum according to the stressors in their lives and their SOC. In the present study it was proposed

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<sup>8</sup> Level of SOC has previously been defined relative to the particular study sample and in numerous different ways. For example, some researchers have used median splits to define weak and strong groups; others have split samples into three equal groups.

that SOC and number of PTSD symptoms would be negatively related; on the basis of Antonovsky's theory and the available research evidence it was expected that a strong SOC would protect against the development of traumatic reactions following a serious cardiac event such as MI.

By far the most debated subject surrounding the SOC concept is whether it can be distinguished from the NA construct or if it is merely another measure of NA. Consistent and strong negative correlations between SOC-29 scores and various measures of NA have been reported and thus, it has been argued that the SOC-29 scale is seriously contaminated with NA. However, Antonovsky wrote, "It seems reasonable to expect that SOC will be negatively related to anxiety" (1987, p. 83), thus the constructs of SOC and NA were always anticipated to be empirically related but conceptually distinct. A certain amount of evidence has accumulated which suggests that the constructs are in fact distinct. However, the vast majority of studies on SOC still fail to control for NA. Thus a main aim of the following study was to investigate the contribution of SOC to the development of PTSD symptoms following MI, over and above any contribution of NA and other known contributing variables.

Evidence regarding the stability of SOC remains sparse. Antonovsky (1979; 1987) has proposed that once adulthood is reached and the SOC has stabilised only major stressors will have any significant effect on the SOC and even then, a degree of consistency or repetition of the stressor is required to facilitate permanent change. Otherwise any changes are expected to be minor and temporary. While the majority of studies have simply assumed that SOC is stable, there is some evidence that when SOC scores are examined at an individual level, many individuals have reported considerable variation in SOC level over a

follow-up period. Furthermore, the pattern of change in SOC scores has not been as Antonovsky would have predicted; individuals with a weak SOC appear to experience improvements in their SOC level in the face of serious illness, just as much as individuals with a strong SOC (Karlsson et al, 2000). A final aim of the present study was to assess the stability of SOC scores in the face of a stressor, and over time.

The hypotheses to be investigated will be:

1. Individuals with PTSD will have lower SOC scores than individuals without PTSD.
- 1b. There will be an inverse correlation between SOC scores and PTSD symptoms.
2. Sense of coherence will explain a significant amount of the variance in post-traumatic stress symptomatology after controlling for negative affectivity and other known contributing variables.
- 3a. There will be no significant difference in the SOC scores of those participants who experience a minor stressor prior to assessment of their SOC and those who do not experience any such stressor.
- 3b. Sense of coherence will be stable across a follow-up period.

#### **6.4 Method**

The method section is divided into four sub-sections describing the study population, the measures used to assess PTSD symptoms, the measures used to assess the relevant psychological variables, and the study procedure.

#### **6.4.1 Study population**

Two-hundred and twenty-two men who were discharged alive following their first MI were identified from the discharge summaries of the men's cardiac ward of the Royal Infirmary of Edinburgh. Patients were admissible to the study if they were aged between 18 – 75 years and resident in the Lothian region. Each patient's general practitioner was contacted initially to establish whether the patient was still alive. Once they were confirmed on their general practitioner's records, patients were contacted by phone and the study was explained to them. Of the 225 potential participants, 68 were untraceable (incorrect GP, incorrect telephone number, no answer to either phonecalls or written invitations). Fifteen were unable to participate for various reasons including blindness, hearing difficulties, work commitments, illness, and subsequent MI. Of the remaining 142 potential participants, 118 (83%) agreed to be interviewed. Written consent was obtained at the time of assessment. See Appendix I for consent forms and participant information sheets. Participants were assessed in the cardiology department of the Royal Infirmary of Edinburgh or in their homes. They were assessed at least three and no more than 10 months after their MI. The local health authority research ethics committee granted ethical approval for the study.

#### **6.4.2 Assessment of PTSD symptoms**

Post-traumatic stress symptoms were assessed by clinical interview and by self-report.

##### Clinical interview:

The PTSD module of the Structured Clinical Interview for the Diagnostic and Statistical Manual 4<sup>th</sup> Edition (SCID; First et al, 1997) is the most widely used "gold standard" criterion against which self-report measures of PTSD have been validated and was the

chosen interview measure. The SCID is described in detail in Chapter 5, section 5.3.3. All SCID interviews were audiotaped and those that produced a positive diagnosis were rated by a second experienced clinician. Inter-rater agreement for PTSD-positive cases was 100%.

*Self-report:*

The Self-Rating Scale for PTSD (SRS; Carlier, Lamberts, Uchelen, & Gersons, 1998) assesses the 17 DSM-IV diagnostic criteria for PTSD and also provides information about symptom severity. The questionnaire comprises 22 items that together assess the entire PTSD syndrome: 5 re-experiencing symptoms, 7 avoidance symptoms, and 5 hyperarousal symptoms. In order to meet diagnostic criteria for PTSD on the SRS an individual must report at least 1 re-experiencing, 3 avoidance, and 2 hyperarousal symptoms. The severity of each item over the previous 4 weeks is rated on a three-point scale and scores range from 0 - 51. Scores in excess of 23 indicate a high likelihood PTSD. The SRS has good internal consistency and reliability, and its developers have reported a sensitivity rate of 86%.

In addition, intrusion and avoidance symptoms were measured using the Revised Impact of Events Scale (IES). The IES is described in detail in Chapter 5, sections 5.3.3 and 5.4.4.

**6.4.3 Assessment of psychological variables**

Sense of coherence was measured using the Orientation to Life Questionnaire (SOC-29; Antonovsky, 1987). The SOC-29 is a 29-item self-administered measure, which assesses the three components of the SOC construct. It contains 11 comprehensibility items, 10 manageability items, and 8 meaningfulness items. Examples of items are: “Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew

well?” (comprehensibility); “Do you think that there will *always* be people whom you’ll be able to count on in the future?” (manageability); “How often do you have the feeling that there’s little meaning in the things you do in your daily life?” (meaningfulness). Responses are given on a seven-point Likert scale and the theoretical range of scores is from 29 – 203. Factor analysis of data collected with the SOC-29 has indicated that the three component scores are not empirically separable (Frenz et al, 1993). Although each item is either a comprehensibility, a manageability or a meaningfulness item, the method used to construct the questionnaire (facet-design) meant that items would be similar to each other on four of five selected facets and this probably accounts for its loading on one rather than three factors. However, studies have used the three component scores separately (Dudek & Koniarek, 2000; Ortlepp & Friedman, 2001). The internal consistency and reliability of the SOC-29 are confirmed by the consistently high levels of Cronbach’s alpha that have been reported. See section 6.3.3 for a detailed review of the psychometric properties of the SOC-29.

Negative affectivity was assessed using the Positive and Negative Affect Schedule (PANAS; Watson et al, 1988). This self-administered measure consists of two independent scales, comprising 10-items each, which assess both negative and positive affectivity. Each item is a word that describes a feeling or emotion and respondents are asked indicate to what extent they feel that way. The PANAS instructions can be modified to assess PA and NA as either a state or a trait variable. Because the variable of interest in this study was trait-NA, general time instructions were used (i.e. “Please indicate to what extent you generally feel this way, that is, how you feel on average”). Responses are recorded on a five-point scale from “Very slightly, or not at all” to “Very much”; NA scores therefore range from 5 – 50. Eight-week test-retest reliability for the PANAS increases as the rated time frame increases.

Reliability is highest for the NA scale using general instructions. Internal consistency for the PANAS is good, and it also has excellent convergent and discriminant correlations with lengthier measures of the underlying mood factors (Watson, Clark, & Tellegen, 1988).

Anxiety and depression were measured using the Hospital anxiety and depression scale (HADS). A complete description of the HADS can be found in Chapter 3, section 3.3.2.

#### **6.4.4 Other measures**

Social support is known to have a moderating effect on stressful life events and has recently been shown to moderate the development of PTSD symptoms in a sample of MI patients (Bennett & Brook, 1999). Furthermore, social support has previously been found to be unrelated to SOC (Hart, Hittner, & Paras, 1991). The Duke-UNC Social Support Questionnaire was therefore included in the battery of questionnaires that participants completed (Duke-UNC; Broadhead et al, 1988). The Duke-UNC is an 8-item, self-administered, functional social support questionnaire. It consists of two subscales measuring confidant support (five items) and affective support (three items). Examples of items are: "I get chances to talk to someone I trust about my personal and family problems" (confidant support) and "I get help when I'm sick in bed" (affective support). Responses are recorded on a five-point scale. The extreme points on the scale are anchored with the responses "As much as I would like" and "Much less than I would like".

Finally, following Bennett & Brook (1999) the degree to which participants were aware that they were of having an MI at the time it occurred was assessed with a single item answered

on a 4-point scale. The scale extremes corresponded to “Certain I was having a heart attack” and “No idea I was having a heart attack”.

Data was also collected on participants’ smoking status, occupation, marital status, previous psychiatric history, attendance at cardiac rehabilitation, and receipt of the British Heart Foundation Heart Manual at hospital discharge.

Appendix II contains copies of measures used in Study IV.

#### **6.4.5 Procedure**

The assessment was completed in the following order:

1. PANAS
2. SOC-29
3. IES
4. SRS
5. HADS
6. SCID
7. Duke-UNC
8. Awareness of MI
9. Sociodemographic and cardiac data

Sense of coherence has been described as a stable dispositional orientation and as such should not significantly change over time. SOC scores would also not be expected to fluctuate as a result of minor stressors, such as recollecting and discussing a traumatic event. The SCID could be considered as a minor stressor potentially evoking unpleasant emotions or memories of the MI event. In order to test the stability of SOC scores in the face of a minor stressor, the study procedure was counterbalanced. Half of the participants completed the SOC-29 prior to PTSD assessment and the other half completed the SOC-29 following assessment of PTSD symptoms. Thus half the participants completed the assessment in the

order outlined above, and the other half completed measures 1 and 2 (SOC and NA) after completing items 3 – 6, and before completing items 7 – 9.

A further check of the stability of SOC was obtained by sending each participant a follow-up SOC-29 questionnaire by post, approximately four weeks after the initial assessment.

Stamped, self-addressed envelopes were enclosed to facilitate reply.

## **6.5 Analysis and results**

### **6.5.1 Analyses**

Number of diagnoses of PTSD according to the self-report measure and the clinical interview was compared using chi-squared analysis. Agreement on “caseness” between the two measures of PTSD was measured using Cohen’s kappa statistic. Independent samples t-tests were used to compare SOC scores of 1) individuals who fulfilled diagnostic criteria for PTSD and those who did not according to both self-report and clinical interview, and 2) those who scored in the high, medium, and low categories on the IES. Independent samples t-tests were also used to compare the number of PTSD symptoms in participants who had previously had a psychiatric disorder and those who had not. The relationship between PTSD severity and SOC was tested by Pearson’s correlations on number of PTSD symptoms and SOC scores. Partial correlations were used to control for NA. Hierarchical regression analysis was used to determine the best predictors of PTSD symptoms and to ascertain the independent contribution of SOC, if any, to PTSD symptoms. Inclusion of five predictor variables in the regression equation necessitated the inclusion of 90 participants (i.e. 50 + 8(5) participants), thus the sample size of  $N = 118$  was sufficient for the proposed

hierarchical regression analysis. To test the stability of SOC, mean SOC scores of those who completed the SOC-29 prior to the PTSD assessments and those who completed it after PTSD assessment were compared using independent samples t-tests. In addition, participants mean scores at initial assessment and follow-up were compared using a paired t-test.

### **6.5.2 Demographic details**

Participants were aged between 36 and 75 years of age. Mean age was 60.4 (9.47) years. The mean interval between MI and assessment was 6.37 (1.8) months, with a range of 3 – 10 months. The majority of the sample was married (92.4%); three men (2.5%) were currently divorced; five (4.2%) were single; and one (0.8%) man was widowed. At the time of assessment 74.6% of the sample were non-smokers, although at the time of their MIs 46.6% smoked. Thirteen (of 116; 11.2%) men had previous diagnoses of depression and one man had a previous anxiety disorder.

### **6.5.3 Prevalence of PTSD**

Sixteen (13.6%) men reported sufficient symptoms to warrant diagnoses of PTSD according to the SRS (self-report questionnaire). The mean number of symptoms reported was 3.93 (2.98) with a range of 0 – 16 symptoms. When PTSD symptoms were assessed by clinical interview (SCID) four (3.4%) men fulfilled DSM-IV diagnostic criteria for PTSD. Chi-square analysis revealed a highly significant difference between the two prevalence rates ( $\chi^2 = 26.39$ ;  $df = 1$ ;  $p < 0.0001$ ). Cohen's kappa statistic was 0.36 and there was 80% agreement

between the two measures. However, there were 8 false positive diagnoses made using the SRS (see *Table 6.1*).

**Table 6.1** Comparison of structured clinical interview (SCID) and self-report (SRS) diagnoses of PTSD in the myocardial infarction patients.

		<i>SCID</i>	
		<i>PTSD +ve</i>	<i>PTSD -ve</i>
<i>SRS</i>	<i>PTSD +ve</i>	4	12
	<i>PTSD -ve</i>	-	102

Patients who fulfilled criteria for PTSD according to the SCID had significantly lower SOC scores than those who did not. The same result was found when PTSD was assessed by self-report (see *Table 6.2*). *Table 6.2* contains information on participants' mean SOC scores. Severity of PTSD symptoms and SOC scores were significantly negatively correlated. This result was found whether symptoms were assessed by clinical interview ( $r = -0.57$ ;  $p < 0.0001$ ) or by self-report (Pearson's  $r = -0.51$ ;  $p < 0.0001$ ). Controlling for NA in the correlational analyses between PTSD symptom severity and SOC scores reduced the magnitude of the correlations but they remained significant: clinical interview ( $r = -0.37$ ;  $p < 0.0001$ ); self-report ( $r = -0.31$ ;  $p < 0.01$ ).

