

**DETECTING DEPRESSION AFTER ACUTE MYOCARDIAL  
INFARCTION AND UNSTABLE ANGINA USING THE  
BECK DEPRESSION INVENTORY – II  
AND THE GERIATRIC DEPRESSION SCALE**

by

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## Abstract

No validation studies have been conducted with the Beck Depression Inventory – Second Edition (BDI-II) or the Geriatric Depression Scale (GDS) in a cardiac population. Because depression is an independent risk factor for mortality in cardiac patients, it is essential to identify a depression screen that is appropriate for this group. A total of 119 patients (89 men and 30 women) were recruited from the coronary care units of three hospitals. Home interviews were conducted approximately 2 weeks post-myocardial infarction (MI) or post-unstable angina/acute coronary syndrome (UA/ACS). Participants were screened for depressive symptoms using the BDI-II and GDS. Research diagnoses of participants' depression were determined using, as a gold standard, the Structured Clinical Interview for *DSM-IV-TR* (SCID-I/NP) criteria for depression. Reliability estimates for both BDI-II and GDS scores were satisfactory. Criterion-related validity was examined by comparing the scores obtained on the BDI-II and GDS with the SCID-I/NP diagnoses of depression. Sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) were evaluated for different cut scores for the BDI-II and GDS, using receiver operating characteristic (ROC) curves. ROC curves revealed that both the BDI-II and GDS demonstrated excellent sensitivity for detecting major depressive disorder and double depression, however, the GDS demonstrated greater specificity and PPV than the BDI-II with this sample. For this population of medically-ill, older adults, it is recommended that researchers and clinicians use the GDS to screen for major depressive disorder or double depression. Neither the BDI-II nor the GDS was effective in screening for the broader or milder forms of depression (i.e., minor depressive disorder, partial remission of major depressive disorder, or dysthymia) in this post-MI and post-UA/ACS sample.

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## Chapter One

### Overview and Summary

According to recent studies, depression is a significant predictor of mortality in cardiac patients who have experienced an acute myocardial infarction (MI; Frasure-Smith, Lespérance, & Talajic, 1993). Moreover, depression is an independent risk factor<sup>1</sup> for death within as few as 4 months to 1 year following patient hospitalization for MI (Bush et al., 2001; Frasure-Smith, Lespérance, Juneau, Talajic, & Bourassa, 1999; Frasure-Smith et al., 1993). This risk factor is at least equivalent in its impact to having had a previous MI and left ventricular dysfunction and is unrelated to the severity of cardiac disease (Frasure-Smith et al., 1993). However, depression in male and female patients who have undergone a cardiac event is neither adequately identified nor treated (Carney et al., 1987; Frasure-Smith et al., 1993).

#### *Statement of the Problem*

Depressed female cardiac patients are a particularly understudied group (Con, Linden, Thompson, & Ignaszewski, 1999), despite women in the general population having incidence rates of major depression more than twice that of men (Weissman, 1987; Weissman, Bland, Joyce, Newman, Wells, & Wittchen, 1993). It should be noted that female post-MI patients are also significantly more likely to suffer reinfarctions (Frasure-Smith et al., 1999). Female cardiac patients, therefore, might be at substantially greater risk than male cardiac patients of having, and dying from, a subsequent MI.

Several well-designed studies have determined the prevalence of depression in cardiac patients. Carney et al. (1987) found a prevalence rate of 18% for a major depressive disorder in patients who have coronary artery disease. Similarly, Frasure-Smith et al. (1993) noted that 16% of the patients recovering from MI met diagnostic criteria for major depression. In addition, Schleifer et al. (1989) reported that 18% of patients recovering from MI exhibited major

depression and that an additional 27% showed evidence of a minor depressive episode. Schleifer et al. also noted that female post-MI patients have a significantly increased risk of meeting criteria for major depression when compared with male post-MI patients.

### *Coronary Heart Disease and Gender*

It is important to point out that cardiovascular disease (includes MI, stroke, and high blood pressure as well as other diseases of the circulatory system) is the leading cause of death of women in Canada (Heart and Stroke Foundation of Canada, 1999) and in the United States (Castelli, 1988). In spite of this, cardiovascular disease is largely perceived in medicine to be a disease of men (Castelli, 1988). This misperception might arise from the fact that relatively few women develop the disease prior to the menopausal years. However, the prospective Framingham Heart Study (Castelli, 1988) of 2336 men and 2873 women, indicated that, once women began to develop the disease, the incidence rates for MI in post-menopausal women quickly escalated to equal the incidence rates observed in men who were 6 to 10 years younger. Thus, while women developed coronary heart disease (CHD), on average, 6 to 10 years later than men, the disease developed at a parallel rate to that of men (Castelli, 1988). One should keep in mind that the cumulative prevalence rate of CHD in men is higher because men begin manifesting the disease much earlier. Because age is a frequent exclusionary criterion in clinical trial participation, most of the research on CHD has been conducted on men. As a result, the applicability of research findings to women is limited (Con et al., 1999; Gurwitz, Col, & Avorn, 1992; Wenger, 1992).

Because female coronary patients are more likely to be older (Gurwitz et al., 1992) and women are at least twice as likely to be depressed as men (Weissman, 1987; Weissman et al., 1993), it is particularly important to include older persons and women in research that investigates the relationship between depression and MI or acute coronary syndrome (ACS).<sup>2</sup>

Gurwitz et al. stated that exclusion of older persons seriously restricts the ability to generalize findings to the exact age group that suffers the most mortality from MI. According to Bush et al. (2001), for those post-MI patients who already had a high risk of mortality due to being 65 years or older, a fourfold increase in death occurred in those who were depressed. Thus, it is especially important to identify a quick, cost-effective method that is appropriate for measuring depression in both male cardiac patients and in their older female counterparts prior to discharge from hospital.

By accurately identifying depression in men and women recovering from MI/ACS and providing some sort of intervention (e.g., counselling, medication, or some combination), lives could perhaps be saved (Linden, Stossel, & Maurice, 1996). At the very least, medical costs for increased post-MI physician and emergency room visits could be limited (Frasure-Smith et al., 2000a) and the quality of life for depressed post-MI patients improved (Linden et al., 1996). The first step in this process would seem to be identifying an appropriate (i.e., valid) screen for depression in this group.

#### *Purpose of this Study*

The purposes of this study were threefold. The first purpose was to determine the reliability and criterion-related validity for participants' scores on the Beck Depression Inventory – Second Edition (BDI-II; Beck, Steer, & Brown, 1996) and the Geriatric Depression Scale (GDS; Yesavage et al., 1983). Criterion-related validity was examined by comparing the scores obtained on these measures with diagnoses determined by this researcher using a modified version of the Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders (Research Version, Non-patient Edition; SCID-I/NP; First, Spitzer, Gibbon, & Williams, 2002) which is based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (*DSM-IV-TR*; American Psychiatric Association, 2000) criteria for depression. The second purpose was

to recommend appropriate cut scores for the BDI-II and GDS for identifying depressed post-MI/ACS patients. Finally, the third purpose was to conduct a preliminary examination of the influence of personal variables (e.g., gender, a previous diagnosis of depression or other health conditions, social support) in addition to the BDI-II or GDS total scores, to determine if these variables helped predict a major depressive disorder in this sample of cardiac patients.

## Chapter Two

### Review of the Literature

Several studies have examined the effects of depression in cardiac patients who have been hospitalized for MI and observed that major depression is an independent risk factor for mortality within 12 months of that event (Bush et al., 2001; Frasure-Smith et al., 1999; Ladwig & Roll, 1994). However, there has been a crucial lack of detection and treatment of depression in post-MI patients who survive to be discharged from hospital (Frasure-Smith et al., 1993; Frasure-Smith et al., 1999; Luutonen, Holm, Salminen, Rislä, & Salokangas, 2002).

The first step in implementing screening to improve detection of depression in post-MI/ACS patients is to find a depression inventory that provides reliable and valid information for both male and female cardiac patients. Previous research that used self-report depression measures as a screen for depression in post-MI/ACS patients appears not to have considered that there might be important differences in the detection of depression between male patients and their older female counterparts (e.g., Frasure-Smith et al., 1999). Furthermore, previous research on the relationship between depression and MI or CHD frequently employed exclusions for participants based on age (e.g., Carney et al., 1987), coexisting serious medical illnesses (e.g., Frasure-Smith et al., 1993) and cognitive impairment (e.g., Schleifer et al., 1989). These restrictions are more likely to exclude female participants due to the older age at which women develop CHD.

No research to date has examined the criterion-related validity of the BDI-II and the GDS with post-MI patients to determine if one inventory might better screen for depression in this mix of male and female patients of middle and advanced age. This study will seek to fill this gap. In order to understand the research relating to MI/ACS and depression, it is necessary to define key terms as they are used in the literature and in this current research. Definitions of key words

relating to cardiovascular diseases, depression, incidence, prevalence, and risk and are set out in Appendix A. First, I will review the literature describing: (a) the prevalence of depression in older adults and medically ill adults; (b) the impact of depression on cardiac patients; (c) the impact of depression on older cardiac patients; (d) the lack of detection and treatment; (e) an overview of gender differences in MI; (f) gender differences in post-MI patients; (g) the impact of gender on post-MI care; (h) and, the impact of depression, older age, and gender on the rehabilitation of cardiac patients. Then, I will briefly summarize the literature and outline the proposed study.

#### *Prevalence of Depression in Older Adults and Medically Ill Adults*

The Yale Epidemiologic Catchment Area study revealed lower prevalence rates of major depression in older adults (defined as 65 years of age or more) than in those aged 45 to 64 years for the catchment area of New Haven, Connecticut (Leaf, Weissman, Myers, Holzer, & Tischler, 1986). However, it is important to note that while women aged 45 to 64 years had a prevalence rate of approximately twice that of men, in the group 65 years of age or more, women had a prevalence rate of major depression at least three times higher than that of men.

Moreover, depression appears to be a significant, expanding problem for the group over the age of 65 (Futtermann, Thompson, Gallagher-Thompson, & Ferris, 1995). Futtermann et al. noted that, because the numbers of institutionalized and medically ill older adults are expanding rapidly, the numbers of depressed older adults in these groups will probably grow quickly as well. They observed that data from both older medically ill outpatients and older, nursing home residents who have extreme disabilities or chronic disease, suggest that the prevalence of depression is double or triple that traditionally observed in community-dwelling elders.

Similarly, Katon and Sullivan (1990) examined a number of studies that used structured clinical interviews, across different samples of adults, and found higher prevalence rates of

depression in the medically ill. They compared the prevalence rates of major depression in studies examining samples of individuals dwelling in the community, receiving outpatient medical treatment and receiving inpatient medical care. Katon and Sullivan reported a consistent increase in the prevalence of major depression (ranging, respectively, from about 3% to 6% to 12%) across these three populations.

In a study designed to detect the presence of major depression in older medically ill persons, Rapp, Parisi, Walsh, and Wallace (1988) examined 150 male inpatients who were 65 years or older from a Veterans Administration Hospital. The researchers also investigated the hospital staff's detection rate of patients' depression by including a blind review of participants' medical charts after discharge. Mean age of the participants was 69.3 years. Rapp et al. administered four self-report depression inventories, together with a semi-structured diagnostic interview guide as a criterion measure. Diagnoses were rendered according to the Research Diagnostic Criteria (RDC). In addition, the authors conducted an examination of the participants' cognitive functioning, using the Mini-Mental State Exam (MMSE), and excluded those individuals who were cognitively impaired. The authors found that 6% of the participants had major depression and an additional 9.3% exhibited minor or intermittent depressive disorders. Of the 23 participants diagnosed with a depressive disorder, only two had been identified as depressed by hospital staff.

Rapp et al. (1988) cautioned that, because their sample was restricted to those who were cognitively intact, inferences should not be made about the prevalence of depression or detection rates in patients who have reduced cognitive abilities. Additionally, because their sample was restricted to older males, they noted that their results had limited application to the population at large. However, the authors stated that the low hospital staff detection rate of depression observed in this study reflected similar rates found in other studies. Rapp et al. also observed that



detection rates by medical staff were generally lower with older adults than with those who were middle-aged. The researchers suggested that depressed older inpatients, therefore, might be at particularly high risk for underdetection of depression.

Thus, while both men and women who have experienced MI are at a higher risk for depression than the community at large, women face a much higher risk than men of developing depression after MI because of their gender and the older age at which they experience MI. Yet, women have not been adequately represented in studies examining the impact of depression on the development of cardiac disease nor have they been adequately represented in studies evaluating the impact of depression on the prognosis for cardiac patients.

#### *Impact of Depression on Cardiac Patients*

In a study conducted for the purpose of detecting major depression in patients confirmed to have coronary artery disease, Carney et al. (1987) found 9 patients (5 men and 4 women) to have a major depressive disorder out of 50 patients (36 men and 14 women), a prevalence rate of 18%. Four of the 9 patients had a familial history of major depression, and 5 of the 9 reported at least one prior major depressive episode. Only patients who were undergoing elective cardiac catheterization were included in this study. Patients who had had a recent MI or other recent serious illness and patients who were over the age of 70 years were excluded from this sample. Patients were administered the Beck Depression Inventory (BDI) followed by structured clinical interviews. Diagnoses of major depression were rendered according to *DSM-III* criteria. There were no significant demographic or medical differences between patients identified as depressed and patients identified as non-depressed, except that smoking was more prevalent in those who were depressed. While this study claimed to have more rigorous evaluation criteria to obtain diagnoses of depression than had previous studies, the generalizability of the findings is limited by the small sample size, particularly for women. Additionally, those patients older than 70 years

of age were not represented and, therefore, the findings cannot be generalized to adults over that age.

In their prospective evaluation of the effect of depression on the mortality of 222 post-MI patients, Frasure-Smith et al. (1993) found a similar prevalence rate for depression to that reported by Carney et al. (1987). Frasure-Smith et al. observed that 16% of the patients recovering from MI met diagnostic criteria for major depression. Patients were assessed for depression while in hospital, between 5 and 15 days after MI. Major depressive disorder was assessed using a modified National Institute of Mental Health Diagnostic Interview Schedule (DIS) based on *DSM-III-R* criteria. The age of the sample ranged from 24 to 88 years with a mean age of 59.6 years and there were no age-based restrictions for participation. Thirty-seven percent of participants had a past history of MI. However, patients were excluded if they had a coexisting medical condition that was likely to have an impact on their 6-month survival or if there were "major problems of cognition" (p. 1820). The sample consisted of 173 men (78%) and 49 women (22%).

In a further description of the nature and course of depression in this sample of post-MI patients, Lespérance, Frasure-Smith, & Talajic (1996) noted that patients who had a previous history of depression were about twice as likely to experience depression in the hospital as those patients without a history of depression. Moreover, of the 35 patients who were diagnosed as having major depression in the hospital, 15 experienced prolonged depression or recurrences during the following year. Lespérance et al. compared depressive symptoms of those post-MI patients who met the criteria for major depression in hospital with nondepressed post-MI patients and reached three major conclusions: (a) Sadness occurred in 80% of the depressed group compared to 7% of the nondepressed group, while about 50% of the depressed group reported loss of pleasure or interest compared to about 2% of the non-depressed group; (b) fatigue was

primarily a symptom of depressed patients and, surprisingly, there was no relationship between complaints of fatigue and indicators of cardiac disease severity (e.g., previous MI or left ventricular ejection fraction); and (c) disturbances of appetite and sleep were shared by both groups. In addition, Frasure-Smith et al. (1993) observed that post-MI patients who were on the blood thinner, warfarin, had a greater likelihood of being depressed, as did patients who stated that they had no close friends. Furthermore, Lespérance et al. followed all of the post-MI patients for 18 months after discharge from hospital and reported that 20.6% of the nondepressed patients became depressed during the first year after discharge, with most of them becoming depressed within 6 months of discharge. Lespérance et al. concluded that the risk for development of depression after MI is highest while in the hospital and throughout the early period after discharge.

Frasure-Smith et al. (1993) found that major depression was an independent risk factor for mortality within 6 months following patient hospitalization for MI. As noted earlier, this risk factor was unrelated to the severity of cardiac disease and its effect was at least equivalent to that of two known risk factors for mortality: a history of MI and left ventricular dysfunction. Twelve post-MI patients died during this 6-month period, all from cardiac causes. Six of these patients had been diagnosed with major depression, with two dying as a result of infarction and four dying because of arrhythmia. The authors acknowledged, however, that there were few deaths and this limited their ability to control for other factors. In addition, only two out of three eligible patients consented to participate with elderly and female patients more likely to refuse. Furthermore, Frasure-Smith et al. observed that the prevalence rate of depression detected in their study was similar to the prevalence rate found in other studies with lower rates of refusal. However, it is possible that in limiting participation to those without other serious medical conditions (a necessary limitation in this instance), this study inadvertently restricted

participation by female post-MI patients. Because women with CHD are older (Castelli, 1988; Gurwitz et al., 1992), they are more likely to have co-existing serious medical illnesses (e.g., Frasure-Smith et al., 1999; Wenger, 1992; Wenger, 1997).

Frasure-Smith et al. (2000b) examined the influence of social support on the prognosis of depressed post-MI men and women who survived for 1 year after discharge from hospital. The authors conducted a secondary analysis of data from 887 post-MI patients who had been given the BDI and six measures of social support at baseline. One-year survival status was subsequently established for all participants. Follow-up interviews were conducted and the BDI was administered to 758 surviving patients. Similar to other studies that have found depression to be persistent in post-MI patients, Frasure-Smith et al. observed that the majority of the survivors who were depressed at the time of hospitalization continued to be depressed at 1 year. However, the authors found that higher levels of social support at baseline predicted fewer depressive symptoms in surviving MI patients over a one-year follow-up. Frasure-Smith et al. pointed out that while “no measure of social support showed any overall relationship with cardiac mortality” (p. 1921), there was a significant interaction between the score on the measure of perceived social support and baseline depression. For patients who had the highest level of perceived social support, surprisingly, there was no increase in cardiac death related to depression. This interaction of perceived social support and depression with one-year cardiac death remained significant even after adjustment for all relevant variables (e.g., sex and left ventricular ejection fraction, age, and sex and smoking). Furthermore, high levels of perceived social support predicted decreases in depression symptoms over the first year after MI and appeared to lessen the effect of baseline depression on cardiac death over that time period.

Frasure-Smith et al. (2000b) cautioned, however, that their study was based on a secondary analysis of data collected from two earlier studies and only 64% of eligible post-MI

patients agreed to participate. The authors also noted that women and patients who perceived low social support at the baseline interview were less inclined to agree to one-year follow-up interviews than were other patients. Frasure-Smith et al. pointed out that this trend might actually have contributed to an underestimation of the magnitude of the impact of low perceived social support on changes in depression over 1 year. Wenger (1997) observed that poorer social support is a confounding feature in the morbidity of older women after MI. Thus, the risk of developing persistent depression after MI might be amplified for women, especially older women.

In contrast, a recent study by Lane, Carroll, Ring, Beevers, and Lip (2001) of 288 patients (215 men [75%] and 73 women [25%]) hospitalized for MI did not find that depressive symptoms predicted mortality within 12 months. However, a close examination of two studies (Frasure-Smith et al., 1993; Lespérance et al., 1996) cited by Lane et al. reveals a major difference in the way Lane et al. and the other two studies defined and measured depression. Both Frasure-Smith et al. and Lespérance et al. used the same study sample. Frasure-Smith et al. and Lespérance et al. both defined depressed individuals as those who met the *DSM-III-R* criteria for major depression. In addition, they used a modified version of the DIS to determine a diagnosis of major depression. Lespérance et al. also administered the BDI to measure the severity of depression.

In contrast, Lane et al., (2001) administered the BDI without the support of a concurring diagnosis. They based their study on the assumption that a score of 10 or more on the BDI could be compared, on an equal basis, to a differential diagnosis of depression. The range of scores on the BDI is designed to assess the intensity or degree of depression and not to differentiate among diagnostic categories (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). In the absence of a clinical diagnosis, it cannot be assumed that a person scoring 10 or more on the BDI is depressed. Lane et al. also referred to individuals who have scores of 10 or more as having

“relatively high levels of depressive symptomatology” (p. 223) when, in fact, their selected cut-off score would include depressive symptoms ranging from mild to severe (Beck, Steer, & Garbin, 1988). In addition, Lane et al.’s low threshold score of 10 would maximize the probability of including all those individuals who might possibly be depressed. This lower threshold would also increase the number of false positives (Beck et al., 1988). Therefore, Lane et al.’s contrasting finding, that depression did not predict mortality within 12 months of an MI, could have been due to a high number of false positives and an erroneous assumption that a score of 10 or more on the BDI could be compared equally to a diagnosis of depression.

In a well-designed, earlier study, Schleifer et al. (1989) evaluated 283 post-MI patients (181 men and 102 women) for depression and found that 18% of patients recovering from MI exhibited major depression and that an additional 27% showed evidence of minor depression. Patients were administered the structured interview, Schedule for Affective Disorders and Schizophrenia (SADS), 8 to 10 days after hospitalization for MI. The Hamilton Depression Rating Scale was also administered to each patient to assess the severity and type of depressive symptoms. Diagnoses were rendered according to the RDC. The mean age of the sample was 63.7 years with ages ranging from 27 to 90 years. Patients were excluded from the sample if they had a fatal non-cardiac illness or if they could not be interviewed because they were too ill, did not speak English or were cognitively impaired.

