

Université de Montréal

**PRESENCE, SEVERITY, AND COURSE OF PSYCHOLOGICAL DISTRESS IN MEN  
AND WOMEN WITH AND WITHOUT CORONARY ARTERY DISEASE**

Psychological status in patients differs as a function of time, sex, and/or coronary artery  
disease status

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*Ce mémoire intitulé*

**Presence, Severity, and Course of Psychological Distress in Men and Women with and without Coronary Artery Disease**

Psychological status in patients differs as a function of time, sex, and/or coronary artery disease status

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## Résumé

La détresse psychologique est plus fréquente et sévère chez les patients atteints de maladies coronariennes (MC) que chez les individus sains. Nous en savons peu sur l'évolution dans le temps de ces différences et si ces différences s'étendent aux personnes atteintes de maladies non cardiovasculaires (CV). **Objectifs:** Examiner la présence, la sévérité et l'évolution de la détresse psychologique chez les hommes et les femmes atteintes de MC et celles du même âge souffrant de maladies non CV. **Méthodes:** 1294 personnes (61% d'hommes; moyenne =  $60,4 \pm 7,0$  ans) atteintes de MC ou de maladies non CV ont été questionnées sur leur support social, leur degré d'hostilité, de stress, d'anxiété et de dépression au départ de l'étude (T1) ainsi que  $4,8 \pm 0,8$  ans plus tard (T2). Des analyses à mesures répétées mixtes (sexe\*statut MC\*temps), de Chi carré et de McNemar ont été effectuées. **Résultats:** Les femmes atteintes de MC ont rapporté davantage de symptômes dépressifs que les autres participants aux deux évaluations ( $p's < 0,01$ ), et davantage de symptômes d'anxiété et de stress que les autres participants au T1 ( $p's < 0,05$ ). Au T2, le stress perçu demeurait significativement plus élevé chez les femmes atteintes de MC que chez les hommes ( $p's < 0,01$ ), bien que les différences d'anxiété n'étaient plus significatives. Les hommes ont rapporté plus d'hostilité que les femmes ( $p=0,001$ ). Les femmes souffrant de MC se situaient davantage dans la plage clinique de dépression ( $p < 0,001$ ), d'anxiété ( $p=0,001$ ) et de stress ( $p=0,030$ ) au T1, et de dépression ( $p=0,009$ ) et de stress ( $p=0,002$ ) au T2. **Conclusion:** L'intensité, la prévalence, et l'évolution de la détresse des patients diffère en fonction de la mesure examinée, de leur sexe et/ou de leur statut CV. Alors que la détresse psychologique était prédominante chez ces patients atteints de diverses maladies, les femmes atteintes de MC étaient particulièrement et chroniquement vulnérables.

**Mots-clés :** détresse psychologique, maladie coronarienne, symptômes dépressifs, symptômes d'anxiété, symptômes de stress, maladie chronique

## Abstract

Psychological distress is more prevalent and severe among patients with coronary artery disease (CAD) compared to healthy individuals. Little is known regarding its time course, and whether these differences extend to individuals with non-cardiovascular (CV) illnesses. **Objective:** This study examined the presence, severity, and time course of psychological distress in men and women with CAD and those of similarly aged individuals suffering from non-CV conditions. **Methods:** 1294 individuals (61% men; mean<sub>age</sub> = 60.4 ± 7.0 years) with stable CAD or non-CV illnesses reported on social support, hostility, stress, anxiety and depression at baseline as well as 4.8 ± 0.8 years later. Analyses involved mixed (Sex\*CAD status\*Time) repeated measures analyses (controlling for relevant covariates), as well as Chi-square and McNemar analyses. **Results:** Women with CAD reported more symptoms of depression compared to other participants at both evaluations (p's<0.01), and reported more symptoms of anxiety and stress compared to others at T1 (p's <0.05). At T2, perceived stress remained significantly greater among women with CAD compared to men (p's<0.01), though differences in anxiety were no longer significant. Men reported more hostility than women (p=0.001). CAD women fell within the clinical range for depression (p<0.001), anxiety (p=0.001), and stress (p=0.030) more frequently compared to others at T1, and for depression (p=0.009) and stress (p=0.002) at T2. **Conclusions:** The evolution of patient distress differed as a function of the measure examined, their sex, and/or CV status. While psychological distress was prevalent among these patients with diverse health conditions, women with CAD were particularly and chronically vulnerable.

*Keywords:* psychological distress, coronary artery disease, depressive symptoms, anxiety symptoms, stress symptoms, chronic illness

## Table of Contents

Résumé .....	i
Abstract.....	iii
Table of Contents .....	iv
List of Tables .....	vi
List of Figures.....	vii
List of Acronyms .....	viii
List of Abbreviations .....	ix
Acknowledgements .....	x
Introduction .....	1
Coronary Artery Disease .....	1
Psychological Co-Morbidity with Coronary Artery Disease .....	5
Trajectory of Psychological Distress in CAD Patients Over Time .....	13
Sex/Gender Differences in Distress among CAD Patients.....	15
Limitations of Previous Investigations .....	18
Objectives and Hypotheses.....	21
Article .....	23

Discussion.....	84
Are Women with CAD Particularly Vulnerable?.....	87
Importance of the Results.....	91
Clinical Implications .....	96
Limitations of the Study .....	99
Strengths of the Study .....	101
Future Directions .....	103
Conclusion.....	113
References .....	115

## **List of Tables**

### **Article**

**Table 1:** Participant characteristics

**Table 2:** Mean psychological distress scores

**Table 3:** Individuals meeting clinically significant cut-offs for each psychological variable

### **Article Supplemental Material**

**Supplemental Table 4:** Mean scores on the individual depression subscales

**Supplemental Table 5:** Mean Perceived Stress Questionnaire (PSQ) subscale scores



## List of Figures

### Article

**Figure 1:** Mean depression score among men and women with and without coronary artery disease (CAD) averaged over time (controlling for covariates).

## List of Acronyms

### In French

CV : Cardiovasculaires  
MC : Maladies coronariennes

### In English

BDI: Beck Depression Inventory  
BMI: Body Mass Index  
CABG: Coronary artery bypass graft  
CAD: Coronary artery disease  
CBT: Cognitive behavioral therapy  
CES-D: Center for Epidemiological Studies-Depression Scale  
CIDI: Composite International Diagnostic Interview  
CMHo: Cook-Medley Hostility Questionnaire  
CVD: Cardiovascular disease  
CQ: Cynicism Questionnaire  
ESSI: Enhancing Recovery in Coronary Heart Disease (ENRICH) Social Support Instrument  
GMDS: Gotland Male Depression Scale  
HADS: Hospital Anxiety and Depression Scale-Anxiety  
LVEF: Left ventricular ejection fraction  
MAACL: Multiple Affect Adjective Checklist  
MDRS: Male Depression Risk Scale  
MHI: Montreal Heart Institute  
MI: Myocardial infarction  
M.I.N.I: Mini International Neuropsychiatric Interview  
PCI: Percutaneous coronary intervention  
PSS: Perceived Stress Scale  
PSQ: Perceived Stress Questionnaire  
STAI: Spielberger State-Trait Anxiety Inventory  
STAXI: Spielberger State-Trait Anger Expression Inventory

## **List of Abbreviations**

e.g.: for example

i.e.: that is

SD: Standard Deviation

T1: Time 1

T2: Time 2

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## **Introduction**

The implications of psychological distress as a risk factor for the development and progression of physical illness, including coronary artery disease, has been well established. In addition, psychological distress has been found to be more prevalent and severe in patients with coronary artery disease (CAD) compared to healthy individuals. Whether CAD patients also differ from individuals with non-cardiovascular (CV) illnesses has received less attention. While the course of depressive symptoms appears to vary across time in individuals with CAD, little is known regarding the course of other psychological distress variables. Furthermore, there is a lack of information on whether men and women with or without CAD differ in the course of psychological distress. This master's thesis will examine the prevalence, severity and course of psychological morbidity of men and women with CAD and similarly aged counterparts suffering from a non-CVD illness over a five-year period.

After detailing the prevalence and clinical portrait of CAD, the introduction examines the experience of depression, anxiety, stress, hostility, and social support among individuals suffering from CAD. Comparisons with individuals not suffering from cardiovascular diseases are made where indicated. Existing literature on the time course of psychological distress in CAD patients and sex/gender differences in distress among CAD patients will follow. Finally, limitations of previous investigations and the objectives and hypotheses of the present study will be presented.

### **Coronary Artery Disease**

Cardiovascular disease (CVD) is a leading cause of disability and mortality worldwide (Roth et al., 2017) and is the second leading cause of mortality among the Canadian population

(Public Health Agency of Canada, 2018). Coronary artery disease (CAD) is the most common cardiovascular disease in Canada and is responsible for approximately half of the deaths due to circulatory system diseases in Canada (Statistics Canada, 2019), as well as approximately 13% of overall mortality in Canada (Statistics Canada, 2013) and abroad (Finegold, Asaria, & Francis, 2013). CAD results from atherosclerosis of the coronary arteries, i.e. the hardening and narrowing of the arteries supplying the heart muscle as a result of build-up of cholesterol and plaque on the inner walls (Hansson, 2005; Martin, 2015). In more advanced stages, this can result in insufficient transport of oxygenated blood to the heart (Hansson, 2005), which can trigger myocardial infarction (heart attack), angina pectoris (chest pain), and ischemic heart failure (Vos et al., 2015). Mortality rates for heart disease have decreased by 23% in Canada from 2000-2013 (Public Health Agency of Canada, 2018), as a result of improved prevention and treatment of CVDs in industrialized countries. Nonetheless, CAD remains prevalent (e.g., 8.1% in Canada (Public Health Agency of Canada, 2018)) and now follows a chronic course for many patients (Robitaille, Dai, & Waters, 2014).

Risk factors for CAD include non-modifiable and modifiable variables such as older age, male sex, a family history of CAD, a sedentary lifestyle, smoking, hypertension, hypercholesterolemia, obesity, and diabetes (Kronmal et al., 2007; Perk et al., 2012). While men have twice the risk of suffering a myocardial infarction and being diagnosed with heart disease a decade earlier than women (Public Health Agency of Canada, 2018), CAD and CVDs more generally remain among the leading killers in women as well. Moreover, women are more likely to die from CAD compared to men (Pathak, Shirodkar, Ruparelia, & Rajebahadur, 2017). Indeed, women are often diagnosed later in the disease trajectory compared to men, when they are older, and their disease is more severe or complicated by other co-morbidities (Bergeison &

Tommaso, 1995; Khan et al., 1990; Loop et al., 1983; Pathak et al., 2017; Penckofer & Holm, 1990; Weaver et al., 1996).

Psychological variables, including symptoms of depression, anxiety, perceived stress, hostility/anger and low social support, as risk factors for CAD have also gained significant support over the years (Charlson, Stapelberg, Baxter, & Whiteford, 2011; Chida & Steptoe, 2009; Gan et al., 2014; Kohli et al., 2014; Perk et al., 2012; Roest, Martens, de Jonge, & Denollet, 2010; Steptoe & Kivimäki, 2013; Suls, 2018; Whalley, Thompson, & Taylor, 2014). For example, diagnoses or symptoms of depression have been shown to increase risk for CAD and MI by 50-170% (for review, refer to Frasure-Smith & Lespérance, 2010). Anxiety has similarly been shown to increase risk for CAD by 26% (for a meta-analysis, refer to Roest et al., 2010), while hostility/anger has been shown to increase risk of CAD events in initially healthy individuals by 19% (for a meta-analysis, refer to Chida & Steptoe, 2009). For its part, psychosocial stress has been identified as an important risk factor for CAD incidence (Belkic, Landsbergis, Schnall, & Baker, 2004; Dragano et al., 2017; Ferrario, Veronesi, Bertù, Grassi, & Cesana, 2017; Kivimäki et al., 2006; Kivimäki et al., 2012; Steptoe & Kivimäki, 2012). According to reviews, stress involving social isolation and/or chronic stress within work or personal life, has been associated with a 40-60% increased risk of CAD morbidity among healthy individuals (Steptoe et al., 2012, 2013). Low social support has similarly been identified as an influential factor in the incidence of CAD among prospective studies with initially healthy study populations (for a meta-analysis, refer to Barth, Schneider, & Von Känel, 2010; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016). Generally, no significant sex differences have been reported in the influence of psychological distress for the development of CAD (Roest et al.,

2010; Valtorta et al., 2016; Yusuf et al., 2004), with the exception of anger and hostility which may pose a greater risk for CAD events in men than women (Chida & Steptoe, 2009).

The personal and societal costs of CAD are enormous. This disease represents a major economic burden for the health care system (Patra et al., 2007), with the overall annual costs for CAD estimated to increase from 11 billion in 2005 to more than 17 billion by 2020 (Thériault, Stonebridge, & Browarski, 2010). Although direct medical expenses are significant, the majority of these costs reflect those incurred as a result of short- and long-term disability associated with CAD (Robitaille et al., 2014).