**Table 6.2** Sense of coherence scores for MI patients who fulfilled DSM-IV diagnostic criteria for PTSD and those who did not

<i>PTSD diagnosis</i>	<i>No of cases</i>	<i>Mean SOC score</i>	<i>t-value</i>	<i>p-value</i>
<i>SCID Yes</i>	4	104.25 (20.8)	4.108	$p < 0.0001$
<i>No</i>	114	151.97 (22.9)		
<i>SRS Yes</i>	16	126.06 (27.7)	4.659	$p < 0.0001$
<i>No</i>	102	154.17 (21.6)		

Participants were also divided into two groups based on IES scores and in accordance with Horowitz's (1982) recommendation that total scores in excess of 19 indicate the presence of a high degree of intrusive and avoidant phenomena: low IES symptoms = 75 (63.5%) participants: mean SOC score - 154.57 (22.2); high IES symptoms = 43 (36.5%) participants: mean SOC score - 143.0 (26.4). The group in the high IES symptoms category had significantly lower SOC scores than the group in the medium or low symptoms categories ( $t = 2.543$ ;  $df = 16$ ;  $p < 0.05$ ).

*The effect of previous psychiatric disorder:*

MI patients who had a previous or current psychiatric disorder (depression or anxiety) were more likely to develop PTSD symptoms than patients who had never had a psychiatric disorder: number of PTSD symptoms according to SRS ( $t = -3.367$ ;  $df = 14$ ;  $p < 0.01$ ); number of PTSD symptoms according to SCID ( $t = -3.708$ ;  $df = 14$ ;  $p < 0.01$ ). Patients who had a previous psychiatric disorder also had significantly lower SOC scores than those who did not ( $t = 5.191$ ;  $df = 16$ ;  $p < 0.0001$ ). See *Table 6.3*.

**Table 6.3** *Mean SOC scores (s.d.) and PTSD severity scores (s.d.) of MI patients who had previous psychiatric disorders and those who did not*

<i>Previous disorder</i>	<i>No of cases</i>	<i>No of PTSD symptoms: SCID</i>	<i>No of PTSD symptoms: SRS</i>	<i>SOC score</i>
<i>Yes</i>	14	5.07 (3.5)	7.57 (4.5)	121.43 (23.5)
<i>No</i>	102	1.52 (1.9)	3.49 (2.4)	153.83 (21.7)

**6.5.4** *The contribution of SOC to PTSD symptoms*

In order to determine whether SOC was a significant independent contributor to the variance in PTSD scores, multiple regression analyses were performed on the data. Using

hierarchical regression analysis, the predictor variables of interest were regressed on the number of PTSD symptoms according to the SCID, in four steps. Order of entry was determined by both theoretical importance and evidence from previous research. Age and awareness of MI at the time were entered at the first step, followed by social support on the second step. These three variables have been shown to significantly contribute to the variance in PTSD symptoms post-MI but were of least interest here. Because the aim of the study was to establish the contribution of SOC to the development of PTSD symptoms *over and above* the contribution of NA, these two variables were entered on separate steps. NA was entered on the third step, and finally, SOC was entered on the fourth step. The model accounted for 40.1% of the variance in PTSD symptoms and the overall relationship was significant ( $F_{5,111}=16.52$ ;  $p < 0.0001$ ). *Table 6.4* shows the results of the regression analysis and the variance explained at each step. Sense of coherence contributed an additional 3.2% to the variance after all other variables had been entered. With other variables held constant PTSD was negatively related to SOC, age, awareness of MI and social support, and positively related to NA. However, only the effects of SOC ( $t=-2.65$ ;  $p < 0.01$ ) and NA ( $t=3.62$ ;  $p < 0.0001$ ) were significant.

**Table 6.4** Results of the final step of the hierarchical regression analysis on number of PTSD symptoms according to the SCID (clinical interview)

<i>Model 4:</i>	<i>Variable</i>	<i>Adjusted R<sup>2</sup></i>	<i>β value</i>	<i>t-value</i>	<i>p-value</i>
	Age		-.12	-.166	.10
	Awareness	.040	-.002	-.024	.98
	Social support	.189	-.14	-1.59	.12
	NA	.369	.33	3.62	<.0001
	SOC	.401	-.28	-2.65	<.01

The hierarchical regression analysis was performed in the same way using SRS symptom scores (i.e. self-reported symptoms). The model explained a total of 31.7% of the variance

in self-reported PTSD symptoms and the relationship was significant ( $F_{5,111}=11.74$ ;  $p < 0.0001$ ). Age, awareness of MI, social support and NA combined explained 30% of the variance in PTSD scores according to self-report. When SOC was entered into the equation it contributed a further 1.7% to explained variance (see *Table 6.5*). However, only the effects of social support and NA were significant. The effect of SOC showed a trend towards significance ( $p=.058$ ).

**Table 6.5** Results of the final step of the hierarchical regression analysis on PTSD symptom severity according to the SRS (self-report)

<i>Model 4:</i>	<i>Variable</i>	<i>Adjusted R<sup>2</sup></i>	<i>β value</i>	<i>t-value</i>	<i>p-value</i>
	Age		-.07	-.85	.25
	Awareness	.013	-.02	-.24	.89
	Social support	.168	-.19	-2.04	<.05
	NA	.300	.29	3.05	<.01
	SOC	.317	-.21	-1.92	.058

### 6.5.5 Stability of SOC scores

There was no significant difference in SOC scores between participants who completed the SOC questionnaire prior to or following the PTSD interview and assessments (148.6 (24.1) *v.* 152.1 (24.7);  $t = -0.763$ ;  $df = 116$ ;  $p > 0.05$ ).

One hundred and five participants (89% of the original sample) completed and returned the follow-up SOC-29 questionnaire. The mean time to follow-up was 6.06 (3.1) weeks. Sense of coherence remained stable across the six weeks: there was no significant difference in mean SOC scores at initial and follow-up assessments (151.0 (22.9) *v.* 149.0 (25.2);  $t = 1.04$ ;  $df = 104$ ;  $p > 0.05$ ).

## 6.6 Discussion

The results of the present study indicated that first-time MI patients who were suffering from PTSD had significantly lower SOC scores than MI patients who were not suffering from the disorder. This result was found when PTSD symptoms were measured by both self-report and structured clinical interview. Thus the first hypothesis was supported. Previous studies have found that Antonovsky's SOC construct is positively related to the management of stress in both daily life (e.g. Gana, 2001) and chronic illnesses such as rheumatism (e.g. Büchi et al, 1998). Sense of coherence has been also found to predict variance in quality of life following both cardiac arrest (Motzer & Stewart, 1996) and MI (Drory et al, 1999). Furthermore, it has been found to have a significant relationship with the development of PTSD symptoms in road traffic accident victims (Frommberger et al, 1999; Schnyder et al, 1999) and fire fighters (Dudek & Koniarek, 2000). However, until the present study there had been no systematic investigation of the contribution of SOC to the development of PTSD symptoms post-MI. This study provides further evidence in support of the ability of individuals who have developed a strong SOC to cope with significant levels of adversity and to remain physically and/or mentally well.

The results of this and other studies have shown that individuals with chronic illnesses and/or diseases have SOC scores comparable with those of the general population. In this study the mean SOC-29 score of the entire sample (N = 118) was 150.4 (24.3). In a study of PTSD in road traffic accident (RTA) victims, mean SOC was 144 (Schnyder et al, 1999) and in another RTA sample it was 155.3 (Frommberger et al, 1999). Liver transplant patients reported mean SOC scores of 152.8 (Newton, 1999) and patients with chronic pain syndrome had mean SOC scores of 143.5 (Soderberg et al, 1997). In healthy populations

mean SOC scores as low as 90 and as high as 160 are regularly reported, with scores of around 130 reported most frequently (e.g. Antonovsky, 1987; Antonovsky, 1993; Strümpfer et al, 1998). Thus, levels of SOC in unwell and traumatised populations tend to be high relative to the normal population. Frommberger et al (1999) have suggested that relief associated with surviving an RTA may be widespread in the initial days and weeks following the accident and that SOC may be temporarily strengthened as a result, accounting for the particularly high mean SOC score in their study. This reasoning could be applied to any population that has survived a life-threatening event.

#### ***6.6.1 Independence of SOC and NA***

A subtle, but central, premise of the SOC approach to individual differences in health proneness must be that the psychological phenomena to which the SOC construct refers are somehow different from the negative and positive aspects of well being to which it is related. The results of studies on SOC have been consistent in their findings that people with a well-developed SOC are more resilient than those with a weaker SOC, but they have also been consistent in the finding that SOC-29 scores are strongly correlated with various measures of NA. Critics of the SOC have claimed that the relationship between SOC and health will disappear if NA is controlled for. A study by Hart et al (1991) found this to be the case. Despite this criticism the vast majority of studies on the SOC have failed to take due consideration of the correlation between SOC and NA. Many studies have reported significant correlations between SOC scores and various subjective and objective measures of health. However, failure to control for NA means it is unclear whether the relationship between SOC and health is an artefact of the SOC-29 scale's inadvertent measurement of

NA, or an important independent relationship between these variables. A main aim of this study was therefore to control for NA whilst assessing SOC and mental health post-MI.

Consistent with the second hypothesis, there was a significant negative correlation between SOC scores and number of PTSD symptoms, even after the effects of NA had been partialled out. The study results therefore confirm the findings of numerous other studies that have reported an inverse relationship between SOC and various measures of psychological distress and ill health. Also in keeping with the results of other studies, the current findings indicated that NA and SOC were inversely correlated ( $r = -.60$ ). However, where other studies reported significant correlations between SOC and various subjective and objective measures of health but failed to control for NA despite significant negative correlations between SOC and NA, this study controlled for NA in the correlational analyses. Therefore, the criticism that SOC was related to PTSD symptomatology because the SOC-29 is actually a measure of NA, is not plausible here.

Furthermore, the results of the hierarchical regression analysis on PTSD symptoms (according to the structured clinical interviews) provide additional evidence that the SOC-29 is not simply a measure of NA. After NA had been entered into the regression equation, SOC-29 scores contributed an additional 3.2% to the variance in PTSD symptoms for a total explained variance of 40.1%. Motzer & Stewart (1996) reported that SOC accounted for an additional 15% in the variance of quality of life scores in cardiac arrest survivors after 16 other potential predictor variables had been entered. The total explained variance in Motzer & Stewart's (1996) model was 64%. They also included a measure of social support in their model and found that it contributed 5% to explained variance. In the present study, social support explained a far greater 15% of the variance in PTSD symptoms. The present results

are more comparable to the findings of Dantas et al (2002) who found that perceived social support contributed around 16%, and SOC contributed a further 5% to the variance in quality of life scores in cardiac patients. Dantas et al's (2002) model also included a number of demographic and illness variables for a total explained variance in quality of life scores of 75.1%. However, both Motzer & Stewart's (1996) and Dantas et al's (2002) sample sizes were not strictly large enough for the number of predictor variables included in their regression analyses and the results should therefore be considered tentative.

When the five predictor variables in the present study were regressed onto PTSD symptoms according to the self-report measure, NA was the only significant predictor variable although SOC showed a trend towards significance ( $p = .058$ ).

### **6.6.2 Stability of the SOC**

Antonovsky (1979; 1987) conceptualised the SOC as a stable dispositional orientation. Once it has stabilised around the age of 30, only major life-events are expected to significantly affect it. However, even in the rare instances when the SOC is altered in the face of major events, Antonovsky wrote that in most cases it will return to its usual level within a few months of the event. However, there has been little assessment of this important theoretical point. Longitudinal studies using the SOC are relatively rare and many of these have not tended to assess SOC on more than one occasion. Instead the aim of these prospective studies has been to assess whether initial levels of SOC affect the later development of illness (e.g. Poppius et al, 1999; Kivimäki et al, 2002). Longitudinal studies that have assessed SOC on two occasions, for example, a four-year follow-up study of Finnish adults, have tended to report unchanged mean SOC scores for the entire study

population (N = 1976) (Suominen, Helenius, Blomberg, Uutela, & Koskenvuo, 2001). This does not allow for the possibility that mean population scores may remain unchanged while significant individual variation in SOC level occurs. What little data exists about the long-term stability of SOC has not always supported Antonovsky's theoretical assumption of stability. For example, Karlsson et al (2000) found that around 40% of their participants' SOC scores fluctuated more than 10% over a 1-year period despite finding no changes in the sample mean over time. One problem with this study however, is that the measure of SOC fluctuation was arbitrarily defined. Therefore, an important aim of the current study was to assess the stability of SOC scores rather than assume it.

Experiencing an MI is a major life event of a magnitude that might be expected to temporarily affect SOC scores in some individuals. Without data on prior SOC, it was impossible to determine whether or not the SOC scores of participants in this study were significantly affected by this life-threatening medical event. However, at the very least, a stable dispositional orientation should not be significantly altered by minor stressors. Discussing their MI several months after it had taken place was considered to be a minor stressor, particularly for patients who may have found the MI more stressful at the time. In order to test the hypothesis that minor stressors will not alter the SOC significantly, participants were randomly assigned to complete the study procedure in one of two conditions: SOC was either measured before or after PTSD symptoms. Measurement of PTSD symptoms required all participants to recall their event and its consequences in detail, as well as discussing each of the potential PTSD symptoms during the structured clinical interview. The results indicated that there was no significant difference in SOC scores between the participants who completed the SOC-29 before or after the PTSD assessment. This supports the conceptualisation of the SOC as a stable personality orientation. As a

further test of the stability of the SOC construct, SOC-29 scores were also assessed over a 6-week period. There was no change in the mean level of SOC in the study sample over this follow-up period. Thus, hypotheses 3a and 3b concerning the stability of SOC scores were supported.

Nonetheless, the consistently high levels of SOC reported in this study and numerous others on individuals with chronic diseases suggest that SOC may be more easily amenable to change than Antonovsky predicted. For example, Motzer & Stewart (1996) wrote that the high levels of SOC found in their cardiac arrest survivor sample suggested that there might be something inherent in their situation that strengthens the SOC. While the RTA victims in Frommberger et al's (1999) study were assessed in the weeks following their accident, Motzer & Stewart's (1996) sample were assessed between 3 months and 5 years post-arrest. Over 90% of the sample were assessed more than one year-post arrest. In another study that assessed RTA victims at three time points over the first year after their accidents, SOC scores were observed to decrease significantly from the first month after the accident to 6 months post-accident. There was no further drop from 6- to 12-months post-accident (Schnyder et al, 2000). The authors note that they cannot be certain whether the higher SOC score immediately following the accident represents a temporary increase followed by a return to usual levels, or a reflection of usual levels of SOC followed by a decrease as a result of the accident. Schnyder et al (2000) used the SOC-13 rather than the SOC-29 to measure SOC. Normative data for the SOC-13 suggests that the mean level of SOC in their study was high even 6- and 12-months post-RTA. On the whole then, a number of study findings circumstantially suggest that surviving a life-threatening event may result in a strengthening of the SOC without specific intervention. However, pre-post longitudinal data

are required to test this hypothesis. This is clearly not feasible for MI/cardiac arrest, but would be possible for planned interventions e.g. CABG or heart transplant.