Schleifer et al. (1989) reinterviewed 171 of these post-MI patients between 3 and 4 months later and found that 77% of patients who were initially diagnosed as having major depression persisted in meeting criteria for major or minor depression. As well, 33% of patients interviewed 3 to 4 months after MI, satisfied criteria for major or minor depression. Additionally, of those who worked in the weeks prior to their MIs, the majority of those with major depression had not resumed working. Depression was related to failure to resume working for those who

were both depressed and medically symptomatic. Patients with major depression reported significantly more stressful life events during the prior year than did those who were not depressed. Patients who had major or minor depression post-MI also disclosed significantly lower self-esteem and a reduced sense of control over their lives than did those who were not depressed. However, Schleifer et al. found that depressed patients did not differ with respect to the incidence of previous MIs.

An interesting finding of Schleifer et al. (1989) was that, while depression was not related to the seriousness of cardiac illness, there was a significant relationship between the presence of depression and noncardiac medical illnesses. Indeed, 16 of the 20 patients (80%) who had serious noncardiac illnesses met criteria for either major or minor depression. In addition, the authors found that female post-MI patients had a significantly greater risk of meeting the criteria for major depression.

Schleifer et al. (1989) noted that their study was limited by the fact that almost 50% of the total population of post-MI patients were not enlisted, due either to short-term mortality or inability to speak English. Those who refused to participate were significantly older but were similar to participants in terms of sex. Furthermore, exclusion of patients who were the most seriously ill post-MI and who, therefore, were more likely to have a higher incidence and more severe course of depression, may have contributed to an underestimation of the prevalence rate of depression in this population (Schleifer et al., 1989).

In a bid to understand the nature of depressive symptoms preceding the occurrence of MI, Appels, Kop, and Schouten (2000) reanalyzed data from an earlier prospective study involving 3877 healthy men. Appels et al. reported that an emotional state labelled “vital exhaustion,” frequently exists prior to MI (para. 4). Vital exhaustion is defined by the authors as a state distinguished by uncommon fatigue, feelings of demoralization, and elevated irritability. Appels

et al. had previously observed that many coronary patients described their emotional state prior to a cardiac event as being distinguished by uncommon feelings of fatigue. Typical statements of patients were: “The fatigue and lack of energy made me feel sad and hopeless,” “I had no more power. That made me feel miserable,” and “I did not have what it takes anymore” (para. 3). In this study, Appels et al. reanalyzed data from an earlier study that used a measure of vital exhaustion, the Maastricht Questionnaire, to predict future MIs in a sample of healthy men. Participants ranged in age from 40 to 65 years and were followed for a period of 4 years. In the reanalysis, Appels et al. found that complaints of fatigue, when compared with the other depressive symptoms of irritability and demoralization, were the strongest predictors of future MIs. However, each of the three subscales of fatigue, irritability and demoralization predicted a future MI, after controlling for smoking, cholesterol, hypertension, and age (Appels et al., 2000). This finding appears to be supported by the large-scale, community-based, prospective study of Penninx et al. (2001) that found depressive symptoms predicted a fatal cardiac event in participants both with, and without, cardiac disease at baseline. Thus, it seems that symptoms of depression can begin some time prior to the actual cardiac event.

Recent studies have continued to explore the potential risk for cardiac mortality in cardiac, as well as noncardiac, patients who experience depression. Penninx et al. (2001) noted that it was critical to a further understanding of the pathway between depression and cardiac disease to explore whether depression has more harmful cardiac consequences for patients with cardiac disease than for those without cardiac disease. Additionally, the authors observed that existing research was not clear as to whether minor depression also could increase the chance of a fatal cardiac event in community members initially without cardiac disease.

Penninx et al. (2001) administered the Center for Epidemiologic-Depression Scale (CES-D) as a depression screen to a randomly selected, community-based cohort of 2847 older men



and women in the Netherlands. Of those participants scoring 16 or more on the depression scale, 86% consented to and were given a diagnostic interview based on *DSM-III* criteria. The mean age of the participants was 70.5 years and ages ranged from 55 to 85 years. Fifty-two percent of the sample was female. Participants were followed over the course of 4 years. Of the total sample, 450 participants had confirmed cardiac disease (includes CHD [angina pectoris or a history of MI] and congestive heart failure) and 2397 participants were free of cardiac disease.

Penninx et al. (2001) found that approximately 20% of the 450 cardiac patients had either minor or major depression, with approximately 2.4% having a major depressive disorder. The overall rate of minor and major depression in the total sample of community-based participants was 15%, with 2% having a major depressive disorder. The authors did not find evidence that depression in cardiac patients had a more powerful adverse cardiac effect than did depression in noncardiac participants. It is important to note, however, they did find that the risk for cardiac mortality differed according to the level of depression. Even after adjusting for confounding variables (e.g., smoking, sex, or comorbidity), the relative risk for cardiac mortality for those with cardiac disease was almost twice as great for those exhibiting major depression (a three-fold increase over those with no depression) as for those exhibiting minor depression (a 1.6-fold increase over those with no depression). Moreover, this higher risk of cardiac mortality held even for those who had major depression but no cardiac disease at baseline. After adjusting for baseline variables, these depressed, noncardiac participants were 3.9 times more likely to suffer cardiac death than nondepressed, noncardiac participants.

When limited to the more narrowly defined CHD mortality only (as opposed to cardiac mortality), the adjusted relative risks for depressed participants with cardiac disease, as compared to participants with neither depression nor cardiac disease, were even more striking. There was a relative risk for CHD mortality of 5.1 for those participants who had major

depression, but no cardiac disease, when compared to participants without depression or cardiac disease. In contrast, when compared to participants with neither depression nor cardiac disease, the relative risk for CHD mortality was 4.5 for cardiac patients having no depression, 8.5 for cardiac patients having minor depression, and 17.7 for cardiac patients having major depression (Penninx et al., 2001).

Thus, for all persons of this cohort, having even minor depression incurred a significantly increased risk of cardiac death (Penninx et al., 2001). Surprisingly, the risk almost doubled for those persons with major depression, whether or not they had cardiac disease. Penninx et al. concluded that: "baseline cardiac disease and depression rather seem to have independent additive effects on cardiac mortality" (p. 226). This finding of depression having an additive effect has been supported by other research as well (e.g., Bush et al., 2001).

Penninx et al. (2001) failed to detect gender differences in the relative risk of cardiac death for depressed participants. There were 184 cardiac deaths among the 2847 participants in this community sample. Forty-eight of the cardiac deaths occurred in participants having either minor or major depression. It could be that there was insufficient power to detect a gender difference for cardiac mortality among these 48 depressed participants. Frasure-Smith et al. (1999), in their study of the relationship between gender, depression and one-year prognosis in post-MI patients, noted that with their observed cardiac mortality rate of 5%, they would need almost 5000 post-MI patients (or, 250 post-MI deaths) to reliably detect a gender difference in mortality that was statistically significant, among patients with increased BDI scores.

In another large-scale, prospective study, Ford et al. (1998) followed a cohort of 1190 male medical students over the course of a 40-year period for occurrences of clinical depression (mean age in 1995 = 66 years). Participants came from the John Hopkins Precursors Study that included all medical school students enrolled from 1948 to 1964. Initially, the students were

given a standardized medical examination in addition to detailed health questionnaires. Since graduation, the cohort has been followed up annually with mailed questionnaires, averaging a 90% response rate over every period of 5 years. Ford et al. noted that several studies had failed to find an association between depression and coronary artery disease. Similarly, they observed that in the largest previous study to find an association between depression and myocardial infarction, appropriate physiological data on cholesterol levels and blood pressure were not collected. The purpose of their study was to determine if an occurrence of clinical depression resulted in an increased risk for coronary artery disease.

Cardiovascular risk factors, such as blood pressure and smoking, were assessed throughout the study (Ford et al., 1998). The presence of depression and subsequent treatment were independently assessed from the self-reports of individuals. Five physician reviewers, who were blind to the purpose of the study, assessed individual responses to questions relating to the incidence of depression. However, due to the lengthy follow-up period, it was not possible to strictly adhere to the current diagnostic criteria, *DSM-III*, for the diagnosis of major depression. The validity of the physicians' diagnoses of depression was taken as confirmed if survey responses indicated that there had been treatment for depression. Ford et al. reported a cumulative 12% incidence rate of clinical depression in their sample. They noted that this finding paralleled the 12.8% rate of depression found in a study using a slightly younger sample of Caucasian men.

Ford et al. (1998) found that men were at significantly greater risk for CHD and MI if they had reported clinical depression. Furthermore, the authors observed that, even 10 years after the first depression onset, clinical depression remained an independent risk factor for the development of CHD. The authors detailed the strengths of their study, including the lengthy follow-up period, the prospective design, detailed assessment of coronary risk factors and the use

of diagnoses of clinical depression as support for their findings. However, they noted that their sample consisted only of men and that the range of their sample was limited in terms of education and socioeconomic status. Moreover, the authors acknowledged that there were no structured clinical interviews to confirm the clinical depression diagnoses and that this was a potential weakness in the study. Nevertheless, this research makes an important contribution to our understanding of the long-term impact of depression on cardiovascular health, albeit in men only. Ford et al. noted that future research needed to address the degree to which treatment of depression influences the risk for coronary artery disease.

Penninx et al. (2001) observed that a majority (62%) of those persons categorized in their study as having minor depression were still depressed after 5 months. Comparable findings have been reported for minor and/or major depression in post-MI patients (Hance, Carney, Freedland, & Skala, 1996; Luutonen et al., 2002; Schleifer et al., 1989). Without treatment, it appears that depression is persistent in the majority of cases. Therefore, it would seem that an appropriate time to intervene with a screen for depression, at least for post-MI/ACS patients, would be prior to their discharge from hospital. This is especially relevant for older patients who have experienced MI because, as Bush et al. (2001) observed, depression in older post-MI patients is linked to increased mortality in as few as 4 months.

Frasure-Smith et al. (1999) noted that the prognosis post-MI is currently “quite good, even for depressed patients” (p. 36) due to advances in treatment regimens. Although Carney et al. (2000) stated that it is not yet clear whether treatment for depression will reduce cardiac mortality in coronary patients, Frasure-Smith et al. pointed out that, beyond the effect of depression on prognosis, depression generates substantial suffering for the families as well as the patients. Glassman et al. (2002) recently conducted a randomized trial of the effects of the antidepressant treatment, Sertraline, on 369 patients (64% male and 36% female) with MI or

unstable angina who had been diagnosed with major depressive disorder. The mean age of the sample was 57.1 years. Glassman et al. (2002) found no significant difference in mortality for those in the treatment group compared to those in the placebo control group. However, the authors observed that in order to have sufficient power to detect a 20% reduction in risk that was statistically significant, they would require a randomized trial involving at least 4000 depressed patients with acute coronary syndrome (Glassman et al., 2002). Furthermore, patients who had serious comorbid noncardiac diseases were excluded. It seems that older adults and women were underrepresented in this study and, therefore, the results cannot be extended to populations other than the ones examined.

A very recent, large-scale study, The Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) Randomized Trial, evaluated the effectiveness of cognitive behaviour therapy in improving mortality or subsequent cardiac events in 2481 MI patients who were diagnosed with a major depressive disorder (Writing Committee for the ENRICHD Investigators, 2003). There were 1397 men and 1084 women, and the mean age of the sample was 61 years. Results showed an improvement at 6 months in levels of depressive symptoms and levels of perceived social support for the depressed group receiving psychosocial treatment in comparison to the depressed group receiving usual care. However, the results failed to show an increase in survival or a decrease in cardiac events for those in the treatment condition when compared to those receiving usual care, over an average of 29 months follow up (Writing Committee for the ENRICHD Investigators, 2003). However, in an earlier statistical meta-analysis of 23 trials examining the effect of psychosocial treatments, over usual rehabilitative care, on the prognosis of patients with coronary artery disease, Linden et al. (1996) found that psychosocial treatments did, indeed, result in a reduction of cardiac mortality. The 23 trials evaluated by Linden et al. were both randomized and controlled. Data on mortality and cardiac event recurrence were

available from approximately one half of the trials. Linden et al. found that the inclusion of psychosocial treatments, with the usual rehabilitation regimens for cardiac patients, significantly reduced morbidity and mortality (nonfatal cardiac events and cardiac all-cause mortality were reduced by approximately 46% and 41%, respectively), as well as psychological distress, over a follow-up period of 2 years or less. Thus, although it is not yet clear whether treatment for depression in post-MI/ACS patients will reduce mortality, accurate detection of depression might be the first step toward improving not only the quality of life for the patient and his or her family but possibly, also, the prognosis.

In summary, the prevalence rate of 16% to 18% for major depression in cardiac patients is substantial. More important, depression in post-MI patients is an independent risk factor for mortality, with higher BDI scores correlating with a correspondingly higher risk for mortality. Surprisingly, depression is also an independent risk factor for developing CHD, even 10 years after the first onset of depression. Symptoms of depression can begin some time prior to the actual cardiac event although the literature on this issue is not clear. Post-MI patients are most at risk for developing depression during hospitalization and within the first 6 months after discharge. Moreover, depression is persistent in the majority of cases. It is important to note that women are more likely to experience depression post-MI, yet they are underrepresented in most studies examining the relationship between depression and CHD. Similarly, older adults have not been adequately represented in previous investigations of depression as it relates to CHD.

#### *Impact of Depression on Older Cardiac Patients*

Citing the sparseness of studies investigating the relationship between depressive symptoms and cardiac risk in older adults, Ariyo et al. (2000) initiated a 6-year prospective study of older Americans. The authors examined a cohort of 4493 older participants (defined as 65 years or older), who were free of cardiovascular disease, for depressive symptoms. The purpose

of the study was to investigate the relationship between symptoms of depression and the risk for subsequent development of CHD and death in older adults. The sample was randomly selected from the Medicare eligibility lists of four communities. Participants were identified as being free from cardiovascular disease at baseline. The sample consisted of 2737 women (mean age = 72) and 1756 men (mean age = 73). Ages ranged at entry from 65 to 98 years. All participants were given a comprehensive, 4- to 5- hour medical examination. Depressive symptoms were measured using a modified short form of the CES-D.

Ariyo et al. (2000) were interested in the cardiovascular event, CHD, specifically defined for the study as: a “first occurrence of angina, myocardial infarction, angioplasty, coronary artery bypass grafting, or coronary death” (p. 1774). A semiannual assessment of all relevant events was conducted. Levels of depression were assessed annually. Over the course of the 6-year period, Ariyo et al. found that depressive symptoms represented an independent risk factor for CHD and total mortality and that higher scores on the depression scale indicated higher risk. These results are similar to other contemporaneous findings for older adults (e.g., Bush et al., 2001; Penninx et al., 2001).

Although Ariyo et al.’s (2000) study supports the current literature on the link between depression and mortality in older cardiac patients their results must be interpreted with some caution in that they measured depressive symptoms only. There were no concurrent clinical diagnoses of depression to validate the inferences they wished to make from the test scores of the depression screening measures. Furthermore, Ariyo et al. provided no reliability or validity estimates for their data. In contrast, the prospective design and random selection of their sample were strengths of the study. Although this research adds to the growing body of literature documenting the relationship of depression in older persons to CHD mortality, its estimate of the

impact of depression on mortality could be diluted. Without a concurrent clinical diagnosis of depression, the scores obtained might not represent fully the depth of the problem.

In a recent prospective study of 271 patients who had experienced MI, Bush et al. (2001) found an increased risk of mortality within four months in those patients who indicated even minimal symptoms of depression. Bush et al. observed that a level of depressive symptoms normally not regarded as clinically significant (a score of less than 10 on the BDI) was associated with an increased risk of death after MI. Bush et al. evaluated the post-MI patients for the presence of mood disorders 2 to 5 days after admission to hospital using the Structured Clinical Interview for *DSM-III-R* (SCID-NP). The sample consisted of 158 men and 113 women, with a mean age of 64.8 years. Thirty percent of the participants had experienced at least one previous MI and 35% had diabetes. Major depression and/or dysthymia were present in a total of 17.2% of the sample, with major depression diagnosed in 9.5%. The BDI was also administered to assess symptoms of depression in each patient. In this study, the prime outcome measure was mortality, irrespective of cause. Survival or death was established by follow-up telephone calls 4 months later to either surviving post-MI patients or, in the event of death, their designated contacts.

Mood disorder and/or a score of 10 or more on the BDI occurred in approximately 27% of the participants (Bush et al., 2001). Also, a prior history of depression was evident in about 18% of the sample. For the participants 65 years of age or older, a score of 10 or more on the BDI was more frequently seen in those who had past histories of depression although a prior history of depression was not linked with an increased risk of death. Among all patients with scores of 10 or more on the BDI, 4-month mortality was 13.2% in comparison with a mortality rate of 5.1% for patients with scores of less than 10 on the BDI.



Although unanticipated, Bush et al. (2001) stated that being age 65 years or older proved to be a leading determinant of death, with 94% of deaths concentrated in this group. Because 17 of the 18 deaths occurred in patients aged 65 years or more, subsequent analysis of the associations between patient characteristics and mortality were limited to this group. Patients in this older group, with a BDI score of 10 or more and/or who had a mood disorder, had a mortality rate of 13.6% at four months. This finding was in comparison to a mortality rate of 3.8% for those 65 years or older without a mood disorder or having a BDI of less than 10. Moreover, this increased risk of death was in addition to, or independent of, the increased risk of mortality associated with being 65 years of age or older, having diabetes mellitus, and having a left ventricular ejection fraction of less than 35%.

Bush et al. (2001) observed that the risk of mortality associated with depression increased with the degree of severity of depressive symptoms as identified by the BDI. Thus, the highest mortality rates were evident in patients who had the most severe symptoms of depression. Furthermore, Bush et al. found that for those patients who already had a high risk of mortality due to conventional prognostic indicators (i.e., being 65 years of age or more, having diabetes mellitus, and having a left ventricular ejection fraction of less than 35%), a fourfold increase in mortality occurred in those who were depressed. Thus, for patients having a combination of all three conventional risk factors, the 4-month rate of mortality was 12% and for those patients who were depressed in addition to having these three factors, the 4-month mortality rate was 50%.

It should be noted that the presentation, symptoms, seriousness of disease, clinical progression, and prognosis of patients who have CHD differ considerably depending on whether the patient is elderly or not (Wenger, 1992). In summary, there are three main points to be gleaned from the literature on older adults. Depressive symptoms are an independent risk factor for CHD and mortality in older healthy community members. For post-MI patients, aged 65

years or more, minimal levels of depressive symptoms predict an increased risk for mortality in as few as 4 months. Most important, for those older post-MI patients who are at high risk due to conventional prognostic indicators, the relationship between depression and mortality is alarming. It is critical, therefore, that we are able to be confident that the inferences we wish to make from the test scores of screening measures are reliable and valid for older as well as younger cardiac patients. It is to be hoped that screening post-MI/ACS patients for depression will ensure access to treatment.

### *Lack of Detection and Treatment*

Despite prevalence rates of 16 to 18% for a major depressive disorder in post-MI patients, depression is neither adequately detected nor treated in men and women who have experienced a cardiac event (Frasure-Smith et al., 1993; Schleifer et al., 1989). Frasure-Smith et al. noted that, prior to their study in 1993, research, linking depression to subsequent cardiac events in post-MI patients, had been based on data limited to specific sub-groups that were collected for different purposes. In addition, they acknowledged that their previous work did not include women.

Although Frasure-Smith et al. (1993) found that 35 post-MI patients met diagnostic criteria for a major depressive episode, hospital records revealed that only 17 of the 222 participants in their sample had been referred for an evaluation to a psychiatrist prior to being discharged from hospital. Frasure-Smith et al. do not state how many of the 17 referred patients were included within the 35 patients identified with major depression by the authors. However, of the 17 referred patients, only 3 (1 of whom died) had been prescribed antidepressant medication. Similarly, in Carney et al.'s (1987) study of 50 patients who had confirmed coronary artery disease, only 2 of the 9 patients who were diagnosed with major depressive disorder had already been identified with, and had received treatment for, depression.

Furthermore, Hance et al. (1996) observed in their study of depression in 200 patients (aged 75 years or less) undergoing the diagnostic procedures cardiac catheterization and coronary angiography, that 34 patients (17%) were diagnosed with a major depressive episode, based on *DSM-IV* criteria, and a further 35 patients (17%) were diagnosed with a current minor depressive episode at the time of hospitalization. Half the patients with major depression were also depressed at the 12-month follow up, while 42% of the patients initially diagnosed with minor depression had developed a major depressive disorder by 12 months. However, only 6 of the 34 patients with diagnosed major depression at baseline received any treatment during the 12-month follow up. Of these six who were treated, four experienced a remission of depression. Hance et al. noted that their results suggest that major depression is persistent, if not treated, in patients with CHD. Moreover, Hance et al. observed that, "minor depression is nearly as likely to develop into major depression as to remit over the course of the 12 months following diagnostic angiography. These findings underscore the importance of treating depression in these patients" (p. 64).