Living with CAD and the possibility of experiencing an acute cardiac event or death can be highly challenging and distressing (Pragle & Salahshor, 2018). The fear of living with a life-threatening condition can alter individuals' perspective of themselves, increasing feelings of vulnerability, helplessness, as well as fear and uncertainty about the future (Barnason, Zimmerman, Nieveen, Schulz, & Young et al., 2012; Marino et al., 2009; Peterson et al., 2010). In light of the various difficulties and significant impairments in physical and psychosocial functioning related to their condition (physical symptoms, potential loss of independence, interpersonal challenges, self-management of the illness, including demanding lifestyle changes (Ahto et al., 1998; Barnason et al., 2012; Britton, Brunner, Kivimaki, & Shipley, 2011; Janssen, Gucht, Dusseldorp, & Maes, 2013; Mosack & Steinke, 2009; Najafi Ghezeljeh, Yadavar Nikravesh, & Emami, 2014; Neill et al., 1985; Oldridge & Stump, 2004; Peterson et al., 2010; Price, 2004; Randall, Molloy, & Steptoe, 2009; Stewart, Davidson, Meade, Hirth, & Makrides, 2000), it may not be surprising that elevated levels of distress have been reported among CAD patients.



## **Psychological Co-Morbidity with Coronary Artery Disease**

### ***Depression***

Depression is a negative affective state that can range from feelings of sadness to a mood disorder associated with affective (sadness, irritability), cognitive (concentration problems, guilt, hopelessness, low self-worth, loss of the ability to take pleasure in daily activities), and somatic (loss of energy, sleep changes, fatigue, altered appetite, unexplained pain) symptoms that impact the extent to which one can perform psychological, physical, and social tasks and roles (American Psychiatric, 2013; VandenBos & American Psychological, 2015). Depression, either as symptom complex or disorder, has been most frequently examined in individuals with CAD compared to other psychological variables (Damen et al., 2015; Meijer et al., 2013; Tully & Higgins, 2014; Tully et al., 2015; Wardenaar, Wanders, Roest, Meijer, & De Jonge, 2015).

Up to one in five patients with stable CAD (defined broadly as presence of angina, post-myocardial infarction (MI) and/or coronary artery bypass graft (CABG)) have been reported to meet clinical criteria for major depression using structured diagnostic interviews (Carney & Freedland, 2017; Sin, Kumar, Gehi, & Whooley, 2016; Steptoe et al., 2013; Tully & Higgins, 2014), with up to 25% more reporting significant symptoms of depression (Steptoe et al., 2013). A study by Bankier and colleagues (Bankier, Januzzi, & Littman, 2004) in 100 outpatients with CAD diagnosed a mean of 1.7 psychiatric disorders per patient, using the Structured Clinical Interview for the DSM-IV (APA, 2000), with current dysthymic disorder (15%), and recurrent major depressive disorder with current major depressive episode (31%) as the most prevalent psychiatric comorbidities. In a recent cross-sectional study among 255 outpatients with CAD (70.2% male, mean age= 58.95 ± 11.03 years), 45% were found to meet the DSM-IV criteria for depression (Al-Abbudi, Lami, & Wady, 2018). A relatively high prevalence of severe

depression (14.40%) was also reported in a recent retrospective study in 514 German patients using the Mini International Neuropsychiatric Interview (M.I.N.I.) the year after the onset of CAD (Schaich et al., 2018). In 80.6% of these patients, the onset of severe depression first manifested after their CAD diagnosis or event. In contrast to these CAD patients, the 12-month prevalence of major depressive disorder according to the DEGS Composite International Diagnostic Interview (M-CIDI) among the elderly German population was 7.7% (4.8% in men, 10.6% in women) (Wittchen, Jakobi, Klose, & Ryl, 2010). In the 2012 Canadian Community Health Survey, a 12-month prevalence of 4.7% of depression was self-reported by Canadians ( $\geq 14$  years of age) (Pearson, Janz, & Ali, 2013).

CAD patients frequently score within the clinical range for depression on questionnaires (Pogosova et al., 2017; Presciutti et al., 2018). For example, Pogosova and colleagues (2017) recently reported a 22.4% prevalence of clinically significant symptoms of depression (Hospital Anxiety and Depression Scale-Anxiety (HADS)  $\geq 8$ ) among 7,589 patients with CAD recruited from 24 European countries a median of 1.4 years after hospitalization due to CAD events. An American national health survey of 30 801 adults reported a 12-month prevalence of major depression using the *International Diagnostic Interview Short Form (CIDI-SF)* in 9.3% of those with self-reported CAD as compared to 4.8% in adults without chronic illness (Egede, 2007). Furthermore, CAD patients generally score higher on questionnaires of depression as compared to population norms (for e.g., (Boutin-Foster, 2008; Rutledge et al., 2016; Shen & Gau, 2017; Wardenaar et al., 2015).

In sum, a high prevalence of depression and depressive symptoms have been reported in patients with stable CAD, whether assessed through structured clinical interview or self-report

questionnaire. Both the prevalence of depressive disorders and the level of depressive symptoms have been reported to be greater than among population norms.

### ***Anxiety***

Anxiety, for its part, is a feeling of apprehension, characterized by “somatic symptoms of tension” and intrusive worried thoughts (Davey, 2010; VandenBos et al., 2015). Anxiety is similarly prevalent among individuals with CAD (Damen et al., 2015; Moser et al., 2010; Tully, Cosh, & Baumeister, 2014; Tully & Higgins, 2014; Versteeg et al., 2013; Wardenaar et al., 2015). A meta-analysis of 43 studies (N=7,973), including longitudinal, cohort and cross-sectional studies, reported a 15.52% prevalence of an anxiety disorder (panic disorder, agoraphobia, generalized anxiety disorder, social phobia, obsessive-compulsive disorder, specific phobia) diagnosed using structured clinical interviews among patients with CAD (Tully et al., 2014). In the retrospective study by Schaich and colleagues (Schaich et al., 2018) mentioned previously, a higher prevalence of anxiety disorders was found after CAD onset, notably agoraphobia (12.1%) and panic disorder (2.9%). Moreover, in 158 patients undergoing CABG (20.9% female), generalized anxiety disorder and panic disorder (according to the M.I.N.I.) were most prevalent, and found in 10% and 11% of individuals, respectively (Tully et al., 2015). While similar to the Canadian lifetime prevalence for generalized anxiety disorder (8.7%), it contrasts with that for panic disorder (3.7%) (*Canadian Community Health Survey [2002]*, 2002; Pearson et al., 2013).

Self-report questionnaires have led to a similar high prevalence of anxiety in patients with CAD (Almeida et al., 2012; Bunevicius et al., 2013; Moser et al., 2010; Pogosova et al., 2017; Sunbul et al., 2013). For example, in the large European investigation by Pogosova and colleagues (2017) mentioned previously, 26.3% of CAD patients reported clinically significant

symptoms of anxiety (score  $\geq 8$  on the HADS). CAD patients generally score higher on questionnaires of anxiety as compared to population norms or community samples (Bunevicius et al., 2013; Moser et al., 2010). For example, 37% of patients who underwent CABG and 42% of post-MI patients 60 years of age or older reported high levels of anxiety (score  $\geq 7$  on the Multiple Affect Adjective Checklist; MAACL) as compared to 17% in community-dwelling aged-matched counterparts with no cognitive impairments or CVD (Moser et al., 2010). Among 523 patients undergoing cardiac rehabilitation (mean age =  $57.5 \pm 9.2$  years), CAD patients had a mean score of 44 on the State-Trait Anxiety Inventory (STAI), with 47% scoring above a clinical cut-off of 45 (Bunevicius et al., 2013), higher than normative scores for men (34.40, SD 8.57) and women (36.70, SD 8.86) aged 50-59 (Knight, Waal-Manning, & Spears, 1983).

In brief, both symptoms of anxiety and anxiety disorders are highly prevalent among individuals with CAD, and generally greater than in population norms.

### ***Hostility***

Hostility is a construct that involves animosity or antagonism, which presents itself through affective (e.g. anger), cognitive (e.g. attitudes including cynicism, mistrust or denigration of others) and/or behavioural aspects (e.g. aggression) (Everson-Rose, Clark, & Henderson, 2013; Miller, Smith, Turner, Guijarro, & Hallet, 1996; VandenBos et al., 2015). High levels of cynical hostility and anger expression, and/or lower anger control have been reported among CAD patients (Tindle et al., 2009; van Montfort, Denollet, Vermunt, Widdershoven, & Kupper, 2017; Wong, Na, Regan, & Whooley, 2013). For instance, van Montfort and colleagues (van Montfort et al., 2017) found high levels of hostility in 19% of patients with CAD (N=681, age =  $64.9 \pm 10.6$ ; 80% men) using the European Society of Cardiology psychosocial screening interview (measured with two questions: “Do you frequently

feel angry over little things?” and “Do you often feel annoyed about other people's habits?”). Similar prevalence rates of high cynical hostility have been found among outpatients with CAD in studies assessing hostility with the Cynicism subscale of the Cook-Medley Hostility questionnaire (CMHo; Cook & Medley, 1954) (Tindle et al., 2009; Wong et al., 2013).

Hostility levels are generally higher among CAD patients compared to “healthy” controls (Izawa et al., 2011; Moser et al., 2010), though inconsistent results have been obtained (Meesters & Smulders, 1994). For example, an investigation found that CAD patients (60 years of age or older) reported higher levels of hostility compared to healthy aged-matched counterparts without CVD (62% vs. 34%; Multiple Affect Adjective Checklist (MAACL)  $\geq 7$ ) (Moser et al., 2010). Greater anger expression and lower anger control (Spielberger State-Trait Anger Expression Inventory (STAXI)) were found among CAD patients (N=302) compared to “healthy” controls (N=221) evaluated for suspected CAD but with less than 50% coronary stenosis (Schmidt et al., 2013). Lastly, in a population study among male adults aged 25-64, the presence of high levels of hostility (WHO MONICA-psychosocial questionnaire) was 2.71 times (1.63-4.52;  $p < 0.05$ ) more likely in patients with CAD compared to the general population (Akimova et al., 2017).

Therefore, high levels of hostility and anger expression have been reported among individuals with CAD, with generally higher levels among CAD patients compared to counterparts without CVD.

### ***Stress***

Stress is a complex construct that usually refers either to the perception of threat (demanding conditions exceeding an individual's resources or stressor) or to the psychological,

behavioural, and/or physiological responses that individuals have in response to stressors (Lazarus, 1966; VandenBos et al., 2015). Though most of the literature has looked at the impact of stress on CAD incidence and future morbidity and mortality (Bagheri et al., 2016; Ferrario et al., 2017; Kivimäki et al., 2012; Shah & Vaccarino, 2016; Steptoe et al., 2012), psychological stress is another common complaint among patients with CAD (Arnold, Smolderen, Buchanan, Li, & Spertus, 2012; Bagheri et al., 2016; Drory, Kravetz, Hirschberger, & Israel Study Group on First Acute Myocardial Infarction, 2003; Drory, Kravetz, Hirschberger, 2002). While 72% of employed hospitalized patients reported stress related symptoms (Lipp's Stress Symptom Inventory) following an acute myocardial infarction in one investigation (Lucinda et al., 2015), most other studies reported somewhat lower incidence levels of stress in CAD patients. For example, a study among 4,202 MI patients (67% male) reported a 24% prevalence of moderate stress and 14% high stress, on the 4-item Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) (Arnold et al., 2012). In contrast, a recent Canadian population survey (Statistics Canada, 2014), reported high levels of daily stress in 22.3% of men and 23.7% of women.

A recent study examined to what extent patients with significant CAD ( $\geq 70\%$  occlusion of 1 or more coronary arteries upon coronary angiography) differed from patients without any significant narrowing ( $< 10\%$  occlusion) of the coronary arteries in terms of experience of stressful life events (Bagheri et al., 2016). Patients with significant CAD reported more stressful life events (scores of 160.3 vs. 139.8 on the Holmes Rahe Life Stress Inventory (Holmes & Rahe, 1967)) in the past year relative to patients without any significant narrowing of the coronary arteries (Bagheri et al., 2016).

In sum, although there is considerable evidence demonstrating a higher risk of incident CAD among healthy individuals with high stress (Kivimäki et al., 2012; Li, Zhang, Loerbroks, Angerer, & Siegrist, 2015; Shah & Vaccarino, 2016), there is limited and inconsistent comparative data on levels of stress post-CAD diagnosis.

### ***Social Support***

A final construct of interest to the current master's thesis is social support. It refers to various types of assistance received by others in order to manage stressors; this can include an individual's tangible or perceived availability of emotional (empathy and caring, such as someone to talk to about how you are feeling), instrumental (practical help, such as financial, cooking, transportation) or informational support (advice and suggestions, such as recommendations from a medical provider or someone who is living with the same disease) (Davey, 2010; VandenBos et al., 2015). Depending on the study, it has been assessed as a function of self-reported quality, availability, and/or satisfaction with social support, or size and frequency of contact with one's social network. It reflects an important construct as it can become an important psychosocial stressor or buffer, depending on whether it is found to be lacking/deficient or satisfactory by individuals (Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003; Uchino, 2006). For example, high levels of perceived social support have been associated with lower levels of anxiety and depression in patients with CAD (Frasure-Smith et al., 2000; Leifheit-Limson et al., 2010; Muhammad et al., 2014; Murphy et al., 2014). Moreover, a cognitive-behavioural intervention that sought to improve social support in post-MI patients was found to improve symptoms of depression (Berkman et al., 2003).