### **6.6.3 Limitations of the study**

One limitation of the study is the fact that the initial assessment of SOC took place approximately six months after patients' MIs. Without a pre-MI assessment of SOC it is not possible to draw any definite conclusions about the impact of such an event on an individual's SOC. Sense of coherence scores were inversely related to PTSD symptoms. However, the observed relationship between PTSD and SOC might work in two directions: PTSD could reduce levels of SOC; alternatively SOC could protect against the development of PTSD. In order to try and overcome this limitation the study design built in two checks of the stability of SOC scores. The study procedure was counterbalanced, and a follow-up assessment of SOC was included six weeks after the initial assessment. Both of these tests suggested that SOC scores were stable and that the theoretical assumption that SOC is largely stable is warranted.

Another limitation of the study is that only men who had suffered a first-time MI were included and therefore it is not advisable to generalise the findings beyond this sample. Furthermore, no data about the severity of MIs was recorded and it is possible that patients who experienced a more severe MI were more likely to develop PTSD symptoms later. However, there is a substantial body of evidence that supports the idea that the severity of a cardiac event, be it MI or cardiac arrest, does not have a significant impact on psychological functioning afterwards (e.g. Dobson et al, 1971; Ladwig et al, 1991). Controlling for the effect of MI severity was therefore not anticipated to significantly alter the results of the

study. Furthermore, obtaining this information would have required the researcher to access further medical records which would have encroached on the privacy of the participants, and it was felt that this was not necessary given that MI severity was not expected to have any effect on PTSD symptoms. Nonetheless, a measure of MI severity would strengthen the findings of the study by clarifying any potential role of this disease factor in the development of PTSD.

With regard to the results of the regression analysis, the amount of explained variance that the final model accounted for (40.1%) is relatively low in comparison with other studies (e.g. Bennet & Brooke, 1999; Dantas et al, 2002; Motzer & Stewart, 1996). However, guidelines for multiple regression analysis (e.g. Tabachnick & Fidell, 2001) indicate that many previous studies have violated fundamental assumptions of regression by including too many predictor variables for the sample sizes available. Furthermore, the inclusion of predictor variables and their order of entry in a stringent hierarchical regression analysis was decided *a priori* and guided by strict theoretical interest.

#### **6.6.4 Implications of the study**

There are two important theoretical implications for Antonovsky's salutogenic theory arising from the results of this study. First, the finding that SOC-29 scores predicted additional variance in PTSD scores over and above the contribution of NA scores, supports the arguments of Antonovsky and Strümpfer that the relationship between the SOC construct and various measures of health and well-being is not solely explicable in terms of NA. By controlling for the effects of NA the present research adds significantly to the body of research on the SOC and its relationship with markers of psychological health.

Secondly, Antonovsky has always maintained that the SOC is a stable personality disposition that is not easily amenable to change. Previous studies have often failed to test this assumption. The results of the present study however, support the assumption that SOC scores are relatively stable over time and also in the face of a minor stressor. However, SOC scores might still be positively affected through interventions that specifically targeted SOC. For example, rehabilitation situations could be structured in order to increase individuals' sense of participation and thereby increase meaningfulness. It might also be possible to increase people's feelings of being able to manage their illness, or to facilitate meaning-making activities on the part of the chronically ill person and/or their families. Given the documented link between SOC and health this avenue of research is well worth exploring.

Finally, in addition to clarifying some theoretical issues surrounding the SOC, the results of the study also indicate that the SOC is a significant psychological predictor of PTSD symptoms post-MI. Future research could investigate the potential mechanisms of this relationship and clarify whether the SOC influences the perception of traumatic events so that individuals with a strong SOC are less likely to perceive the event as stressful and traumatic in the first instance, or whether individuals with a strong SOC can better cope with the consequences of stress caused by exposure to traumatic events.

## **Chapter 7**

### **Study V: The relationship of Sense of Coherence, PTSD symptoms, and linguistic style in MI recollection**

#### ***7.1 Introduction***

The first and third studies reported in this thesis showed that anxiety, depression, and PTSD are important psychological consequences of cardiac arrest and MI. Study IV went a step further and investigated the role of a number of personality variables in the development of traumatic reactions to MI. The fifth study extends the investigation of how and why most people cope very well with serious medical events such as MI, and how and why a small minority have such difficulty adjusting, by examining potential linguistic correlates of PTSD symptoms. In doing so it draws on the writing paradigm of James Pennebaker and his colleagues. By incorporating this paradigm into the assessment of MI survivors it was proposed that a clearer understanding of the processes behind most individual's success in coping with their illness might be found. In the following introduction to Chapter 7 the reader is introduced to Pennebaker's writing paradigm and the literature on the relationship between emotional expression and health.

#### ***7.2 Coping with trauma***

How do people come to find meaning in traumatic experiences? Certainly, given the relatively low rates of PTSD in various populations, the vast majority of people are capable of successfully adjusting to the most traumatic of situations. In the previous study the focus was on the relationship between Aaron Antonovsky's salutogenic theory of health and

coping, and the development of adverse reactions to a medical trauma, namely MI. Antonovsky believed that the ability to find meaning in situations was central to people's ability to cope with stressors and to stay healthy. He named one of the three central components in his salutogenic theory, 'meaningfulness'. Antonovsky (1979; 1987) proposed that an individual's sense of meaningfulness is fostered by the opportunity to participate in the decision-making that affects one's life, both as a child and as an adult. In this chapter, the focus will turn to some research that indicates that by talking about, or in some other way confronting, traumatic experiences, individuals can derive meaning from the event. The evidence also suggests that this 'confronting' is both psychologically and physically beneficial.

### ***7.2.1 Social sharing of emotional material***

Research has shown that when people experience a trauma, or indeed any type of emotional event, they tend to talk about it. This social sharing of emotional experience is a cross-cultural phenomenon (e.g. Singh-Manoux, 1998; Yogo & Onoe, 1998) and the degree of social sharing surrounding a particular event is a function of the disruptiveness of the event: the more disruptive the event, the more people talk about it (Luminet, Bouts, Delie, Manstead, & Rimé, 2000). Social sharing of emotion occurs equally for positive and negative emotions, with the notable exceptions of shame and guilt. While people generally share their emotion on the day it occurs, in the case of shame or guilt the sharing tends to be somewhat delayed (Rimé, Philippot, Boca, & Mesquita, 1992). Interestingly, studies have shown that personality traits do not explain the extent of social sharing of emotion. The fact that people of all ages in all cultures willingly engage in the sharing of even negative emotions suggests that there must be some benefit accruing from the practice. Anecdotally,

people certainly believe that talking about an emotional experience is relieving. However, research has shown that emotional memories that were not shared were no more emotionally arousing at the time of retrieval than emotional memories that were shared (Finkenauer & Rimé, 1998). Much of the research on the social sharing of emotion has been carried out within the context of bereavement. Funeral and grieving rituals often include the social sharing of personal and family histories. Research has identified a number of functions of the social sharing of emotion. One of its important functions appears to be the construction and consolidation of memory. By socially rehearsing memories, people's memories of people and events are indirectly strengthened. Sharing of emotional material also appears to contribute to the processing of the emotional information and to the completion of cognitive needs which are elicited by the emotional event. For example, experiencing the death of a loved one can shatter a person's basic belief that they live in an orderly, understandable and meaningful world (e.g. Glick, Weiss, & Parkes, 1974). Or as Antonovsky might put it, personal bereavement challenges a person's sense of coherence. Finding meaning in the death of a loved one is an important part of the grieving process, and social sharing is thought to be one way of giving the death and its consequences more meaning. Finally, social sharing can enhance interpersonal relationships and social integration. Following bereavement, the social sharing of emotion may contribute to the development of new relationships, and also provides the bereaved with social support from family and existing friends. Given the importance of social support in coping with illness, it is possible to extrapolate from findings on bereavement and suggest that disclosure of emotional material may be important for the maintenance of health, or perhaps recovery following illness.

### 7.2.2 *Emotional expression and psychological and physical health*

Around the same time as some of the first social sharing research in Europe was being conducted, a separate group in the United States was beginning to explore what happened when people were unwilling or unable to socially share emotional upheavals. This research suggested that the act of inhibiting or holding back thoughts, feelings, or behaviours involved biological work that in and of itself was stressful. If people were forced to actively inhibit over long periods of time, it was thought that the probability would be greater that they would suffer from a greater variety of psychosomatic illnesses (for a discussion of this inhibitory model, see Pennebaker (1997a).

Evidence for the inhibition model and stress related disease has come from a variety of sources. For example, Kagan, Reznick, & Snidman (1988) have found that children as young as 2-4 years old who are inhibited relative to other children, have higher resting cortisol and autonomic nervous system levels and are more prone to colds, allergies, and ear infections than their less shy or inhibited peers. Cole, Kemeny, Taylor, & Visscher (1996) have reported that gay men who conceal their homosexual status are more likely to suffer from major illnesses such as cancer than men who are open about their sexuality.

Furthermore, gay men who are HIV-positive and conceal their sexuality die more quickly of AIDS than men who are more open about their homosexuality. Other research has indicated that the more bereaved individuals are able to talk about their spouses' death, the healthier they are in the year following the death (Pennebaker & O'Heeron, 1984).

Gradually, the inhibition approach grew to incorporate more cognitive and social factors, as it became apparent that the inhibition model was insufficient to explain the beneficial effects

of disclosure. Researchers began thinking that disclosing or not disclosing information may lead to a number of cognitive side effects and that these might contribute to the beneficial effects of disclosure. In two studies by Murray and his colleagues (Donnelly & Murray, 1991; Murray, Lamnin, & Carver, 1989) students either wrote or talked to a therapist about a trauma or about superficial topics. In addition to greater emotional expression in the two trauma conditions, participants who wrote or talked about upheavals showed greater cognitive changes across the four days of the study. Cognitive change was measured by judges who evaluated transcripts on the degree to which they exhibited greater understanding of the problem and the awareness of alternative explanations for the upheavals. Post-experimental self-reports of cognitive change were also found in the groups who wrote or talked about the emotional event. Pennebaker's studies (see Pennebaker, 1989) also confirm this finding. Participants in numerous of his disclosure studies have reported that writing about a trauma forced them to think differently about it.

While early work on disclosure of emotion focused more on self-reports of talking about experiences, around fifteen years ago Pennebaker and his colleagues began to explore the nature of writing or talking about negative or traumatic experiences as a way of coping with them. Numerous studies by various research groups have now found that confronting deeply personal issues actually promotes physical health, subjective well being, and selected adaptive behaviours. A few studies have concentrated on verbal disclosure of material, but by far the majority have asked individuals to disclose personal information through writing. Before reviewing some of the results of these studies, the written disclosure paradigm that has been used in the majority of the research will be described in the following subsection.

### 7.2.2.1 The disclosure paradigm

The standard laboratory writing technique involves assigning participants to one of two or more groups. All the groups are asked to write about assigned topics for approximately 15-30 minutes, usually on around 3-5 consecutive days. Writing is generally done in a laboratory setting with no feedback given. People assigned to the control conditions are typically required to write about superficial topics, such as what they did yesterday. The experimental group however, are asked to write about some important emotional issue of their choice. The standard instructions for those assigned to the experimental group are a variation of the following:

*For the next (three) days, I would like you to write about your very deepest thoughts and feelings about an extremely important emotional issue that has affected you and your life. In your writing I would like you to really let go and explore your very deepest emotions and thoughts. You might tie your topic to your relationships with others, including parents, lovers, friends, or relatives, to your past, your present, or your future, or to who you have been, who you would like to be, or who you are now. You may write about the same general issues or experiences on all days of writing or on different topics each day. All your writing will be completely confidential. Don't worry about spelling, sentence structure or grammar. The only rule is once you begin writing, continue to do so until your time is up.*

Pennebaker, Zech, & Rimé (in press) have reported that the writing paradigm has proven to be exceptionally powerful. Participants – from children to the elderly, from college students to maximum security prisoners – disclose a wide range and depth of traumatic experiences. The paradigm has amply demonstrated that when people are given the opportunity to disclose deeply personal aspects of their lives, they readily do so. While a large number of participants report crying or being very upset by the experience, the overwhelming majority report that the writing experience was valuable and meaningful to them.

### 7.2.3 *The effects of disclosure on outcome measures*

There have been several reviews of studies that have investigated the effects of disclosure (e.g. Pennebaker, 1997b; Smyth, 1998). Writing about emotional experiences relative to writing about superficial control topics has been found to be associated with significant reductions in physician visits from before to after writing among relatively healthy samples (Pennebaker & Beall, 1986; Pennebaker, Kiecolt-Glaser, & Glaser, 1988). Writing and/or talking about emotional topics has also been found to influence some immune function indices in beneficial ways, including t-helper cell growth (Pennebaker et al, 1988), antibody response to the Epstein-Barr virus (Esterling, Antoni, Kumar, & Schneiderman, 1990), and antibody response to hepatitis B vaccinations (Petrie, Booth, Pennebaker, Davison, & Thomas, 1995). Self-reports also indicate that writing about upsetting experiences, although potentially painful at the time of writing, produces long-term improvements in mood and well-being in comparison with controls. A meta-analysis of written disclosure studies has indicated that in general, writing about emotional topics is associated with significant improvements in psychological well-being (Smyth, 1998). Behavioural changes have also been found. For example, senior professionals who have been made redundant get new jobs more quickly than controls after writing (Spera, Buhrfeind, & Pennebaker, 1994). However, despite the evidence of a direct effect on health and some behaviours, there are few reliable changes in self-reported health related behaviours such as exercising or smoking.

In different experiments on written disclosure, participants have been asked to write from one to five days, sometimes consecutively, sometimes with sessions separated by a week. Writing times have ranged from 10 to 30 minutes for each writing session. In Smyth's (1998) meta-analysis the evidence suggested that the greater the number of days of writing,

the greater the effects. Research evidence also suggests that there are no linguistic, educational or cultural effects of the disclosure paradigm: disclosure has been shown to have similar benefits for senior professionals, college students and prisoners. Finally, few consistent personality differences have distinguished who benefits, from who does not benefit from writing. However, there is some evidence that participants who are high in hostility (Christensen & Smith, 1994) and alexithymia (Paez, Velasco, & Gonzalez, 1999) benefit more from writing than those low in these traits, and that men may benefit more than women (see Smyth, 1998).