More recent studies such as Frasure-Smith et al. (1999) observed that, although post-MI patients with in-hospital high BDI scores had more than twice the likelihood of seeing a psychiatrist than those patients with scores of less than 10 on the BDI, most patients with high scores did not see a psychiatrist at all. Moreover, only 20% of the men and women with high BDI scores had any communication with a psychiatrist. Of the 839 patients who completed interviews within the year post-MI, only 36 recounted receiving a prescription for antidepressants. Correspondingly, Bush et al. (2001) noted in their examination of 271 post-MI patients that, while approximately 26 patients were diagnosed in hospital with major depression, only 16 patients had received antidepressants upon discharge.

A recent study of 85 post-MI patients in Finland, however, found that, of the 18 patients who had depressive symptoms of 10 or more on the BDI (indicating at least mild depressive symptoms), not one was referred for a psychiatric evaluation during hospitalization (Luutonen et al., 2002). On hospital admission, one of these patients was taking a low-dose antidepressive medication while 3 patients were on the anti-anxiety medication, benzodiazepine. It is important to point out that, of the 18 patients who scored 10 or more on the BDI at baseline, and survived, the majority (73.3%) still had depressive symptoms at 18 months. Luutonen et al. also reported that 5 patients scored 19 or more on the BDI (indicating moderate to severe depressive symptoms) at baseline and by 18 months, this figure had increased to 8 patients. However, none of these 8 patients had been prescribed adequate antidepressive medication and only two had received treatment in mental health care facilities.

While there appears to be improvement in recent years, at least in North America, in the detection of depression in post-MI patients while in hospital, it seems that there are still depressed post-MI/ACS patients who are being discharged from hospital without benefit of a treatment plan. Given the serious consequences of depression for the prognosis of post-MI patients, it is hoped that this current research will pave the way for a valid screening program for depression to be implemented in hospitals.

It is necessary now to review our current knowledge of cardiovascular diseases in men and women in Canada and in the United States. We need to consider the incidence and prevalence of these diseases as well as hospitalization and mortality rates for both genders. An understanding of these matters will lead to an understanding of how depression in these patients might have a very different impact on the medical prognosis for post-MI women as compared to post-MI men.

### *Overview of Gender Differences in MI*

In Canada, there is a lack of data on the incidence and prevalence of heart disease, although there are detailed data on mortality for the same. Based on hospitalization rates by age group, it is apparent that MI becomes a key health problem for men beginning at age 45 and for women at age 55. In 1997, MI accounted for approximately 9% of all deaths for women and 11% of all deaths for men in Canada (Heart and Stroke Foundation of Canada, 1999). For both sexes, mortality rates in the United States for ischemic heart disease accelerate sharply with increasing age. Because women comprise the majority of the aged population in the United States – the age group that records a higher prevalence of cardiovascular and coronary diseases among women – more women than men in the United States currently die of CHD (Wenger, 1997). Wenger stressed that, “It should be obvious, although likely unintended, that any age-based limitation of access to care disproportionately disadvantages women with coronary heart disease; a challenge to society is to ensure that this inequity is not acceptable” (p. 22).

Wenger (1997) stated that the medical prognosis of CHD is affected not only by access to the diagnostic procedures but also by the therapy selected. Wenger argued that these, in turn, can be affected by the decisions of both physicians and patients and by the “societal perceptions of the importance of coronary heart disease as a problem for women” (p. 32). The prevalence of CHD in men is larger than it is in women of comparable age and although this gender difference is most apparent at a younger age, it continues throughout life (Wenger, 1997). Consequently, CHD has not traditionally been considered to be as important a problem for women as it is for men. Although Wenger noted that there is evidence that the gender gap is shrinking in relation to the care of coronary patients, Heart and Stroke Foundation of Canada (1999) observed that, “marked differences exist in the rate of hospitalization and procedures for men and women that are still unexplained” (p. vi). Although rates of hospitalization for all cardiovascular diseases

steadily increase with age, surprisingly, the rates are higher in Canada for men than they are for women. Indeed, for MI, the hospitalization rates are substantially higher for men than for women, across all age groups. It should be noted that the same person might be counted more than once, because the data are based on the yearly number of hospitalizations (Heart and Stroke Foundation of Canada, 1999).

For those who suffer MI, more women than men are older and women have more serious comorbidity (coexisting illnesses), resulting in a less favourable outcome (Wenger, 1997). Moreover, women are often unaware that they have even had an MI. The women from the Framingham Heart Study (Kannel, Sorlie, & McNamara, 1979) had a higher ratio of unrecognized MIs, approximately half of which were labelled as silent. Both silent and unrecognized MIs are more likely in those who are of an older age and have either hypertension or diabetes (Wenger, 1997). In addition, in the United States, women face a morbidity confounded by increased complications and severity of MI, poorer social support, and higher poverty rates for older women than for older men. Finally, women are more often ineligible for thrombolytic, or clot-busting, therapy because they delay reporting to hospital after the occurrence of chest pain symptoms (Wenger, 1997). It is not known whether this delay in seeking help is due to women underestimating their cardiac symptoms (Vaccarino, Krumholz, Berkman, & Horwitz, 1995), women having insufficient social support, a lack of perception that CHD for older women is a serious clinical problem, or some other unidentified cause (Wenger, 1997).

For women who experience an MI, the following mortality statistics are of concern. When one considers the impact that the addition of depression into the mix might have, it seems imperative to argue the case for the validation of a depression screen that is appropriate for both men and older women. The Framingham Heart Study (Kannel, Sorlie, & McNamara, 1979)

indicated one-year mortality for women was 45% following MI, in contrast to 19% for men. Thirty-day mortality rates for post-MI women (28%) were also significantly higher in comparison to post-MI men (16%). In addition, for these women, early reinfarction (a negative prognostic indicator) was more common (Kannel et al., 1979; Wenger, 1997). Similarly, in a review of 27 studies reporting gender-related mortality rates for MI, crude mortality rates in women were observed to be higher than in men either during initial hospitalization or within the first month after MI (Vaccarino et al., 1995). The important point is that Vaccarino et al. concluded that women still might be at a higher risk for mortality than men even though a substantial portion of the increased mortality for women within the first month of hospitalization is explained by differences in age and other characteristics (e.g., diabetes, history of CHD, and hypertension) at baseline.

Thus, post-MI women are at a substantial disadvantage when compared to post-MI men in that they are older, have more serious comorbidity, and more serious complications, including death, from MI. Furthermore, at some subtle level, women who have CHD are still contending with an undercurrent of misperception that CHD is not as serious for them as it is for men.

#### *Gender Differences in Post-MI Patients*

As noted earlier, Schleifer et al. (1989) observed that female patients who had experienced MI had a significantly greater risk of meeting major depression criteria in comparison to male post-MI patients. Similarly, in a secondary analysis on data pooled from two prior studies, Frasure-Smith et al. (1999) examined gender differences for the effect of depression on one-year cardiac mortality in 896 post-MI patients. The sample contained 613 men (mean age = 57.8 years) and 283 women (mean age = 62.8 years). Frasure-Smith et al. found female patients to be depressed at a rate twice that of male patients, even after controlling for differences in physiological (e.g., age, diabetes, history of hypertension, left ventricular ejection

fraction, and previous MI) and psychological variables (e.g., social desirability, living alone, and anxiety). Thus, women's higher rate of depression after MI could not be explained by baseline differences between the genders in physiological or psychological variables.

Frasure-Smith et al. (1999) found that in-hospital depression after MI was a significant predictor of death within 1 year for both men and women. Post-MI patients who were depressed were significantly more likely to experience death from cardiac causes and to have an arrhythmic event than were post-MI patients who were not depressed. Frasure-Smith et al. noted that the mean depression scores for women ( $M = 11.3$ ) were significantly higher than for men ( $M = 7.1$ ) and about 50% of the women and 25% of the men obtained scores of 10 or more on the BDI. The authors observed that the relationship between gender and cardiac outcome was less pronounced after controlling for depression, for all cardiac events. However, Frasure-Smith et al. found that, even after adjusting for depression, it was still significantly more likely for women to suffer reinfarctions, leading them to suggest that, for this data set, depression did not explain differences in prognosis for men and women. Furthermore, Frasure-Smith et al. failed to detect a gender difference in overall deaths from cardiac causes. It is important to note, however, that they did find that cardiac deaths for both men and women were significantly related to increased scores on the BDI. Frasure-Smith et al. observed, therefore, that both male and female post-MI patients merit closer clinical evaluation if they are experiencing even mild to moderate depressive symptoms.

Frasure-Smith et al. (1999) acknowledged that there were certain limitations to their study. First, the study was comprised of secondary analysis of data from two distinct studies. Neither of the studies was designed to evaluate gender differences in factors linked to prognosis. Second, older patients and women were significantly more likely to decline to participate in the study than younger patients and men. Therefore, generalization to older persons and women is



restricted. Third, the authors cautioned that the BDI is a measure of depressive symptomatology and not a diagnosis of major depression (Frasure-Smith et al., 1999). This study examined gender differences in the relationship between the presence of depressive symptoms (as measured by BDI scores) and one-year cardiac mortality. It did not measure the impact of diagnosed depression on one-year cardiac mortality in post-MI patients. Consequently, a number of those patients identified as depressed might not have been and, conversely, some patients identified as not depressed might have, in fact, been depressed. Thus, it is possible that the actual relationship between gender and cardiac mortality was diluted.

In addition to the above limitations, Frasure-Smith et al. (1999) noted that no interview was conducted of those who died in hospital in the early period after MI in their study. Thus, Frasure-Smith et al. were unable to evaluate the relationship of depression to early mortality in hospital, although previous research has documented gender differences most strongly for in-hospital mortality (Fiebach, Viscoli, & Horwitz, 1990; Vaccarino et al., 1995). Frasure-Smith et al. stated that the 37 cardiac deaths in their sample was a relatively small number of deaths, which limited their ability to control for numerous variables. Frasure-Smith et al. also pointed out that, with an observed percentage of cardiac deaths in this study of only 5%, they did not have sufficient power to reliably detect a gender difference in mortality.

Furthermore, there was a significant difference between the mean ages of the female and male post-MI patients as well as a significant difference between the percentage of women 65 years of age or older (50.5%) and the percentage of men in that same age group (25.6%). It also could be that the relationship between gender and cardiac death was weakened because the Beck Depression Inventory was not the most appropriate measure to use for the detection of depressive symptoms in this sample of men and significantly older women. Thus, a depression measure that

was developed for use with older persons might have more accurately identified depressive symptoms in these older women.

In contrast to the conclusions of Frasure-Smith et al. (1999), Tofler et al. (1987) found that the prognosis for women after MI was significantly worse than for men. The authors examined a sample of 816 patients who had been confirmed to have MI and were 75 years of age or less, for the effects of race and gender on their long-term prognosis. The sample was selected from 985 patients who were randomly chosen from 9,450 patients screened from the Multicenter Investigation of the Limitation of Infarct Size (MILIS) study. When categorized by gender and race, the sample contained 226 women (63 Black women and 163 White women) and 590 men (79 Black men and 511 White men). Baseline measurements (e.g., left ventricular function and serial blood samples) were taken on all patients in the MILIS study, in addition to extensive data collected throughout the study on patients' medical histories, daily clinical events and vital signs. All patients were reexamined at 3 and 6 months and their vital status was monitored via telephone at 6-month intervals. The mean duration of follow up was 32 months.

In their sample, Tofler et al. (1987) found the death rate for women, during hospitalization for MI, to be significantly greater than for men. Tofler et al. also found that the women were, on average, older than the men, had a higher prevalence of hypertension and diabetes mellitus, and were more likely to have congestive heart failure history and a familial background of infarction prior to 60 years of age. Thus, women had more identifiable baseline risk factors that predicted mortality than did men (Tofler et al., 1987). This finding is supported by more recent studies that have found post-MI women to be significantly older and to have, more often, medical histories that include hypertension, diabetes mellitus (Fiebach et al., 1990; Frasure-Smith et al., 1999), and congestive heart failure (Fiebach et al., 1990). The key point is that Tofler et al. observed, over a 48-month period, that the mortality rate due to cardiac causes

for women (31%) was significantly higher than for men (18%), even after adjustment for differences in baseline risk factors.

Tofler et al. (1987) noted that, even after adjustment for 14 baseline variables that were either known from the MILIS study to predict mortality, or that showed a lack of balance for sex or race, the probability of death remained significantly greater for women. In addition, the authors stated that, although the prognosis for Black men was not different from that for White men, Black women had the worst survival rate due to cardiac causes of all four subgroups. Thus, the post-MI prognosis for women, especially Black women, was significantly worse than for men.

Tofler et al. (1987) acknowledged that there was a significantly higher ratio of women to men among Black patients, indicating that there may have been a selection bias in their sample, due to factors such as a delay in seeking medical help among Black men. In addition, Tofler et al. did not adjust for baseline variables for in-hospital mortality (Vaccarino et al., 1995). Thus, it is not clear if the significant relationship between gender and in-hospital mortality would have continued after adjustment. Also, because post-MI patients over the age of 75 were excluded from this study, the results cannot be generalized to very elderly persons.

As noted earlier, the participation of elderly post-MI women in clinical trials has been limited by frequent age-related exclusionary criteria (Gurwitz et al., 1992; Wenger, 1992). In a review of 191 randomized clinical trials (specific to pharmacotherapies utilized in the treatment of MI) from 1960 to 1991, Gurwitz et al. found that women comprised only 20% of the 145,388 MI participants. Overall, age-based exclusions for participants were operative in more than 60% of the studies and, for the clinical trials published after 1979 ( $n = 155$ ), age-based exclusions occurred in 73%. Furthermore, studies in which age-based exclusions were operative had a significantly smaller percentage of female participants (18%) in comparison with studies having

no such exclusions (23%) and the proportion of female participants was significantly related to the study population's mean age. The authors observed that exclusion of older persons from participating in clinical trials relating to MI seriously restricts the ability to generalize research findings to the exact age group that encounters the most morbidity and mortality from MI.

Moreover, Gurwitz et al. (1992) noted that exclusionary criteria were not always explicitly stated. Gurwitz et al.'s review of studies required that there be either a formal statement about age exclusions or a detailed description of the study population's demographics. They observed that the mean ages of patients in studies that specifically employed age-based exclusions (56.8 years) and studies that simply described the demographic characteristics of their populations (59.2 years) were comparable. Therefore, Gurwitz et al. suggested that, "tacit criteria for the exclusion of older patients were operative even among studies that did not expressly acknowledge such exclusions" (p. 1420). Thus, women were more apt to be excluded when age-based restrictions are implemented in clinical trials because they develop cardiovascular disease later than do men and they live to an older age than men (Gurwitz et al., 1992; Wenger, 1992). It is also possible that women might have been restricted from participating, on the basis of age, in studies investigating methods of detecting depression in cardiac patients after MI.

The literature on gender differences in post-MI patients indicates that women are depressed at a rate twice that of men and this difference can not be explained by differences in physiological or psychological variables. In addition, women have a significantly higher mean level of depressive symptoms than men - higher levels of symptoms are related to increased risk for cardiac death in both genders. Most important, the prognosis for women after MI is significantly worse than for men.

*Impact of Gender on Post-MI Care*

In order to evaluate gender bias in physicians' referral for cardiac catheterization and coronary bypass surgery after MI, Steingart et al. (1991) conducted a prospective study that compared the care given by physicians to male and female cardiac patients prior to their enrolment by random selection in a large, multicenter, post-infarction drug intervention trial, the Survival and Ventricular Enlargement Study (SAVE). The trial was conducted in 112 hospitals throughout Canada and the United States. Patients were selected for inclusion in SAVE on the basis that each had suffered a similar cardiac event. Steingart et al. analysed data from all 2231 patients from SAVE (1842 men and 389 women). Each patient had experienced an MI 3 to 16 days earlier. Steingart et al. found that the women were significantly older and, prior to the qualifying cardiac event, had coronary risk factors that were more severe and more prevalent than the men. Also, women were significantly more likely to have a familial history of heart disease and a personal history of hypertension or diabetes. Of the 389 women, 86% were post-menopausal. Prior to their index infarctions, both sexes had similar histories of angina, brought on by similar levels of activity. Despite women reporting greater disability from symptoms of angina prior to their index infarctions, women were less likely to have been referred for cardiac catheterization (15.4% vs. 27.3%) and coronary bypass surgery (5.9% vs. 12.7%) than men. Multiple regression analysis demonstrated that men were twice as likely as women to have had these two procedures before their index infarctions, independent of other relevant variables (e.g., previous infarction, left ventricle ejection fraction, history of diabetes, history of hypertension, family history of cardiac disease, and age less than 65 years). However, if a woman underwent cardiac catheterization prior to her index infarction then gender-related differences in the subsequent use of bypass surgery were not significant. Both sexes were equally likely to have

cardiac catheterization and revascularization after the index infarction (i.e., before randomization into SAVE).

Steingart et al. (1991) pointed out that previous research into gender-related differences in the spending of health care funds was limited to single hospitals. In contrast, their study analyzed data collected through validated questionnaires and uniform methods across 112 hospitals throughout Canada and the United States. Moreover, patients were selected for inclusion in SAVE on the basis that each had experienced a similar cardiac event. However, women were excluded from participating in SAVE for different reasons than were men. The inclusion criteria for SAVE stated that if patients experienced myocardial ischemia after their index infarction, they were required to have a cardiac catheterization and revascularization to be eligible for randomization into SAVE. However, Steingart et al. noted, that among those patients who experienced clinical ischemia subsequent to their index infarction, women were twice as likely to be excluded as men from participation in SAVE because cardiac catheterization was not performed. Thus, the authors observed that their own study's selection of participants might have been biased because they included in their analysis only those patients who were enrolled in SAVE.

In a larger, more recent study of gender bias in cardiac catheterization and revascularization after MI, Jaglal, Goel, and Naylor (1994) evaluated gender differences in the rates of coronary angiography, coronary artery bypass surgery, and percutaneous transluminal coronary angioplasty among 6949 patients. Patients who had recently been discharged from hospital with a principal diagnosis of acute MI during a 6-month period in 1990 were selected from the Ontario's Hospital Medical Records Institute. This data source recorded all acute care hospital discharges for Ontario. The sample consisted of 4462 men and 2487 women and each individual selected represented a single index event. Patients were followed through record

linkage for a period of 6 to 12 months post-discharge to determine what invasive coronary procedures, if any, had taken place following their acute MI. Jaglal et al. observed that women were, on average, eight years older ( $M = 72$ ,  $SD = 11$ ) than men ( $M = 64$ ,  $SD = 13$ ) and women had more diagnoses of congestive heart failure and concurrent diabetes mellitus than men. Mortality rates in hospital were higher for women than men (23.5% vs. 14.5%). Furthermore, higher mortality rates for women than men were evident in every age group evaluated.

For each of the three procedures evaluated (angiography, coronary artery bypass surgery, and percutaneous transluminal coronary angioplasty), proportionately fewer women than men received the procedure (Jaglal et al., 1994). In total, 18.4% of the male patients received angiography while 9.9% of the female patients underwent the same procedure. In the logistic regression analyses, even after adjusting for comorbidity, age, and mortality, men were still significantly more likely to have angiography than women, with an odds ratio for receiving angiography of 1.4 (95% CI 1.2 to 1.6). Proportionately more men than women (12.1% vs. 6.2%) underwent revascularization (either coronary bypass surgery or angioplasty). Furthermore, when evaluated by type of revascularization, there was still a twofold difference between men and women receiving the procedure. However, Jaglal et al. noted that once patients had received an angiogram, the proportion of men and women undergoing revascularization was not different. When taken together with similar findings in the British health care system by Petticrew, McKee, and Jones (as cited in Jaglal et al., 1994), Jaglal et al. concluded that their results indicated that physicians' practice styles were driving the differences between male and female patients in rates of revascularization.

Sheifer, Escarce, and Schulman (2000) recently reviewed 27 studies published between 1984 and 1998 that documented race and gender differences in the utilization of invasive cardiac procedures for patients who have coronary artery disease. Sheifer et al. concluded that the studies

consistently showed that, when compared with Whites and men, Blacks and women were considerably less likely to undergo standard interventions. The authors noted that although many factors contribute to racial differences (e.g., socio-economic influences, patient preferences, geographical disparities, and access to specialized cardiovascular services) and gender differences (e.g., clinical differences), they did not fully explain the disparities in medical care for race and gender. Sheifer et al. concluded that, for both race and gender, physicians' decisions also appeared to contribute, thus, suggesting that subconscious biases may play a part in the disparities of treatment.

Therefore, given the possible biases and documented disparities in medical care outlined above, it is not surprising that physicians' referral and encouragement might also play an influential part in, not only women's opportunities to participate, but also their willingness to engage in rehabilitation programs after MI. For women who are either older or depressed, the influence of their physicians might be especially critical in that these women are less likely to participate in rehabilitation programs or recommendations than are individuals who are younger, emotionally robust, or male.