According to a Canadian Survey, social support is largely available in the general population in differing degrees based on sex and type of support: tangible support (70% men,

65% women), affective support (72% men, 77% women), social interaction (70% men, 71% women), emotional/informational support (59% men, 65% women) (*National Population Health Survey, 1998-1999: household component Health Reports 2000*).

The evaluation of social support among CAD patients, however, has produced mixed results. Kähkönen et al. (Kähkönen, Kankkunen, Miettinen, Lamidi, & Saaranen, 2017), found that a majority of their 416 patients with CAD reported high emotional (95.2%) and functional support (84.9%) from their social network (Social Support of People with Coronary Heart Disease self-report questionnaire). Along similar lines, only about 12% of 1,951 patients reported low perceived social support following the first month of recovery after an acute MI on the Enhancing Recovery in Coronary Heart Disease (ENRICHD) Social Support Instrument (ESSI) (2 items or more  $\leq 3$  and total score  $\leq 18$ ) (Leifheit-Limson et al., 2012). However, another study using the same questionnaire 1-month post acute MI found a somewhat higher prevalence of low perceived social support (26%) (Berkman et al., 2003). In contrast, in a small qualitative study of mostly male survivors of MI and their spouses, only half of the participants described receiving emotional support (50%), informational support (43%), and merely 11% described receiving instrumental support from their social network or health care providers (Stewart et al., 2000).

Thus, while the levels of social support may be a determining factor for distress in CAD patients, the perceived quality of support in this patient population is unclear due to limited investigations.



## **Trajectory of Psychological Distress in CAD Patients Over Time**

In sum, data to date suggests that individuals with CAD experience significant distress. The extent to which this level of distress remains stable over time has received relatively little attention, with the exception perhaps of depression (Contrada, Boulifard, Idler, Krause, & Labouvie, 2006; Jovanova et al., 2016; Kroemeke, 2016; Murphy et al., 2008b; Olsen, Schirmer, Wilsgaard, Bønaa, & Hanssen, 2018; Palacios, Khondoker, Mann, Tylee, & Hotopf, 2018; Polsky et al., 2005; Rothenbacher et al., 2015; Ruo et al., 2006; Tully & Higgins, 2014).

Rothenbacher and colleagues (2015) recruited 996 patients aged 30–70 years with stable CAD at two cardiac rehabilitation clinics within three months of their CAD event (first cardiac event or coronary artery revascularization) and evaluated the symptoms of depression using the HADS at baseline and then again one year later. A total of 13.5% of the sample scored within the high range of the HADS at baseline; 62.7% of whom maintained elevated scores at follow-up. Moreover, 10.3% of the sample that had originally reported few depressive symptoms showed clinically significant symptoms at follow-up. Consistent elevations in symptoms of depression have been found in men and women followed for up to 11 years (Jovanova et al., 2016; Polsky et al., 2005). On the other hand, a recent study found greater symptoms of depression (HADS) among 775 older patients undergoing first-time percutaneous coronary intervention (PCI), which decreased over a three-year follow-up (Olsen et al., 2018). In 803 CAD patients recruited from primary care and having completed the HADS questionnaire every 6 months over a three-year period, it was found that the course of distress in CAD patients is chronic yet uneven, with 2% indicating initially high levels of depression at the study entry only, 8% reporting increasing symptoms over time, 7% reporting chronically high symptoms over time and 14% showing fluctuating symptoms over time (Palacios et al., 2018). Nonetheless,

higher levels of depression at first evaluation was shown to increase the risk of depression at follow-up in separate research (Murphy et al., 2008a; Murphy et al., 2008b).

Henneke Versteeg and colleagues (2015), for their part, evaluated anxiety with the STAI questionnaire amongst 486 patients (20% female) during the 18 months following hospitalization for an MI. The course of anxiety was stable in most patients; being chronically high in 17% of patients (STAI score= 50.7–53.1, across the study period), and steadily low among patients reporting lower levels of anxiety (STAI score= 29.8–35.9 across the study period) across all assessment times (Versteeg, Roest, & Denollet, 2015). Similarly, persistent symptoms over 6-months were reported in the cardiac patients (following an acute MI, acute cardiac event, PCI, or CABG) with anxiety symptoms at hospitalization (Murphy et al., 2014). In contrast, in the large prospective study of patients undergoing first-time PCI mentioned above (Olsen et al., 2018), symptoms of anxiety (HADS), like depression, were found to decrease over the 3-yr follow-up.

Finally, in the only study to our knowledge that examined the course of stress in CAD patients, the level of perceived stress measured by the 14-item Perceived Stress Scale (PSS-14) among 2,358 women and 1,151 men (mean age 47) has been shown to decrease among patients from first assessment at initial hospitalization for MI to one-year post-MI (Xu et al., 2017).

No data regarding the course of hostility and social support in patients with CAD was found.

In sum, individuals with CAD experience significant distress as exhibited by high levels of depression, anxiety, stress, hostility, levels that are generally greater than that found in the general population or healthy controls. Remarkably less research has examined whether this distress remains elevated across time, with the exception perhaps of depression, and to a much

lesser extent anxiety. Data to date suggests a chronic course of these symptoms in many patients, though variations have also been reported. Data regarding changes in hostility, perceived social support and stress are lacking or extremely limited.

### **Sex/Gender Differences in Distress among CAD Patients**

Whether individual differences such as sex/gender influence psychological distress or its evolution over time in patients with CAD is important to consider. As is the case in most epidemiological studies, the prevalence of psychological symptoms or disorders involving depression, stress and anxiety, is generally greater and more severe among women than men in CAD populations (Al-Abbudi et al., 2018; Balog et al., 2003; Consedine, Magai, & Chin, 2004; Doyle et al., 2015; Olsen et al., 2018; Pająk et al., 2013; Schaich et al., 2018; St-Jean, D'Antono, & Dupuis, 2005; Vaccarino et al., 2003). A meta-analysis by Shanmugasegaram and colleagues (Shanmugasegaram, Russell, Kovacs, Stewart, & Grace, 2012) indicated a two-time higher rate of major depression in women with CAD compared to men with CAD. Likewise, recent data suggest that women reported feeling sad or depressed approximately two-times more frequently as compared to men (19.2% vs. 10.1%) in a cross-sectional study of 15,828 patients with stable CAD (19% women) (Guimaraes et al., 2017). Similar findings were reported in two cross-sectional studies that collected data in several European countries among CAD patients (Pająk et al., 2013; Pogosova et al., 2017). For example, Pająk and colleagues (2013) found depressive symptoms in 8.2 to 35.7% of men and in 10.3 to 62.5% of women, while symptoms of anxiety were found in 21.5 to 63.7% women compared to 12.0 to 41.8% of men, in their study of 8,580 patients with CAD across 22 European countries. Similarly, Pogosova and colleagues (2017) found that the prevalence of significant symptoms of depression and anxiety on the HADS was

also higher among women (30.6% and 39.4%, respectively) than men (19.8% and 22.1%, respectively) among 7,589 patients with CAD examined a median of 1.4 years after hospitalisation due to CAD events and recruited from 24 European countries.

Concerning stress, 21.2% of the 2,967 female patients with CAD reported feeling stressed frequently, compared to only 9.8% of the 12,861 male patients with CAD in a large sample of 15,828 individuals (Guimaraes, 2017). While levels of hostility are generally higher in men compared to women (Barefoot et al., 1991; Engebretson & Matthews, 1992; Knox et al., 1998; Scherwitz, Perkins, Chesney, & Hughes, 1991; Montfort et al., 2017), some evidence suggests there may not be a sex difference in hostility levels among older adults (74 years, SD = 6.0) compared to young and middle-aged adults (Consedine et al., 2004; D'Antono, Moskowitz, & Nigam, 2013).

Social support was found to be lower among men with CAD in comparison to women with CAD in one study (Knox et al., 1998), but the opposite was reported in a review article in patients 1 year post-MI (Kristofferzon, Löfmark, & Carlsson, 2003). A recent investigation found that lower levels of social support, and higher levels of symptoms of stress and depression were more prevalent among 520 cardiovascular patients (which included acute MI, arterial fibrillation and heart failure) that were older, female and unmarried (Dupre et al., 2017).

Whether sex differences influence the course of psychological distress in patients with CAD is important but has received relatively little attention. In studies assessing the course of depression in only one sex, symptoms remained high in both samples of women (Ruo et al., 2006; Murphy et al., 2008b) and men (Jovanova et al., 2016). No significant sex differences were found in the course of depressive symptoms post-CABG or following other cardiac events/procedures in two studies that specifically examined this question (Murphy et al., 2008a;

Murphy et al., 2014).

However, findings for symptoms of anxiety are mixed (Murphy et al., 2008a; Murphy et al., 2014; Olsen et al., 2018; Palacios et al., 2018). In comparison to two studies that found no sex differences in the course of anxiety among cardiac patients following a cardiac event or procedure (Murphy et al., 2008a; Murphy et al., 2014), Palacios et al (Palacios et al., 2018) and Olsen et al. (Olsen et al., 2018) reported that women were more likely to have chronically high, worsening or fluctuating anxiety compared to men.

Although the level of perceived stress was reported to be higher in female patients from first assessment at initial hospitalization for MI to one-year post-MI, the course and rate of decreasing symptoms of perceived stress did not differ between men and women (Xu et al., 2017). Data on sex differences in the course of hostility and social support in patients with CAD is missing.

In sum, the prevalence of psychological symptoms or disorders involving depression, stress and anxiety, is generally greater and more severe among women than men in CAD populations. Research on sex differences in the levels of hostility and social support among patients with CAD is scarce and it is unclear whether sex differences are present.

Whether sex influences the course of psychological distress in patients with CAD has received relatively little attention and has not been studied for hostility and social support. Data to date suggests no sex difference in the course of symptoms of depression in CAD patients. Among the few studies that have examined anxiety and stress longitudinally after CAD diagnosis, data is mixed.

## **Limitations of Previous Investigations**

The previous investigations have certain lacunae that require our attention. Indeed, most investigations have assessed the impact of psychological factors on the development or prognosis of CAD. Of those studies in patients with established CAD, distress was typically examined only once. This is a major limitation. A one-time assessment makes it difficult to evaluate the extent to which these symptoms are acute and reactive to the current health or life situation of individuals, and potentially requiring only minimal psychosocial support, or whether the symptoms are more enduring and functionally limiting, and thus requiring more clinical attention. Significant psychological distress among patients with CAD can impact the course of cardiac recovery and adherence to treatment recommendations (Cohen, Edmondson, & Kronish, 2015; Staniute, Brozaitiene, & Bunevicius, 2013; Wang et al., 2007). This may be all the more true among individuals whose distress remains chronic or increases, but this has not been examined to any great extent. Given the increasing number of patients who are now living longer with this disease, it is imperative to better understand not only the prevalence but also the time course of their distress. Only then can we better assess the extent to which current medical treatment is adequately addressing the psychosocial needs of patients. Therefore, measuring distress at several time points would provide better estimates of distress within this population including its stability. Most studies that have included two or more time points for the evaluation of distress have also been limited as they have done so over relatively short periods of time (months to 1.5 years). However, as patients with CAD can live with this disease over decades, other relevant psychosocial, economic, and health challenges may also occur and impact psychological health over this extended period of time. Thus, our longer follow-up period (of approximately 5 years) is an additional strength to our study.

Expenditures caused by CAD are further increased among those with comorbid psychological distress, in whom delayed return to work (Haschke, Hutter, & Baumeister, 2012) and increased healthcare utilization (Baumeister, Haschke, Munzinger, Hutter, & Tully, 2015; Finegold et al., 2013; Menzin, Wygant, Hauch, Jackel, & Friedman, 2008) may be observed. Moreover, given research showing increased risk for future morbidity and mortality in CAD patients experiencing depression (Carney & Freedland, 2017; Lichtman et al., 2014; Suls, 2018; Tully & Higgins, 2014; Wu & Kling, 2016), anger/hostility (Chida & Steptoe, 2009; Mostofsky, Penner, & Mittleman, 2014; Smeijers et al., 2017), anxiety (Celano et al., 2015; Rutledge et al., 2013a; Smeijers et al., 2017; Suls, 2018), stress (Bagheri et al., 2016; Li et al., 2015; Shah & Vaccarino, 2016) and low social support (Barth et al., 2010), it is crucial to better understand the extent of distress, its time course, and its specificity to CAD in order to improve the planning of patient care. More specifically, it is important to establish the course of distress to be able to recommend whether repeated measures long-term are required, and to better tailor complementary psychosocial interventions if patient distress is currently not being efficiently attended to or treated. In particular, there is a lack of data regarding the course of stress, hostility and social support in patients with CAD, as well as potential sex differences in this regard.

Whether sex differences influence the (prevalence and) course of psychological distress in patients with CAD has also received relatively little attention. It is also important to understand sex differences in psychological morbidity in this patient population in order to confirm whether the sex difference found in the general population for psychological distress persists in this patient population in order to advance the knowledge necessary for improving risk stratification of patients at higher risk of distress. This would aid in the management of

symptoms of distress by directing higher risk patients toward more thorough follow-ups and treatments.