#### ***7.2.4 Cognitive change and physical health following written disclosure of trauma***

There is growing evidence that particular patterns of linguistic use and change during disclosure tasks are significantly related to subsequent health improvements. Pennebaker & Francis (1996) reported that the more that college students increased their use of insight-related (e.g. realise, know, understand) and causal (e.g. because, cause, reason) words over three days of a written disclosure experiment, the more their health improved. They propose that this pattern of results indicates the students' attempts to understand and find meaning in their experiences. They further reported that students' use of negative emotion words was unrelated to long term health changes. On the other hand, the more they used positive emotion words over time, the more their physical health improved. However, this finding is the opposite of the results obtained in the pilot experiment for the study (Pennebaker, 1993). In the pilot study the more that students increased their use of negative emotion words, the greater were the benefits to their physical health over time.

Pennebaker, Mayne, & Francis (1997) subsequently tested three competing hypotheses that might account for changes in physical and mental health following written disclosure of trauma: 1) cognitive change, 2) differential emotion, and 3) summed emotion. The cognitive change hypothesis proposes that the use of more self-reflective and causal thinking words will predict better emotional and physical health. The differential hypothesis states that it is the proportion of negative relative to positive emotion words that a person uses in their writing that is beneficial for later health, i.e. a high proportion of positive emotion and low proportion of negative emotion words is beneficial. Finally, the summed emotion hypothesis proposes that it does not matter whether the emotion expressed during writing is positive or negative. Rather, it is simply important that *either* positive or negative emotion is expressed. On the basis of seven samples including bereaved adults, unemployed engineers, male prisoners and college students, the authors concluded that none of the hypotheses was related to the distress outcomes. However for the more behavioural outcome measures (e.g. improved grades, finding work) the cognitive change hypothesis fit the data best. As participants use of cognitive dimension words increased their physician visits decreased, rate of reported symptoms decreased, students' grades improved and unemployed engineers found work faster. Expressing more positive words and fewer negative emotion words was also associated with better health outcomes (differential emotion model), but the summed emotion model was unrelated to all outcome measures.

Donnelly & Murray (1991) also assessed cognitive and emotional changes as a result of disclosing emotional material. They found that in comparison with controls who wrote about inconsequential topics, the two intervention groups expressed more positive emotion and less negative emotion in their writing/talking over four days. Furthermore, both intervention groups showed increases in self-esteem as well as adaptive cognitions, relative

to controls during the study period. Two months later both treatment groups reported thinking differently about their topic but there was no evidence of an effect on physical or emotional health in either group.

The cognitive-change effects of writing about emotional topics have also been demonstrated by preliminary evidence which shows that after writing people change the way they interact with others (Mehl, Pennebaker, Crow, Dabbs, & Price, 2001).

In summary, there is evidence that the linguistic patterns in peoples' writing about past traumas are related to various outcomes including some related to physical health and self-esteem. The evidence is inconclusive as to whether it is the expression of more emotion about the event or improved cognitive understanding of the event that is responsible for the beneficial effects.

### 7.2.5 *Linguistic styles*

As with spoken language, written language is different from person to person. But can language reflect personality? Certainly, there is an assumption that people verbally express themselves in stable and unique ways but despite this assumption language has rarely been considered as a *bona fide* individual difference. Powerful situational constraints may have been one reason for this lack of focus on language use as an individual difference, but there were also a number of practical and conceptual issues that also contributed. For example, deciding on what dimensions of language to focus on and what units of analysis to use.

However, there are now numerous word-based text analysis programs, and the development of many of these was guided by psychoanalytic themes. Some studies have now shown that

text analysis can distinguish several psychiatric diagnoses. For example, it has been claimed that text analysis can distinguish schizophrenia (Taylor, Reed, & Benrenbaum, 1994) and depression (Schnurr, Rosenberg, & Oxman, 1992).

### **7.2.5.1 The Linguistic Inquiry and Word Count Program**

In the mid 1990s Pennebaker & Francis (1996; 1999) developed their own word-based text analysis program, called Linguistic Inquiry and Word Count, or LIWC. The LIWC program consists of a main text processing module and an external support dictionary. The dictionary file comprises over 2,000 words and/or word-stems that are assigned to one or more of 61 subdictionaries or scales. Each of the subdictionaries is composed of groups of related words that tap a particular dimension of language, for example negative or positive emotion. LIWC calculates the number of words, sentences, percentages of unique words (i.e. words that are not in the program dictionary), and dictionary words. The sums of each of the scales are then converted to percentage of total words. The dictionaries were initially generated by groups of judges, Roget's Thesaurus, dictionaries, emotion and other questionnaires, as well as analyses of words used by participants in previous studies writing about emotion and control topics. After word-lists were compiled, at least three judges independently determined which category or categories each word should go in. A word was included if two or more judges agreed on its inclusion (Pass 1). On Pass 2, at least three new judges evaluated each word within a broader category (e.g. all cognitive strategies words or all positive emotion words) that had been previously agreed on during Pass 1 and assigned them to one or more of the subcategories. Reliabilities among judges were compared on each pass. Percentage agreement among the three judges was 93.1% for Pass 1 and 98.1% for Pass 2 (see Francis & Pennebaker, 1993). The primary LIWC categories and the subscales with sample words used in this study can be seen in Appendix III.

### 7.2.6 *Aims and hypotheses*

This study was inspired by two strands of previously unrelated theory and research: firstly, the written disclosure paradigm of Pennebaker and his colleagues and secondly, Antonovsky's understanding of the comprehensibility component of the SOC as the cognitive component of the construct. Study V was designed to investigate any potential interactions between the comprehensibility component of the SOC, levels of PTSD symptoms following a trauma (MI), and the linguistic dimensions (e.g. emotional or cognitive) with which people recollect the trauma and its implications. Two sources of potential interaction were explored: 1) interactions between SOC-comprehensibility and language use; and 2) PTSD symptoms following a trauma and language use.

1) The comprehensibility subscale of the SOC-29 assesses the degree to which people have a coherent comprehension of the world. It therefore assesses the cognitive aspect of the SOC (see section 6.3). However, Antonovsky has stated that the SOC-29 is only one way in which it is possible to assess the SOC. Research has suggested that people use language as a means of understanding the world and events that occur in it (see section 7.2.1). Sense of coherence research has shown that people differ in the extent to which they are able to achieve this cognitive understanding of their world. The proposal in the present study was to investigate whether scores on the comprehensibility (i.e. cognitive) subscale of the SOC-29 would be related to the frequency with which individuals used cognitive process words in a written disclosure task.

2) Numerous studies have shown that written disclosure of traumatic events favourably affects subsequent physical and mental health. There is some evidence that the cognitive

work undertaken to assimilate the trauma whilst writing is one of the driving factors behind this effect: increases in the frequency of cognitive word use in writing over time have been associated with improved subsequent health (Pennebaker & Francis, 1986; Pennebaker et al, 1997). With only a single example of participants' writing about their MI, it would not be possible to test the cognitive change hypothesis. However, extrapolating from the cognitive change hypothesis, it might be expected that individuals who show evidence of prior cognitive assimilation of their MI will be better adjusted to it afterwards. Thus it was hypothesised that the use of cognitive words (assumed to reflect cognitive assimilation of the event) in written recollection of an MI would be related to the level of PTSD symptoms reported by individuals who have recently experienced an MI. An alternative explanation of the benefits of written disclosure tasks is that the extent to which people discuss the trauma in emotional terms is an important factor in demonstrating beneficial effects of writing about trauma: increases in the frequency of emotional word use in writing over time have been associated with improved subsequent health (Pennebaker et al, 1997). Furthermore, research has shown that individuals who disclose emotional material experience a wide range of health benefits in comparison with those who do not (e.g. Cole et al, 1996). Therefore, it was proposed that the relationship between emotion word-use in written disclosure about MI and PTSD symptoms following the infarction, should also be examined.

The hypotheses were that:

1. MI patients' scores on the SOC-29 comprehensibility subscale will be positively associated with the frequency with which they use cognitive-type words in a written disclosure task relating to their MI.

2. PTSD symptomatology in post-MI patients will be inversely associated with their use of cognitive process words when writing about their MI.
- 3a. PTSD symptoms in post-MI patients will be associated with the frequency of negative emotion and/or positive emotion word use in patients' written recollection of their MIs.
- 3b. PTSD symptoms will be associated with the frequency of both negative and positive emotion word use in the written disclosure task (summed emotion hypothesis).
- 3c. PTSD symptoms will be associated with the relative frequency of positive and negative emotion word use in the written disclosure task (differential emotion hypothesis).

### **7.3 Method**

The method section is divided into four sub-sections describing the study population, the measures used to assess PTSD and SOC, the writing task, and the study procedure.

#### **7.3.1 Study population**

Participants who completed Study IV also took part in the present study. A detailed description of the participants and the selection criteria is described in Chapter 6, section 6.4.1. All 118 participants who took part in Study IV also agreed to take part in the written disclosure task. However, two participants failed to write anything during the allocated time. Therefore the sample size in Study V was  $N = 116$ . All participants were first time male MI patients.

### 7.3.2 Measures and materials

#### Sense of Coherence – comprehensibility:

Sense of coherence was assessed using the SOC-29 questionnaire, described in detail in sections 6.3.3 and 6.4.3. The SOC-29 was then scored for each of its three component subscales, including comprehensibility.

#### Post-traumatic stress symptoms:

PTSD symptom severity was established using the SCID and the SRS (see section 6.4.2 for descriptions of the interview schedule and self-report questionnaire).

#### Written disclosure of MIs:

Following the writing paradigm outlined in the introduction to this study, participants were asked to write about their recollection of and recovery from their MI. All participants received the same written instructions. The instructions used in this study were based on generic instructions used in other studies on the effects of writing about trauma. The instructions were as follows:

*During the next part of today's session I would like you to let go and write about your very deepest thoughts and feelings about having your heart attack. As you know, having a heart attack is a major event in anyone's life. In your writing, you might like to write about your emotions and thoughts, for example, about how your partner or family were affected, about issues of adjusting to having had a heart attack, for example any changes in diet, exercise or work. You might like to write about thoughts and feelings about your future, or even about who and where you are, and where you would like to be in the future. The important thing is that you really let go and dig down to your very deepest emotions and thoughts and explore them in your writing.*

*Please do not worry about spelling or grammar. These are not important for our purpose today. You will have about 10 minutes to write about your heart attack.*

*Mood assessment:*

Participants rated their mood immediately before and after writing on a 100mm visual analogue scale. Instructions were as follows:

*“We would like to know what kind of mood you are in right now: Please indicate with an “x” on the scale below how you are feeling at present.”*

The scale extremes were anchored with the words “very good mood” and “very bad mood”.

**7.3.3 Procedure**

All participants completed the questionnaires and the PTSD interview in the same session as the written disclosure task. Half of the participants completed the writing task immediately following the SOC-29 questionnaire, and before completing the PTSD assessment. The other half completed both the SOC-29 and the PTSD assessment before writing. Thus half the participants had discussed their event in detail with the investigator prior to writing about it. This was as a result of the counter-balancing procedure necessary for the assessment of the stability of SOC scores in Study IV. The investigator left the room while the participants completed the written disclosure task. After the first 10 minutes the investigator returned to the room and if participants were still writing, left again for a further 5 minutes. If participants were still writing after 15 minutes, they were given a final 5 minutes to complete their writing. Thus no participant wrote for more than 20 minutes.

## 7.4 *Analysis and Results*

### 7.4.1 *Statistics*

Independent sample t-tests were used to examine differences in word use between those who completed the writing task before the PTSD assessment and those who completed it afterwards. A paired samples t-test was conducted to examine the effect of the writing task on participants' mood. The hypotheses were tested using Pearson's correlational analyses on the SOC-comprehensibility scores, the PTSD symptom severity scores, and the percentages of cognitive and emotion words used in the written disclosure task. Writing samples were analysed using the LIWC program described in detail in section 7.2.5.1. Appendix III contains details of the cognitive process, negative emotion, and positive emotion word categories as they are defined in the LIWC program. Standard LIWC categories with no amendments were used in the LIWC analyses of written texts. All statistical analyses were carried out using SPSS version 9.0.

### 7.4.2 *Results*

There was no evidence of a relationship between the total number of words written during the writing task and the severity of PTSD symptoms (Interview:  $r = .08$ ;  $p > .05$ ; Self-report:  $r = .13$ ;  $p > .05$ ). However, there was a difference between the total number of words written and whether the writing task preceded or followed the PTSD assessment ( $t = 2.68$ ;  $df = 114$ ;  $p < .01$ ). Participants who wrote about their MI before being assessed for PTSD symptoms wrote significantly more words than those participants who wrote about their MI after assessment for PTSD (200.5 (117.9) words *v.* 151.1 (75.9) words). There were no

differences however, between the ‘before’ and ‘after’ groups in the frequency with which they used negative emotion, positive emotion, and cognitive process words (see *Table 7.1*).

**Table 7.1** Comparison of participants who completed the written disclosure task prior to or following the assessment for PTSD symptoms: frequency of negative emotion, positive emotion and cognitive word use

<i>LIWC category</i>	<i>Writing prior</i>	<i>Writing after</i>	<i>t value</i>	<i>p value</i>
<i>Negative emotion</i>	2.3	2.0	.99	.33
<i>Positive emotion</i>	2.5	2.4	.40	.69
<i>Cognitive mechanism</i>	6.5	6.8	-.63	.53

There was no effect of the writing task on the participants’ mood before and after the writing task (85.2 (16.9) v. 83.5 (20.6);  $t = 1.24$ ;  $df = 114$ ;  $p > .05$ ).

#### Hypothesis 1:

Correlational analysis showed that there was no significant relationship between scores on the SOC-comprehensibility subscale and the frequency with which patients employed cognitive process words in their writing ( $r = -.01$ ;  $p > .05$ ). Thus there was no evidence to support the first hypothesis.

#### Hypothesis 2:

The second hypothesis was tested using PTSD symptom severity scores according to both self-report and structured clinical interview. No significant relationship between cognitive process word use and self-reported PTSD symptoms ( $r = .13$ ;  $p > .05$ ) or PTSD symptoms according to the clinical interview assessments ( $r = .06$ ;  $p > .05$ ) was observed.