#### *Impact of Depression, Older Age, and Gender on the Rehabilitation of Cardiac Patients*

Major depression interferes with rehabilitation efforts for patients who have CHD (Romanelli, Fauerbach, Bush, & Ziegelstein, 2002; Ziegelstein et al., 2000). Furthermore, even for nondepressed coronary patients, being female and 62 years of age or more are especially salient factors in predicting inadequate referral and, therefore, poor patient response to rehabilitation efforts (Ades, Waldmann, Polk, & Coflesky, 1992). Ziegelstein et al. conducted a recent evaluation of whether depression had an influence on adherence to post-MI rehabilitation efforts. Ziegelstein et al. used a combination of the Structured Clinical Interview for *DSM-III-R* and the BDI to determine the presence of a mood disorder and the severity of depressive



symptoms, respectively, in 204 patients who recently had MIs. The sample contained 116 men and 88 women, with a mean age of 64.3 years for the total sample. The authors reported that 15.2% of the participants met diagnostic criteria for major depression and/or dysthymia.

Ziegelstein et al. (2000) found that patients with symptoms of depression measuring 10 or more on the BDI had significantly lower adherence in following recommendations to exercise, to reduce stress, to increase social support, and to maintain a low-cholesterol and low-fat diet than did those patients with symptoms of depression less than 10 on the BDI. For those patients who were diagnosed with major depression and/or dysthymia, the authors found that, in addition to lower compliance with the above recommendations, they also had significantly lower adherence in taking medications as prescribed, than did those patients who were not diagnosed with a mood disorder.

Ziegelstein et al. (2000) concluded that these findings could explain the poorer long-term prognosis in post-MI patients with depression at the time of hospitalization. However, they noted a possible limitation to their study in that adherence to recommendations for reducing risk were measured by self-report and were not verified independently. Also, the method of recommending risk-reducing behaviours was not standardized. Furthermore, the presence of additional medical conditions might have affected the complexity of prescribed recommendations for risk reduction (Ziegelstein et al., 2000). It should be noted that the study made no reference to having evaluated gender or age differences between those who complied with treatment recommendations and those who did not.

In an earlier study, Ades, Waldmann, Polk, et al. (1992) examined 226 coronary patients aged 62 years or more and found that participation in cardiac rehabilitation was only 21% for this older sample. Older men were more likely to participate in cardiac rehabilitation than were older women. More important, there were gender differences in the manner in which physicians

recommended cardiac rehabilitation. Despite equivalent rehabilitation benefits for both older men and women, older women were less likely to participate in a cardiac rehabilitation program, mainly due to lower rates of physician recommendation (Ades, Waldmann, Polk, et al., 1992). The recommendation of the primary physician was the key predictor of participation by older cardiac patients (Ades, Waldmann, McCann, & Weaver, 1992; Ades, Waldmann, Polk, et al., 1992).

Older women were less likely to participate in cardiac rehabilitation due to lower rates of physician recommendation and depression may compound the problem of poor adherence to recommendations for exercise, diet, and medication regimens. Therefore, it is especially critical to detect depression in older female coronary patients. Depressed older female coronary patients may be at substantially greater risk for death than depressed older male coronary patients, all other risk factors being equal.

Carney, Freedland, Eisen, Rich, and Jaffe (1995) studied adherence to medication regimes, over a 3-week period, for 55 patients who had coronary artery disease and had received elective diagnostic angiography. All patients were 65 years of age or older. Patients who had moderate to severe cognitive impairment were excluded from the study, as were those who had experienced MI or other serious illness within the previous 4 weeks. A few days after the angiography, patients were administered a structured clinical interview by a trained research assistant and a depression diagnosis was independently arrived at by two senior clinicians. Ten (18%) of the 55 consenting participants met the criteria for a major depressive disorder, based on the *DSM-III-R*. An unobtrusive electronic chip was used to monitor adherence to the prescribed medication treatment regimen. The importance of taking aspirin to prevent MI was carefully explained to the participants and reinforced by medical staff. Patients were requested to take two low-dose aspirin per day, once in the morning and once in the afternoon.

Carney et al. (1995) found a significant difference in treatment compliance between those participants who were depressed and those who were not. Nondepressed patients complied with the treatment regimen an average of 69% of the 21 days and depressed patients complied with the prescribed regimen an average of 45%. Carney et al. pointed out that a difference of this size in adherence is clinically significant for numerous cardiac medications. The authors noted that their study is consistent with the notion that poor medication adherence might be partially responsible for the increased rates of mortality and morbidity in cardiac patients who are older and depressed.

Gurwitz et al. (1992) observed that because the most frequently measured outcomes (e.g., mortality and repeat infarction) are more inclined to happen in older patients, the likelihood of detecting positive treatment effects might increase if samples include older patients. Therefore, it is particularly important to isolate an easily administered, cost-effective measure that is appropriate for identifying depressive symptoms in both male cardiac patients and their older female counterparts, before they are discharged from hospital.

### *Summary and Proposed Study*

In summary, the prevalence rate for major depression in post-MI patients (ranging from 9.5% to 18%) is considerably higher than it is in the community at large. Furthermore, the link between depression after MI and mortality appears to be strong and unremitting. Depression has been shown to predict CHD mortality in community members, whether or not they had cardiac disease at baseline. Moreover, depression predicted the development of CHD in community members even 10 years after the first onset of depression. Most important, the effects of depression are independent and additive to other preexisting risks for cardiac mortality. When older post-MI adults have the conventional prognostic indicators for mortality (i.e., being 65 years of age or more, having diabetes mellitus, and having a left ventricular ejection fraction of

less than 35%), the risk for cardiac mortality in those who are depressed is fourfold in comparison to similar patients who are not depressed. Although the evidence is not clear as to whether depressed post-MI women are more at risk for death than depressed post-MI men, we do know that they are twice as likely to be depressed as men after experiencing MI. In addition, we know that women in Canada currently have lower rates of hospitalization and procedures for coronary care than men and that this difference is unexplained. We also know that post-MI women are older and have more serious comorbid conditions and, as a result, their risk for morbidity and mortality is even further increased – they are especially vulnerable.

Therefore, it is vital that we have confidence that the inferences we draw from patients' test scores on depression screens are reliable and valid for both male and female cardiac patients. Although there appears to be some improvement in the detection of post-MI depression recently, there is still a decided lack of detection and treatment for these patients. Accurate, timely identification and treatment of depression could lead to an improvement in mortality rates for both men and women. At the very least, it could give rise to a reduction in medical costs due to post-MI patients making fewer hospital emergency and physician visits after initial discharge. Because depressed patients are less likely to adhere to medication regimens and rehabilitation programs, the potential for improvement in physical outcome is significant. A further important consideration, in the call for assessment and treatment of post-MI/ACS depression, is the potential for improvement in quality of life for depressed patients and their families. However, depression in MI/ACS patients, whether male or female, first must be accurately identified before either appropriate counselling and/or depression medication can be provided.

This study proposed to isolate a reliable, valid and cost-effective method of routinely screening for depression in cardiac patients who have been hospitalized for MI/ACS. This study was designed to investigate the following research questions:

1. Do the scores from the BDI-II and the GDS show internal consistency when used with post-MI/ACS patients, and do the scores of one of these measures show significantly more reliability than the other?
2. Do the scores of the BDI-II and the GDS show criterion-related validity (using mean score differences, sensitivity, specificity, and the positive predictive value [PPV] and negative predictive value [NPV; see Appendix A]) to the diagnosis obtained through the SCID-I/NP, or do the scores of one measure show greater criterion-related validity to the SCID-I/NP diagnosis than the other?
3. What are the recommended cut scores for identifying depressed individuals who have been hospitalized post-MI/ACS?
4. Do personal variables (such as gender, living alone, smoking, a previous diagnosis of depression, diabetes, stroke, taking the medication warfarin, and social support), in addition to the depression screen (BDI-II or GDS), help predict whether or not a participant in this sample is depressed?

## Chapter Three

## Method

*Participants*

*Recruitment.* Patients were recruited from the coronary care units of St. Paul's Hospital, Vancouver General Hospital, and Surrey Memorial Hospital. Patients were required to meet the criteria for either an acute (including recent or evolving) MI, or unstable angina pectoris (UA; Alpert, Thygesen, Antman, Bassand, et al., 2000).<sup>3</sup>

- 1) For a diagnosis of an acute, recent, or evolving MI the following criteria were met:
  - a) Typical rise and gradual fall of the biochemical marker, Troponin I, of at least 0.1  $\mu\text{L}$ , or; typical rise and gradual fall of the biochemical marker, Troponin T, of at least 0.05  $\mu\text{L}$ ; with at least one of the following:
    - i) ischemic chest pain;
    - ii) development of new pathologic Q waves on the ECG;
    - iii) ECG changes indicative of ischemia (ST segment elevation or depression  $\geq 1$  mm in 2 contiguous leads).
- 2) For a diagnosis of unstable angina pectoris, the following criteria were met: (i) and (iii) from above, without elevation of cardiac markers.

Recruitment was restricted to patients living in the Lower Mainland, specifically, Vancouver, Surrey, Delta, North Delta, Burnaby, New Westminster, North Vancouver, West Vancouver, Coquitlam, Maple Ridge, and Langley. Patients had to be medically stable, free of angina pain, and free of other life-threatening medical conditions. Patients who had acute delirium, diagnosed dementia, cognitive impairment, or who were receiving kidney dialysis were excluded from this study. Participants were required to speak and understand English. For

participants who could not read English or who had poor vision, the BDI-II and GDS were administered orally.<sup>4</sup> For the purpose of this research, cognitive impairment was defined as having a total score on the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) of 23 or less. Folstein, Anthony, Parhad, Duffy, and Gruenberg (1985) reported a cut score of 23 or less on the MMSE for identifying cognitive impairment in clinical work. Only one person scored below the cut point, with a score of 18. However, this woman was blind, unable to read English, and five of the questions (worth a total of nine points) were not applicable, so she was included in the sample.

*Description of sample.* The sample consisted of 89 men and 30 women who ranged in age from 37 to 92 years ( $M = 62.97$ ,  $SD = 11.61$ ). There was no significant difference in the mean ages of men ( $M = 61.78$ ,  $SD = 11.41$ ) and women ( $M = 66.50$ ,  $SD = 11.66$ ),  $t(117) = -1.95$ ,  $p = .053$ ,  $d = 0.42$ .<sup>5</sup> The sample was 82.4% Caucasian, 9.2% South Asian or Middle Eastern, 4.2% East Asian, 1.7% First Nations or Aboriginal, and 2.5% Other. Of the total sample, 59.7% had 13 or more years of education, 34.5% had 9 to 12 years, and 5.9% had eight years or less. More men than women (70.8% vs. 53.3%) were married or in a common-law relationship. Of the total men, 6.7% were widowed, 11.2% were single, and 11.2% were divorced or separated. Twenty percent of the women were widowed, 13.3% were single, and 13.3% were divorced or separated. A total of 25.8% of the men and 36.7% of the women lived alone.

Fifty-eight percent of the participants were diagnosed with acute MI whereas the remaining participants were diagnosed with UA/ACS. The proportion of men to women across both diagnostic groups was not significantly different,  $\chi^2(1, N = 119) = .223$ ,  $p = .64$ ,  $\phi = 0.04$ .<sup>6</sup> Almost half of the participants (46.1% of the men and 50% of the women) reported having had a previous cardiac event or heart condition.<sup>7</sup> As a result of their current cardiac event, 49.4% of the men and 53.3% of the women underwent angioplasty, 18.0% of the men and 3.3% of the

women received by-pass surgery, 1.1% of the men had a valve replacement and by-pass surgery, and 1.1% of the men had a pacemaker inserted. More than twice as many women than men (26.7% vs. 12.4%) smoked. Thirty percent of the women and 16.9% of the men reported having been diagnosed previously with depression and 16.7% of the women and 7.9% of the men reported that they were currently on anti-depressant medication.

*Description of decliners.* Of the patients who were approached for this study, 65.6% of the men and 55.7% of the women agreed to participate. For patients who declined to participate, age and gender were collected. Overall, 37.1% ( $n = 83$ ) of the 224 patients approached to participate in this study refused to take part. This rate of refusal is somewhat higher than the refusal rates of 32.1% (Frasure-Smith et al., 1983) and 29.5% (Strik, Honig, Lousberg, & Denollet, 2001) found in earlier research with post-MI patients. However, similar to previous research (Frasure-Smith et al., 1993; Schleifer et al., 1989; Strik et al., 2001), decliners were significantly older ( $M = 67.63$ ,  $SD = 12.90$ ) than participants ( $M = 62.97$ ,  $SD = 11.61$ ),  $t(200) = -2.68$ ,  $p = .01$ ,  $d = 0.38$ . Furthermore, this research found that female decliners ( $M = 72.07$ ,  $SD = 13.53$ ) were significantly older than male decliners ( $M = 65.48$ ,  $SD = 12.13$ ),  $t(81) = -2.23$ ,  $p = .03$ ,  $d = 0.53$ .

Of the total number of people who originally agreed to be contacted at home for an interview appointment ( $N = 141$ ), 22 ultimately did not participate, which produced an attrition rate of 15.6%. Reasons for attrition included: too ill to participate within the allotted time frame ( $n = 12$ ), unable to contact ( $n = 5$ ), unavailable within the time frame ( $n = 3$ ), and died in hospital ( $n = 2$ ). The proportion of men to women among all three groups (participant, decliner, and attrition) was not significantly different,  $X^2(2, N = 224) = 2.33$ ,  $p = .31$ ,  $\phi = 0.10$ . In contrast, earlier research that screened post-MI patients for a depressive disorder (Frasure-Smith et al., 1993; Strik et al., 2001) found that decliners were significantly more likely to be women.



## Measures

*Beck Depression Inventory – Second Edition (BDI-II)*. The BDI-II (Beck et al., 1996) is a self-report measure of depressive symptomatology consisting of 21 items. Each item contains four response options ranging from 0 to 3; higher scores indicate a greater severity of depressive symptoms. Total scores are obtained by summing the responses to the 21 items and can range from 0 to 63. The BDI-II was specifically developed to assess depressive symptoms based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (*DSM-IV*; American Psychiatric Association, 1994) criteria. The BDI-II constitutes a considerable revision of the BDI (Beck, Rush, Shaw, & Emery, 1979), including extending the time frame for duration of symptoms to 2 weeks in order to assess more completely the criteria for depression according to the *DSM-IV*.

*Geriatric Depression Scale (GDS)*. The GDS (Yesavage et al., 1983) is a 30-item measure of depressive symptoms specifically designed for evaluating depression in elderly persons. A simplified (yes/no) response format is used. Responses reflecting a more depressed response are scored as “1” whereas responses in the nondepressed direction are scored as “0”. Items are summed and total scores can range from 0 to 30; higher scores indicate a greater severity of depressive symptoms.

*Structured Clinical Interview for DSM-IV-TR Axis I Disorders (SCID-I/NP)*. The SCID-I/NP (Research Version, Non-patient Edition; First et al., 2002) is a semi-structured diagnostic interview constructed to aid researchers, trainees, and clinicians in making reliable psychiatric diagnoses based on *DSM-IV* criteria (First, Gibbon, Spitzer, & Williams, n.d.). The edition SCID-I/NP (Non-patient) is designed for use in studies in which the participants are not *psychiatric* patients but, rather, are from the community (Spitzer, Williams, Gibbon, & First, 1992). The SCID’s modular construction allows it to be adapted for use in studies that are

concerned only with specific diagnoses. A modified version assessing only mood disorders was employed. Thus, for this research, modules A (Mood Episodes), B/C (Psychotic Screen), D (Mood Differential), and J (Minor Depressive Disorder section of Optional Disorders) were used. Modified versions of both the SCID and SCID-I have been used as gold standards in research evaluating depression in MI patients (Bush et al., 2001; Romanelli, et al., 2002; Strik et al., 2001; Ziegelstein et al., 2000). The SCID forms a record for each of the disorders being tested as to their presence or absence for current and lifetime episodes. Diagnoses can also be categorized as subthreshold if the researcher determines that many of the features of the disorder are present despite a participant not meeting the full criteria for the disorder (Spitzer et al., 1992).

*Mini-Mental State Examination (MMSE).* The MMSE (Folstein et al., 1975) was administered to screen for, and exclude, participants who have cognitive impairment. The MMSE consists of 11 questions covering orientation, attention, memory, comprehension of verbal and written instructions, confrontational naming, expressive language and visuospatial skills that can be administered by a lay interviewer in 5 to 10 minutes. Scores can range from 0 to 30; higher scores indicate a greater level of cognitive functioning.

*Personal demographic form.* A personal demographic form (see Appendix B) was orally administered to participants once they had completed all depression measures and the structured interview. The demographic form enquired about each patient's age, gender, level of education, marital status, living arrangement, ethnic/racial/cultural background, recent history of smoking, history of diagnosed depression, familial history of depression, concurrent serious medical illnesses, history of cardiac events or heart condition, surgical intervention for the current cardiac event, and perceived level of social support.

### *Procedure*

All cardiac patients who met the inclusion criteria and consented to participate were included in this study. A clinical nurse leader or patient services coordinator determined which patients met the study criteria and a nurse gave those patients a Letter of Initial Contact. I then approached and fully explained the study to patients who had verbally consented to receiving more information. I obtained patients' verbal consent to contact them once they had been discharged in order to arrange an interview time. Following hospital discharge, participants were interviewed in their homes, normally 12 to 16 days from the date of hospital admission. Informed consent was obtained at this time. One participant who had not been discharged by the 15<sup>th</sup> day received the informed consent, SCID-I/NP interview, and all measures in hospital. Seven patients were interviewed prior to 12 days because they were not available during the specified time period due to travel commitments, a scheduled return to work, or the scheduled end of this study. Twenty patients were granted extensions because they were too ill to participate earlier and two patients were inadvertently delayed because of interview scheduling problems. Thus, while home interviews ranged from 8 to 29 days after admission to hospital, the majority (76%) of the interviews were conducted between 12 and 16 days ( $M = 14.99$ ,  $SD = 3.01$ ) after the admission date.

At each home interview, written informed consent was obtained and the MMSE was administered. Trained research assistants administered all depression measures and I conducted all of the SCID-I/NP interviews. The research assistants and I were blind to the results of each other's measure(s). Administration of the measures and the structured clinical interview were counterbalanced. Therefore, the SCID-I/NP was given either first or last according to a digram-balanced approach (Keppel, 1991) "in which each condition precedes and follows all other conditions once" (p. 339). A third depression screening measure, the Hubley Depression Scale

for Older Adults (HDS-OA; Hubley, 1993, 1998), was administered in this study but is not reported on here. Thus, participants were randomly assigned to one of six different orders of presentation for the structured clinical interview and the self-report measures.

I took extensive notes on patients' responses to the SCID-I/NP questions as well as notes on patients' demeanour. The personal demographic form was administered orally to participants at the end of each study session in order for the research assistants and I to remain blind to information that might cause expectancy effects. Participants were provided with a list of community counselling resources at the end of the session. The total time required for each home interview was, on average, 1 hour and 30 minutes, although depressed participants took considerably longer. In five cases, the SCID-I/NP portion of the home interviews was audio taped, with separate prior informed consent, and subsequently reviewed by my supervisor, Dr. Anita Hubley, to ensure that the SCID-I/NP research diagnoses were arrived at appropriately. On average, every 24th interview was audio taped.

## Chapter Four

### Results

#### *Missing and Ambiguous Data*

During the consent procedure, participants were advised that they had the right to refuse to answer any specific question. When items from the BDI-II or GDS were either omitted or marked ambiguously by a participant, research assistants presented those items again for clarification or to ensure they had not been missed accidentally. Nonetheless, some participants either refused to respond to specific items on the scales or stated that they preferred to give a multiple or ambiguous response to certain scale items. Therefore, I had to decide how I would deal with missing and ambiguous responses for each depression scale prior to conducting analyses for the total scores on each measure. If more than one response was given for an item (e.g., both “yes” and “no” were circled on the GDS), I will be using the term *multiple* response. If there was an unclear response given (e.g., the area in between “yes” and “no” was circled), I will be using the term *ambiguous* response.

*BDI-II.* Neither the BDI-II manual (Beck et al., 1996) nor the current literature provides instructions on how to deal with missing responses on this scale. Schafer and Olsen (1998) note that simple mean substitution for missing responses would seriously diminish relationships among variables. Because each item on the BDI-II contains four response options and a specific option could not be reasonably selected to replace missing responses, it was decided to exclude patients who had missing responses on the BDI-II from the analyses involving the BDI-II. Two participants each had two missing responses and five participants each had one missing response on the BDI-II. Thus, 3.4% of the men and 13.3% of the women had to be excluded from these analyses due to missing responses. Five of the nine missing responses for the BDI-II were for item 21, “Loss of Interest in Sex.” Ten percent of female participants and 2.3% of male

participants did not respond to that item. Two missing responses on the BDI-II were for item 4, "Loss of Pleasure," one missing response was for item 1, "Sadness," and the remaining missing response was for item 16, "Changes in Sleeping Pattern."

When multiple responses were given for a particular item, the highest marked response (i.e., more depressive response) was selected as the score for that item, following the procedure set out in the manual. No women, but 2.3% of the men gave multiple responses to BDI-II items. One participant gave multiple responses for items 16, "Changes in Sleeping Pattern" and 18, "Changes in Appetite" and one other participant gave a multiple response for item 19, "Concentration Difficulty." Therefore, analyses of scores for the BDI-II were computed for the 112 participants who had complete data.