Moreover, most research has assessed symptoms of psychological distress either during hospitalization after an acute cardiovascular event, or shortly thereafter, which may inflate the prevalence of symptoms of distress (Meijer et al., 2011; Thombs et al., 2006; Van Melle et al., 2004), and not be representative of the levels or types of distress experienced by patients with stable CAD.

In addition, few of the investigations to date have actively compared CAD patients with similar aged patients experiencing other health challenges recruited from a similar environment. Rather, prevalence rates or scores on questionnaires have typically been compared with population norms (Dozois, Ahnberg, & Dobson, 1998) or to healthy controls of similar age recruited from community centers or health clinics (e.g. Almeida et al., 2012; Bagheri et al., 2016; Izawa et al., 2011; Moser et al., 2010; Schmidt et al., 2013). Although significant distress has also been reported in individuals suffering from other health conditions (Collins, Corcoran, & Perry, 2009; Cooper et al., 2007; Dowlatshahi, Wakkee, Arends, & Nijsten, 2014; Matcham, Rayner, Steer, & Hotopf, 2013; Palinkas, Wingard, & Barrett-Connor, 1990), the quantitative and qualitative difference with CAD is unknown. Information comparing CAD with other patient types is needed to guide treatment efforts as CAD may be more related to particular psychological symptoms and course of symptoms.

Comparing CAD with other patient types can also aid to inform public health policy, including decisions about where to spend public funds based on whether CAD is associated with more disability than other illnesses. The few studies that have compared the prevalence of distress between CAD patients and other types of lower-mortality illnesses have found higher



levels of depression and anxiety to be reported in CAD patients (Bayat et al., 2011; Clarke & Currie, 2009; Gadalla, 2008; Palinkas et al., 1990; Scott et al., 2007). Reducing the extraneous influence of societal or environmental factors with the potential to influence distress and CAD, such as the society's current economical standing, socio-cultural expectations, different health care systems, or the level of development, by recruiting from a similar location would better address the potential role of type of illness on distress (and its course). Most comparison groups, whether population norms or "healthy" controls recruited within the community, have been problematic as generally the only requirement is that these participants do not have CAD. Consequently, previous comparison groups may include various possible confounding factors as these individuals may be extremely healthy, or on the other hand may have other life-threatening diseases.

### **Objectives and Hypotheses**

The primary objective of this prospective investigation was to evaluate whether psychological distress among individuals with CAD was more severe and/or persistent over a five year period compared to those suffering from other non-life threatening non-CVD health issues, and whether such differences were further affected by their sex. Psychological distress was evaluated across symptoms of depression, anxiety, hostility, and/or stress as well as low perceived social support. Evaluating psychological morbidity, as well as its evolution and severity over time has the potential to advance medical knowledge and the planning of patient care.

Consistent with the literature, it was expected that participants with CAD would report greater psychological distress across the different measures and time points as compared to

individuals with other non-CVD illnesses. Given numerous epidemiological studies have shown psychological symptoms or disorders to be more severe and prevalent among women than men in CAD and other populations (Doyle et al., 2015; Pająk et al., 2013; Panagioti, Scott, Blakemore, & Coventry, 2014; Xu et al., 2017), it was hypothesized that distress would be generally greater among women (especially those with CAD) than men. We expected levels of hostility to be higher among men than women as per previous evidence (Barefoot et al., 1991; Engebretson & Matthews, 1992; Knox et al., 1998; Scherwitz et al., 1991), with the difference diminishing at follow-up, as data from this and other laboratories suggests sex/gender differences in hostility levels may diminish with age (Consedine et al., 2004; D'Antono et al., 2013). Since results on social support among men and women with CAD are mixed (Knox et al., 1998; Kristofferzon et al., 2003), no specific hypotheses were elaborated. As little is known regarding potential sex and CAD status differences in the course of other psychological distress, these aspects remain exploratory.

## Article

*(Revised and resubmitted to the Journal of the American Heart Association)*

### **Severity of psychological distress over five years differs as a function of sex and presence of coronary artery disease**

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### **Author Note**

We have no conflicts of interest to disclose.

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## Abstract

**Background:** Psychological distress is more prevalent and severe among patients with coronary artery disease (CAD) compared to healthy individuals. Little is known regarding its time course, and whether these differences extend to individuals with non-cardiovascular (CV) illnesses. This study examined the presence, severity, and time course of psychological distress in men and women with CAD and those of similarly aged individuals suffering from non-CV conditions.

**Methods:** 1294 individuals (61% men; mean<sub>age</sub> = 60.4 ± 7.0 years) with stable CAD or non-CV illnesses reported on social support, hostility, stress, anxiety and depression at baseline as well as 4.8 ± 0.8 years later. Analyses involved mixed (Sex\*CAD status\*Time) repeated measures analyses (controlling for relevant covariates), as well as Chi-square and McNemar analyses.

**Results:** Women with CAD reported more symptoms of depression compared to other participants at both evaluations (p's <0.01), and reported more symptoms of anxiety and stress compared to others at T1 (p's <0.05). At T2, perceived stress remained significantly greater among women with CAD compared to men (p's <0.01), though differences in anxiety were no longer significant. Men reported more hostility than women (p=0.001). CAD women fell within the clinical range for depression (p<0.001), anxiety (p=0.001), and stress (p=0.030) more frequently compared to others at T1, and for depression (p=0.009) and stress (p=0.002) at T2.

**Conclusions:** The evolution of patient distress differed as a function of the measure examined, their sex, and/or CV status. While psychological distress was prevalent among these patients with diverse health conditions, women with CAD were particularly and chronically vulnerable.

*Keywords:* psychological distress, coronary artery disease, depressive symptoms, anxiety symptoms, stress symptoms, chronic illness

## Introduction

While significant improvements in prevention and “treatment” of coronary artery disease (CAD) has led to decreases in mortality rate, CAD remains prevalent (e.g., 8.5% in Canada), follows a chronic course for many patients (Public Health Agency of Canada, 2018), and may contribute to psychological distress.

Up to one in five patients with stable CAD (defined broadly in the literature as presence of angina, post-myocardial infarction (MI) and/or coronary artery bypass graft (CABG)) have been reported to meet clinical criteria for major depression using structured diagnostic interviews (Carney & Freedland, 2017; Steptoe & Kivimäki, 2013; Tully & Higgins, 2014), with up to 25% more reporting significant symptoms of depression (Steptoe & Kivimäki, 2013). In contrast, 4.7% 12-month prevalence rates of depression were reported in a large Canadian national health survey (Pearson, Janz, & Ali, 2013). Severity of depression symptoms are also generally significantly higher in CAD patients compared to population norms (Boutin-Foster, 2008; Crawford, Cayley, Lovibond, Wilson, & Hartley, 2011; Dozois, Ahnberg, & Dobson, 1998; Drory, Kravetz, & Hirschberger, 2002; Drory, Kravetz, Hirschberger, & Israel Study Group on First Acute Myocardial Infarction, 2003; Rutledge et al., 2016; Vilagut, Forero, Barbaglia, & Alonso, 2016; Wardenaar, Wanders, Roest, Meijer, & De Jonge, 2015).

Anxiety is similarly prevalent among individuals with CAD (Moser et al., 2010; Tully, Cosh, & Baumeister, 2014; Versteeg et al., 2013). According to a longitudinal study of patients undergoing a CABG, generalized anxiety disorder (10%) and panic disorder (11%) were most prevalent (Tully et al., 2015). While similar to the Canadian lifetime prevalence for generalized anxiety disorder (8.7%), it differs markedly for panic disorder (3.7%) (Pearson, 2013; Statistics

Canada, 2012). Self-report questionnaires have led to similar conclusions (Almeida et al., 2012; Bunevicius et al., 2013; Moser et al., 2010; Sunbul et al., 2013).

CAD patients have also been reported to have higher levels of cynical hostility and greater anger expression (Silarova, Nagyova, Rosenberger, van Dijk, & Reijneveld, 2016) compared to individuals evaluated for suspected CAD but with less than 50% coronary stenosis (Schmidt et al., 2013; Wong, Na, Regan, & Whooley, 2013), or compared to age and/or sex matched participants with no history of any heart disease (Izawa et al., 2011; Meesters & Smulders, 1994; Moser et al., 2010; Schmidt et al., 2013).

Psychological stress is another common complaint among CAD patients (Arnold, Smolderen, Buchanan, Li, & Spertus, 2012; Bagheri et al., 2016; Drory et al., 2002). In a recent study, patients with significant CAD ( $\geq 70\%$  occlusion of 1 or more coronary arteries) upon coronary angiography reported more stressful life events in the past year relative to patients without any significant narrowing ( $< 10\%$  occlusion) of the coronary arteries (Bagheri et al., 2016). Similarly, 72% of working hospitalized patients reported high stress levels (Lipp's Stress Symptom Inventory) following an acute myocardial infarction (AMI) (Amaral et al., 2015). In contrast, a Canadian population survey reported 22.3% of men and 23.7% of women to experience high levels of stress (Statistics Canada, 2014).

The absence or presence of social support can act as an important psychosocial stressor or buffer (Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003; Uchino, 2006). The evaluation of social support among CAD patients has produced mixed results (Berkman et al., 2003; Kähkönen, Kankkunen, Miettinen, Lamidi, & Saaranen, 2017; Leifheit-Limson et al., 2012; Lett et al., 2007). For example, among patients having experienced an acute MI (AMI), social support was reported to be both high in 1951 patients 1 month post-discharge (80%) (Leifheit-

Limson et al., 2012) and low among patients within first month of MI event (between 26-60%) (Berkman et al., 2003; Lett et al., 2007) using the same social support questionnaire.

While data to date suggests a high level of psychological distress in patients with CAD, the extent to which it remains elevated over time has received relatively little attention, with the exception of depression (Kroemeke, 2016; Murphy et al., 2008b; Ruo et al., 2006). There is evidence for both a chronic and a varying course of depression among patients with CAD over follow-up periods of 1-8 years (Kroemeke, 2016; Olsen, Schirmer, Wilsgaard, Bønaa, & Hanssen, 2018; Palacios, Khondoker, Mann, Tylee, & Hotopf, 2018; Polsky et al., 2005; Ruo et al., 2006; Tully & Higgins, 2014). One study observed a stable course of anxiety, which was chronically high among 17% of patients, 18 months following an MI (Versteeg, Roest, & Denollet, 2015). On the other hand, the course of perceived stress among a large sample of middle-aged women and men has been shown to decrease between initial hospitalization for MI to one year later (Xu et al., 2017). Importantly, there is evidence from studies among community-dwelling individuals (Thielke, Diehr, & Unutzer, 2010) and patients with CAD (Palacios et al., 2018; Versteeg et al., 2015; Xu et al., 2017), that women have more chronic elevations in distress. Little is known regarding the course of hostility or social support received in patients with CAD.

Few investigations to date have actively compared CAD patients with similar aged patients experiencing other health challenges and recruited from a similar environment, to reduce the influence of extraneous environmental or demographic differences. Rather, prevalence rates or scores on questionnaires have typically been compared with population norms (Dozois et al., 1998) or to healthy controls of similar age recruited from community centers or health clinics (Almeida et al., 2012; Bagheri et al., 2016; Izawa et al., 2011; Moser et

al., 2010; Schmidt et al., 2013). Given research showing increased risk for future morbidity and mortality in CAD patients experiencing depression (Carney & Freedland, 2017; Tully & Higgins, 2014; Wu & Kling, 2016), anger/hostility (Chida & Steptoe, 2009; Mostofsky, Penner, & Mittleman, 2014), anxiety (Celano et al., 2015; Rutledge et al., 2013a), stress (Li, 2015; Shah & Vaccarino, 2016) and low social support (Barth, Schneider, & von Känel, 2010), it is crucial to better understand the extent of distress, its time course, and its specificity to sex and CAD in order to improve the planning of patient care.

The current 5-year prospective investigation sought to evaluate whether the presence, severity, and time course of psychological distress (depression, anxiety, hostility, stress) and perceived social support among individuals with CAD differed from those of similarly aged individuals suffering from other non-CVD conditions, and recruited within the same environment. Whether sex differences exist in the prevalence and evolution of psychological morbidity was also of primary interest. Although significant distress has been reported in individuals suffering from other health conditions (e.g. (Collins, Corcoran, & Perry, 2009; Dowlatshahi, Wakkee, Arends, & Nijsten, 2014; Matcham, Rayner, Steer, & Hotopf, 2013)), the quantitative and qualitative difference with CAD is unknown. It was expected that participants with CAD would report more significant and chronic psychological distress. As per previous evidence in CAD and other populations (Collins et al., 2009; Doyle et al., 2015; Pająk et al., 2013; Xu et al., 2017), we expected the prevalence of psychological symptoms of anxiety, stress, and depression to be generally greater and more persistent among women than men. Since hostility is generally higher in men compared to women (Barefoot et al., 1991; Knox et al., 1998; Scherwitz, Perkins, Chesney, & Hughes, 1991), we expected hostility to be higher among men,



particularly CAD men. For its part, differences and changes in social support remain to be determined.

## **Methods**

The current study is part of a larger prospective investigation (BEL-AGE) on psychological burden and pathological aging in individuals with CAD and non-CVD patients experiencing other nonfatal illnesses.