*Hypotheses 3a, 3b and 3c:*

PTSD symptoms in post-MI patients were not associated with the frequency of positive emotion word use in patients' written recollection of their MIs (Interview:  $r = -.10$ ;  $p > .05$ ; Self-report:  $r = -.10$ ;  $p > .05$ ). However, the correlation between negative emotion word use and PTSD symptoms according to both self-report ( $r = .32$ ;  $p < .0001$ ) and clinical interview ( $r = .41$ ;  $p < .0001$ ) was statistically significant. Thus the more PTSD symptoms a patient was experiencing, the more likely they were to use negative emotion words when writing about their MI. Furthermore, there was a significant correlation between positive and negative emotion word use combined (Hypothesis 3b: summed emotion hypothesis) and the severity of PTSD symptomatology according to the SCID interviews. This was not observed on the analysis of PTSD symptoms according to self-report. The relative frequency of positive and negative emotion word use was also calculated<sup>9</sup>. The differential emotion hypothesis (Hypothesis 3c) was supported by the data for both PTSD symptoms according to self-report and clinical interview. Correlation coefficients and p-values for hypotheses 3a, 3b, and 3c are shown in *Table 7.2*.

**Table 7.2** *Correlations between PTSD symptoms according to self-report and structured clinical interview and positive emotion, negative emotion, summed emotion and differential emotion word use on a written disclosure task*

Method	Positive Emotion	Negative Emotion	Summed Emotion	Differential Emotion
Self-report	-.10	.32 <sup>#</sup>	.12	-.25 <sup>†</sup>
Interview	-.10	.41 <sup>#</sup>	.19 <sup>*</sup>	-.29 <sup>†</sup>

\*  $p < .05$

†  $p < .01$

#  $p < .0001$

<sup>9</sup> The frequency of negative emotion word-use was subtracted from the frequency of positive emotion word-use to create a differential emotion frequency.

## 7.5 Discussion

Study V was designed to investigate the potential relationship between the comprehensibility component of the SOC construct and the frequency with which MI patients use words reflecting cognitive processes when writing about their MIs. No relationship between scores on the SOC-29 comprehensibility subscale and frequency of cognitive word-use was found. This finding was unexpected given that Antonovsky has written that the comprehensibility component of the SOC reflects the extent to which an individual considers the world to be structured, predictable and explicable, and is thus conceptualised as the cognitive component of the SOC. It seemed plausible to propose that the higher an individual's SOC-comprehensibility score was, the more that evidence of cognitive processing would be observable in their own writing. Antonovsky has written that the SOC-29 questionnaire is only one way of measuring an individual's SOC (Antonovsky, 1987; p. 63-64). It was thought that the frequency of cognitive words used by an individual in their language might be another indicator of their level of cognitive interaction with the world: greater use of cognitive words might reflect a greater tendency to seek and find structure in the world. Certainly, some patients wrote about their MIs in a way which indicated a degree of cognitive processing surrounding the event, and particularly attempts to understand why they had suffered a 'heart attack'. For example, the following are extracts from a number of participants' writing samples:

*"I immediately recognised that I was having a heart attack and ....my innermost thoughts on this dreadful evening I was having was that I was now being called by my maker and I remember in my thoughts I was saying "What have I done to deserve this?"".."*

*"I thought why [did I have a heart attack] and soon came to the conclusion [that] the main causes were thirty years of smoking and over the past ten years a fair amount of stress due to redundancies."*

*“My heart attack was very traumatic.....it was probably caused by too much stress and alcohol.”*

*“The year 2000 was very stressful due to various family problems and made me wonder if my heart attack was due to these.”*

Despite evidence of cognitive processing of the event in the writing of these participants (e.g. “probably caused by”, “made me wonder”, “came to the conclusion”) the first hypothesis was unsupported by the data.

A second aim of the study was to ascertain if the frequency with which people utilised cognitive and/or emotion words in their writing was related to the degree to which they were experiencing PTSD symptoms as a result of their MI, i.e. the study was an investigation of linguistic correlates of PTSD symptoms. The analysis on cognitive process words revealed that MI patients’ use of cognitive-type words in written disclosure of their MIs, was not related to the severity of self-reported PTSD symptoms related to the MI. The finding was the same when PTSD symptom severity was gauged by structured clinical interview. Thus there was no evidence to support the second hypothesis. While previous studies on written disclosure of trauma have shown that cognitive change (i.e. an increase in the frequency of cognitive process word-use) over the course of several days writing about a trauma is associated with subsequent health benefits (Pennebaker, Mayne & Francis, 1997; Pennebaker & Francis; 1996), the present study was not designed as an intervention and thus only one sample of writing was available from each participant. Nonetheless, it was thought that people’s writing might capture any cognitive processing of their MI undertaken prior to the study, and that this might be related to psychological adjustment after the event. However, it may be that the outcome measure used in this study (PTSD symptoms) is not affected by cognitive processing as much as behavioural outcome measures. While

Pennebaker, Mayne & Francis (1997) reported an association between cognitive change and certain behaviours (e.g. GP attendance), they also reported that cognitive change was not associated with outcome measures related to psychological distress. Finally, similarly to the present study, Donnelly & Murray (1991) failed to find any relationship between cognitive change during a written disclosure intervention and improvements in psychological and physical health two months later.

There was also no direct relationship found between PTSD symptoms (according to self-report and clinical interview) and positive emotion word use. On the other hand, patients' use of negative emotion words was significantly correlated with the number of PTSD symptoms they were experiencing. This result was the same whether symptoms were assessed by interview or by self-report. Thus the more PTSD symptoms a person was experiencing, the more likely they were to use negative emotion words in their writing about their MI. This pattern of results partially supports the third hypothesis about the use of emotion words and PTSD symptoms. It seems intuitive that individuals with PTSD symptoms following MI would use more negative emotion words in their writing about their MI. However, it would also make intuitive sense that individuals who were better adjusted to their MI and were experiencing little or no psychological distress, would use more positive emotional language than patients who were experiencing PTSD symptoms, but this was not the case. Pennebaker & Francis (1996) have previously reported that students' use of negative emotion words was not related to long-term health changes, but their use of positive emotion words was: the more they increased their use of positive emotion words over time the greater were the subsequent benefits to health. However, the pilot study for Pennebaker & Francis's (1996) study found the opposite pattern of results – negative emotion word use and not positive emotion word use was related to later health

improvements. This results of the present study therefore support the findings of the pilot study (Pennebaker, 1993).

To test the third hypothesis, the combined frequency of positive and negative emotion words was used in the correlational analysis. There was a significant correlation between the frequency of summed emotion word-use and PTSD symptoms according to clinical interview, but not self-report. A differential emotion hypothesis was also tested. For this analysis the frequency of negative emotion word-use was subtracted from the frequency of positive emotion word-use, and the resulting differential emotion frequency was significantly inversely correlated with PTSD symptoms. This suggests that individuals with more PTSD symptomatology have a tendency to use fewer positive emotion words relative to their use of negative emotion words than individuals with fewer PTSD symptoms. These results are broadly consistent with the findings reported by Pennebaker, Mayne & Francis (1997) where the differential emotion hypothesis was the best predictor of health outcomes among seven samples of healthy individuals and the summed emotion hypothesis was not supported. In the present study the summed emotion hypothesis was supported by the data, but the correlation coefficients and the significance levels in the analysis of the two hypotheses more strongly support the differential emotion hypothesis (see Table 7.2). It is possible that the correlation between negative emotion word-use and PTSD symptoms is driving the correlation between the summed emotion word-use and PTSD symptoms.

### ***7.5.1 Limitations of the study***

In this study, there was an assumption that individuals who had already undertaken more cognitive processing of their MI would be experiencing better psychological adjustment to

their MIs and heart disease. The finding that there was no relationship between cognitive process words and PTSD symptoms could mean that this assumption is inaccurate. Alternatively, it is possible that writing about an event on just one occasion cannot accurately capture the degree of cognitive processing undertaken surrounding the event, prior to writing. Therefore another limitation of the study was that there was only one writing session. The majority of written disclosure studies have at least three sessions. By including further sessions it would have been possible to collect data on cognitive/emotion word-use change over time. This would then have allowed further clarification of the potential role of cognitive processing, as well as positive and negative emotion, in recovery from a trauma.

Another limitation of the present study is that it is not possible to draw inferences about causality from correlational analyses. This limitation means that interpretation of the findings with regard to word-use is problematical. It is possible that individuals who wrote more negatively about their MI have a tendency to view the world in a more negative manner, or to experience greater degrees of negative emotionality, and are therefore at greater risk of appraising their MI in a negative manner. This then could leave them at a greater risk of developing PTSD symptoms. An alternative explanation is that individuals who have developed PTSD symptoms subsequently use greater frequencies of negative emotion words when given the opportunity to write about their MI experience.

Another important limitation of this study concerns the use of a computer based text analysis program, the LIWC. One of the problems with computer based text analysis programs is that they cannot take account of people's use of irony, sarcasm, metaphor, or other subtle ways of communicating. In addition, programs like LIWC can misclassify certain meanings

as it cannot control for the context of speech, and the multiple meanings of words. This limitation has implications for the assumption that cognitive process word-use can reflect levels of SOC-comprehensibility. If the LIWC cannot assess context then cognitive process word-use may be indicative of cognitive processing but not of level of comprehensibility. For example, “I can’t understand why I had a heart attack” would be coded the same as “I understand why I had a heart attack”. However, from studies of written disclosure as well as studies about the process of bereavement, thinking about events allows people to come to an understanding of them. Therefore it seems reasonable to assume that despite the limitations of the LIWC individuals who use more cognitive process words in their writing have done more cognitive processing of the event they write about. This same limitation with regard to the LIWC applies to assessment of emotion word use: “I wasn’t anxious about my heart attack” has the same frequency of negative emotion word-use as “I was anxious about my heart attack”. Therefore it is possible that LIWC analyses of negative emotion words is ‘contaminated’ with positive emotion words which would have an effect on the study results, particularly with regard to the differential emotion hypothesis. This limitation however, applies to all studies of this nature.

### ***7.5.2 Implications of the study***

The finding that there was no relationship between cognitive process word use and the SOC-29 comprehensibility subscale has implications for the environmental validity of the SOC-29 scale. In the previous chapter, the results of Study IV showed that SOC was not merely positively expressed negative affectivity. The SOC-29 is therefore tapping into some psychological processes over and above NA, but what they are is as yet inadequately understood. Antonovsky proposed that the comprehensibility component of the SOC

referred to the extent to which an individual appraised the world as being predictable and explicable. This study attempted to tap into individuals' understanding of the world using both Antonovsky's SOC-29 scale and a textual analysis of their writing about a significant event. However, the results of this study have shown that cognitive process word-use frequency cannot be used as a proxy for SOC-comprehensibility.

According to the summed emotion hypothesis, the beneficial effects of writing are attributable to experiencing and writing about any emotion surrounding the event whether it is negative or positive. However, according to the differential emotion hypothesis, the lower the frequency of negative emotion word-use relative to positive emotion word-use, the greater the benefit of written disclosure. The findings of this study clearly show that negative emotion word-use is related to the severity of PTSD symptoms after an MI, but that positive emotion word-use is not related to PTSD symptoms. This pattern of findings strengthens the theoretical evidence in support of the differential emotion hypothesis.

This finding with regard to the differential emotion hypothesis could have important implications for the treatment of PTSD. Despite the widespread use of debriefing following traumas, the most recent review of the research suggested that giving people the opportunity to talk about the trauma in the immediate aftermath - debriefing - is not beneficial and recommended that the automatic use of debriefing should be stopped (Rose et al, 2002). Pennebaker and his colleagues' work on written disclosure of trauma, as well as the results of the present study, suggest that when encouraging individuals to talk about their experiences psychologists and counsellors should be careful not to allow people to focus solely on the negative emotions (e.g. anxiety, fear) surrounding it, and should encourage discussion of positive emotions (e.g. relief, gratefulness) about traumatic events.

Finally, the vast majority of individuals who took part in this study reported that they very much appreciated the opportunity to talk about their MI and many of them referred to this in their writing. There is plentiful evidence that writing about traumatic events has beneficial effects on health and behaviour. There is also evidence that even minimal symptoms of depression are related to mortality post-MI. A simple writing intervention could be incorporated into cardiac rehabilitation programs at minimal expense. Future research could ascertain if this type of intervention has a beneficial effect on cardiac mortality rates, perhaps through the reduction of post-MI depression.

## **Chapter 8**

### **Summary and Conclusion**

In this final chapter the main findings of the five studies and the ways in which they have extended knowledge in the area of psychological consequences of serious cardiac events are outlined. The chapter is divided into two subsections. The first deals with the two studies on memory impairment; the second deals with the three studies on post-traumatic stress disorder (PTSD).

#### ***8.1 Memory impairment: a neuropsychological consequence***

Study 1 showed that the memory impairment known to affect out-of-hospital cardiac arrest survivors is also a problem for many in-hospital cardiac arrest (IHCA) survivors. The majority of work on cardiac arrest – not just work on neuropsychological consequences of cardiac arrest – has been conducted with out-of-hospital cardiac arrest (OHCA) survivors. While there are difficulties associated with collecting data on IHCA patients, for example, far fewer people arrest while in hospital making it more difficult to reach ideal sample targets, it is important that these patients are studied in their own right because there are a number of differences between this and the OHCA arrest group that might affect their neuropsychological outcome (see sections 3.2.2 and 3.5.1). This study was the first to focus on memory impairment in IHCA patients and the results of the study showed that memory impairment following IHCA was more serious and widespread than expected. The study results indicated that 26% of IHCA patients had moderate or severe memory impairment according to assessments using an ecologically valid memory test. The percentages of OHCA and MI patients with this degree of memory deficits were 38% and 0% respectively.

This finding of widespread memory impairment in IHCA survivors has obvious implications for patients' management. Patients need to be advised that their functional capacity at home, in the work place, in social interactions or in cardiac rehabilitation programs could be compromised by these deficits. Greater attention should be made to assessing cognitive outcomes following in- and out-of-hospital cardiac arrest in order to identify in particular those patients who are severely memory-impaired. Finally, the findings of the first study highlight the need to identify useful methods of memory rehabilitation for cardiac patients.