*GDS.* Of the total sample, 4.5% of the men and 6.7% of the women had missing responses on the GDS. There appear to be no specific guidelines in the literature for dealing with either missing or ambiguous items on the GDS. Because the GDS uses a dichotomous response scale, missing data could be scored in either the nondepressed or depressed direction. In a study using the short GDS, Cwikel and Ritchie (1988) hypothesized that it was possible that their treatment of missing data by scoring them in the nondepressed direction could have contributed to the low specificity of the short GDS as a screening instrument. Because the purpose of the GDS, in the present study, was to screen for depression in a post-MI and post-UA/ACS sample, it was decided to score missing items in the depressed direction rather than risk missing possible cases. Instructions to count the highest marked (i.e., more depressed) response in the event of multiple responses on the BDI-II (Beck et al., 1996) also lends support to the decision to score missing items in the depressed direction on a dichotomous scale such as the GDS. Items on the GDS for which there was an ambiguous or multiple response were also scored in the depressed direction, following the method employed by Olin, Schneider, Eaton, Zemansky, and Pollock

(1992) for participants endorsing both responses on the GDS. No women, but 3.4% of the men gave multiple or ambiguous responses to GDS items. Missing and ambiguous responses for the GDS were scored in the depressed direction for (a) one participant who had four missing and one ambiguous response, (b) one participant who had two missing responses, (c) four participants who each had one missing response, (e) one participant who had two ambiguous responses, and (f) one participant who had one ambiguous response. Scoring missed or ambiguous responses in the depressed direction increased only one participant's total GDS score from the nondepressed to depressed range (i.e., the total score increased from 9 to 11) based on the typical GDS cut scores of 10/11 (Brink et al., 1982; Rapp et al., 1988). Therefore, analyses of scores for the GDS were calculated using all 119 participants.

In total, there were 10 missing responses for a variety of GDS items. Specifically, there were two missing responses each for GDS items 15, "Wonderful to be alive," and 19, "Find life exciting." There was one missing response each for the following items: (a) item 5, "Hopeful about future," (b) item 12, "Prefer to stay home," (c) item 20, "Hard to get started," (d) item 21, "Feel full of energy," (e) item 22, "Feel situation hopeless," and (f) item 23, "Most people better off." In total, there were four multiple or ambiguous responses to items on the GDS. There were two multiple or ambiguous responses for item 2, "Dropped activities" and one multiple or ambiguous response for each of items 5, "Hopeful about future" and 14, "Problems with memory."

Overall, missing responses on the BDI-II seemed to have a greater impact on women than men in the present study due, in large part, to item 21, "Loss of Interest in Sex." In total, 6.7% of the women, but only 2.3% of the men, had to be excluded from analyses involving the BDI-II solely because of a missing response on item 21. For the GDS, no particular item presented

difficulty for either men or women, with 4.5% of men and 6.7% of women having missing responses on that measure.

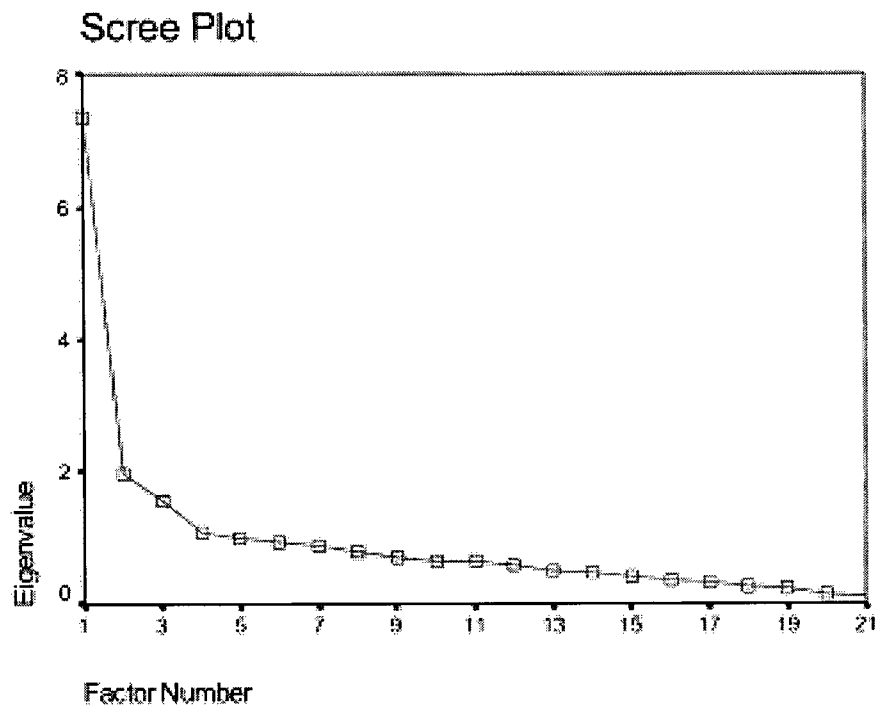
### *Exploratory Factor Analysis*

Factor analyses were conducted for the BDI-II and GDS, not so much to examine the factor structure of each scale, but rather to determine whether or not it was appropriate to use total scores for each scale for this sample. Essential unidimensionality was the minimum criterion for use of a scale's total score. Thus, for each depression measure, I directed the SPSS factor analysis program to test the fit for one factor, rather than extracting all factors that had initial eigenvalues of 1.0 or more.

*BDI-II.* An exploratory factor analysis using principal axis factoring was performed on the 21 items from the BDI-II. In accordance with the suggested guideline of 5 to 10 cases per item (Gorsuch, 1983), the sample size for this study ( $n = 112$ ) was considered sufficient to conduct exploratory factor analysis. The data met the minimum Kaiser-Meyer-Olkin criteria of .6 for sampling adequacy ( $KMO = .81$ ). In addition, Bartlett's Test of Sphericity was significant,  $\chi^2(210) = 1060, p < .001$ , confirming that the correlation matrix was not an identity matrix (Pett, Lackey, & Sullivan, 2003). An evaluation of the eigenvalues and the scree plot for the BDI-II revealed an essentially unidimensional factor structure (see Figure 4.1). The one factor had an initial eigenvalue of 7.36 and explained 35.1% of the total variance in the item responses. The first initial eigenvalue was 3.75 times larger than the second initial eigenvalue. Therefore, the BDI-II was found to have an essentially unidimensional factor structure in this study, thus supporting the use of total scores with this sample.



Figure 4.1

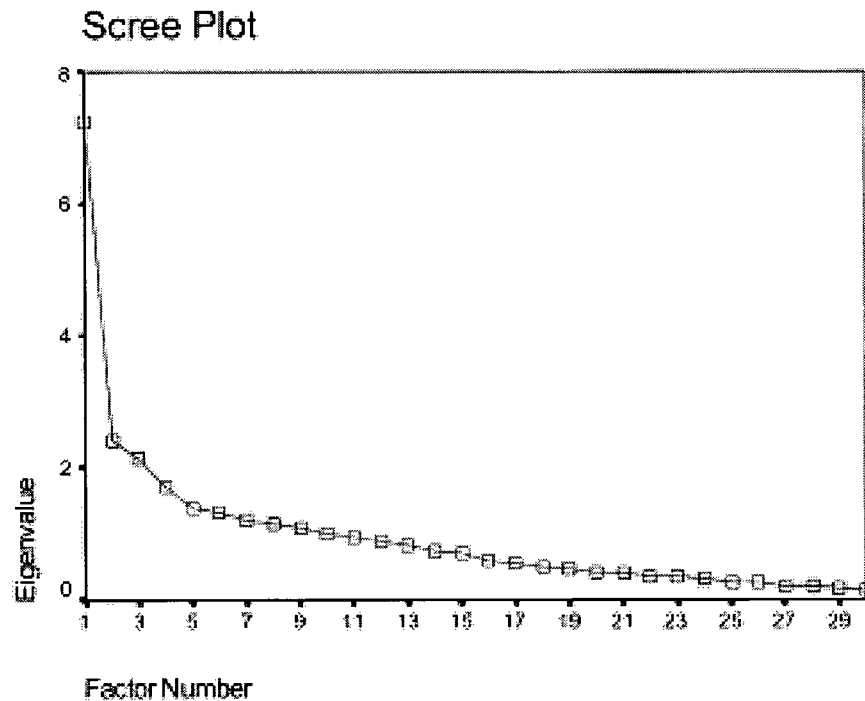
*Scree Plot of the BDI-II Total Score*

*GDS.* An exploratory factor analysis using principal axis factoring was performed on the 30 items from the GDS. According to the suggested guideline of 5 to 10 cases per item (Gorsuch, 1983), the sample size for the GDS portion of the study ( $n = 119$ ) at 4 cases per item was considered slightly less than adequate for exploratory factor analysis to be conducted on the 30 items. However, the data met the Kaiser-Meyer-Olkin criteria for sampling adequacy ( $KMO = .75$ ) and the criteria for Bartlett's Test of Sphericity,  $X^2(435) = 1383, p < .001$  (Pett et al., 2003). An evaluation of the eigenvalues and the scree plot for the GDS revealed an essentially unidimensional factor structure (see Figure 4.2). The one factor had an initial eigenvalue of 7.22 and explained 24.1% of the total variance in the item responses. The first initial eigenvalue was 2.99 times greater than the second initial eigenvalue. Thus, it was found that the GDS had an

essentially unidimensional factor structure in this study that supported the use of total scores with this sample.

Figure 4.2

*Scree Plot of the GDS Total Score*



*Reliability*

*Internal consistency.* Reliability estimates of participants' total scores for both the BDI-II and the GDS were obtained using Cronbach's alpha internal consistency coefficients. Alpha was calculated for the overall sample, as well as for the total scores of male and female participants. For the overall sample, total scores for the BDI-II yielded an alpha coefficient of .89. The alpha was .81 for male participants and .94 for female participants. Scores for the GDS yielded an alpha coefficient of .88 for the overall sample, .85 for male participants, and .91 for female participants.

*Item-total correlations.* Means, standard deviations, and corrected item-total correlations for males, females, and the overall sample for the BDI-II and GDS are shown in Tables 4.1 and 4.2, respectively. Corrected item-total correlations for the whole sample ranged from .30 to .71 for the BDI-II and from .26 to .65 for the GDS, indicating that both inventories appear to have adequate item homogeneity. Corrected item-total correlations for male patients ranged from .20 to .49 for the BDI-II and .14 to .65 for the GDS. Corrected item-total correlations for female patients ranged from .24 to .85 for the BDI-II and .18 to .79 for the GDS.

Table 4.1

*Means, Standard Deviations, and Corrected Item-Total Correlations of the BDI-II*

Item	<i>M</i>	<i>SD</i>	Male	Female	Overall
			<i>r</i> <sub>tot</sub>	<i>r</i> <sub>tot</sub>	<i>r</i> <sub>tot</sub>
1. Sadness	.21	.49	.37	.61	.55
2. Pessimism	.25	.55	.36	.73	.60
3. Past Failure	.27	.54	.47	.83	.54
4. Loss of Pleasure	.33	.53	.45	.74	.55
5. Guilty Feelings	.19	.41	.20	.75	.46
6. Punishment Feelings	.18	.65	.21	.69	.44
7. Self-Dislike	.21	.57	.46	.81	.68
8. Self-Criticalness	.26	.53	.38	.74	.52
9. Suicidal Thoughts	.13	.44	.23	.74	.42
10. Crying	.19	.56	.36	.69	.57
11. Agitation	.36	.60	.38	.66	.49
12. Loss of Interest	.26	.60	.49	.84	.64
13. Indecisiveness	.21	.47	.44	.72	.59

					Detecting Depression	59
14. Worthlessness	.17	.48	.49	.85	.71	
15. Loss of Energy	.95	.60	.45	.57	.50	
16. Changes in Sleeping	.86	.85	.29	.48	.30	
17. Irritability	.33	.56	.36	.73	.55	
18. Changes in Appetite	.76	.75	.41	.24	.35	
19. Concentration Difficulty	.44	.61	.40	.64	.46	
20. Tiredness	.88	.70	.42	.58	.51	
21. Loss of Interest in Sex	.57	.94	.48	.53	.54	

*Note.* BDI-II = Beck Depression Inventory – II. Each item has as possible score range of 0 to 3 with 3 representing a greater depressive response.

Table 4.2

*Means, Standard Deviations, and Corrected Item-Total Correlations of the GDS*

Item	<i>M</i>	<i>SD</i>	Male	Female	Overall
			<i>r</i> <sub>tot</sub>	<i>r</i> <sub>tot</sub>	<i>r</i> <sub>tot</sub>
1. Satisfied with life	.17	.38	.39	.69	.53
2. Dropped activities	.44	.50	.27	.52	.35
3. Life empty	.12	.32	.52	.58	.51
4. Often bored	.29	.46	.33	.36	.31
5. Hopeful about future	.13	.33	.37	.76	.51
6. Bothered by thoughts	.09	.29	.31	.79	.49
7. In good spirits	.05	.22	.36	.58	.38
8. Something bad happen	.13	.33	.27	.74	.46
9. Feel happy	.14	.34	.36	.55	.43
10. Feel helpless	.17	.38	.64	.70	.65

				Detecting Depression	60
11. Often restless and fidgety	.29	.45	.46	.37	.42
12. Prefer to stay home	.37	.49	.56	.29	.48
13. Worry about future	.20	.40	.35	.35	.35
14. Problems with memory	.14	.35	.16	.49	.31
15. Wonderful to be alive	.08	.28	.35	.44	.40
16. Feel downhearted/ blue	.12	.32	.39	.62	.51
17. Feel worthless	.10	.30	.37	.46	.44
18. Worry about past	.07	.25	.38	.65	.45
19. Find life exciting	.40	.49	.34	.57	.43
20. Hard to get started	.39	.49	.65	.18	.50
21. Feel full of energy	.72	.45	.34	.36	.36
22. Feel situation hopeless	.09	.29	.45	.54	.49
23. Most people better off	.14	.34	.46	.64	.52
24. Upset over little things	.19	.39	.14	.46	.26
25. Feel like crying	.09	.29	.25	.74	.49
26. Trouble concentrating	.21	.41	.38	.28	.37
27. Enjoy getting up	.15	.36	.24	.23	.26
28. Avoid social gatherings	.28	.45	.37	.28	.33
29. Easy to make decisions	.17	.38	.31	.33	.35
30. Mind as clear	.29	.46	.43	.23	.38

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*Note.* GDS = Geriatric Depression Scale. Each item has as possible score range of 0 (not depressed) to 1 (depressed).

### *Correlation of BDI-II and GDS Total Scores*

The relationship between the total scores for the BDI-II and GDS was evaluated using the Pearson product-moment correlation coefficient. Preliminary analyses indicated that there was no violation of the assumptions relating to normality, homoscedasticity, and linearity. There was a strong, positive correlation between the total BDI-II and GDS scores with high scores on the BDI-II associated with high scores on the GDS,  $r = .76, n = 112, p = < .0005$ .

### *Prevalence of BDI-II and GDS Depressive Symptoms*

The mean BDI-II score was 7.97 ( $SD = 7.15$ ). Of the 112 patients who completed all items on the BDI-II, 16.1% had scores of 14 or greater, indicating at least a mild level of depressive symptoms (Beck et al., 1996). More than four times as many women than men (38.5% vs. 9.3%) had scores of 14 or greater for the BDI-II. The mean GDS score was 6.19 ( $SD = 5.34$ ). Of the 119 patients who completed the GDS, 20.2% scored 11 or higher indicating that they were above the suggested normal range of depressive symptoms for older persons (Brink et al., 1982). More women than men (26.7% vs. 18%) had scores of 11 or higher for the GDS.

### *Prevalence of SCID-I/NP Depressive Disorders*

Six participants received SCID-I/NP diagnoses of major depressive disorder and one additional participant was diagnosed as having double depression (major depressive disorder and dysthymic disorder) for a prevalence rate of 5.9% for the two disorders. Of the remaining participants, two were diagnosed with dysthymic disorder, two with minor depressive disorder (one of whom was subthreshold for major depressive disorder), and three with partial remission of a major depressive disorder. The overall prevalence rate for participants diagnosed with any of the above depressive disorders was 11.8%. Not counted in the overall prevalence rate was one additional participant who was diagnosed as subthreshold for major depressive disorder.

### *Gender Differences in Mean Scores for the BDI-II and GDS*

Significantly higher mean scores on the BDI-II were found for women ( $M = 11.73$ ,  $SD = 10.74$ ,  $Mdn = 7.50$ ) than for men ( $M = 6.84$ ,  $SD = 5.21$ ,  $Mdn = 6.00$ ),  $t(28.64) = -2.25$ ,  $p = .03$ ,  $d = 1.0$ . Because one female participant had an outlier total score of 52 on the BDI-II, the medians are reported as well. The mean overall score on the GDS for women ( $M = 8.30$ ,  $SD = 6.54$ ) was significantly higher than that for men ( $M = 5.48$ ,  $SD = 4.71$ ),  $t(117) = -2.56$ ,  $p = .01$ ,  $d = 0.55$ .

### *Criterion-Related Validity*

*Mean score differences.* If the BDI-II and GDS provide valid inferences about depressive symptoms in this sample of post-MI and post-UA/ACS patients, there should be a significant difference in the mean scores of the BDI-II and GDS between depressed and nondepressed participants. Thus, criterion-related validity was examined by comparing the differences in the mean scores of the BDI-II and GDS between participants categorized as nondepressed and participants categorized as depressed using research diagnoses from the SCID-I/NP. For the purpose of this analysis, diagnoses of depression were grouped into four dichotomous (present/not present) categories: (a) major depressive disorder, (b) major depressive disorder or double depression, (c) major depressive disorder, double depression, minor depressive disorder, or partial remission of major depressive disorder, and (d) major depressive disorder, double depression, minor depressive disorder, partial remission of major depressive disorder, or dysthymic disorder. Table 4.3 sets out the mean score differences for the BDI-II and GDS for each of the four depression categories.

For the GDS, a significant difference was found between the mean scores of nondepressed and depressed participants for all of the SCID-I/NP diagnostic categories. For the BDI-II, a significant difference was found between the mean scores of nondepressed and depressed participants for most of the SCID-I/NP diagnostic categories. Interestingly, for major

depressive disorder alone, a significant difference was not found between the mean scores of nondepressed and depressed participants. It should be pointed out, however, that this statistical artefact was due to an outlier (i.e., BDI-II score = 52 for one participant that was 28 points higher than the next nearest BDI-II total score), which produced a large standard deviation for the depressed group.<sup>8</sup> When this BDI-II outlier total score was removed from the data and the *t*-test was conducted again, a significant difference was revealed between the mean scores of the nondepressed ( $M = 7.15$ ,  $SD = 5.52$ ) and depressed ( $M = 16.60$ ,  $SD = 4.72$ ) participants,  $t(109) = -3.76$ ,  $p = .00$ ,  $d = 1.74$ .

Table 4.3

*BDI-II and GDS Means and Standard Deviations for Nondepressed and Depressed Groups*

	SCID-I/NP Diagnoses		
	Nondepressed	Depressed	<i>t</i> -test Results
Major Depression			
BDI-II	7.15 (5.52)	22.50 (15.06)	$t(5.08) = -2.49, p = .06, d = 4.91$
GDS	5.55 (4.51)	18.33 (5.68)	$t(117) = -6.69, p = .00, d = 2.83$
Major Depression & Double Depression			
BDI-II	7.06 (5.46)	21.71 (13.90)	$t(6.12) = -2.78, p = .03, d = 4.64$
GDS	5.48 (4.47)	17.57 (5.56)	$t(117) = -6.84, p = .00, d = 2.69$



Mixed Depression  
Group 1

BDI-II	6.75 (5.28)	18.17 (11.72)	$t(11.54) = -3.33, p = .01, d = 3.17$
GDS	5.34 (4.46)	13.83 (6.60)	$t(117) = -5.93, p = .00, d = 1.82$

Mixed Depression  
Group 2

BDI-II	6.77 (5.32)	16.43 (11.68)	$t(13.78) = -3.05, p = .01, d = 2.48$
GDS	5.19 (4.37)	13.71 (6.08)	$t(117) = -6.52, p = .00, d = 1.87$

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*Note.* SCID-I/NP = Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders, Research Version, Non-patient Edition; GDS = Geriatric Depression Scale; BDI-II = Beck Depression Inventory – Second Edition; Mixed Depression Group 1 = major depressive disorder, double depression, minor depressive disorder, or partial remission of major depressive disorder; Mixed Depression Group 2 = major depressive disorder, double depression, minor depressive disorder, partial remission of major depressive disorder, or dysthymic disorder.

*Receiver-operating characteristic (ROC) curves.* Criterion-related validity was also examined by evaluating sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the BDI-II and GDS in differentiating depressed and nondepressed cardiac patients using, as a gold standard, research diagnoses from the SCID-I/NP. Table 4.4 sets out the relationship between the four values and shows how the values are calculated.