### **Participants**

Participants were recruited among individuals already participating in the André and France Desmarais Hospital Cohort of the Montreal Heart Institute (MHI), for which eligibility includes age 18 or older, working at or attending the MHI for any reason (including blood tests) and family members or friends of patients. Most CAD participants were recruited into the MHI biobank while they were waiting for an appointment for tests or medical consult in outpatient care, or through mailings from their cardiologists. Inclusion into BEL-AGE further required participants to a) have agreed to be contacted for other investigations; b) have been recruited into the MHI Cohort approximately 5 years prior to participation in BEL-AGE; c) be between the ages of 30-70 at entry into the MHI Cohort; d) speak and read either French or English e) have no prior or current diagnosis of other major life-threatening disease (e.g. AIDS, amyotrophic lateral sclerosis, cancer); f) have completed most of the psychological questionnaires; and g) not have a family member already participating in the study. At follow-up, they also needed to h) be living in the greater Montreal area; i) have no major cognitive impairment or serious psychological disorder (e.g. bipolar disorder, schizophrenia, delirium or dementia) capable of preventing understanding or full participation in the study; j) not be

currently pregnant or breastfeeding. Patients with history of depression or anxiety were not excluded. CAD was defined as prior MI, CABG, coronary angioplasty, or stenosis greater than 50% on angiography confirmed through medical record review. Non-CVD status was defined by the absence of CAD, angina, arrhythmia, congenital heart disease, heart failure, cardiomyopathy, and stroke. The number and types of illnesses experienced by the non-CVD group were very diverse (e.g., arthritis, diabetes, high blood pressure, gastroesophageal reflux, asthma, eczema, etc.). Healthy individuals had no diagnosis of hypertension, hypercholesterolemia, diabetes or any other chronic illness. Consent to participate in BEL-AGE meant consent to forward relevant data obtained in the MHI Cohort to BEL-AGE.

Between September 2012 and May 2017, 1325 individuals were recruited into BEL-AGE. At the time of preparing this manuscript, complete data was available for 773 men and 494 women. A mean of 4.76 years ( $\pm 0.79$  SD) elapsed between evaluations.

**Time 1 procedure:** Eligible participants of the MHI Cohort were given an appointment with a nurse at the MHI to complete sociodemographic, medical/health, and psychological questionnaires. While questionnaires on hostility and depression were completed on site, other psychological and health behaviour questionnaires could be completed at home and returned via mail. Questionnaires were not returned by 205 participants.

**Time 2 procedure:** Consenting participants were given an appointment at the MHI on a weekday morning between 8am-10am and completed sociodemographic, medical, lifestyle and psychological questionnaires on site.

BEL-AGE was approved by the Research and Ethics Board of the MHI.

## **Measures**

*Socio-demographic information* included sex, age, marital status, ethnicity, income, and education.

*Health information* included weight, height, waist circumference, medications, personal and family medical history, as well as behavioral risk factors (e.g. physical activity, diet, alcohol, tobacco consumption).

*The Center for Epidemiological Studies Depression Scale-Revised (CESD-R; Eaton, Smith, Ybarra, Muntaner, & Tien, 2004)*: The 20-item revised version of the CES-D (Lewinsohn, Seeley, Roberts, & Allen, 1997) is a self-report scale used in epidemiological research to assess depressive symptomatology (Radloff, 1977). Each item is scored on a scale of 0 (“not at all or less than 1 day”) to 3 (“5-7 days” or “nearly every day for 2 weeks”). CES-D total scores range from 0-60, with a cut-off score of 16 or greater suggesting risk of clinical depression (Eaton et al., 2004). This instrument has a very good internal consistency among the general population ( $\alpha=0.85-94$ ) (Carleton et al., 2013; Van Dam & Earleywine, 2011) and psychiatric samples ( $\alpha=0.85$ ) (Carleton et al., 2013). In the current investigation, internal consistency was  $\alpha=0.89$  (times 1 and 2) while 5-year test-retest was 0.45.

*Spielberger State-Trait Anxiety Inventory –State version (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)*: a 20-item self-report scale that assess anxiety as an emotional state (state-anxiety). Each item is measured on a scale of 1 (“almost never”) to 4 (“almost always”), with total scores ranging between 20-80, with a cut-off score of 39-40 suggesting clinically significant symptoms of anxiety (Knight, Waal-Manning, & Spears, 1983; Spielberger et al., 1983). Internal consistency for state-anxiety ( $\alpha=0.91$ ) is excellent (Barnes, Harp, & Jung, 2002). In the current investigation, internal consistency varied between 0.87 (time 2) and 0.91 (time 1), with a 5-year test-retest of 0.43.

*The Cook-Medley Hostility Inventory (CMHo; Cook & Medley, 1954)*: an empirically derived self-report scale from the MMPI, scored on a dichotomic scale (0 or 1) and measuring tendencies towards cynicism, hostile attribution, hostile affect and aggressive responding (Brydon et al., 2010). The 39-item abbreviated version of the CMHo was used in this study (Barefoot, Larsen, von der Lieth, & Schroll, 1995). Higher scores indicate greater hostility. The CMHo has good internal consistency ( $\alpha=0.82-0.86$ ) (Smith & Frohm, 1985) and has been used reliably in research on CAD. In the current investigation, internal consistency was  $\alpha=0.81-0.82$ , while 4-year test-retest was 0.73.

*The Perceived Stress Questionnaire (PSQ; Levenstein et al., 1993)*: a 30-item questionnaire with 7 subscales used to measure perceived stressful life events and circumstances, and reactions to stress. Respondents rate how often the item applies to them on a 4-point scale from 1 (“almost never”) to 4 (“usually”). The questionnaire produces a total PSQ index ((raw score-30)/90), which represents the level of stress of each participant, varying from 0 (lowest level of stress) to 1 (highest level of stress). A score of 0.45-0.60 on the PSQ index indicates a moderate stress level, while scores  $>0.60$  reflect high stress. It has excellent internal consistency ( $\alpha \geq 0.90$ ) and test-retest reliability ( $\alpha=0.82$ ) (Lehman, Burns, Gagen, & Mohr, 2012; Levenstein et al., 1993; Montero-Marin, Demarzo, Pereira, Olea, & García-Campayo, 2014). In the current investigation, internal consistency ranged from  $\alpha=0.94-0.95$ , while 5-year test-retest was 0.66.

*Social Support Questionnaire (adapted from the MOS Social Support Survey; Ware Jr, 2000)*: a 7-item self-report scale assessing the participants’ perceived amount of social support accessible. Items are scored from 0 (“none of the time”) to 4 (“all of the time”), with total scores ranging from 0 to 28. It has very good internal consistency ( $\alpha=0.81$ ; Holden, Lee, Hockey, Ware,

& Dobson, 2014) and concurrent validity (Gjesfjeld, Greeno, & Kim, 2008). In the current investigation, internal consistency was  $\alpha = 0.89$ , while 5-year test-retest was 0.63.

The psychometric properties of these various questionnaires had also been validated in French (Anderson, Bilodeau, Deshaies, Gilbert, & Jobin, 2005; Bergeron, Landry, & Bélanger, 1976; Bouvard, Anne, & Roulin, 2012; Consoli, Taine, Szabason, & Lacour, 1997; Fuhrer & Rouillon, 1989; Hathaway, MacKinley, & Perse, 1966).

### *Statistical Analyses*

Chi-square analyses and one-way ANOVAs were performed to determine whether the groups differed with respect to participant characteristics (see Table 1).

To increase normality, scores for the CES-D were log-transformed. Covariates for main analyses were selected from previous literature and included age, marital status, years of education, household income, BMI, smoking status, weekly alcohol consumption, anxiolytic or antidepressant use, past psychiatric diagnosis (Akhtar-Danesh & Landeen, 2007; Brännlund & Hammarström, 2014; Grant et al., 2009; Jorm et al., 1999; Lavie & Milani, 2004; McAuley & Rudolph, 1995; Ross, 2017; Wade & Cairney, 2000).

Group differences in psychological distress and course over time was examined using mixed 2 (CAD Status: CAD vs. Other illness) x 2 (Sex: Men vs. Women) x 2 (Time: Baseline, Follow-up) analyses of variance (ANOVAs) controlling for the above covariates.

Analyses were also performed on dichotomic variables, using clinical cut-off scores for anxiety, depression, and stress (refer to Measures section for cut-offs). Chi-square analyses were performed to assess group (CAD men, non-CV men, CAD women, non-CV women) differences at each time point, while McNemar analyses were employed to evaluate change

over time for each individual group. Analyses were performed separately for each psychological measure.

Statistical significance was set at 0.05. Data were analyzed using SPSS version 24 (IBM Corp, 2016).

## **Results**

### **Participant Characteristics**

Table 1 shows participant characteristics. Men (61% of the sample) were more likely to be cohabitating with a partner and to have a higher yearly household income compared to women. Women were previously diagnosed with depression ( $X^2=6.46$ ,  $p=0.011$ ), and were currently prescribed antidepressant medication ( $X^2=5.19$ ,  $p=0.023$ ) and anxiolytics ( $X^2=15.02$ ,  $p<0.001$ ) more frequently than men. Women with CAD were less frequently employed at study entry compared to other groups ( $p$ 's $<0.05$ ). Participants without CVD were more likely to have a higher yearly household income compared to patients with CAD, though no other significant differences in sociodemographic, past psychological diagnosis or current psychotropic medication was observed.

### **Evaluation of differences in distress (continuous data) as a function of group and time**

Refer to Table 2 for group means and SD.

*Depression:* A significant Sex by CAD status interaction emerged,  $F(1, 1184)=11.977$ ,  $p=0.001$ , ( $\eta_p^2=0.010$ ). More specifically, women with CAD reported more symptoms of depression compared to men with CAD ( $p<0.001$ ,  $g=0.51$ ), non-CV men ( $p=0.003$ ,  $g=0.50$ ), and non-CV women ( $p=0.001$ ,  $g=0.34$ ) (see Fig 1.).

*Anxiety:* A significant main effect of Time,  $F(1,994)=5.304, p=0.021, (\eta_p^2=0.005)$ , and a significant Time by Sex by CAD status interaction,  $F(1, 994) = 7.252, p=0.007, (\eta_p^2=0.007)$  emerged. At Time 1, women with CAD reported more symptoms of anxiety compared to men with CAD ( $p=0.015, g=0.45$ ) and non-CV women ( $p=0.005, g=0.48$ ). By Time 2, there were no significant differences. There was a significant decrease in symptoms of anxiety in men with CAD ( $p<0.001, \eta_p^2=0.192$ ), non-CV men ( $p<0.001, \eta_p^2=0.296$ ), women with CAD ( $p<0.001, \eta_p^2=0.286$ ), and non-CV women ( $p<0.001, \eta_p^2=0.152$ ) over time.

*Perceived Stress:* A significant Time by Sex by CAD status interaction emerged,  $F(1, 995) = 8.941, p=0.003, (\eta_p^2=0.009)$ . At Time 1, women with CAD perceived greater stress compared to CAD men ( $p<0.001, g=0.57$ ), non-CV men ( $p=0.007, g=0.38$ ), and non-CVD women ( $p=0.001, g=0.41$ ). By Time 2, perceived stress among women with CAD was significantly greater compared to men with CAD ( $p=0.001, g=0.49$ ) and non-CV men ( $p=0.014, g=0.16$ ). There was a statistically significant decrease in perceived stress scores for men with CAD ( $p=0.016, \eta_p^2=0.015$ ), non-CV men ( $p=0.001, \eta_p^2=0.054$ ), and women with CAD ( $p=0.023, \eta_p^2=0.052$ ) over time.

*Hostility:* A significant main effect of Sex  $F(1, 1184)= 10.987, p=0.001, (\eta_p^2=0.009)$  was found. Men reported more hostility than women ( $p=0.001, g=0.19$ ).

*Social Support:* A significant main effect of CAD status  $F(1,987)=5.052, p=0.025, (\eta_p^2=0.005)$  emerged, with greater social support reported by non-CV participants compared to CAD participants ( $p=0.025, g=0.27$ ).

### **Differences in prevalence of distress (categorical data) by group and time**

Refer to Table 3 for the N (%) of participants reaching clinically significant thresholds.

*Depression:* A significant main effect of Group at Time 1,  $X^2=19.43$ ,  $p<0.001$ ,  $\phi_c=0.126$  and at Time 2,  $X^2=11.67$ ,  $p=0.009$ ,  $\phi_c=0.098$  emerged. Women with CAD fell within the clinical range for depression more frequently than other groups.

McNemar analyses showed that more individuals fell within the clinical range of depression at Time 2 compared to Time 1 (12% vs. 8%), with the most notable increases observed in men with CAD ( $p<0.001$ , OR=2.65) and women without CV ( $p=0.038$ , OR=2.08).

*Anxiety:* A significant effect of Group emerged at Time 1,  $X^2=16.17$ ,  $p=0.001$ ,  $\phi_c=0.126$ , that just missed significance at Time 2,  $X^2=7.625$ ,  $p=0.054$ ,  $\phi_c=0.086$ . Women with CAD fell within the clinical range for anxiety more frequently compared to other groups.