Given the findings of Study I, a logical next step and one that was in keeping with the desire to have a practical bent to this thesis, was to investigate the efficacy of a known memory rehabilitation technique with the memory impaired IHCA survivors from Study I. Thus Study II used an errorless learning method to teach new material to the IHCA survivors. In comparison with a traditional trial and error approach, there was no significant advantage of the errorless technique for those patients who had memory impairment, over and above its advantage with those patients who did not have memory difficulties. While this overall finding was disappointing, a secondary analysis actually showed that some of the more impaired patients did in fact benefit from the errorless learning method. This suggests that the methods of errorless learning may be of benefit to some cardiac patients and further work should be undertaken to establish if this is the case. Errorless learning principles have after all been widely and successfully used with diverse populations who have both memory impairments and/or learning difficulties. Study II was the first such study to use errorless principles with cardiac arrest patients. The results of the study can be seen as an important first step in addressing the need for providing suitable techniques for cardiac patients with memory difficulties to cope with the challenges of daily life after their arrest. While there was no apparent benefit of errorless learning found in the study, this result may have

occurred because of the difficulty in encouraging the participants to make errors during the errorful trials and not due to any inherent lack of benefit of the technique with these patients. Further investigations may yet show that errorless learning methods are useful in the case of memory-impaired cardiac arrest survivors.

## **8.2 *Post-traumatic stress disorder: a psychosocial consequence***

Study III was the first of three studies on PTSD as a consequence of cardiac arrest and MI. In this study the aim was to establish a true prevalence rate of PTSD in cardiac arrest patients and to compare this with that in MI patients. Previously, only one study had assessed intrusive and avoidance symptoms in cardiac arrest patients. While a number of studies had investigated PTSD symptoms in MI patients, few of these actually used a clinical interview and instead relied on various self-report measures. There were two particularly important findings from this study. The first was that a significant minority (19%) of in-hospital cardiac arrest patients were suffering from symptoms of anxiety and distress that were serious enough to cause them significant impairment in their lives and to warrant a diagnosis of PTSD according to diagnostic structured clinical interviews. The second was that the self-report measure used in this study, and one which has been used in numerous previous studies of PTSD and MI, was very unreliable at accurately detecting cases of PTSD. This study therefore provides evidence that the true prevalence of PTSD cannot be established using self-report questionnaires.

Study IV had both practical and theoretical aims. On a practical level it aimed to establish the contribution of a number of psychological and psychosocial variables to the development of PTSD symptoms post-MI. The purpose here was that if a psychological

variable such as sense of coherence (SOC) is known to contribute to the development of PTSD symptoms following infarction, then it could be targeted in cardiac rehabilitation programs or in more general cardiac out-patient clinics, with the ultimate goal of improving prognosis for patients. Of course, this would require that SOC levels were amenable to change through intervention or otherwise. Therefore, the theoretical strand of this chapter tackled the previously neglected area of the stability of SOC. In a similarly theoretical vein, the study addressed the issue of whether SOC is theoretically distinct from negative affectivity. The results of this chapter indicated that SOC predicted a small but significant amount of the variance in PTSD symptoms, over and above the contribution of two other important psychological and psychosocial predictors (NA and social support). This result also supported the conceptual distinction of NA and SOC. The study tested the stability of SOC scores in two ways: 1) over a 6-week follow-up period, and 2) in the face of a minor stressor (i.e. recollecting and disclosing a recent MI). The results indicated that SOC scores were stable in both assessments and support Antonovsky's (1979; 1987) theory that SOC is a stable construct.

Also, although Study IV was primarily designed to address some questions surrounding SOC, it also extended the literature on the prevalence of the PTSD in an MI population. The sample size in the fourth study is larger than any sample size in previously published studies of PTSD in MI patients. It is also the first study to assess such a large sample using both a self-report measure of PTSD and a clinical interview. It was thought that the absence of a statistically significant difference in PTSD prevalence between MI and cardiac arrest patients in Study III may have been due to a lack of statistical power. The prevalence rate for PTSD in MI patients was lower in Study IV (3%) than in Study III (7%). Comparing data from Study III arrest patients and from Study IV MI patients, the prevalence rate for

PTSD of 3% in MI patients was significantly different from the prevalence rate of 19% in cardiac arrest patients. This finding confirms that statistical power was indeed an important factor in Study III. It also confirms the necessity of using structured clinical interviews with a sufficiently large sample to establish true rates of the disorder.

Finally, Study V was a further investigation of the SOC. It was designed to investigate any potential interactions between the comprehensibility component of the SOC, levels of PTSD symptoms following MI, and the linguistic dimensions with which people recollect the MI and its implications. The results showed that levels of comprehensibility were not associated with cognitive word-use during written recollection of MI. Another aim of Study V was to establish if there was any relationship between PTSD symptoms and language use in the written disclosure task. The results in this regard showed a clear tendency of MI patients with more PTSD symptoms to use more negative emotion words in their writing. The study also served the purpose of introducing this method i.e. written disclosure, which has been shown to improve health and reduce distress in various populations. While the study did not actually assess written disclosure as an intervention in this instance, there is scope for including such an intervention in existing cardiac rehabilitation programs at minimal expense. Any physical or psychological health benefits of an intervention could be assessed using a case-control design.

### **8.3 Conclusion**

The goal of the present thesis was to investigate some of the important psychological consequences of CHD in order to hopefully contribute to a more accurate and complete picture of morbidity following two serious cardiac events: cardiac arrest and myocardial

infarction (MI). From the start, it was intended that the work undertaken for this thesis should have a strong practical element, as well as a more theoretical one. In achieving these goals a total of five experimental studies were conducted with a large number of both cardiac arrest and MI patients. The findings have extended our knowledge of issues facing many thousands of people in the UK today and suggested numerous ways in which interventions for use with cardiac patients might proceed.

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## **Appendix I**

### **PATIENT INFORMATION SHEETS AND CONSENT FORMS**

## PATIENT INFORMATION SHEET

### **“A study of memory function in patients who have suffered a blackout in hospital”**

You have been invited to take part in the above research study, which investigates possible problems that some patients may encounter following a blackout whilst in hospital. Blackouts are quite common and sometimes occur because of a temporary problem with the heart rhythm. We know that some patients may suffer from a loss of memory for a period of time. We also know that memory can be improved using a technique called ‘errorless learning’. This research first investigates how common memory loss is in patients who have had a blackout during admission to hospital and then looks at whether it is possible to improve patients’ memories using ‘errorless learning’.

Although this study will not benefit you directly it is hoped that it will help in the diagnosis and rehabilitation of memory problems in future patients.

#### What is involved if I agree to take part in this research study?

If you agree to participate in the study, you will be asked to come to the hospital and undergo some simple assessments. These involve a short questionnaire and reading assessment, followed by a memory task. Overall these assessments take about 35 minutes.

Then you will be given a simple learning/memory training task which will take about 45 minutes. You will be given a break between the memory assessment and the learning/memory training task. None of these tests have any known harmful effects.

You are not under any obligation to participate in this study, and you may withdraw from it **at any time** without affecting your future care. All personal information, and the results of all tests are treated as confidential, and will only be seen by properly authorised persons. Your general practitioner and your consultant will be informed if you agree to participate in the study. Travel expenses involved in participating in the study will be covered. This research project is covered, in the event of accident, through insurance arrangements with the University of Edinburgh.

#### Other information

Dr Neil Grubb is the main investigator in this research study, and can be contacted at the Royal Infirmary of Edinburgh through the switchboard (0131) 536 1000.

Dr Peter Bloomfield is a consultant Cardiologist who is not directly involved with this study, and is available to independently advise you about the study and participation if you should wish (0131) 536 2009.

**“A study of memory function in patients who have  
suffered a blackout in hospital”**

- I agree to participate in this study
- I have read this consent form and Patient Information Sheet and had the opportunity to ask questions about them.
- I agree for notice to be sent to my General Practitioner about my participation on this study.
- I agree to the provision of any clinically significant information to my General Practitioner.
- I understand that I am under no obligation to take part in this study and that a decision not to participate will not alter the treatment that I would normally receive.
- I understand that I have the right to withdraw from this study at any stage and that to do so will not affect my treatment.
- I understand that this is non-therapeutic research from which I cannot expect to derive any benefit.

Signature of Patient:

.....

Name of Patient:

--

Signature of Investigator:.....

Date:.....

Four copies to be made

- Top copy to be retained by investigator
- Second copy to be retained by patient
- Third copy to be sent to patient's General Practitioner
- An additional copy to be filed in any relevant hospital case notes

## PATIENT INFORMATION SHEET

### **“A study of the prevalence of memory impairment, and the effect of errorless learning on memory training, in patients who have suffered a blackout in hospital”**

You have been invited to take part in the above research study, which investigates possible problems that some patients may encounter following a blackout whilst in hospital. Blackouts are quite common and sometimes occur because of a temporary problem with the heart rhythm. Doctors now understand that some patients who suffer blackouts may suffer from a loss of memory for a period of time. We also know that memory can be improved using a technique called ‘errorless learning’. This research investigates how common memory loss is in patients who have had a blackout during admission to hospital and also examines whether it is possible to improve patients’ memories using errorless learning.

It is hoped that this research will help in the diagnosis and rehabilitation of memory problems in future patients.

#### What is involved in this research study?

If you decide to take part, you will be asked to attend the Cardiology Out-patient Department at the Royal Infirmary of Edinburgh for some assessments that will take approximately ninety minutes. The tests will be divided into two parts. For the first part you will be asked to do a memory assessment which takes about twenty-five minutes. You will then be given a five-minute break. After this, you will be taken through a simple memory-training task which will take about 50 minutes. Half way through the memory-training you will be asked to fill in a questionnaire that asks about your recent mood and health. You will also be taken through a short reading task. These assessments are not stressful, and in our experience patients have enjoyed doing them.

#### What happens now?

Participation in this study is voluntary, and your future treatment will not be affected if you decide not to take part. You may also withdraw from the study **at any time**. As part of normal procedure, we will inform your General Practitioner and, if applicable, your hospital consultant, if you agree to participate in the study. This research project is covered, in the event of accident, through insurance arrangements with the University of Edinburgh.

Dr Neil Grubb is the main investigator in this research study, and can be contacted at the Royal Infirmary of Edinburgh through the switchboard (0131 536 1000).

Dr Nicholas Boon is a consultant Cardiologist who is not directly involved with this study, and is available to independently advise you about the study and participation if you should wish (0131 536 2002).

**“A study of the prevalence of memory impairment, and the effect of errorless learning on memory training, in patients who have suffered a blackout in hospital”**

- I agree to participate in this study
- I have read this consent form and Patient Information Sheet and had the opportunity to ask questions about them.
- I agree for notice to be sent to my General Practitioner about my participation on this study.
- I agree to the provision of any clinically significant information to my General Practitioner.
- I understand that I am under no obligation to take part in this study and that a decision not to participate will not alter the treatment that I would normally receive.
- I understand that I have the right to withdraw from this study at any stage and that to do so will not affect my treatment.
- I understand that this is non-therapeutic research from which I cannot expect to derive any benefit.

Signature of Patient:

.....

Name of Patient:

Signature of Investigator:.....

Date:.....

Four copies to be made

Top copy to be retained by investigator

Second copy to be retained by patient

Third copy to be sent to patient's General Practitioner

An additional copy to be filed in any relevant hospital case notes

## PATIENT INFORMATION SHEET

### **“A study of the prevalence post-traumatic stress disorder in patients with previous blackouts in hospital”**

Doctors now understand that some patients who suffer blackouts can suffer complications afterwards. You are invited to take part in a research study which investigates this problem. In this study, we are interviewing patients who have had a previous admission to hospital. We plan to compare patients who suffered a blackout (due to an abnormal heart beat) with patients who did not blackout during their admission. We hope that this study will help us recognise and understand possible complications of blackouts in future patients.

#### What is involved in this research study?

If you decide to take part, you will be asked to attend the Cardiology Department at the Royal Infirmary of Edinburgh for a test that will take approximately one hour. You will be taken through a number of questionnaires that ask about your stress levels and how your admission to hospital has affected you since. These questionnaires are used because we realise that some patients find their illness and admission to hospital a traumatic experience, which could have long-term effects such as causing anxiety. We believe that it is important to find out how common these symptoms are after an acute illness.

#### What happens now?

Participation in this study is voluntary, and your future treatment will not be affected if you decide not to take part. As part of normal procedure, we will inform your General Practitioner and, if applicable, your hospital consultant, if you agree to participate in the study. Also, this research project is covered, in the event of accident, through insurance arrangements with the University of Edinburgh.

If you would like to take part in this study, please indicate so (tick the YES box) on the attached letter, and return it to us in the enclosed stamped, addressed envelope. If you would prefer not to take part, it will still help us if you could spare the time to return the letter, after ticking the NO box.

Dr Neil Grubb is the main investigator in this research study, and can be contacted at the Royal Infirmary of Edinburgh through the switchboard (0131 536 1000).

Dr Nicholas Boon is a consultant Cardiologist who is not directly involved with this study, and is available to independently advise you about the study and participation if you should wish (0131 536 2002).

**“A study of the prevalence of post-traumatic stress disorder in patients with previous blackouts in hospital”**

- I agree to participate in this study
- I have read this consent form and Patient Information Sheet and had the opportunity to ask questions about them.
- I agree for notice to be sent to my General Practitioner about my participation on this study.
- I agree to the provision of any clinically significant information to my General Practitioner.
- I understand that I am under no obligation to take part in this study and that a decision not to participate will not alter the treatment that I would normally receive.
- I understand that I have the right to withdraw from this study at any stage and that to do so will not affect my treatment.
- I understand that this is non-therapeutic research from which I cannot expect to derive any benefit.

Signature of Patient:

.....

Name of Patient:

Signature of Investigator:.....

Date:.....

Four copies to be made

Top copy to be retained by investigator  
Second copy to be retained by patient  
Third copy to be sent to patient's General Practitioner  
An additional copy to be filed in any relevant hospital case notes

## CONTROL PATIENT INFORMATION SHEET

### **“A study of the prevalence post-traumatic stress disorder in patients who experienced a heart attack in hospital”**

Doctors now understand that some patients who suffer heart attacks may experience some complications afterwards. You are invited to take part in a research study which investigates this problem. In the study, we are interviewing patients who have had a previous heart attack. We plan to compare patients who experience a heart attack, with patients who experience a heart attack complicated by cardiac arrest. We hope that this study will help us recognise and understand possible complications of heart attack and cardiac arrest in future patients.