Table 4.4

*Evaluating Sensitivity, Specificity, PPV, and NPV*

		SCALE DECISION		
		Not Depressed	Depressed	
GOLD STANDARD	Not Depressed	true negatives	false positives	<i>Specificity</i>
	Depressed	false negatives	true positives	<i>Sensitivity</i>
		<i>NPV</i>	<i>PPV</i>	

*Sensitivity* = true positives / (false negatives + true positives)

*Specificity* = true negatives / (true negatives + false positives)

*PPV* = true positives / (false positives + true positives)

*NPV* = true negatives / (true negatives + false negatives)

*Note.* From Hubley, A. M. (2002). *Assessing depression in older adults: A review of screening measures*. Unpublished manuscript, University of British Columbia, Vancouver, BC. Reprinted with permission.

Sensitivity is the percentage of individuals in the sample identified as depressed by the depression scale out of those identified as depressed according to the gold standard (SCID-I/NP) diagnoses. Specificity is the percentage of individuals in the sample identified as nondepressed by the depression scale out of those identified as nondepressed (Hubley, 2002) according to the gold standard (SCID-I/NP) diagnoses. Of special interest to the clinician are the predictive values of a diagnostic test in predicting the presence or absence of a disorder (e.g., depression) when it is unknown if the individual has that disorder (Wassertheil-Smoller, 1990). The PPV is the percentage of truly depressed individuals out of those identified by the depression scale as depressed. The NPV is the percentage of truly nondepressed individuals out of those identified

by the depression scale as nondepressed (Hubley, 2002). Predictive values are greatly influenced by the prevalence of the disorder in the population. When the disorder has a low prevalence, the PPV of a diagnostic test drops relatively sharply. For a diagnostic test to be considered good (i.e., the test improves one's guess about the patient's depression status over the guess one would make based solely on the general prevalence of depression), the PPV of that test should be high even when the prevalence of the disorder is low. Furthermore, specificity is more important than sensitivity in determining the PPV of a test. A large increase in sensitivity results in a small increase in the PPV of a test whereas a small increase in specificity results in a large increase in the PPV of the test. Thus, the practical worth of a diagnostic screen depends on a combination of the prevalence of the disorder, sensitivity, and specificity all of which influence the screen's predictive values (Wassertheil-Smoller, 1990).

Receiver operating characteristic (ROC) curves are utilized to describe and compare the accuracy of diagnostic instruments (Hanley & McNeil, 1983). The optimal cut score for any diagnostic screen will vary according to the specific clinical situation in which it is to be used (Hsiao, Bartko, & Potter, 1989). The ROC program calculates the sensitivity and specificity for each obtained raw score on a depression inventory (or any diagnostic test), as if the raw score had been selected as the cut score or the diagnostic threshold for a decision. The ROC program computes the numbers of true positives, false positives, true negatives, and false negatives that would occur at that threshold. For each cut score, the ROC curve plots the proportion of true positives (i.e., the percentage of truly depressed individuals who are correctly identified as depressed) against the proportion of false positives (i.e., the percentage of truly nondepressed individuals who are mistakenly identified as depressed). This results in a bowed curve, beginning in the lower left corner where the percentages are both 0, to the upper right corner where the percentages are both 100. Each point in the curve corresponds to a specific cut score or

threshold, with the highest threshold (most strict) being at the lower left and the lowest threshold (most lenient) at the upper right (Swets, Dawes, & Monahan, 2000). The more accurately a diagnostic test is able to differentiate those who have disorders from those who do not, the more the ROC curve diverges toward the upper left corner of the graph. The area under the curve (AUC) is a measure of the accuracy of a diagnostic test and can range from 0.0 to 1.0. A perfect test would have an AUC of 1.0. The line of no information, or random ROC, has an AUC of 0.5 and forms a diagonal line running from the lower left to the upper right boundaries of the graph (Hsiao et al., 1989). An AUC of .80 or more indicates that a diagnostic test is useful as a case-finding screen (Holmes, 1998).

ROC curve analyses were conducted on the scores for 112 participants for whom complete data for both the BDI-II and GDS were available, using the computer program *Analyse-It* (*Analyse-It for Microsoft Excel*, 2000). One advantage of this program is that it permits comparison of the AUC for both measures. *Analyse-It* employs the non-parametric method (see Beck & Schultz, 1986) for the construction of curves. In addition, *Analyse-It* uses the Hanley and McNeil method for comparing curves that takes into account the between-area correlation arising from having paired data (see Hanley & McNeil, 1983). For this evaluation, diagnoses of depression were again grouped into four dichotomous (present/not present) categories: (a) major depressive disorder, (b) major depressive disorder or double depression, (c) major depressive disorder, double depression, minor depressive disorder, or partial remission of major depressive disorder, and (d) major depressive disorder, double depression, minor depressive disorder, partial remission of major depressive disorder, or dysthymic disorder.

Tables 4.5 to 4.8 show the sensitivity, specificity, PPV, and NPV of a range of cut scores for the BDI-II and the GDS as determined by the ROC curve analysis for each of the four depression categories. Because of the strong correlation between the presence of depression in

post-MI patients and repeat cardiac events, or even mortality, it is important to focus more on the sensitivity of the depression inventories for detecting depressive symptoms in this patient sample. Focusing on a balance between the sensitivity and specificity of each depression inventory for detecting depressive symptoms in this group comes with the risk of serious consequences for the patients whose depression is not detected. For the following categories, I will use four terms to describe cut scores. I will use the term, *conventional*, to refer to cut scores suggested by the authors of the BDI-II or GDS and/or cut scores frequently used by clinicians and researchers. I will also use the term, *reported*, to refer to other cut scores reported in previous relevant studies. The term, *optimal*, will be used to refer only to an optimal balance between sensitivity and specificity. Finally, I will use the term, *recommended*, to refer to cut scores recommended by this research for use with a post-MI or post-UA/ACS population.

*Category 1: SCID-I/NP diagnosis of major depressive disorder.* The AUC for the BDI-II and GDS were .91 and .97, respectively, and this difference was not significant ( $p = .06$ ). Observation of Table 4.5 shows that the conventional cut score of 14 (Beck et al., 1996; Norris Arnau, Bramson, & Meagher, 2004) for the BDI-II yielded the optimal balance between sensitivity (83%) and specificity (88%) but failed to identify one participant diagnosed with a major depressive disorder and the PPV (28%) was low. An examination of the patterns of Tables 4.5 to 4.8 indicates that, while there was no observed BDI-II score of 18 in this study, the reported BDI-II cut score of 18 for younger, primary care medical patients (Arnau et al., 2001) would likely produce sensitivities far too low to be useful for detecting any category of depression with a post-MI or post-UA/ACS population. Table 4.5 shows that the conventional GDS cut scores of 10 (Rapp et al., 1988) and 11 (Brink et al., 1982; Olin et al., 1992; Parmelee et al., 1989) produced high sensitivities (100%) and NPVs (100%), but the specificities and PPVs were substantially lower than those produced by the GDS cut score of 14 which also had a

sensitivity and NPV of 100%, as noted below. The low PPVs of the GDS conventional cut scores indicated that the cut scores of 10 and 11 overidentified depression in this sample.

An examination of Table 4.5 also shows that the cut scores of 10 for the BDI-II and 14 for the GDS each produced the highest sensitivity (100%) and the highest specificity (75% and 94%, respectively) out of the multiple lower cut scores that demonstrated 100% sensitivity for these scales. Furthermore, at these cut scores all of the people categorized by both scales as not having a major depressive disorder were, in fact, not depressed (NPVs = 100%). Not surprisingly, given the values for specificity, although both cut scores identified all individuals diagnosed with major depressive disorder, the BDI-II cut score of 10 resulted in a considerably lower PPV (18%) than the PPV (50%) produced by the GDS cut score of 14. Thus, only 18% of the people identified by the BDI-II, using a cut score of 10, as having a major depressive disorder were, in fact, depressed. However, 50% of the people identified by the GDS, using a cut score of 14, as having a major depressive disorder were depressed. The recommended GDS cut score of 14 also provided the optimal balance between sensitivity (100%) and specificity (94%) for this scale.

Table 4.5

*SCID-I/NP Diagnosis of Major Depressive Disorder*

Scale and cut score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
BDI-II $\geq 9$	100	72	17	100
BDI-II $\geq 10$	100	75	18	100
BDI-II $\geq 11$	83	76	17	99
BDI-II $\geq 12$	83	80	19	99
BDI-II $\geq 13$	83	84	23	99

			Detecting Depression	70
BDI-II $\geq 14$	83	88	28	99
BDI-II $\geq 15$	-	-	-	-
BDI-II $\geq 16$	-	-	-	-
BDI-II $\geq 17$	67	92	31	98
BDI-II $\geq 18$	-	-	-	-
BDI-II $\geq 19$	50	94	33	97
<hr/>				
GDS $\geq 9$	100	74	18	100
GDS $\geq 10$	100	79	21	100
GDS $\geq 11$	100	83	25	100
GDS $\geq 12$	100	88	32	100
GDS $\geq 13$	100	90	35	100
GDS $\geq 14$	100	94	50	100
GDS $\geq 15$	67	94	40	98

*Note.* SCID-I/NP = Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders, Research Version, Non-patient Edition; GDS = Geriatric Depression Scale; BDI-II = Beck Depression Inventory – Second Edition; PPV = positive predictive value, and; NPV = negative predictive value. The dashes for the BDI-II indicate that the ROC curve analysis could not calculate sensitivity and specificity for unobserved raw scores.

*Category 2: SCID-I/NP diagnosis of major depressive disorder or double depression.*

The AUC for the BDI-II and GDS were .92 and .96, respectively; there was no significant difference between the AUC ( $p = .08$ ). Table 4.6 shows that the conventional cut score of 14 for the BDI-II produced the optimal balance between sensitivity (86%) and specificity (89%). Of the multiple cut scores producing a sensitivity of 86% for the BDI-II, the cut score of 14 produced

the highest specificity. However, the PPV (34%) was somewhat lower for this BDI-II cut score than the PPV (50%) produced by the GDS cut score of 14 for which there was also an optimal balance between sensitivity (86%) and specificity (94%). Although both optimally-balanced cut scores of 14 for the BDI-II and 14 for the GDS produced sensitivities of 86%, the GDS demonstrated a higher specificity (89% vs. 94%) at this threshold. However, it should be noted that each of these cut scores failed to identify one participant who had either major depressive disorder or double depression, an important consideration when one is working with a sample of post-MI or post-UA/ACS patients. Table 4.6 also shows that, although the conventional GDS cut scores of 10 and 11 produced sensitivities of 100%, they also resulted in somewhat lower rates of specificity (80% and 84%, respectively), accounting for the low PPVs (25% and 29%, respectively) at this level. Thus, none of the aforementioned cut scores of 14 for the BDI-II, or 10, 11, and 14 for the GDS produced both high sensitivity and high specificity for this particular category of depressive disorders.

Observation of Table 4.6 shows that the cut scores of 10 for the BDI-II and 13 for the GDS each produced a sensitivity of 100% in detecting individuals diagnosed as having either a major depressive disorder or double depression. At these cut scores, both the BDI-II and the GDS also correctly categorized all of the people (NPV = 100%) identified by the scales as having neither major depressive disorder nor double depression. The cut scores of 10 for the BDI-II and 13 for the GDS also produced the highest specificities of 75% and 91%, respectively, out of the multiple cut scores demonstrating sensitivities of 100% for each scale. However, the BDI-II cut score of 10 produced a considerably lower PPV than that produced by the GDS cut score of 13 (21% vs. 41%, respectively). Thus, at these cut scores, only 21% of individuals identified by the BDI-II, compared to 41% of individuals identified by the GDS, as having a major depressive disorder or double depression, were, in fact, depressed. The lower specificity of



the BDI-II, when compared to that of the GDS (75% vs. 91%, respectively), would account for the difference in PPVs at these cut scores, given that the sensitivities and prevalence rates of the disorder were the same for each scale. Therefore, although both the cut scores of 10 for the BDI-II and 13 for the GDS identified all of the cases of major depressive disorder or double depression, the cut score of 10 for the BDI-II produced both a lower specificity and a low PPV. In contrast, the recommended GDS cut score of 13 had high sensitivity, high specificity, and more accurately distinguished between those who were depressed and those who were not depressed.

Table 4.6

*SCID-I/NP Diagnosis of Major Depressive Disorder or Double Depression*

Scale and cut score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
BDI-II $\geq$ 9	100	72	19	100
BDI-II $\geq$ 10	100	75	21	100
BDI-II $\geq$ 11	86	77	20	99
BDI-II $\geq$ 12	86	81	23	99
BDI-II $\geq$ 13	86	85	27	99
BDI-II $\geq$ 14	86	89	34	99
BDI-II $\geq$ 15	-	-	-	-
BDI-II $\geq$ 16	-	-	-	-
BDI-II $\geq$ 17	71	92	39	98
BDI-II $\geq$ 18	-	-	-	-
BDI-II $\geq$ 19	43	94	33	96

GDS $\geq$ 9	100	74	21	100
GDS $\geq$ 10	100	80	25	100
GDS $\geq$ 11	100	84	29	100
GDS $\geq$ 12	100	89	37	100
GDS $\geq$ 13	100	91	41	100
GDS $\geq$ 14	86	94	50	99
GDS $\geq$ 15	57	94	40	97

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*Note.* SCID-I/NP = Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders, Research Version, Non-patient Edition; GDS = Geriatric Depression Scale; BDI-II = Beck Depression Inventory – Second Edition; PPV = positive predictive value, and; NPV = negative predictive value. The dashes for the BDI-II indicate that the ROC curve analysis could not calculate sensitivity and specificity for unobserved raw scores.

*Category 3: SCID-I/NP diagnosis of major depressive disorder, double depression, minor depressive disorder, or partial remission of major depressive disorder.* The AUC for the BDI-II and the GDS were .89 and .88, respectively. This difference was not significant ( $p = .71$ ). In order to detect this broader range of depressive disorders, one must try to balance the need for high sensitivity with the decreases in specificity and PPV that a low cut score would incur (see Table 4.7). Cut scores of 10 on the BDI-II and 7 on the GDS each produced sensitivities of 92% and yielded the highest specificities for each scale out of the multiple cut scores producing sensitivities of 92%. The respective cut scores each identified all but one individual diagnosed with this broader range of depressive disorders and each cut score correctly identified as not depressed 99% of the individuals categorized by the scales as not depressed. However, at these cut scores, lower specificities (78% and 71%, respectively) for the BDI-II and GDS contributed to low PPVs (33% and 28%, respectively). Thus, at these cut scores, only 33% of the individuals

identified by the BDI-II as depressed and 28% of the individuals identified by the GDS as depressed were, in fact, depressed. Similarly, the cut scores of 11 for the BDI-II and 9 for the GDS, although demonstrating the optimal balance between sensitivity and specificity for each scale, produced little improvement in specificities over the respective cut scores of 10 and 7 and virtually no improvement in PPVs. Therefore, there was no cut score for either scale that demonstrated both high sensitivity and high specificity for this broader range of depressive disorders with this sample.

Table 4.7

*SCID-I/NP Diagnosis of Major Depressive Disorder, Double Depression, Minor Depressive Disorder, or Partial Remission of Major Depressive Disorder*

Scale and cut score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
BDI-II $\geq$ 7	100	60	23	100
BDI-II $\geq$ 8	92	69	26	99
BDI-II $\geq$ 9	92	75	31	99
BDI-II $\geq$ 10	92	78	33	99
BDI-II $\geq$ 11	83	80	33	98
BDI-II $\geq$ 12	75	83	35	97
BDI-II $\geq$ 13	67	86	36	96
BDI-II $\geq$ 14	58	89	39	95
BDI-II $\geq$ 15	-	-	-	-
BDI-II $\geq$ 16	-	-	-	-
BDI-II $\geq$ 17	50	93	46	94
BDI-II $\geq$ 18	-	-	-	-

BDI-II $\geq$ 19	33	95	44	92
GDS $\geq$ 5	100	56	21	100
GDS $\geq$ 6	92	65	24	99
GDS $\geq$ 7	92	71	28	99
GDS $\geq$ 8	75	73	25	96
GDS $\geq$ 9	75	75	27	96
GDS $\geq$ 10	67	80	29	95
GDS $\geq$ 11	67	84	33	96
GDS $\geq$ 12	67	89	42	96
GDS $\geq$ 13	67	91	47	96
GDS $\geq$ 14	58	95	58	95
GDS $\geq$ 15	42	95	50	93

*Note.* SCID-I/NP = Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders, Research Version, Non-patient Edition; GDS = Geriatric Depression Scale; BDI-II = Beck Depression Inventory – Second Edition; PPV = positive predictive value, and; NPV = negative predictive value. The dashes for the BDI-II indicate that the ROC curve analysis could not calculate sensitivity and specificity for unobserved raw scores.

*Category 4: SCID-I/NP diagnosis of major depressive disorder, double depression, minor depressive disorder, partial remission of major depressive disorder, or dysthymic disorder.* The AUC were .84 and .89 for the BDI-II and GDS, respectively. Again, this difference was not significant ( $p = .15$ ). If the purpose of a screen for this sample is to detect all of the above depressive disorders, the cut scores of 7 for the BDI-II and 7 for the GDS each had sensitivities of 93% and each identified all but one individual diagnosed with a depressive

disorder. Table 4.8 shows the results. However, the cut scores of 7 for the BDI-II and 7 for the GDS produced both low specificities (60% and 72%, respectively) and low PPVs (25% and 33%, respectively). That is, for the cut scores of 7, only 25% of the individuals predicted to be depressed by the BDI-II and 33% of the individuals predicted to be depressed by the GDS were, in fact, depressed. Similarly, the cut scores for the BDI-II and GDS (10 and 9, respectively) that each produced an optimal balance between sensitivity and specificity also each yielded low PPVs of 33% and 32%, respectively. Thus, again, for a broader category of depressive disorders, there was no cut score for either the BDI-II or the GDS that could be recommended as having demonstrated both high sensitivity and high specificity with this sample.

Table 4.8

*SCID-I/NP Diagnosis of Major Depressive Disorder, Double Depression, Minor Depressive Disorder, Partial Remission of Major Depressive Disorder, or Dysthymic Disorder*

Scale and cut score	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
BDI-II $\geq$ 4	100	27	16	100
BDI-II $\geq$ 5	93	40	18	98
BDI-II $\geq$ 6	93	49	21	98
BDI-II $\geq$ 7	93	60	25	98
BDI-II $\geq$ 8	86	69	29	97
BDI-II $\geq$ 9	79	75	31	96
BDI-II $\geq$ 10	79	78	33	96
BDI-II $\geq$ 11	71	80	33	95
BDI-II $\geq$ 12	64	83	35	94
BDI-II $\geq$ 13	57	86	36	93

BDI-II $\geq 14$	50	89	39	93
BDI-II $\geq 15$	-	-	-	-
BDI-II $\geq 16$	-	-	-	-
BDI-II $\geq 17$	43	93	46	92
BDI-II $\geq 18$	-	-	-	-
BDI-II $\geq 19$	29	95	44	90

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GDS $\geq 5$	100	57	25	100
GDS $\geq 6$	93	66	28	99
GDS $\geq 7$	93	72	33	99
GDS $\geq 8$	79	75	31	96
GDS $\geq 9$	79	77	32	96
GDS $\geq 10$	71	82	36	95
GDS $\geq 11$	71	86	42	96
GDS $\geq 12$	71	91	53	96
GDS $\geq 13$	71	93	59	96
GDS $\geq 14$	50	95	58	93
GDS $\geq 15$	36	95	50	91

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*Note.* SCID-I/NP = Structured Clinical Interview for *DSM-IV-TR* Axis I Disorders, Research Version, Non-patient Edition; GDS = Geriatric Depression Scale; BDI-II = Beck Depression Inventory – Second Edition; PPV = positive predictive value, and; NPV = negative predictive value. The dashes for the BDI-II indicate that the ROC curve analysis could not calculate sensitivity and specificity for unobserved raw scores.

### *Predicting Diagnoses of Major Depression*

Two preliminary, exploratory binary logistic regressions were conducted to examine if the personal variables of gender, living alone (yes/no), smoking (yes/no), previous diagnosis of depression (yes/no), diabetes (yes/no), stroke (yes/no), warfarin (yes/no),<sup>9</sup> and social support (3 – 12 points), in addition to a depression screen (BDI-II or GDS), could help predict whether or not a participant in this sample was diagnosed with a major depressive disorder according to the SCID-I/NP. Forward entry of variables into the model, using likelihood ratio (LR), was used. A separate regression was conducted with each of the BDI-II and GDS. I would caution that these results are extremely preliminary because of the low base rate of depression within this sample. Given the low base rate, the model fit results are not very useful. The more useful information is that, of all of the variables, only the depression screen (in each regression) and a previous diagnosis of depression entered into the model. For the first logistic regression, the Wald test = 4.8 and the odds ratio = 1.2 for the BDI-II total scores whereas, for the variable of previous diagnosis of depression, the Wald test = 3.4 and the odds ratio = 9.3. That is, the odds of being diagnosed with major depressive disorder were 1.2 times more likely for every one-point increase in the BDI-II total score. Furthermore, in the presence of the BDI-II total score variable, participants with a previous diagnosis of depression were approximately 9 times more likely to be diagnosed with a major depressive disorder.