McNemar analyses showed that the prevalence of clinical anxiety decreased significantly in men with CAD ( $p<0.001$ , OR=0.21), non-CV men ( $p<0.001$ , OR=0.07), women with CAD ( $p<0.001$ , OR=0.15), and non-CV women ( $p<0.001$ , OR=0.40).

*Perceived Stress:* A significant effect of Group at Time 1,  $X^2=20.44$ ,  $p<0.001$ ,  $\phi_c=0.141$ , and at Time 2,  $X^2=18.94$ ,  $p<0.001$ ,  $\phi_c=0.136$  emerged. Women with CAD fell within the moderate-high level of perceived stress more frequently compared to other groups.

McNemar analyses showed that fewer individuals fell within the moderate-high stress level at Time 2 compared to Time 1 (16% vs. 20%), however this change was significant only for men with CAD ( $p<0.002$ , OR=0.41).

Results of additional post hoc analyses can be found in Supplemental materials. Sex by Time ANOVAs were repeated on the CES-D and PSQ subscales while controlling for covariates to determine whether greater depression and stress observed in CAD women was mostly seen on somatic symptoms. Independent samples t-tests were performed on time since first or last coronary event/procedure and the number of CAD events/procedures prior to time 1 to



determine whether greater psychological distress in women vs. men with CAD may reflect more recent CAD events or more chronic disease. Independent samples t-tests were performed to determine whether participants with CAD reporting clinically significant distress (depression, anxiety, or moderate-high stress) had experienced a cardiac event closer in time prior to each psychological assessment. Lastly, chi-square analyses were performed in order to examine whether the decreases in symptoms of anxiety and perceived stress over time among participants parallel changes in employment status.

### **Discussion**

We sought to evaluate whether psychological distress among patients with CAD was more severe and/or persistent compared to patients suffering from other non-life threatening health conditions, and whether such differences were further affected by sex. While the prevalence of distress was found to be elevated overall, its presence, intensity, and/or evolution over time differed as a function of patient's sex, CV status, as well as the dimension of distress examined. Distress among women with CAD was particularly high and persistent over time.

At study entry, the overall prevalence of "patients" meeting clinically significant symptoms of depression, anxiety, and/or moderate-high stress was high as compared to the general population (Gadalla, 2008; Statistics Canada, 2014; The Canadian Community Health Survey, 2016). Participants reported relatively high social support, which was slightly but significantly greater among non-CV participants. High levels of social support have been reported among patients with CAD in some (Kähkönen et al., 2017; Leifheit-Limson et al., 2012; Leifheit-Limson et al., 2010; Wang et al., 2019) but not all studies (Berkman et al., 2003; Lett et al., 2007). While greater hostility in CAD patients compared to healthy individuals has previously been found (Meesters & Smulders, 1994; Moser et al., 2010; Wong et al., 2013), in

the current investigation CAD participants were not more hostile as compared to individuals suffering from other non-CV disorders. However, individuals with CAD were more likely to suffer from depression, anxiety, or stress compared with those with non-fatal, non-CV illnesses, which was consistent with the few studies that examined this issue (Bayat et al., 2011; Clarke & Currie, 2009; Gadalla, 2008; Scott et al., 2007). Importantly, with the exception of hostility, the greatest distress was particularly evident in the CAD women compared to women with other health issues and men. Greater distress in women has been reported in the general population (e.g. (Gadalla, 2008; O'Donnell, Cheung, Bennett, & Lagacé, 2016; Van de Velde, Bracke, & Levecque, 2010)), and among individuals with chronic illnesses including CAD (e.g. (Gadalla, 2008; Palinkas, Wingard, & Barrett-Connor, 1990; Parashar et al., 2009; Thielke et al., 2010; Tully & Baker, 2012; Xu et al., 2017)). CAD men showed similar levels of overall distress compared to men with non-CVD in the current investigation, though they were more likely to have received a prior mood or anxiety diagnosis. Prevalence of depressive symptoms in CAD men has varied greatly in the literature, ranging from 8.2-54% (Burker et al., 1995; Guimaraes et al., 2017; Pająk et al., 2013; Pogosova et al., 2017). Inconsistencies may reflect differences in the method and timing of assessment, such as inclusion of individuals with stable CAD versus shortly after a CAD event (Bunevicius et al., 2013; Delewi et al., 2017; Murphy et al., 2014; Murphy et al., 2008b; Roest, Wardenaar, & de Jonge, 2016; Xu et al., 2017) or before/after an invasive procedure (Murphy et al., 2008a; Sunbul et al., 2013; Tully & Baker, 2012). Timing of assessment matters as men with CAD with greater distress in our study were significantly more likely to have experienced a CAD event or procedure closer in time to baseline or follow-up assessments compared to those experiencing little distress (see Supplementary material).

Reported levels of hostility and social support remained stable across participants over the follow-up period, consistent with the few investigations that have prospectively followed changes in hostility in the general population (Adams, 1994; Nabi et al., 2010; Roberts & DelVecchio, 2000) and social support among patients post-MI (Dhand, Longstreth Jr, Chaves, & Dhamoon, 2018; Wang et al., 2019). While the overall prevalence of moderate-high stress and anxiety decreased among patients, the proportion of participants reporting depression increased significantly, particularly in men with CAD and women without CVD. Women with CAD continued to report significantly greater symptoms of depression and stress compared to others at follow-up. Symptoms of depression have been shown to persist, increase (Burker et al., 1995; Kroemeke, 2016; Murphy et al., 2014; Murphy et al., 2008b; Palacios et al., 2018; Polsky et al., 2005), or decrease (Kroemeke, 2016; Murphy et al., 2008a; Murphy et al., 2008b; Olsen et al., 2018; Palacios et al., 2018) over time in patients with CAD. What contributes to these varying trajectories remains to be elucidated. Numerous investigations specifically using the CES-D in different populations have reported an increase in symptoms of depression with age (Beekman et al., 1995; Mirowsky & Ross, 1992; Stordal et al., 2001; Thielke et al., 2010). This may reflect risk factors for depression that worsen with age, including declining health, loneliness, or loss of social support (Beekman et al., 1995). Somatic symptoms of physical illness may mimic those of depression, potentially inflating the levels of depression at follow-up (Poole, Dickens, & Steptoe, 2011; Roest et al., 2016; Silverstein, 2002). Increased depression was unlikely to just reflect worsening physical illness in our participants, as cognitive and affective symptoms of depression also increased (see Supplemental material). Decreases in the severity of anxiety with age among clinical samples or the general population have also been reported (Bryant, Jackson, & Ames, 2009; Jorm, 2000; Jorm et al., 2005; Murphy et al., 2008a;

Murphy et al., 2008b; Olsen et al., 2018; Ramsawh, Raffa, Edelen, Rende, & Keller, 2009; Remes, Brayne, Linde, & Lafortune, 2016; Scott et al., 2007; Self, Thomas, & Randall, 2012), and may reflect the waning societal and work demands of older individuals (Scott et al., 2007; Villamil, Huppert, & Melzer, 2006). Indeed, our participants reported fewer worries and were less likely to be working at follow-up compared to study onset (27% vs 40%).

Sex differences in the course of psychological distress in patients with CAD have received relatively little attention. Sex differences were observed for depression, anxiety and stress in the current study. In contrast, no significant sex differences were found in the time course of depressive symptoms following cardiac events/procedures (Murphy et al., 2008a; Murphy et al., 2014), or in perceived stress one-year post-MI (Xu et al., 2017). Findings for symptoms of anxiety have been mixed following cardiac events/procedures (Murphy et al., 2008a; Murphy et al., 2014; Olsen et al., 2018; Palacios et al., 2018).

Sex differences in the diagnosis and management of CAD as well as in life circumstances may have contributed to the greater distress in women with CAD. Women are often diagnosed later in the disease trajectory compared to men, when they are older, and their disease is more severe or complicated by other co-morbidities (Khan et al., 1990; Pathak, Shirodkar, Ruparelia, & Rajebahadur, 2017). Women with CAD in the current study were slightly older than the men with CAD, but no more likely to be suffering from acute CAD events (see Supplemental material), hypertension, diabetes, and hypercholesterolemia prior to baseline. They did however have a lower income and were more frequently living alone, factors known to be associated with higher levels of distress (Grant et al., 2009; Sonnenberg, Beekman, Deeg, & van Tilburg, 2000; Van de Velde et al., 2010; Xu et al., 2015) and physical health status in patients with CAD, particularly women (Doering et al., 2011; Horsten, Mittleman, Wamala, Schenck-Gustafsson,

& Orth-Gomer, 2000; Orth-Gomér & Leineweber, 2005; Staniute, Brozaitiene, & Bunevicius, 2013). However, sex differences remained when controlling for these variables. Greater somatization among women (Kroenke & Spitzer, 1998; Silverstein, 1999, 2002) was unlikely to explain our results as generally CAD women also presented with significantly more cognitive and affective symptoms of depression, as well as anxiety and stress, compared to other groups. Similarly, a higher heritability for fear, phobias, and depression among women (McLean & Anderson, 2009) is inconsistent with the fact that women with non-CV illnesses were not particularly more distressed than the men.

Alternatively, sex differences in socialization (e.g. less social reinforcement of emotional expression, other than anger (McLean & Anderson, 2009)) could have contributed to under-reporting of psychological symptoms in men. Depressed men more frequently engage in denial or inhibition of emotional expression (Eisler & Blalock, 1991), as well as more irritability, aggressive and destructive behaviors to cope with distress (Blanco, Hasin, Petry, Stinson, & Grant, 2006; Eisler & Blalock, 1991; Parker & Brotchie, 2010), behaviors not reflected in most questionnaires on depression. Indeed, the greater risk of suicide in men likely reflects a high degree of distress that is not presently well identified or treated (Oquendo et al., 2002). Higher levels of hostility, alcohol consumption, and smoking among the men compared to women in the current study may denote greater distress than indicated by questionnaires. Finally, distressed CAD men may have been more likely to have died prematurely compared to those with little distress (survival effect) (Carney & Freedland, 2017; Celano et al., 2015; Wu & Kling, 2016). Indeed, two recent meta-analyses among individuals with CAD reported a greater association between depression and cardiac prognosis in men compared to women (Doyle et al., 2015; Smaardijk, Maas, Lodder, Kop, & Mommersteeg, 2020).

## **Strengths and Limitations**

The majority of participants were French Canadian and Caucasian, limiting the generalizability of findings to individuals of different cultures. Psychological distress was based on self-report questionnaires, rather than on clinical interviews. However, the relevance of distress to disease development, progression, and/or mortality has been shown in individuals meeting diagnostic criteria for psychological disorders (Carney & Freedland, 2017; De Hert, Detraux, & Vancampfort, 2018; Tully, Harrison, Cheung, & Cosh, 2016; Tully & Higgins, 2014), as well as those showing even mild symptoms of distress on questionnaires (Bagheri et al., 2016; Celano et al., 2015; Martin-Subero et al., 2017; Stewart et al., 2017; Tully et al., 2014; Tully & Higgins, 2014). Unfortunately, we do not have data on severity of illness experienced by our participants, and cannot speak to the impact of this on our results. However, psychological distress has not always been associated with disease severity in prior research (Denollet et al., 1996; Fortune, Richards, Griffiths, & Main, 2002; Jarpa et al., 2011; Klaassen, Nyklíček, Traa, & de Nijs, 2012). Moreover, non-CV conditions can be quite debilitating or demanding (e.g., arthritis, diabetes) and impair daily functioning to a similar extent as CAD, though there is considerable variability in severity of illness both within and across groups. We had missing data for certain participants for the measures of anxiety, perceived stress and social support. However, they did not differ on any sociodemographic variable nor on depression or hostility as compared to individuals with these psychological variables available (see Supplemental material).

Strengths of the study include the longitudinal evaluation of several psychological risk factors for CAD over a five-year period. While the course of depression over time had been examined to a certain extent, the literature on anxiety, stress, hostility, and social support was

limited. Presence of CAD was operationalized more strictly and excluded symptoms of angina in the absence of verified coronary occlusion. Many previous studies included the presence of angina even though many patients have non-cardiac chest pain (Tully & Higgins, 2014; Versteeg et al., 2013). Non-CVD status excluded presence of any cardiovascular disease or symptoms. Well-validated measures were used to assess distress. The large sample size and purposeful recruitment of women allowed sex differences to be examined. Analyses further controlled for psychotropic medication, previous psychiatric diagnosis, as well as sociodemographic and lifestyle habits previously associated with psychological distress.