#### What is involved in this research study?

If you decide to take part, you will be asked to attend the Cardiology Department at the Royal Infirmary of Edinburgh for an assessment that will take approximately one hour. During the assessment you will be taken through a number of simple questionnaires that ask about your mood and stress levels and how your admission to hospital has affected you since. The session also includes a short interview where we discuss your experience in more detail. The questionnaires and interview are used because we realise that some patients find their illness and admission to hospital a traumatic experience, which could have long-term effects such as causing anxiety. We believe that it is important to find out how common these symptoms are after an acute illness.

#### What happens now?

Participation in this study is voluntary, and your future treatment will not be affected if you decide not to take part. As part of normal procedure, we will inform your General Practitioner and, if applicable, your hospital consultant, if you agree to participate in the study. Also, this research project is covered, in the event of accident, through insurance arrangements with the University of Edinburgh.

Dr Neil Grubb is the main investigator in this research study, and can be contacted at the Royal Infirmary of Edinburgh through the switchboard (0131 536 1000).

Dr Nicholas Boon is a consultant Cardiologist who is not directly involved with this study, and is available to independently advise you about the study and participation if you should wish (0131 536 2002).

**“A study of the prevalence post-traumatic stress disorder in patients who experienced a heart attack in hospital”**

- I agree to participate in this study
- I have read this consent form and Patient Information Sheet and had the opportunity to ask questions about them.
- I agree for notice to be sent to my General Practitioner about my participation on this study.
- I agree to the provision of any clinically significant information to my General Practitioner.
- I understand that I am under no obligation to take part in this study and that a decision not to participate will not alter the treatment that I would normally receive.
- I understand that I have the right to withdraw from this study at any stage and that to do so will not affect my treatment.
- I understand that this is non-therapeutic research from which I cannot expect to derive any benefit.

Signature of Patient:

.....

Name of Patient:

Signature of Investigator:.....

Date:.....

Four copies to be made

Top copy to be retained by investigator

Second copy to be retained by patient

Third copy to be sent to patient's General Practitioner

An additional copy to be filed in any relevant hospital case notes

## PATIENT INFORMATION SHEET

### **The impact of psychological factors on recollection of the event and the development of post-traumatic stress symptoms following MI**

You have been invited to take part in the above research study, which investigates how psychological factors can affect the way in which you remember your cardiac event, and your recovery afterwards. Doctors are beginning to understand that some patients who survive a heart attack, continue to suffer from disturbing recollections of the experience long after they have otherwise physically recovered. These memories can prevent those patients from making a full recovery. It is thought that certain psychological factors can influence health by affecting the way in which different people think about and recollect their experiences. We believe it is important to find out more about how these factors can cause people to remember and understand their illness in different ways that can have an impact on their recovery. It is hoped that this research will help in the identification and rehabilitation of people at risk of poor recovery following a serious cardiac event.

#### What is involved in this research study?

If you decide to take part, you will be asked to attend the Cardiology Out-patient Department at the Royal Infirmary of Edinburgh for an interview that will take approximately ninety minutes. The interview will be divided into three parts. For the first part you will be asked to fill in two questionnaires assessing your psychological outlook which will take about twenty minutes. You will then be given a five-minute break. After this, you will be asked to write a little about your recollection of your cardiac event. This will be followed by another five-minute break. You will then be asked to fill in three more short questionnaires about how you have been affected by your experience, and finally you will have an opportunity to discuss your experience and how you have been recovering in a more detailed manner. With your permission this interview will be recorded. The questionnaires are not stressful, and in our experience patients have found the opportunity to talk about their experience valuable. Four weeks after the study we will post you two questionnaires that you will have seen before and ask you to complete and return them to us.

#### What happens now?

Participation in this study is voluntary, and your future treatment will not be affected if you decide not to take part. You may also withdraw from the study **at any time**. As part of normal procedure, we will inform your General Practitioner and, if applicable, your hospital consultant, if you agree to participate in the study. This research project is covered, in the event of accident, through insurance arrangements with the University of Edinburgh.

Dr Neil Grubb is the main investigator in this research study, and can be contacted at the Royal Infirmary of Edinburgh through the switchboard (0131 536 1000).

Dr Nicholas Boon is a consultant Cardiologist who is not directly involved with this study, and is available to independently advise you about the study and participation if you should wish (0131 536 2002).

Should you find some of the questions or the interview upsetting and wish to discuss this with someone, Prof. Ronan O'Carroll, Clinical Psychologist can be contacted at 01334 463041.

**The impact of psychological factors on recollection of the event and the development of post-traumatic stress symptoms following MI**

- I agree to participate in this study
- I have read this consent form and Patient Information Sheet and had the opportunity to ask questions about them.
- I agree for notice to be sent to my General Practitioner about my participation in this study.
- I agree to the provision of any clinically significant information to my General Practitioner.
- I understand that I am under no obligation to take part in this study and that a decision not to participate will not alter the treatment that I would normally receive.
- I understand that I have the right to withdraw from this study at any stage and that to do so will not affect my treatment.
- I understand that this is non-therapeutic research from which I cannot expect to derive any benefit.

Signature of Patient:

.....

Name of Patient:

Signature of Investigator:.....

Date:.....

Four copies to be made

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- Second copy to be retained by patient
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- An additional copy to be filed in any relevant hospital case notes

## **Appendix II**

### **MEASURES USED IN STUDIES I, III AND IV**

## HADS SCALE

Name:

Study No:

Date:

Doctors are aware that emotions play an important part in most illnesses. If your doctor knows about these feelings he will be able to help you more. This questionnaire is designed to help your doctor know how you feel. Read each item and place a firm tick in the box opposite the reply which comes closest to how you have been feeling IN THE PAST WEEK.

Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought out answer.

*Tick only one box in each section*

### **I feel tense or 'wound up':**

Most of the time [ ]  
A lot of the time [ ]  
Time to time, Occasionally [ ]  
Not at all [ ]

### **I still enjoy the things I used to enjoy:**

Definitely as much [ ]  
Not quite so much [ ]  
Only a little [ ]  
Hardly at all [ ]

### **I get a sort of frightened feeling as if something awful is about to happen:**

Very definitely and quite badly [ ]  
Yes, but not too badly [ ]  
A little, but it doesn't worry me [ ]  
Not at all [ ]

### **I can't laugh and see the funny side of things:**

As much as I always could [ ]  
Not quite so much now [ ]  
Definitely not so much now [ ]  
Not at all [ ]

### **Worrying thoughts go through my mind:**

A great deal of the time [ ]  
A lot of the time [ ]  
From time to time but not too often [ ]  
Only occasionally [ ]

### **I feel cheerful:**

Not at all [ ]  
Not often [ ]  
Sometimes [ ]  
Most of the time [ ]

### **I can sit at ease and feel relaxed:**

Definitely [ ]  
Usually [ ]  
Not often [ ]  
Not at all [ ]

### **I feel as if I am slowed down:**

Nearly all the time [ ]  
Very often [ ]  
Sometimes [ ]  
Not at all [ ]

### **I get a sort of frightened feeling like 'butterflies' in the stomach:**

Not at all [ ]  
Occasionally [ ]  
Quite often [ ]  
Very often [ ]

### **I have lost interest in my appearance:**

Definitely [ ]  
I don't take so much care as I should [ ]  
I may not take quite as much care [ ]  
I take just as much care as ever [ ]

### **I feel restless as if I have to be on the move:**

Very much indeed [ ]  
Quite a lot [ ]  
Not very much [ ]  
Not at all [ ]

### **I look forward with enjoyment to things:**

As much as I ever did [ ]  
Rather less than I used to [ ]  
Definitely less than I used to [ ]  
Hardly at all [ ]

### **I get sudden feelings of panic:**

Very often indeed [ ]  
Quite often [ ]  
Not very often [ ]  
Not at all [ ]

### **I can enjoy a good book or radio or TV programme:**

Often [ ]  
Sometimes [ ]  
Not often [ ]  
Very seldom [ ]

## National Adult Reading Test

(NART)

<b>Chord</b>	<b>Superfluous</b>
<b>Ache</b>	<b>Simile</b>
<b>Depot</b>	<b>Banal</b>
<b>Aisle</b>	<b>Quadruped</b>
<b>Bouquet</b>	<b>Cellist</b>
<b>Psalm</b>	<b>Façade</b>
<b>Capon</b>	<b>Zealot</b>
<b>Deny</b>	<b>Drachm</b>
<b>Nausea</b>	<b>Aeon</b>
<b>Debt</b>	<b>Placebo</b>
<b>Courteous</b>	<b>Abstemious</b>
<b>Rarefy</b>	<b>Détente</b>
<b>Equivocal</b>	<b>Idyll</b>
<b>Naïve</b>	<b>Puerperal</b>
<b>Catacomb</b>	<b>Aver</b>
<b>Gaoler</b>	<b>Gauche</b>
<b>Thyme</b>	<b>Topiary</b>
<b>Heir</b>	<b>Leviathan</b>
<b>Radix</b>	<b>Beatify</b>
<b>Assignate</b>	<b>Prelate</b>
<b>Hiatus</b>	<b>Sidereal</b>
<b>Subtle</b>	<b>Demesne</b>
<b>Procreate</b>	<b>Syncope</b>
<b>Gist</b>	<b>Labile</b>
<b>Gouge</b>	<b>Campanile</b>

REVISED **IMPACT OF EVENT SCALE (IES)**

Name.....

Date:.....

Study No:.....

Below is a list of comments made by people after stressful life events. Please answer each item, indicating how frequently these comments were true for you **DURING THE LAST SEVEN DAYS**. If they did not occur during that time, please circle the "not at all" response.

1.~	I thought about it when I didn't mean to	Not at all	Rarely	Sometimes	Often
2.	I avoided letting myself get upset when I thought about it or was reminded of it	Not at all	Rarely	Sometimes	Often
3.	I tried to remove it from my memory	Not at all	Rarely	Sometimes	Often
4.~	I had trouble falling asleep or staying asleep because thoughts about it came into my mind	Not at all	Rarely	Sometimes	Often
5.~	I had waves of strong feeling about it	Not at all	Rarely	Sometimes	Often
6.~	I had dreams about it	Not at all	Rarely	Sometimes	Often
7.	I stayed away from reminders of it	Not at all	Rarely	Sometimes	Often
8.	I felt as if it hadn't happened or it wasn't real	Not at all	Rarely	Sometimes	Often
9.	I tried not to talk about it	Not at all	Rarely	Sometimes	Often
10.~	Pictures about it popped into my mind	Not at all	Rarely	Sometimes	Often
11.~	Other things kept making me think about it	Not at all	Rarely	Sometimes	Often
12.	I was aware that I still had a lot of feelings about it, but I didn't deal with them	Not at all	Rarely	Sometimes	Often
13.	I tried not to think about it	Not at all	Rarely	Sometimes	Often
14.~	Any reminder brought back feelings about it	Not at all	Rarely	Sometimes	Often
15.	My feelings about it were rather numb	Not at all	Rarely	Sometimes	Often

Hand-Scoring Answer Sheet



Edna B. Foa, PhD

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or Identification Number

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ABCD

Product Number  
51623

## Part 1

people have lived through or witnessed a very  
and traumatic event at some point in their lives.  
s a list of traumatic events. Put a checkmark in the  
ct to ALL of the events that have happened to you  
you have witnessed.

Serious accident, fire, or explosion (for example,  
an industrial, farm, car, plane, or boating accident)

Natural disaster (for example, tornado, hurricane,  
flood, or major earthquake)

Non-sexual assault by a family member or  
someone you know (for example, being mugged,  
physically attacked, shot, stabbed, or held at  
gunpoint)

Non-sexual assault by a stranger (for example,  
being mugged, physically attacked, shot, stabbed,  
or held at gunpoint)

Sexual assault by a family member or someone  
you know (for example, rape or attempted rape)

Sexual assault by a stranger (for example, rape  
or attempted rape)

Military combat or a war zone

Sexual contact when you were younger than 18  
with someone who was 5 or more years older than  
you (for example, contact with genitals, breasts)

Imprisonment (for example, prison inmate,  
prisoner of war, hostage)

Torture

Life-threatening illness

Other traumatic event

If you marked Item 12, specify the traumatic event  
below.

IF YOU MARKED ANY OF THE ITEMS ABOVE,  
CONTINUE. IF NOT, STOP HERE.

## Part 2

(14) If you marked more than one traumatic event in Part 1, put a checkmark in the box below next to the event *that bothers you the most*. If you marked only one traumatic event in Part 1, mark the same one below.

- Accident
- Disaster
- Non-sexual assault/someone you know
- Non-sexual assault/stranger
- Sexual assault/someone you know
- Sexual assault/stranger
- Combat
- Sexual contact under 18 with someone 5 or more years older
- Imprisonment
- Torture
- Life-threatening illness
- Other

In the box below, briefly describe the traumatic event you marked above.

---

---

---

---

---

---

---

---

Below are several questions about the traumatic event you just described above.

- (15) How long ago did the traumatic event happen?  
(circle ONE)
- 1 Less than 1 month
  - 2 1 to 3 months
  - 3 3 to 6 months
  - 4 6 months to 3 years
  - 5 3 to 5 years
  - 6 More than 5 years

For the following questions, circle Y for Yes or N for No.

During this traumatic event:

- (16) Y N Were you physically injured?
- (17) Y N Was someone else physically injured?
- (18) Y N Did you think that your life was in danger?
- (19) Y N Did you think that someone else's life was in danger?
- (20) Y N Did you feel helpless?
- (21) Y N Did you feel terrified?

## Part 3

is a list of problems that people sometimes have experiencing a traumatic event. Read each one carefully and circle the number (0-3) that best describes how often that problem has bothered you IN THE PAST MONTH. Rate each problem with respect to the traumatic event you described in Item 14.