For the second logistic regression, the Wald test = 5.6 and the odds ratio = 1.8 for the GDS total scores whereas, for the variable of previous diagnosis of depression, the Wald test = 4.1 and the odds ratio = 31.8. That is, the odds of being diagnosed with a major depressive disorder were 1.8 times more likely for every increase of one point in the GDS total score. Moreover, when the GDS total score variable was present, participants with a prior diagnosis of

depression were approximately 32 times more likely to be diagnosed with a major depressive disorder. Again, I would remind the reader that these results are exploratory only.



## Chapter Five

## Discussion

*Prevalence of SCID-I/NP Depressive Disorders*

The prevalence rate of approximately 6% for major depressive disorder and double depression found in this sample was lower than anticipated, although not far below the prevalence rate of 9.5% for major depressive disorder found in a sample of older post-MI patients (Bush et al., 2001). There are several possible explanations for this lower rate. First, the lower rate could be attributed to the requirement that, in this study, the full 2-week duration criterion be met for a diagnosis of major depressive disorder. In contrast, Schleifer et al. (1989), who found a prevalence rate for major depressive disorder of 18% in post-MI patients, set the duration criterion for depressive symptoms at only 1 week. Similarly, Frasure-Smith et al. (1993) found a prevalence rate of 16% for major depressive disorder for post-MI patients; however, the authors set the temporal criterion for depressive symptoms from the date of patient admission to hospital to the date of the interview, which varied from 5 to 15 days. Second, the prevalence rate found for this research could be lower because the criteria set for this study for the presence of each particular depressive symptom were strict. The *DSM-IV-TR* states that the symptoms of a major depressive episode must be present “for most of the day, nearly every day, for at least 2 consecutive weeks” (American Psychiatric Association, 2000, p. 349). Within the SCID-I/NP, the interviewer inquires about the presence of depressive symptoms “for most of the day, nearly every day,” for at least a 2-week period and rates the symptoms as *absent*, *subthreshold*, or *threshold*. For the purpose of this research, it was decided that a depressive symptom had to be present for 12 or more days of the 2-week criterion to qualify as a *threshold* symptom of major depressive disorder. Similarly, it was decided a depressive symptom had to be present for 10 or 11 days to be recorded as *subthreshold*. It is important to note that, in contrast to Frasure-Smith

et al. (1993), Schleifer et al. (1989), and the Writing Committee for the ENRICHD Investigators (2003), depressive symptoms lasting 9 days or less were classified as *absent* in the present study. Third, a possible contributing factor to the lower prevalence rate of major depression in this sample was that, on rare occasions, I noted that nurses had excluded patients whom they believed would not make good participants (i.e., the patients were deemed to be too anxious or too depressed!) despite meeting the study criteria. Finally, because they were not interviewed, there was no information about whether patients who refused to participate, or who had agreed to participate but ultimately did not take part in the study, were depressed or not. In this research, older people, generally, were more likely to refuse to participate. Furthermore, female decliners were significantly older than male decliners. It is important to note that the Yale Epidemiologic Catchment Area study revealed that, in the group 65 years of age or more, women had a prevalence rate of major depression at least three times higher than that of men (Leaf et al., 1986). This older group of individuals, especially women, are the very post-MI and post-UA/ACS patients who might be most at risk if they are depressed yet they tend to be the least inclined to participate.

#### *Missing and Ambiguous Data on the BDI-II and GDS*

In the present research, non-response rates were comparable for the BDI-II and GDS. Similar to the present study, Olin et al. (1992) found nonresponse rates of older adults to individual items on the BDI and GDS were comparable. In contrast, Jefferson et al. (2000) compared item responses on the BDI-II and GDS in a sample of older women and found a significantly greater number of items left blank for the BDI-II than the GDS. In the present research, of all participants, 5.9% and 5.0%, respectively, missed items on the BDI-II and GDS. Thus, it was as likely that one would have to deal with the issue of missing items for one scale as it was for the other. Similarly, in this research, participants were as likely to endorse multiple or

ambiguous responses (1.7% vs. 2.5%, respectively) on the BDI-II as on the GDS. Similar to this research, Jefferson et al. (2000) observed no significant difference between the number of participants endorsing multiple responses on the BDI-II and the number endorsing multiple responses on the GDS for their sample of older women. However, in an earlier study of community-dwelling older adults, 46% ( $n = 23$ ) endorsed multiple responses on the BDI whereas only 8% ( $n = 4$ ) endorsed multiple responses on the GDS (Olin et al., 1992).

In the present research, four of the nine missing responses for the BDI-II were random. The remaining five missing BDI-II responses were for item 21, "Loss of Interest in Sex." Two of the three women who did not answer item 21, "Loss of Interest in Sex," wrote "n/a" beside their missing responses. The remaining woman simply refused to answer item 21. Of the two men who did not respond to item 21 on the BDI-II, one man explained to the research assistant that the question was not applicable because he was 79 years old. The other man told the research assistant that he was widowed implying that the item was not applicable to him. The five participants who had missing responses for item 21 ranged in age from 73 to 79 years. In their study of older women, Jefferson et al., (2000) found that 12 of the 14 participants who missed responses on the BDI-II did not answer the "Loss of Interest in Sex" item. Furthermore, three of the women wrote "n/a" beside their missed response for item 21. Thus, it would seem that older individuals, particularly older women, are not only less inclined to answer the "Loss of Interest in Sex" item, they are also less inclined to view it as even applicable to them. It could be that participants who missed responses to item 21 assumed the question implied that a partner was required. Clearly, older adults seem to have more difficulty responding to the item, "Loss of Interest in Sex," than they do to other items on the BDI-II.<sup>10</sup> In excluding patients who had incomplete data on the BDI-II, there is a risk that the results may be biased if the participants who completed all responses were not representative of the entire sample (Schafer & Olsen,

1998). It should be noted that no participants who were actually depressed were excluded from the present research because of missing responses. Further research on methods of dealing with missing and ambiguous data on the BDI-II and GDS is needed.

### *Psychometric Properties of the BDI-II and GDS*

Results of exploratory factor analyses, in the present research, indicated that the BDI-II and GDS have essentially unidimensional factor structures, thus supporting the use of total scores with this sample.

*Internal consistency.* The reliability estimate reported for this research of .89 for the overall sample for BDI-II total scores is satisfactory and consistent with the coefficients alpha of .91 and .89 respectively reported for BDI-II scores with older primary care medical patients (Norris et al., 2004) and depressed geriatric inpatients (Steer et al., 2000), respectively. In the present research, the alpha was .81 for male participants and .94 for female participants for scores on the BDI-II. There appear to be no published studies examining reliability for BDI-II total scores with older men. However, with a sample of 58 older women, Jefferson et al. (2000) found good internal consistency for scores on the BDI-II ( $\alpha = .85$ ).

For the GDS total scores, the reliability estimate reported for this research of .88 for the overall sample is also satisfactory and consistent with an earlier evaluation of the GDS with institutionalized, elderly residents that reported total scores to have high internal consistency (standardized  $\alpha = .91$ ; Parmelee et al., 1989). The alpha coefficient for GDS scores in the present research was .85 for males and .91 for females. Rapp et al. (1988) reported a slightly higher coefficient alpha of .92 for GDS scores with a sample of 150 elderly male medical inpatients. Jefferson et al. (2000) found good internal consistency for the scores of older female participants on the GDS ( $\alpha = .84$ ). One possible explanation for the somewhat lower reliability estimates for the scores of men on both measures in this research is that women's

scores were more variable and we know reliability increases with variability in test scores (Traub & Rowley, 1991).

*Item-total correlations.* Corrected item-total correlations for the whole sample of .30 to .71 for the BDI-II in this research are adequate but somewhat lower than the range of .54 to .74 reported by Arnau et al. (2001) for younger primary care medical patients. This difference was due, in part, to the low corrected item-total correlations in this research for somatic items 16, “Changes in Sleeping Pattern” and 18, “Changes in Appetite.” This likely reflects symptom overlap between depression and the aftermath of the cardiac event. For the GDS, corrected item-total correlations for the whole sample of .26 to .65 in the present research are also adequate and similar to the range of .28 to .72 reported by Parmelee et al. (1989) for institutionalized elderly adults.

#### *Gender Differences in Mean Scores*

With the present sample, significantly higher mean scores on the BDI-II and GDS were found for women than men. This finding is consistent with earlier research that showed a significant gender difference in the means of the overall scores for the BDI-II with primary care medical patients (Arnau et al., 2001) and for the GDS with older adults (Allen-Burge et al., 1994; Parmelee et al., 1989). According to a pattern observed in the general depression literature, women report a higher number of depressive symptoms than men (Culbertson, 1997). However, there is considerable controversy in the literature as to whether women actually experience a greater number or severity of symptoms or, simply, that they are more willing to admit experiencing those symptoms. For example, for the BDI, Allen-Burge et al. (1994) found that, with depressed geriatric psychiatric inpatients, men were less inclined than women to endorse questions relating to a sense of failure, body image change, self-dislike, and crying spells.

### *Mean Score Differences Between Nondepressed and Depressed Groups*

For the BDI-II and GDS, mean scores were significantly different between nondepressed and depressed participants for the SCID-I/NP diagnostic categories. These results provided criterion-related evidence to support the use of total scores to screen for depression in cardiac patients. This finding is consistent with earlier research that observed significant differences between the mean BDI-II scores for nondepressed and depressed primary care patients when compared to diagnoses of major depression using the *DSM-IV*-based Patient Health Questionnaire (Arnau et al., 2001) and among the mean GDS scores for normal, mildly depressed and severely depressed older adults, based on the Research Diagnostic Criteria for depression (Yesavage et al., 1983).

### *Recommendations for Selecting Cut Scores*

In selecting a cut score, institutions need to set a threshold that makes sense for their specific situation because finding all or most of the true positives comes at a cost of increased false positives or false alarms. Within each setting, it is important to determine how crucial it is to find all or most of the true positives. Institutions have to consider the prevalence of the condition in the population as well as whether treatment is available for diagnosed individuals. They must also balance the consequence of missing true positives against the probability of incurring costs for diagnostic testing on false positives (i.e., nondepressed individuals who score in the depressed range on a screening measure; Swets et al., 2000). In selecting appropriate cut scores for post-MI and post-UA/ACS patients, one must consider that depression is a significant predictor of mortality in cardiac patients within as few as 4 months to 1 year following an acute MI (Bush et al., 2001; Frasure-Smith et al., 1999; Frasure-Smith et al., 1993). Depressed cardiac patients not only experience a reduced quality of life (Linden et al., 1996), but they are also less likely to adhere to medication (Carney et al., 1995; Ziegelstein et al., 2000), diet, and exercise

regimens (Ziegelstein et al., 2000). Reduced treatment compliance could partially account for the increased mortality and morbidity (Carney et al., 1995) and the poorer long-term prognosis (Ziegelstein et al., 2000) in depressed cardiac patients. Therefore, in selecting appropriate cut scores for this sample, one must also consider the impact that reduced compliance in these activities could have on the physical well being of depressed cardiac patients. One must balance these implications against the financial cost to hospitals for additional mental health assessments on nondepressed post-MI and post-UA/ACS patients who score in the depressed range on a screening measure. Reported prevalence rates for major depressive disorder in cardiac patients, which range from approximately 6% (in the present study) to 18% (Bush et al., 2001; Frasure-Smith et al., 1993; Schleifer et al., 1989; Strik et al., 2001), when viewed together with the possible physical and emotional cost to depressed cardiac patients, suggest that the focus should be more on sensitivity than specificity when selecting appropriate cut scores for this population.

Guck, Kavan, Elsasser, and Barone (2001) state that patients with a score in the depressed direction should be interviewed more comprehensively to either confirm depression or rule it out. A similar caution was issued by MacMillan, Patterson, Wathen, and the Canadian Task Force on Preventive Health Care (2005) who advised that a positive screening result must be followed up with accurate diagnosis and efficacious treatment and monitoring in order to realize the benefits of depression screening. There is effective, available treatment for depressed cardiac patients. Cognitive-behaviour therapy is the most efficacious psychological treatment for post-MI patients and, due to the relative lack of effects on the cardiovascular system, selective serotonin reuptake inhibitors are the preferred antidepressant treatment (Guck et al., 2001). In combination, the two treatments present the best option for recovery from depression for cardiac patients (Guck et al., 2001). However, depressed post-MI and post-UA/ACS first must be accurately identified.

*Major depressive disorder.* The ROC curve analysis indicated both the BDI-II and GDS were excellent case-finding screens for major depressive disorder. The cut scores of 10 for the BDI-II and 14 for the GDS both demonstrated high sensitivity (100%) in detecting patients with major depressive disorder. However, at these cut scores, the BDI-II was less effective than the GDS in correctly identifying individuals who were not depressed in this sample. The BDI cut score of 10 produced only moderate specificity of 75% and a very low PPV of 18%, making it impractical and costly to use as a screen for major depressive disorder with a post-MI or post-UA/ACS population. These results are consistent with earlier research that reported a sensitivity of 100% and specificity of 70% for the BDI-II cut score of 10 in detecting major depressive disorder in a sample of younger, primary care medical patients (Arnau et al., 2001). The GDS cut score of 14 produced high sensitivity (100%) combined with high specificity (94%) and a substantially higher PPV of 50% with the present post-MI and post-UA/ACS sample.

One possible explanation for the higher specificity and PPV for the GDS is that the GDS was specifically developed as a depression screening instrument for, and validated with, older adults (Yesavage et al., 1983). Of the 100 items originally tested for the GDS, the 12 somatic items tested did not have sufficiently high correlations with the total scores to merit inclusion in the final 30-item GDS. Thus, one advantage of the GDS over other depression inventories such as the BDI-II, when screening older adults for depression is that the GDS does not contain somatic items (Yesavage et al., 1983). Although the somatic items contained in the BDI-II were accurate indicators of depression for older primary care patients (Norris et al., 2004), this may not extend to post-MI and post-UA/ACS patients who have experienced more severe illness. Olin et al. (1992) observed that the Beck Depression Inventory's (Beck et al., 1979) "sensitivity to somatic complaints may reduce its specificity only in samples with substantial medical or psychiatric illness" (p. 192). Indeed, a review of the corrected item-total correlations of the BDI-



II for the present research show that the two lowest item-total correlations were for somatic items: (a) item 16, "Changes in Sleeping Patterns" ( $r_{\text{tot}} = .30$ ); and (b) item 18, "Changes in Appetite" ( $r_{\text{tot}} = .35$ ).

Because the GDS demonstrated higher specificity and considerably higher PPV than the BDI-II with this sample, it is recommended that only the GDS be used to screen for the category of major depressive disorder in a post-MI or post-UA/ACS population and that the cut score be set at 14 and greater. Using the recommended cut score of 14 for the GDS in this sample would incur an additional cost for the further assessment by mental health professionals of six individuals incorrectly predicted to have a major depressive disorder (i.e., false positives). However, this small cost would be more than offset by the reduced medical costs for post-MI physician and emergency room visits likely to be incurred by depressed patients (Frasure-Smith et al., 2000a). Possible decreased morbidity and mortality and potential improvement in the quality of life for depressed post-MI and post-UA/ACS patients and their families (see Linden et al., 1996) would also mitigate the initial cost and inconvenience of additional patient assessments.

*Major depressive disorder and double depression.* ROC curve analysis indicated that both the BDI-II and GDS are excellent case-finding screens for major depressive disorder and double depression. The cut scores of 10 for the BDI-II and 13 for the GDS each produced sensitivities of 100% in detecting individuals diagnosed with either disorder. Again, however, the BDI-II cut score of 10 demonstrated a lower specificity than the GDS cut score of 13 (75% vs. 91%, respectively) and yielded a substantially lower PPV (21% vs. 41%, respectively). Although the BDI-II correctly identified all seven cases of major depressive disorder or double depression in this sample, it also incorrectly identified as depressed 26 additional individuals who, in fact, were not depressed. The lower specificity and PPV produced by the BDI-II cut

score of 10 make this scale impractical to use as a screen for either major depressive disorder or double depression in a hospital where it is necessary to keep the costs of unwarranted assessments to a minimum. In contrast, the GDS correctly identified all seven individuals who had either major depressive disorder or double depression and incorrectly identified as depressed an additional 10 individuals who would require further assessment.

*Milder depressive disorders.* When it comes to screening for a broader range of depressive disorders than major depressive disorder and double depression, neither the BDI-II nor the GDS does an adequate job of distinguishing depressed from nondepressed individuals. This is not surprising given that the BDI-II was designed to assess the severity of depressive symptoms among individuals diagnosed with major depressive disorder (Beck et al., 1996) and that Yesavage et al. (1983) used, in the development and validation of the GDS, samples of older adults who were either normal or being treated for depression. It appears that neither scale was specifically designed to detect the milder forms of depression such as dysthymic disorder, minor depressive disorder, and partial remission of major depressive disorder. For example, the essential criterion for dysthymic disorder, as defined by the *DSM-IV-TR* is chronically depressed mood that exists for a period of at least 2 years (American Psychiatric Association, 2000). The GDS and BDI-II inquire only about depressive symptoms over a very short duration of one and two weeks, respectively. Therefore, it is recommended that neither the BDI-II nor the GDS be used to screen for these milder forms of depression with this population. More research is needed to determine if there are scales that can accurately screen for a broader and milder range of depressive disorders with post-MI and post-UA/ACS patients.

#### *Predicting Diagnoses of Major Depression*

In addition to BDI-II or GDS total scores, personal and demographic variables (e.g., gender, living alone, social support, the presence of health conditions such as diabetes, prior

stroke, or a previous diagnosis of depression, and behaviours such as smoking) were evaluated for their ability to predict a SCID-I/NP diagnosis of depression in this sample. The present research found that no variables except a previous diagnosis of depression and the BDI-II or GDS total scores predicted a diagnosis of depression for this sample. Because of the low base rate of depression in this sample, these results should be considered preliminary. The personal variables used in the present study were selected because earlier research indicated that cardiac patients had a greater likelihood of being depressed if they were female (Frasure-Smith, et al., 1999; Frasure-Smith et al., 1993; Schleifer et al., 1989), smoked (Carney et al., 1987), were on the blood thinner, warfarin (Frasure-Smith et al., 1993), or they lacked social support (Frasure-Smith et al., 2000b). Also, cardiac patients were more likely to become depressed if they had had a previous diagnosis of depression (Lespérance et al., 1996) or if they had a co-existing illness such as diabetes (Egede, 2005). Similarly, older adults were more likely to be depressed if they had had a stroke (Penninx et al., 1996). The variable “living alone” was included in the data collection although recent research has found that, for older adults, social isolation was a more critical variable in the prediction of depression than simply living alone (Osborn, 2003). Nonetheless, for this sample of post-MI and post-UA/ACS patients, it appears that these particular personal variables (with the exception of having had a previous diagnosis of depression) were not especially salient.

### *Strengths of the Present Study*

There are five major strengths of the present research that distinguish it from previous research conducted with a post-MI sample. First, to my knowledge, the present research is the only study to have examined validity for the BDI-II and GDS with a post-MI sample. Furthermore, Strik et al. (2001) is the only other validation study of depression instruments with a sample of post-MI patients. Strik et al. validated the BDI, the 90-item Symptom Check List,

and the Hospital Anxiety and Depression Scale, using the Structured Clinical Interview for *DSM-IV* as the gold standard.

Second, older adults and women were included in the present research. There were no explicit or implicit age-based restrictions for participation. Gurwitz et al. (1992) observed that studies of the pharmacological treatment of post-MI patients in which age-based exclusions were operative had a significantly smaller percentage of female participants than studies with no such exclusions and the proportion of female participants was significantly related to the study sample's mean age. Furthermore, Gurwitz et al. stated that age-based exclusions were not always explicitly stated and that there could be "tacit criteria" (p. 1420) operative for the exclusion of older patients. Gurwitz et al. noted that for studies in which there were implicit age-based restrictions, the mean age of participants approximated that of participants in similar studies in which there were no explicitly stated age-based restrictions. For the current research, the sample's average age was 62.97 ( $SD = 11.61$ ) years. This finding is similar to the average age ( $M = 63.7$ ) reported by Schleifer et al. (1989) in their study of depression in post-MI patients in which there were no restrictions for participation by older adults and women.

Third, unlike some of the depression research with post-MI patients (e.g., Frasure-Smith et al., 1993; Glassman et al., 2002; Schleifer et al., 1989; Writing Committee for the ENRICHD Investigators, 2003), this study required that the full temporal criterion of 2 weeks (based on the *DSM-IV-TR*) for a diagnosis of major depressive disorder be met. It is important to note that, according to the *DSM-IV-TR*, symptoms of major depressive disorder or minor depressive disorder that do not meet the temporal criterion of 2 weeks are not considered depression. My decision provided a stricter criterion for diagnosis in the present study, relative to others in the literature.