### **Clinical Implications and Conclusions**

Psychological distress has been associated with adverse health outcomes in patients with various health conditions (Keles, Ekici, Ekici, Bulcun, & Altinkaya, 2007; Noel et al., 2004) including CAD (Arnold et al., 2012; Horsten et al., 2000; Lett et al., 2007; Orth-Gomér & Leineweber, 2005; Staniute et al., 2013; Wang et al., 2007), and to poorer adherence to health recommendations (Cohen, Edmondson, & Kronish, 2015). As patients are now living longer with disease, it becomes all the more important to better understand the time course of the various psychological states and traits that put them at risk. Our findings of significant psychological symptoms among our participants with and without CVD, that persisted despite a five-year interval suggests that patient distress is currently not being efficiently attended to or treated. Indeed, in the case of the women, distress remained high despite psychopharmacological treatment in a significant proportion of them. While women with CAD reported greater distress compared to men, it is impossible to determine from this data whether this difference in distress was present prior to CAD onset, or whether it arose in response to CAD symptoms and diagnosis. Given the evidence demonstrating that psychological distress is a strong predictor for

CAD development (Charlson, Stapelberg, Baxter, & Whiteford, 2011; Chida & Steptoe, 2009; Gan et al., 2014; Kohli et al., 2014; Perk et al., 2012; Roest, Martens, de Jonge, & Denollet, 2010; Steptoe & Kivimäki, 2013; Suls, 2018; Whalley, Thompson, & Taylor, 2014), repeated screening for distress and tailoring of complementary psychosocial interventions are required and should be considered at this time for all patients independently of diagnosis. Greater attention to patient's psychological state could help reduce the considerable personal and societal costs associated with persistent distress, accelerate return to work (Haschke, Hutter, & Baumeister, 2012) and decrease healthcare utilization (Baumeister, Haschke, Munzinger, Hutter, & Tully, 2015; Finegold, Asaria, & Francis, 2013). Psychological interventions (e.g. cognitive behavioral therapy or stress management) in patients with CAD may improve quality of life and psychological distress over the long-term (Janssen, Gucht, Dusseldorp, & Maes, 2013; Whalley et al., 2014), as well as medical outcomes (Rutledge, Redwine, Linke, & Mills, 2013). Unfortunately, psychological interventions are not frequently offered in routine care.

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The authors report no conflicts of interest.

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## References

- Adams, S. H. (1994). Role of hostility in women's health during midlife: A longitudinal study. *Health Psychology, 13*(6), 488.
- Akhtar-Danesh, N., & Landeen, J. (2007). Relation between depression and sociodemographic factors. *International Journal of Mental Health Systems, 1*(1), 4.
- Almeida, O. P., Beer, C., Lautenschlager, N. T., Arnolda, L., Alfonso, H., & Flicker, L. (2012). Two-year course of cognitive function and mood in adults with congestive heart failure and coronary artery disease: the Heart-Mind Study. *International Psychogeriatrics, 24*(1), 38-47.
- Amaral, V. F. d., Baena, C. P., Carvalho, K. A. T. d., Faria-Neto, J. R., Francisco, J. C., Guarita-Souza, L. C., . . . ProsdÛcimo, A. C. M. G. (2015). Evaluation of the prevalence of stress and its phases in acute myocardial infarction in patients active in the labor market. *Brazilian Journal of Cardiovascular Surgery, 30*(1), 16-23.
- Anderson, D., Bilodeau, B., Deshaies, G., Gilbert, M., & Jobin, J. (2005). French-Canadian validation of the MOS social support survey. *The Canadian Journal of Cardiology, 21*(10), 867-873.
- Arnold, S. V., Smolderen, K. G., Buchanan, D. M., Li, Y., & Spertus, J. A. (2012). Perceived Stress in Myocardial Infarction : Long-Term Mortality and Health Status Outcomes. *Journal of the American College of Cardiology, 60*(18), 1756-1763.
- Bagheri, B., Meshkini, F., Dinarvand, K., Alikhani, Z., Haysom, M., & Rasouli, M. (2016). Life Psychosocial Stresses and Coronary Artery Disease. *International Journal of Preventive Medicine, 7*.

- Barefoot, J. C., Larsen, S., von der Lieth, L., & Schroll, M. (1995). Hostility, incidence of acute myocardial infarction, and mortality in a sample of older Danish men and women. *American Journal of Epidemiology*, *142*(5), 477-484.
- Barefoot, J. C., Peterson, B. L., Dahlstrom, W. G., Siegler, I. C., Anderson, N. B., & Williams Jr, R. B. (1991). Hostility patterns and health implications: correlates of Cook-Medley Hostility Scale scores in a national survey. *Health Psychology*, *10*(1), 18.
- Barnes, L. L., Harp, D., & Jung, W. S. (2002). Reliability generalization of scores on the Spielberger state-trait anxiety inventory. *Educational and Psychological Measurement*, *62*(4), 603-618.
- Barth, J., Schneider, S., & von Känel, R. (2010). Lack of social support in the etiology and the prognosis of coronary heart disease: a systematic review and meta-analysis. *Psychosomatic Medicine*, *72*(3), 229-238.
- Baumeister, H., Haschke, A., Munzinger, M., Hutter, N., & Tully, P. J. (2015). Inpatient and outpatient costs in patients with coronary artery disease and mental disorders: a systematic review. *BioPsychoSocial medicine*, *9*(1), 11.
- Bayat, N., Alishiri, G. H., Salimzadeh, A., Izadi, M., Saleh, D. K., Lankarani, M. M., & Assari, S. (2011). Symptoms of anxiety and depression: A comparison among patients with different chronic conditions. *Journal of Research in Medical Sciences: the Official Journal of Isfahan University of Medical Sciences*, *16*(11), 1441.
- Beekman, A. T., Deeg, D. J., van Tilburg, T., Smit, J. H., Hooijer, C., & van Tilburg, W. (1995). Major and minor depression in later life: a study of prevalence and risk factors. *Journal of Affective Disorders*, *36*(1), 65-75.

- Bergeron, J., Landry, M., & Bélanger, D. (1976). The development and validation of a French form of the State-Trait Anxiety Inventory. *Cross-Cultural Anxiety, 1*, 41-50.
- Berkman, L. F., Blumenthal, J., Burg, M., Carney, R. M., Catellier, D., Cowan, M. J., . . . Enhancing Recovery in Coronary Heart Disease Patients, I. (2003). Effects of treating depression and low perceived social support on clinical events after myocardial infarction: the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) Randomized Trial. *JAMA, 289*(23), 3106-3116.
- Blanco, C., Hasin, D. S., Petry, N., Stinson, F. S., & Grant, B. F. (2006). Sex differences in subclinical and DSM-IV pathological gambling: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychological Medicine, 36*(7), 943-953.
- Boutin-Foster, C. (2008). An item-level analysis of the Center for Epidemiologic Studies Depression Scale (CES-D) by race and ethnicity in patients with coronary artery disease. *International Journal of Geriatric Psychiatry, 23*(10), 1034-1039.
- Bouvard, M., Anne, D., & Roulin, J. (2012). Confirmation des dimensions de la version française de l'échelle d'auto-évaluation Center for Epidemiological Studies Depression (CES-D). *L'Encéphale*.
- Brännlund, A., & Hammarström, A. (2014). Higher education and psychological distress: a 27-year prospective cohort study in Sweden. *Scandinavian Journal of Public Health, 42*(2), 155-162.
- Bryant, C., Jackson, H., & Ames, D. (2009). Depression and anxiety in medically unwell older adults: prevalence and short-term course. *International Psychogeriatrics, 21*(4), 754-763.

- Brydon, L., Strike, P. C., Bhattacharyya, M. R., Whitehead, D. L., McEwan, J., Zachary, I., & Steptoe, A. (2010). Hostility and physiological responses to laboratory stress in acute coronary syndrome patients. *Journal of Psychosomatic Research*, *68*(2), 109-116.
- Bunevicius, A., Staniute, M., Brozaitiene, J., Pop, V. J., Neverauskas, J., & Bunevicius, R. (2013). Screening for anxiety disorders in patients with coronary artery disease. *Health and Quality of Life Outcomes*, *11*(1), 37.
- Burker, E. J., Blumenthal, J. A., Feldman, M., Burnett, R., White, W., Smith, L. R., . . . Reves, J. (1995). Depression in male and female patients undergoing cardiac surgery. *British Journal of Clinical Psychology*, *34*(1), 119-128.
- Carleton, R. N., Thibodeau, M. A., Teale, M. J., Welch, P. G., Abrams, M. P., Robinson, T., & Asmundson, G. J. (2013). The center for epidemiologic studies depression scale: a review with a theoretical and empirical examination of item content and factor structure. *PloS one*, *8*(3).
- Carney, R. M., & Freedland, K. E. (2017). Depression and coronary heart disease. *Nature Reviews Cardiology*, *14*(3), 145.
- Celano, C. M., Millstein, R. A., Bedoya, C. A., Healy, B. C., Roest, A. M., & Huffman, J. C. (2015). Association between anxiety and mortality in patients with coronary artery disease: A meta-analysis. *American Heart Journal*, *170*(6), 1105-1115.
- Charlson, F. J., Stapelberg, N. J., Baxter, A. J., & Whiteford, H. A. (2011). Should global burden of disease estimates include depression as a risk factor for coronary heart disease? *BMC Medicine*, *9*(1), 47.

- Chida, Y., & Steptoe, A. (2009). The Association of Anger and Hostility With Future Coronary Heart Disease : A Meta-Analytic Review of Prospective Evidence. *Journal of the American College of Cardiology*, 53(11), 936-946.
- Clarke, D. M., & Currie, K. C. (2009). Depression, anxiety and their relationship with chronic diseases: a review of the epidemiology, risk and treatment evidence. *Medical Journal of Australia*, 190(7), S54.
- Cohen, B. E., Edmondson, D., & Kronish, I. M. (2015). State of the art review: depression, stress, anxiety, and cardiovascular disease. *American Journal of Hypertension*, 28(11), 1295-1302.
- Collins, M. M., Corcoran, P., & Perry, I. J. (2009). Anxiety and depression symptoms in patients with diabetes. *Diabetic Medicine*, 26(2), 153-161.
- Consoli, S., Taine, P., Szabason, F., & Lacour, C. (1997). Elaboration et validation d'un questionnaire de stress perçu proposé comme indicateur de suivi en médecine du travail. *L'Encéphale*, 23(3), 184-193.
- Cook, W. W., & Medley, D. M. (1954). Proposed hostility and Pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology*, 38(6), 414-418.
- Crawford, J., Cayley, C., Lovibond, P. F., Wilson, P. H., & Hartley, C. (2011). Percentile Norms and Accompanying Interval Estimates from an Australian General Adult Population Sample for Self-Report Mood Scales (BAI, BDI, CRSD, CES-D, DASS, DASS-21, STAI-X, STAI-Y, SRDS, and SRAS). *Australian Psychologist*, 46(1), 3-14.
- De Hert, M., Detraux, J., & Vancampfort, D. (2018). The intriguing relationship between coronary heart disease and mental disorders. *Dialogues in Clinical Neuroscience*, 20(1), 31.

- Delewi, R., Vlastra, W., Rohling, W. J., Wagenaar, T. C., Zwemstra, M., Meesterman, M. G., . . . de Winter, R. J. (2017). Anxiety levels of patients undergoing coronary procedures in the catheterization laboratory. *International Journal of Cardiology*, *228*, 926-930.
- Denollet, J., Rombouts, H., Gillebert, T., Brutsaert, D., Sys, S., & Stroobant, N. (1996). Personality as independent predictor of long-term mortality in patients with coronary heart disease. *The Lancet*, *347*(8999), 417-421.
- Dhand, A., Longstreth Jr, W., Chaves, P. H., & Dhamoon, M. S. (2018). Social Network Trajectories in Myocardial Infarction Versus Ischemic Stroke. *Journal of the American Heart Association*, *7*(8), e008029.
- Doering, L. V., McKinley, S., Riegel, B., Moser, D. K., Meischke, H., Pelter, M. M., & Dracup, K. (2011). Gender-specific characteristics of individuals with depressive symptoms and coronary heart disease. *Heart & Lung: The Journal of Acute and Critical Care*, *40*(3), e4-e14.
- Dowlatshahi, E. A., Wakkee, M., Arends, L. R., & Nijsten, T. (2014). The prevalence and odds of depressive symptoms and clinical depression in psoriasis patients: a systematic review and meta-analysis. *Journal of Investigative Dermatology*, *134*(6), 1542-1551.
- Doyle, F., McGee, H., Conroy, R., Conradi, H. J., Meijer, E., Steeds, A., . . . Jonge, d. P. (2015). Systematic Review and Individual Patient Data Meta-Analysis of Sex Differences in Depression and Prognosis in Persons With Myocardial Infarction: A MINDMAPS Study. *Psychosomatic Medicine*, *77*(4), 419-428.
- Dozois, D. J. A., Ahnberg, J. L., & Dobson, K. S. (1998). Psychometric Evaluation of the Beck Depression Inventory-II. *Psychological Assessment*, *10*(2), 83-89.