0 Not at all or only one time  
1 Once a week or less/once in a while  
2 2 to 4 times a week/half the time  
3 5 or more times a week/almost always

- 0 2 3 Having upsetting thoughts or images about the traumatic event that came into your head when you didn't want them to
- 0 2 3 Having bad dreams or nightmares about the traumatic event
- 0 2 3 Reliving the traumatic event, acting or feeling as if it was happening again
- 0 2 3 Feeling emotionally upset when you were reminded of the traumatic event (for example, feeling scared, angry, sad, guilty, etc.)
- 0 2 3 Experiencing physical reactions when you were reminded of the traumatic event (for example, breaking out in a sweat, heart beating fast)
- 0 2 3 Trying not to think about, talk about, or have feelings about the traumatic event
- 0 2 3 Trying to avoid activities, people, or places that remind you of the traumatic event
- 0 2 3 Not being able to remember an important part of the traumatic event
- 0 2 3 Having much less interest or participating much less often in important activities
- 0 2 3 Feeling distant or cut off from people around you
- 0 2 3 Feeling emotionally numb (for example, being unable to cry or unable to have loving feelings)
- 0 2 3 Feeling as if your future plans or hopes will not come true (for example, you will not have a career, marriage, children, or a long life)

- (34) 0 1 2 3 Having trouble falling or staying asleep
- (35) 0 1 2 3 Feeling irritable or having fits of anger
- (36) 0 1 2 3 Having trouble concentrating (for example, drifting in and out of conversations, losing track of a story on television, forgetting what you read)
- (37) 0 1 2 3 Being overly alert (for example, checking to see who is around you, being uncomfortable with your back to a door, etc.)
- (38) 0 1 2 3 Being jumpy or easily startled (for example, when someone walks up behind you)
- (39) How long have you experienced the problems that you reported above? (circle ONE)
  - 1 Less than 1 month
  - 2 1 to 3 months
  - 3 More than 3 months
- (40) How long after the traumatic event did these problems begin? (circle ONE)
  - 1 Less than 6 months
  - 2 6 or more months

## Part 4

Indicate below if the problems you rated in Part 3 have interfered with any of the following areas of your life DURING THE PAST MONTH. Circle Y for Yes or N for No.

- (41) Y N Work
- (42) Y N Household chores and duties
- (43) Y N Relationships with friends
- (44) Y N Fun and leisure activities
- (45) Y N Schoolwork
- (46) Y N Relationships with your family
- (47) Y N Sex life
- (48) Y N General satisfaction with life
- (49) Y N Overall level of functioning in all areas of your life

## Self Rating Scale for PTSD (SRS-PTSD: DSM-IV)

### Questions about Effects of Traumatic Event

Below are several statements that might be applicable to you *ever since* you experienced the traumatic event. Please fill in the O before the response that best describes your situation. Please bear in mind that we are asking you about the past *4 weeks*.

- 1a. I thought about the event regularly, even if I didn't want to.  
 not at all  
 less than four times a week  
 four or more times a week
- 1b. Sometimes images of the event shot through my mind.  
 not at all  
 less than four times a week  
 four or more times a week
- 2a. I repeatedly dreamed about the event.  
 not at all  
 once a week  
 twice a week or more
- 2b. Sometimes I woke up in a pool of sweat or screaming.  
 not at all  
 once a week  
 twice a week or more
3. I had the feeling I was reliving the event (or certain moments of it).  
 not at all  
 once  
 more than once
4. I felt very bad (sad, angry, scared, etc) or got upset whenever I was reminded of the event, for example, by the radio, television, newspaper, people, or situations.  
 not at all  
 a little bit  
 very much
5. If I think about the event it makes me feel bad physically. For instance, my chest aches, I shiver or perspire, I get nauseous or I get a headache.  
 not at all  
 a little bit  
 very much
- 6a. I did my best or forced myself not to think about the event.  
 not at all  
 a little bit  
 very much
- 6b. Which of the following have you done since the event? (You can fill in more than one response)  
 drink more alcohol  
 use more drugs  
 gamble  
 take more medicine  
 escape by working a lot  
 stop working  
 not want to watch television anymore  
 not want to read a newspaper any more  
 want to see fewer people  
 wander the streets
7. Ever since the event I have been avoiding people or things (such as shops, restaurants, movies, airports or parties) that remind me of the event.  
 not at all  
 a little bit  
 very much
- 8a. As regards the memory of the event:  
 I can remember everything very well  
 I can remember only a few details  
 I have no memory at all of a large part of it
- 8b. I had the feeling that the event was a bad dream, as if it did not really happen.  
 not at all  
 a little bit  
 very much
9. Ever since the event, I have not enjoyed or been interested in things I used to like such as hobbies or recreational activities.  
 not at all  
 a little bit  
 very much
10. Ever since the event, I have not been spending as much time with other people.  
 not at all  
 a little bit  
 very much
11. Ever since the event, I have felt less involved with other people: it is as if my feelings are not there anymore.  
 not at all  
 a little bit  
 very much
12. Ever since the event, I have been pessimistic about my future. For example, I do not expect much from life, my job, or relationships with other people.  
 not at all  
 a little bit  
 very much
13. Ever since the event, I have had trouble sleeping. I have trouble falling asleep, or I wake up in the middle of the night and can't get back to sleep.  
 not at all  
 once or twice a week  
 three or more times a week
14. Ever since the event, I have been more apt to be impatient or lose my temper.  
 not at all  
 once every two weeks  
 more than once a week
- 15a. Ever since the event, I have been having trouble concentrating, for example, on reading a book or a newspaper or on my work.  
 not at all  
 a little bit  
 very much
- 15b. Ever since the event, I have been more apt to forget things.  
 not at all  
 a little bit  
 very much
16. Ever since the event, I have felt less at ease or less safe.  
 not at all  
 a little bit  
 very much
17. Ever since the event, I have been more nervous and more jumpy, for instance if I hear a sudden sound.  
 not at all  
 once every two weeks  
 more than once a week

Sometimes upsetting things that happen to people—such as experiencing a heart attack as you did – can keep coming back in nightmares, flashbacks, or thoughts that you can't get rid of. Has that happened to you since your heart attack?

If NO: What about being upset when you were in a situation that reminded you of it?

### **CRITERIA FOR PTSD**

How did you react when your heart attack happened? Were you very afraid or did you feel terrified or helpless?

**Now I would like to ask a few questions about specific ways that it may have affected you.**

**For example...**

...did you think about your heart attack when you did not want to or did thought about it come to you suddenly when you didn't want them to?

...what about having dreams about it?

...what about finding yourself acting or feeling as if you were back in the situation?

...what about getting very upset when something reminded you about your heart attack?

...what about having physical symptoms – such as breaking out in a sweat, breathing heavily or irregularly, or your heart pounding or racing?

**AT LEAST ONE "B" SYMPTOM MUST BE POSITIVE**

RE-EXPERIENCING –

**Since your heart attack....**

...have you made a special effort to avoid thinking or talking about what happened?

...have you stayed away from things or people that reminded you of your heart attack?

...have you been unable to remember some important part of what happened?

Have you been much less interested in doing things that used to be important to you, such as seeing friends, reading books or watching TV?

...have you felt distant or cut off from others?

...have you felt "numb" or as if you no longer had strong feelings about anything or loving feelings for anyone?

...did you notice a change in the way you think about or plan for the future?

**AT LEAST THREE "C" SYMPTOMS MUST BE POSITIVE**      AVOIDANCE –

**Since the heart attack....**

...have you had trouble sleeping? What kind of trouble?

...have you been unusually irritable? What about outbursts or anger?

...have you had trouble concentrating?

...have you been watchful or on guard even when there was no reason to be?

...have you been jumpy or easily startled, such as by sudden noises?

**AT LEAST TWO "D" SYMPTOMS MUST BE POSITIVE**

AROUSAL –

How long have these symptoms lasted?

Have you had any symptoms in the past month?

Clinically significant impairment?

# POSITIVE AND NEGATIVE AFFECT SCHEDULE

Name:..... Before/After:.....  
Date:..... Study Number:.....

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word.

Indicate to what extent you generally feel this way, that is, how you feel on average.

Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

..... interested  
..... distressed  
..... excited  
..... upset  
..... strong  
..... guilty  
..... scared  
..... hostile  
..... enthusiastic  
..... proud  
..... irritable  
..... alert  
..... ashamed  
..... inspired  
..... nervous  
..... determined  
..... attentive  
..... jittery  
..... active  
..... afraid

## SOC-29

Below is a series of questions relating to various aspects of our lives. Each question has seven possible answers. Please mark the number which best expresses your answer, with numbers 1 and 7 being the extreme answers. If the words under 1 are right for you, circle 1; if the words under 7 are right for you, circle 7. If you feel differently, circle the number which best expresses your feeling. You can choose any number between 1 and 7. Please give only one answer to each question.

1. When you talk to people do you have the feeling that they don't understand you?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

never have  
this feeling

always have  
this feeling

2. In the past, when you had to do something which depended upon the cooperation of others, did you have the feeling that it:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

surely wouldn't  
get done?

surely would  
get done?

3. Think of the people with whom you come into contact daily, aside from the ones to whom you feel closest. How well do you know most of them?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

you feel that  
they're strangers

you know them  
very well

4. Do you have the feeling that you don't really care about what goes on around you?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very seldom  
or never

very often

5. Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

never happened

always  
happened

6. Has it happened that people whom you counted on disappointed you?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

never happened

always  
happened

7. Life is:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

full of  
interest

completely  
routine

8. Until now your life has had:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

no clear goals  
or purpose at all

very clear goals  
and purpose

9. Do you have the feeling that you're being treated unfairly?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

10. In the past ten years your life has been:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

full of changes  
without your  
knowing what  
will happen next

completely  
consistent  
and clear

11. Most of the things you do in the future will probably be:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

completely  
fascinating

deadly  
boring

12. Do you have the feeling that you are in an unfamiliar situation and don't know what to do?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

13. What best describes how you see life?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

one can always  
find a solution  
to painful things  
in life

there is no  
solution to  
painful things  
in life

14. When you think about life, you very often:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

feel how good  
it is to be alive

ask yourself why  
you exist at all

15. When you face a difficult problem, the solution is:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

always confusing  
and hard to find

always completely  
clear

16. Doing the things you do every day is:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

a source of  
deep pleasure  
and satisfaction

a source of  
pain and boredom

17. Your life in the future will probably be:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

full of changes  
without your  
knowing what  
will happen next

completely  
consistent  
and clear

18. When something unpleasant happened in the past your tendency was:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

to feel very  
upset about it

to say "OK, that's that,  
I have to live with it"  
and go on

19. Do you have very mixed up feelings and ideas?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

20. When you do something that gives you a good feeling:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

it's certain that  
you'll go on  
feeling good

it's certain that  
something will  
happen to spoil  
that feeling

21. Does it happen that you have feelings inside that you would rather not feel?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

22. You anticipate that your personal life in the future will be:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

totally without  
meaning and  
purpose

full of meaning  
and purpose

23. Do you think that there will *always* be people whom you'll be able to count on in the future?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

you're certain  
there will be

you doubt  
there will be

24. Does it happen that you have the feeling that you don't know exactly what's about to happen?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

25. Many people, even those with a strong character, sometimes feel like losers or blunderers in certain situations. How often have you felt this way in the past?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

never

very often

26. When something happened, have you generally found that:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

you overestimated  
or underestimated  
its importance?

you saw things in  
the right proportion?

27. When you think about difficulties you are likely to face in important aspects of your life, do you have the feeling that:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

you will always  
succeed in overcoming  
the difficulties

you won't succeed  
in overcoming  
the difficulties

28. How often do you have the feeling that there's little meaning in the things you do in your daily life?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

29. How often do you have feelings that you're not sure you can keep under control?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

very often

very seldom  
or never

Thank you for your time.

## Duke-UNC Social Support Questionnaire

HERE IS A LIST OF SOME THINGS THAT OTHER PEOPLE DO FOR US OR GIVE US THAT MAY BE HELPFUL OR SUPPORTIVE. PLEASE READ EACH STATEMENT CAREFULLY AND PLACE A CHECK (✓) IN THE BLANK THAT IS CLOSEST TO YOUR SITUATION.

HERE IS AN EXAMPLE:	As much as I would like	Much less than I would like
I get enough vacation time.....	. . . ✓ . . .	. . . . .

If you put a check where we have, it means that you get almost as much vacation time as you would like, but not quite as much as you would like.

ANSWER EACH ITEM AS BEST YOU CAN. THERE ARE NO RIGHT OR WRONG ANSWERS.

- |  | As much as<br>I would like | Much less<br>than I<br>would like |
|--|----------------------------|-----------------------------------|
| I get....  |                            |                                   |
| 1. love and affection.....   | . . . . .                  | . . . . .                         |
| 2. chances to talk to someone about<br>problems at work or with my<br>housework.....   | . . . . .                  | . . . . .                         |
| 3. people who care what happens me....   | . . . . .                  | . . . . .                         |
| 4. chances to talk to someone I trust<br>about my personal and family<br>problems..... | . . . . .                  | . . . . .                         |
| 5. chances to talk about money matters..   | . . . . .                  | . . . . .                         |
| 6. invitations to go out and do things<br>with other people.....                       | . . . . .                  | . . . . .                         |
| 7. useful advice about important things<br>in life.....                                | . . . . .                  | . . . . .                         |
| 8. help when I'm sick in bed.....  | . . . . .                  | . . . . .                         |

## **Appendix III**

### **LIWC CATEGORIES AND SAMPLE WORDS**

## PRIMARY LIWC CATEGORIES

DIMENSION	EXAMPLES
<b>1. STANDARD LINGUISTIC DIMENSIONS</b>	
Total pronouns	
Negations	
Assents	
Articles	
Prepositions	
Numbers	
<b>2. PSYCHOLOGICAL PROCESSES</b>	
<b>Affective or Emotional processes</b>	happy, ugly, bitter
Positive Emotions	happy, pretty, good
Positive feelings	happy, joy, love
Optimism and energy	certainty, pride, win
Negative Emotions	hate, worthless, enemy
Anxiety or fear	nervous, afraid, tense
Anger	hate, kill, pissed
Sadness or depression	grief, cry, sad
<b>Cognitive Processes</b>	cause, know, ought
Causation	because, effect, hence
Insight	think, know, consider
Discrepancy	should, would, could
Inhibition	block, constrain
Tentative	maybe, perhaps, guess
Certainty	always, never
<b>Sensory and Perceptual Processes</b>	see, touch, listen
<b>Social Processes</b>	talk, us, friend
<b>3. RELATIVITY</b>	
<b>Time</b>	hour, day, o'clock
<b>Space</b>	around, over, up
<b>Motion</b>	walk, move, go
<b>4. PERSONAL CONCERNS</b>	
<b>Occupation</b>	work, class, boss
<b>Leisure activity</b>	house, tv, music
<b>Money and financial issues</b>	cash, taxes, income
<b>Metaphysical issues</b>	God, heaven, coffin
<b>Physical states and functions</b>	ache, breast, sleep