Fourth, in the present study, counterbalancing was implemented, using a digram-balanced design, to control for threats to internal validity caused by order effects. This is critical because always completing the SCID-I/NP first could influence subsequent responses on the depression screening measures and vice versa. For example, if participants were to always complete the SCID-I/NP first, they might be tired and less interested in accurately responding to the self-report questionnaires or, alternatively, their perception of questions on the depression measures might be unduly influenced by their participation in the structured interviews. For the same reasons, it is equally essential to vary the order of presentation among the depression screening measures themselves. In contrast, Strik et al. (2001) administered all of the structured clinical interviews at one month post-MI and asked participants to complete their three depression measures post-interview at home. The structured clinical interview and the depression questionnaires were not counterbalanced with each other and there was nothing to indicate in the Strik et al. study that the depression questionnaires were counterbalanced among themselves either.

Finally, a further strength of this study was the standardized administration of the depression measures and the presence of a researcher who answered questions and clarified instructions for the participants. Standardization of administration is an important element of the present research because the researchers ensured that: (a) participants completed the questionnaires in the same session as the interview (e.g., a delay of 2 weeks could result in a real change in depression symptoms), (b) participants had adequate lighting to read the questions, (c) participants understood instructions for the completion of each depression measure, (d) if it was suspected that participants could not read or their vision was impaired, the depression measures were administered orally, (e) when items on the depression measures seemed to cause hesitation in participants, they were asked if they needed clarification of the questions, and (f) participants

themselves completed the depression measures, without influence from family members or friends. In contrast, in the study by Strik et al. (2001), participants were asked to complete the three self-report depression measures on their own at home following the post-MI interview. Participants were given 2 weeks in which they could return the measures before receiving a reminder by telephone. In the Strik et al. research, for example, there was no protocol in place to ensure: (a) counterbalancing of the structured clinical interview and the self-report questionnaires, (b) completion of the questionnaires by the participants themselves without the influence of others, and (c) completion of the questionnaires before a real change in depressive symptoms could take place.

### *Limitations*

There are five limitations in the present research that I will discuss. First, a major limitation of this study is that there might have been a qualitative difference in the perception of patients between the importance of a study in which recruitment was conducted by physicians or nurses carrying the full weight of the hospital's authority and recruitment conducted by a master's student from UBC. Even though nurses obtained the initial verbal consent of patients, the nurses were frequently overworked and understaffed, and, at times, harried. Understandably, nurses were not always enthusiastic about providing the patient with adequate information about the study. The possible perception by patients that I did not have the full weight of the hospital's authority could have played a role in the higher refusal rate found in this research.

Second, unlike prior research investigating depression with post-MI patients, I asked patients to allow me and a research assistant into their homes to conduct interviews with them. Older adults, particularly older women, might have felt very uneasy about having strangers into their homes. Alternatively, they might have felt overwhelmed at the prospect of having to prepare for visitors (e.g., clean up their home, dress for guests, make coffee or tea) when they

were still recovering. This could also explain the higher refusal rate found in the present research for older adults, especially older women, as patient interviews in previous post-MI research were conducted in hospital (Bush et al., 2001; Frasure-Smith et al., 1993; Schleifer et al., 1989).

Third, a substantial limitation of this study is that all of the information obtained from participants was self-report and involved recall of symptoms over the past two weeks. This is important in that patients' memories may not have been accurate. Furthermore, there was no independent corroboration of reported symptoms.

Fourth, a limitation of this study was that only participants from the Lower Mainland who were within a 50 kilometre drive from my home were included as a result of the time and funding constraints of the study. This geographical restriction had a negative impact on the number of post-MI and post-UA/ACS patients I was able to recruit from each hospital.

Finally, it was unfortunate that I was not able to obtain a larger sample size with an equal number of female participants. There was a relatively small number of acute MI patients from the Lower Mainland admitted weekly to the three hospitals. I recruited and interviewed patients for almost 8 months, from mid-February to the end of September, 2004. It was decided to stop collecting data at that point. Because older patients, especially older female patients, were less likely to participate in this study, the time limitation was an especially important factor in being able to recruit sufficient numbers from these groups. Because of the small number of female relative to male post-MI or post-UA/ACS patients, it is expected that I would have had to collect data for approximately 16 more months to recruit an equal number of female patients. Due to the sample size obtained for women, I was not able to conduct some of the analyses by gender that I would have liked (e.g., criterion-related validity analyses by gender; a detailed gender analysis of items from the depression inventories that initially were not answered, caused difficulty, were

answered in an ambiguous way, or were declined to be answered) and other examples, such as the binary regression analyses, were weakened.

### *Role of Counselling in the Health Field*

While there are numerous depression screening instruments available, some measures might screen better for depressive disorders in this post-MI or UA/ACS population. The current findings contribute to both research and practice by evaluating the degree to which the BDI-II and GDS are effective screening measures for depressive disorders with individuals who have experienced MI or UA/ACS. The present research indicated that, although both the BDI-II and GDS were excellent case-finding screens for major depression or double depression, the BDI-II was less effective than the GDS at distinguishing between true positives and false positives within this sample. The findings contribute to practice in that they will increase physicians', clinicians', and counsellors' awareness of the effectiveness of the GDS as a depression screen for cardiac patients. Moreover, these findings will allow practitioners to use appropriate GDS cut scores when screening for a major depressive disorder or double depression in this population. Furthermore, these findings show that neither the BDI-II nor the GDS are effective screens for the broader or milder forms of depressive disorders. The overall findings might lead to more accurate screening and, thus, timely treatment, including counselling and/or depression medication, for both women and men.

Currently, many hospitals are neither screening for depression nor can they afford to provide the services of a clinical psychologist for all potentially depressed cardiac patients. Understanding the psychological relationship between depression and CHD and developing effective programs for the psychosocial treatment of depressed cardiac patients is no longer within the exclusive domain of clinical psychologists and social workers. Master's students in counselling psychology have conducted research on the psychological aspects of recovery for



cardiac patients who have experienced angioplasty (Postgrad and beyond, n.d.) and coronary artery bypass surgery (e.g., Con et al., 1999). Counselling psychologists (e.g., Drs. Guck and Kavan of Guck et al., 2001) advocate a cognitive-behaviour program of counselling interventions (e.g., relaxation and imagery techniques) in addition to anti-depressant medication for the optimal reduction of cardiac-related depression. There is also a role to play for registered clinical counsellors from accredited Master's level counselling psychology programs. Clinical counsellors who have specialized in the treatment of depression using cognitive-behaviour therapy can provide treatment that is an effective complement to anti-depressant medication not only for depressed cardiac patients but also for other depressed patients in the health field.

### *Future Directions*

I will discuss three directions for future research and/or practice. First, more research is needed to determine if depression precedes or develops subsequent to cardiac events. The research is not clear on this issue, although Carney, Freedland, and Jaffe (1991) found that for 22% of their sample of post-MI patients, major depression preceded the onset of MI by at least 2 weeks. This issue is important because the focus of counselling interventions could differ depending on whether the depression developed because of psychosocial factors present prior to the cardiac event (e.g., marital stress, social isolation, or work-related issues or unemployment) or psychosocial factors arising out of the cardiac event itself. For example, Guck et al. (2001) noted that post-MI patients frequently experience anxiety over resuming activity, especially sexual activity, and both post-MI patients and their families can experience feelings of loss or helplessness. To facilitate such a study, I would recommend that the SCID-I/NP directions be retained for asking participants about whether there was a 2-week period of time within the *past month* in which they experienced the requisite depressive symptoms. Retention of the original

SCID-I/NP direction regarding the duration criterion for depressive symptoms would assist researchers in determining if depression was present prior to the cardiac event.

Second, more research is needed to address the issue of screening for the milder forms of depressive disorders with post-MI and post-UA/ACS patients. This may involve the development of new screening measures with different time periods for assessing symptoms. This is important because research has shown that even the presence of lower levels of depressive symptoms can increase the mortality risk in post-MI patients (Bush et al., 2001).

Finally, once hospital screening for depression in post-MI patients has been initiated, future directions for counsellors and researchers should focus on the development of cost-effective, efficacious group counselling treatment specifically for cardiac patients (based on the cognitive-behaviour model) and on patients' psychological outcomes post-treatment.

## Endnotes

<sup>1</sup> A factor that contributes significantly to variance in the outcome (e.g., the outcome measure of mortality). A factor that has a significant additive effect (Bush et al., 2001).

<sup>2</sup> MI has been more broadly defined in recent literature and falls under the larger umbrella term of acute coronary syndrome (Alpert et al., 2000). Throughout this literature review, I will be making reference to both terms as MI/ACS.

<sup>3</sup> In the literature review, I used the terms acute MI and the broader term ACS to more closely correspond with terms used in previous research investigating depression in cardiac patients after an acute cardiac event. Because some physicians continue to use the broader umbrella term, ACS, to describe patients who present with UA, from this point forward, I shall refer to patients as having either acute MI or UA/ACS.

<sup>4</sup> With elderly medical inpatients, there are no significant differences on depression measures administered orally or in written form (Rapp et al., 1988).

<sup>5</sup> Cohen's  $d$  effect sizes are categorized as follows: large =  $d > 0.8$ , medium =  $0.2 < d < 0.8$ , and small =  $0 < d < 0.2$  (Gravetter & Wallnau, 2005).

<sup>6</sup>  $\Phi$  effect sizes are categorized as follows: large = 0.50, medium = 0.30, small = 0.10, and trivial = less than 0.10 (Gravetter & Wallnau, 2005).

<sup>7</sup> These included diagnosed events or conditions such as MI, unstable angina, acute coronary syndrome, coronary artery disease, valve or by-pass surgery, and angioplasty.

<sup>8</sup> This is the same outlier total score that produced a positive skew in the distribution of BDI-II scores for women, and resulted in me reporting the medians for both men and women earlier in these results under *Gender Differences in Mean Scores for the BDI-II and GDS*.

<sup>9</sup> There were no participants who were on the blood thinner, warfarin, who were diagnosed with any form of depression. Therefore, I did not include the variable, warfarin, in either logistic regression.

<sup>10</sup> Please note that a majority of older adults did answer the “Loss of Interest in Sex” question.

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## Appendix A

## Definitions

*Cardiovascular disease.*

Cardiovascular disease is defined as diseases of the circulatory system, including ischemic heart disease, acute myocardial infarction, stroke, high blood pressure, arrhythmias, valvular heart disease, and peripheral vascular disease (Heart and Stroke Foundation of Canada, 1999).

*Congestive heart failure.*

Congestive heart failure occurs when the heart is unable to maintain sufficient pumping function (Heart and Stroke Foundation of Canada, 1999).

*Coronary artery disease.*

Coronary artery disease is a form of heart disease in which cholesterol deposits, or plaques, occur within a coronary artery arising from the aorta. The blood flow to the heart muscle can be obstructed when the plaques cause a small clot to form. Symptoms of coronary artery disease include angina pectoris (chest pain), acute myocardial infarction, and sudden death (caused by a rhythm disturbance) (MedicineNet.com, n.d.).

*Coronary heart disease (CHD).*

CHD is defined as having angina pectoris (squeezing pain) or a history of myocardial infarction (Penninx et al., 2001).

*Dysthymia (Dysthymic disorder).*

The essential criterion for dysthymic disorder, as defined by the *DSM-IV-TR* is chronically depressed mood that exists for a period of at least 2 years. The depressed mood must be experienced for most of the day more than half of the days during this period. At least two of the following symptoms also must be present during the periods of depressed mood: (a)

inadequate appetite or overeating, (b) hypersomnia or sleeplessness, (c) low self-esteem, (d) low energy or extreme tiredness, (e) poor concentration or indecisiveness, and (f) a feeling of hopelessness. During this period of 2 years, continuous freedom from symptoms must not last longer than 2 months. In addition, there can be no major depressive episodes during this time. The condition is not diagnosed as dysthymic disorder if the individual has ever: met the criteria for cyclothymic disorder; had manic, mixed, or hypomanic episodes, or; experienced the depressive symptoms solely during a chronic psychotic disorder. Dysthymic disorder is not diagnosed if the depressed mood is due to the direct result of drugs or a medical disorder, such as hypothyroidism or Alzheimer's disease. Finally, the depressive symptoms must cause significant impairment or distress in functioning either socially or at work (American Psychiatric Association, 2000).

*Incidence.*

The number of established new events, e.g., persons becoming ill with a particular disease, during a defined period in a given population (Stedman's Medical Dictionary, 1995).

*Ischemic heart disease.*

Any condition in which there is a deficiency or absence of blood supply to the heart muscle, causing it to become damaged or work inefficiently. It is frequently caused by atherosclerosis and includes acute myocardial infarction, angina pectoris, sudden death, and chronic ischemic heart disease (Heart and Stroke Foundation of Canada, 1999).

*Left ventricle.*

The left ventricle is the lower chamber on the left side of the heart. This ventricle receives the arterial blood from the left atrium and drives it into the aorta by contracting its walls (Stedman's Medical Dictionary, 1995).

*Major depressive episode.*

The criteria for a major depressive episode, as defined by the *DSM-IV-TR* include five or more of the following symptoms, present for a 2-week period: (a) depressed mood; (b) loss of pleasure or interest; (c) increase or decrease in appetite or weight; (d) changes in sleep; (e) changes in psychomotor activity; (f) a decrease in energy; (g) feelings of guilt or worthlessness; (h) inability to concentrate, think or make decisions; and (i) recurrent suicidal ideation or thoughts of death, plans or attempts at suicide. Loss of pleasure or interest or depressed mood must comprise at least one of the five or more symptoms. In addition, the depression must cause significant impairment or distress in functioning either socially or at work. The symptoms must not be the direct physiological result of a substance such as a medication or a drug of abuse; or a medical disorder, such as hypothyroidism, and; the symptoms must not be better explained as bereavement. Finally, the symptoms must not meet the criteria for a mixed episode. The *DSM-IV-TR* states that, “when sadness, guilt, insomnia, or weight loss are present in a person with a recent myocardial infarction, each symptom would count toward a Major Depressive Episode because these are not clearly and fully accounted for by the physiological effects of a myocardial infarction” (American Psychiatric Association, 2000, p. 351).

*Minor depressive episode.*

The criteria for a minor depressive episode, as defined by the *DSM-IV-TR* include at least two but not more than four of the following symptoms, present for a 2-week period: (a) depressed mood; (b) loss of pleasure or interest; (c) increase or decrease in appetite or weight; (d) changes in sleep; (e) changes in psychomotor activity; (f) a decrease in energy; (g) feelings of guilt or worthlessness; (h) inability to concentrate, think or make decisions; and (i) recurrent suicidal ideation or thoughts of death, plans or attempts at suicide. Loss of pleasure or interest or depressed mood must comprise at least one of the symptoms. In addition, the depression must

cause clinically significant impairment or distress in functioning either socially or at work. For some individuals, near-normal functioning may be present but it is obtained only through greatly increased effort. In addition, there can never have been a major depressive or mixed episode and criteria are not met for dysthymic disorder (American Psychiatric Association, 2000).

*Mixed episode.*

A mixed episode is defined by the *DSM-IV-TR* as meeting criteria for both a major depressive episode and a manic episode for a period of time comprising at least one week. The symptoms must not be the direct result of any substance, such as drugs of abuse or medication, or a medical condition. In addition, the symptoms must be severe enough that there is significant impairment or distress in functioning either socially or at work, or hospitalization is required, or psychotic features are present (American Psychiatric Association, 2000).

*Myocardial infarction (MI).*

MI is “a manifestation of ischemic heart disease” and is defined as a sudden, severe death of heart muscle tissue caused by the obstruction of blood flow, due to a blood-clot in the coronary arteries (Heart and Stroke Foundation of Canada, 1999, p. 105). MI is commonly known as a heart attack. When the adjective, acute, precedes MI, it refers to a current case (as opposed to a history of MI).

*Negative predictive value (NPV).*

The NPV is the percentage of truly nondepressed individuals out of those identified by the depression scale as nondepressed (Hubley, 2002).

*Odds.*

Odds, or odds ratio, refers to the ratio of the probability of occurrence to the probability of non-occurrence of an event (Stedman’s Medical Dictionary, 1995).

*Positive predictive value (PPV).*

The PPV is the percentage of truly depressed individuals out of those identified by the depression scale as depressed (Hubley, 2002).

*Prevalence.*

The number of cases of a particular disease, present in a certain population, at a specified period of time, or at a specific moment in time (Stedman's Medical Dictionary, 1995).

*Relative risk.*

Relative risk refers to the ratio of the risk of disease among those exposed to a risk factor, to the risk of disease among those not exposed to a risk factor (Stedman's Medical Dictionary, 1995).

*Risk.*

The probability that a specific event will happen (Stedman's Medical Dictionary, 1995).

*Sensitivity.*

Sensitivity is the percentage of depressed individuals in the sample that were accurately identified as depressed by the depression scale when compared to diagnoses rendered by a gold standard such as the SCID-I/NP or DSM-IV-TR (Hubley, 2002).

*Silent myocardial infarction.*

An infarction that is accompanied by none of the typical features and symptoms of MI (Stedman's Medical Dictionary, 1995).

*Specificity.*

Specificity is the percentage of nondepressed individuals in the sample that were accurately identified as nondepressed by the depression scale when compared to diagnoses rendered by a gold standard such as the SCID-I/NP or DSM-IV-TR (Hubley, 2002).

## Appendix B

**Identifying Negative Mood after Cardiac Events**Personal Demographic Form

*Please answer the following demographic questions as accurately as you can. All of the information that you provide on this form will be kept confidential. This information is primarily collected for the purpose of describing the study sample.*

- 1) Birthdate: \_\_\_\_\_ (day) \_\_\_\_\_ (mo.) \_\_\_\_\_ (yr.)
- 2) Gender: \_\_\_\_\_ MALE \_\_\_\_\_ FEMALE
- 3) Education:
  - \_\_\_\_\_ 0 – 8 years schooling
  - \_\_\_\_\_ 9 – 12 years schooling
  - \_\_\_\_\_ 13+ years schooling
- 4) Age: \_\_\_\_\_ YEARS
- 5) Are you currently married/in a common-law relationship? \_\_\_\_\_ YES \_\_\_\_\_ NO
  - a) If no, are you widowed? \_\_\_\_\_ YES \_\_\_\_\_ NO
  - b) If no, are you divorced/separated? \_\_\_\_\_ YES \_\_\_\_\_ NO
- 6) Do you live alone? \_\_\_\_\_ YES \_\_\_\_\_ NO
- 7) What is your primary ethnic/racial/cultural background?
  - \_\_\_\_\_ White (e.g., Caucasian, Anglo, European origin)
  - \_\_\_\_\_ First Nations or Aboriginal
  - \_\_\_\_\_ South Asian/Middle Eastern (e.g., Indian, Arabic)
  - \_\_\_\_\_ Asian (e.g., Chinese, Japanese, Korean)
  - \_\_\_\_\_ Hispanic (e.g., Latino, Mexican, Spanish)
  - \_\_\_\_\_ Other (specify if your primary identity is with a group other than those listed above): \_\_\_\_\_
- 8) Do you currently smoke? \_\_\_\_\_ YES \_\_\_\_\_ NO
  - a) If yes, how long have you smoked? \_\_\_\_\_ years
  - b) If no, have you ever smoked? \_\_\_\_\_ YES \_\_\_\_\_ NO
    - i) If yes, how long did you smoke? \_\_\_\_\_ (years)

ii) If yes, when did you quit? \_\_\_\_\_

- 9) Have you ever been diagnosed as having depression? \_\_\_\_\_ YES \_\_\_\_\_ NO
- 10) Is there a history of depression in your family? \_\_\_\_\_ YES \_\_\_\_\_ NO  
a) If yes, explain: \_\_\_\_\_
- 11) Have you ever been diagnosed as a diabetic? \_\_\_\_\_ YES \_\_\_\_\_ NO  
a) If yes, explain: \_\_\_\_\_
- 12) Has your physician ever told you that you have had a stroke? \_\_\_\_\_ YES \_\_\_\_\_ NO  
a) If yes, explain: \_\_\_\_\_
- 13) Do you have a thyroid disorder? \_\_\_\_\_ YES \_\_\_\_\_ NO  
a) If yes, explain: \_\_\_\_\_
- 14) Have you had a cardiac event or heart condition before your present cardiac event?  
a) If yes, explain: \_\_\_\_\_  
\_\_\_\_\_  
b) If participant mentions either *atrial fibrillation* or *valve surgery*, then ask:  
Are you currently taking the medication coumadin (or warfarin)?  
\_\_\_\_\_ YES \_\_\_\_\_ NO
- 15) Have you had any surgical intervention as a result of this most recent cardiac event?  
\_\_\_\_\_ YES \_\_\_\_\_ NO  
a) If yes, what type of intervention have you had? \_\_\_\_\_  
\_\_\_\_\_
- 16) This next set of questions asks about the amount of social support you feel you have in your life generally. Please circle the response that most closely represents how you feel.
- a) Do you belong to a group (e.g., social, cultural, religious) that makes you feel supported? *Strongly Disagree* *Disagree* *Agree* *Strongly Agree*
- b) Do you feel that you have someone you can confide in, or talk to, about your private feelings or concerns? *Strongly Disagree* *Disagree* *Agree* *Strongly Agree*
- c) Do you feel that you have someone you can really count on to help you out in a crisis situation? *Strongly Disagree* *Disagree* *Agree* *Strongly Agree*