- Drory, Y., Kravetz, S., & Hirschberger, G. (2002). Long-term mental health of men after a first acute myocardial infarction. *Archives of Physical Medicine and Rehabilitation*, 83(3), 352-359.
- Drory, Y., Kravetz, S., Hirschberger, G., & Israel Study Group on First Acute Myocardial Infarction. (2003). Long-term mental health of women after a first acute myocardial infarction. *Archives of Physical Medicine and Rehabilitation*, 84(10), 1492-1498.
- Eaton, W. W., Smith, C., Ybarra, M., Muntaner, C., & Tien, A. (2004). Center for Epidemiologic Studies Depression Scale: review and revision (CESD and CESD-R).
- Eisler, R. M., & Blalock, J. A. (1991). Masculine gender role stress: Implications for the assessment of men. *Clinical Psychology Review*, 11(1), 45-60.
- Finegold, J. A., Asaria, P., & Francis, D. P. (2013). Mortality from ischaemic heart disease by country, region, and age: statistics from World Health Organisation and United Nations. *International Journal of Cardiology*, 168(2), 934-945.
- Fortune, D. G., Richards, H. L., Griffiths, C. E., & Main, C. J. (2002). Psychological stress, distress and disability in patients with psoriasis: consensus and variation in the contribution of illness perceptions, coping and alexithymia. *British Journal of Clinical Psychology*, 41(2), 157-174.
- Fuhrer, R., & Rouillon, F. (1989). La Version française de l'échelle CES-D (Center for Epidemiologic Studies-Depression Scale). Description et traduction de l'échelle d'autoévaluation. *Psychiatrie & Psychobiologie*.
- Gadalla, T. (2008). Association of comorbid mood disorders and chronic illness with disability and quality of life in Ontario, Canada. *Chronic diseases in Canada*, 28(4), 148-154.



- Gan, Y., Gong, Y., Tong, X., Sun, H., Cong, Y., Dong, X., . . . Deng, J. (2014). Depression and the risk of coronary heart disease: a meta-analysis of prospective cohort studies. *BMC Psychiatry, 14*(1), 371.
- Gjesfjeld, C. D., Greeno, C. G., & Kim, K. H. (2008). A confirmatory factor analysis of an abbreviated social support instrument: The MOS-SSS. *Research on Social Work Practice, 18*(3), 231-237.
- Grant, B. F., Goldstein, R. B., Chou, S. P., Huang, B., Stinson, F. S., Dawson, D. A., . . . Pickering, R. P. (2009). Sociodemographic and psychopathologic predictors of first incidence of DSM-IV substance use, mood and anxiety disorders: results from the Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions. *Molecular Psychiatry, 14*(11), 1051.
- Guimaraes, P. O., Granger, C. B., Stebbins, A., Chiswell, K., Held, C., Hochman, J. S., . . . Stewart, R. A. (2017). Sex differences in clinical characteristics, psychosocial factors, and outcomes among patients with stable coronary heart disease: insights from the STABILITY (Stabilization of Atherosclerotic Plaque by Initiation of Darapladib Therapy) trial. *Journal of the American Heart Association, 6*(9), e006695.
- Haschke, A., Hutter, N., & Baumeister, H. (2012). Indirect costs in patients with coronary artery disease and mental disorders: a systematic review and meta-analysis. *International Journal of Occupational Medicine and Environmental Health, 25*(4), 319-329.
- Hathaway, S. R., MacKinley, J., & Perse, J. (1966). *Inventaire multiphasique de personnalité du Minnesota (MMPI): manuel*: Centre de psychologie appliquée.

- Heinrichs, M., Baumgartner, T., Kirschbaum, C., & Ehlert, U. (2003). Social support and oxytocin interact to suppress cortisol and subjective responses to psychosocial stress. *Biological Psychiatry, 54*(12), 1389-1398.
- Holden, L., Lee, C., Hockey, R., Ware, R. S., & Dobson, A. J. (2014). Validation of the MOS Social Support Survey 6-item (MOS-SSS-6) measure with two large population-based samples of Australian women. *Quality of Life Research, 23*(10), 2849-2853.
- Horsten, M., Mittleman, M., Wamala, S., Schenck-Gustafsson, K., & Orth-Gomer, K. (2000). Depressive symptoms and lack of social integration in relation to prognosis of CHD in middle-aged women. The Stockholm Female Coronary Risk Study. *European Heart Journal, 21*(13), 1072-1080.
- Izawa, S., Eto, Y., Yamada, K. C., Nakano, M., Yamada, H., Nagayama, M., . . . Nomura, S. (2011). Cynical hostility, anger expression style, and acute myocardial infarction in middle-aged Japanese men. *Behavioral Medicine, 37*(3), 81-86.
- Janssen, V., Gucht, V. D., Dusseldorp, E., & Maes, S. (2013). Lifestyle modification programmes for patients with coronary heart disease: a systematic review and meta-analysis of randomized controlled trials. *European Journal of Preventive Cardiology, 20*(4), 620-640.
- Jarpa, E., Babul, M., Calderón, J., González, M., Martínez, M., Bravo-Zehnder, M., . . . Massardo, L. (2011). Common mental disorders and psychological distress in systemic lupus erythematosus are not associated with disease activity. *Lupus, 20*(1), 58-66.
- Jorm, A. F. (2000). Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychological Medicine, 30*(1), 11-22.

- Jorm, A. F., Rodgers, B., Jacomb, P. A., Christensen, H., Henderson, S., & Korten, A. E. (1999). Smoking and mental health: results from a community survey. *Medical Journal of Australia, 170*(2), 74-77.
- Jorm, A. F., Windsor, T., Dear, K., Anstey, K., Christensen, H., & Rodgers, B. (2005). Age group differences in psychological distress: the role of psychosocial risk factors that vary with age. *Psychological Medicine, 35*(9), 1253-1263.
- Kähkönen, O., Kankkunen, P., Miettinen, H., Lamidi, M. L., & Saaranen, T. (2017). Perceived social support following percutaneous coronary intervention is a crucial factor in patients with coronary heart disease. *Journal of Clinical Nursing, 26*(9-10), 1264-1280.
- Keles, H., Ekici, A., Ekici, M., Bulcun, E., & Altinkaya, V. (2007). Effect of chronic diseases and associated psychological distress on health-related quality of life. *Internal Medicine Journal, 37*(1), 6-11.
- Khan, S. S., Nessim, S., Gray, R., Czer, L. S., Chaux, A., & Matloff, J. (1990). Increased mortality of women in coronary artery bypass surgery: evidence for referral bias. *Annals of Internal Medicine, 112*(8), 561-567.
- Klaassen, K., Nyklíček, I., Traa, S., & de Nijs, R. (2012). Distressed personality is associated with lower psychological well-being and life satisfaction, but not disability or disease activity in rheumatoid arthritis patients. *Clinical Rheumatology, 31*(4), 661-667.
- Knight, R. G., Waal-Manning, H. J., & Spears, G. F. (1983). Some norms and reliability data for the State--Trait Anxiety Inventory and the Zung Self-Rating Depression scale. *The British Journal of Clinical Psychology, 22*, 245-249.
- Knox, S. S., Siegmund, K. D., Weidner, G., Ellison, R. C., Adelman, A., & Paton, C. (1998). Hostility, social support, and coronary heart disease in the National Heart, Lung, and

- Blood Institute Family Heart Study. *The American Journal of Cardiology*, 82(10), 1192-1196.
- Kohli, P., Whelton, S. P., Hsu, S., Yancy, C. W., Stone, N. J., Chrispin, J., . . . Martin, S. S. (2014). Clinician's guide to the updated ABCs of cardiovascular disease prevention. *Journal of the American Heart Association*, 3(5), e001098.
- Kroemeke, A. (2016). Depressive symptom trajectories over a 6-year period following myocardial infarction: predictive function of cognitive appraisal and coping. *Journal of Behavioral Medicine*, 39(2), 181-191.
- Kroenke, K., & Spitzer, R. L. (1998). Gender Differences in the Reporting of Physical and Somatoform Symptoms. *Psychosomatic Medicine*, 60(2), 150-155.
- Lavie, C. J., & Milani, R. V. (2004). Impact of aging on hostility in coronary patients and effects of cardiac rehabilitation and exercise training in elderly persons. *The American Journal of Geriatric Cardiology*, 13(3), 125-130.
- Lehman, K. A., Burns, M. N., Gagen, E. C., & Mohr, D. C. (2012). Development of the Brief Inventory of Perceived Stress. *Journal of Clinical Psychology*, 68(6), 631-644.
- Leifheit-Limson, E. C., Reid, K. J., Kasl, S. V., Lin, H., Buchanan, D. M., Jones, P. G., . . . Lichtman, J. H. (2012). Changes in social support within the early recovery period and outcomes after acute myocardial infarction. *Journal of Psychosomatic Research*, 73(1), 35-41.
- Leifheit-Limson, E. C., Reid, K. J., Kasl, S. V., Lin, H., Jones, P. G., Buchanan, D. M., . . . Lichtman, J. H. (2010). The role of social support in health status and depressive symptoms after acute myocardial infarction: evidence for a stronger relationship among women. *Circulation: Cardiovascular Quality and Outcomes*, 3(2), 143-150.

- Lett, H. S., Blumenthal, J. A., Babyak, M. A., Catellier, D. J., Carney, R. M., Berkman, L. F., . . . Schneiderman, N. (2007). Social support and prognosis in patients at increased psychosocial risk recovering from myocardial infarction. *Health psychology : Official Journal of the Division of Health Psychology, American Psychological Association*, 26(4), 418-427.
- Levenstein, S., Prantera, C., Varvo, V., Scribano, M. L., Berto, E., Luzi, C., & Andreoli, A. (1993). Development of the Perceived Stress Questionnaire: a new tool for psychosomatic research. *Journal of Psychosomatic Research*, 37(1), 19-32.
- Lewinsohn, P. M., Seeley, J. R., Roberts, R. E., & Allen, N. B. (1997). Center for Epidemiologic Studies Depression Scale (CES-D) as a screening instrument for depression among community-residing older adults. *Psychology and Aging*, 12(2), 277-287.
- Li, J., Zhang, M., Loerbroks, A., Angerer, P., & Siegrist, J. (2015). Work stress and the risk of recurrent coronary heart disease events: A systematic review and meta-analysis. *International Journal of Occupational Medicine and Environmental Health*, 28(1), 8-19.
- Martin-Subero, M., Kroenke, K., Diez-Quevedo, C., Rangil, T., de Antonio, M., Morillas, R. M., . . . Planas, R. (2017). Depression as measured by PHQ-9 versus clinical diagnosis as an independent predictor of long-term mortality in a prospective cohort of medical inpatients. *Psychosomatic Medicine*, 79(3), 273-282.
- Matcham, F., Rayner, L., Steer, S., & Hotopf, M. (2013). The prevalence of depression in rheumatoid arthritis: a systematic review and meta-analysis. *Rheumatology*, 52(12), 2136-2148.

- McAuley, E., & Rudolph, D. (1995). Physical activity, aging, and psychological well-being. *Journal of Aging and Physical Activity*, 3(1), 67-96.
- McLean, C. P., & Anderson, E. R. (2009). Brave men and timid women? A review of the gender differences in fear and anxiety. *Clinical Psychology Review*, 29(6), 496-505.
- Meesters, C. M., & Smulders, J. (1994). Hostility and myocardial infarction in men. *Journal of Psychosomatic Research*, 38(7), 727-734.
- Mirowsky, J., & Ross, C. E. (1992). Age and depression. *Journal of Health and Social Behavior*, 187-205.
- Montero-Marin, J., Demarzo, M. M. P., Pereira, J. P., Olea, M., & García-Campayo, J. (2014). Reassessment of the psychometric characteristics and factor structure of the 'Perceived Stress Questionnaire'(PSQ): analysis in a sample of dental students. *PLoS one*, 9(1), e87071.
- Moser, D. K., Dracup, K., Evangelista, L. S., Zambroski, C. H., Lennie, T. A., Chung, M. L., . . . Heo, S. (2010). Comparison of prevalence of symptoms of depression, anxiety, and hostility in elderly patients with heart failure, myocardial infarction, and a coronary artery bypass graft. *Heart & Lung : the Journal of Critical Care*, 39(5), 378-385.
- Mostofsky, E., Penner, E. A., & Mittleman, M. A. (2014). Outbursts of anger as a trigger of acute cardiovascular events: a systematic review and meta-analysis. *European Heart Journal*, 35(21), 1404-1410.
- Murphy, B. M., Elliott, P. C., Higgins, R. O., Le Grande, M. R., Worcester, M. U., Goble, A. J., & Tatoulis, J. (2008). Anxiety and depression after coronary artery bypass graft surgery: most get better, some get worse. *European Journal of Cardiovascular Prevention and Rehabilitation : Official Journal of the European Society of*

*Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology, 15(4), 434-440.*

Murphy, B. M., Elliott, P. C., Worcester, M. U. C., Higgins, R. O., Grande, M. R., Roberts, S. B., & Goble, A. J. (2008). Trajectories and predictors of anxiety and depression in women during the 12 months following an acute cardiac event. *British Journal of Health Psychology, 13(1), 135-153.*

Murphy, B.M., Ludeman, D., Elliott, P., Judd, F., Humphreys, J., Edington, J., . . . Worcester, M. (2014). Red flags for persistent or worsening anxiety and depression after an acute cardiac event: a 6-month longitudinal study in regional and rural Australia. *European Journal of Preventive Cardiology, 21(9), 1079-1089.*

Nabi, H., Singh-Manoux, A., Ferrie, J. E., Marmot, M. G., Melchior, M., & Kivimäki, M. (2010). Hostility and depressive mood: results from the Whitehall II prospective cohort study. *Psychological Medicine, 40(3), 405-413.*

Noel, P. H., Williams, J. W., Jr., Unutzer, J., Worchel, J., Lee, S., Cornell, J., . . . Hunkeler, E. (2004). Depression and comorbid illness in elderly primary care patients: impact on multiple domains of health status and well-being. *Annals of Family Medicine, 2(6), 555.*

O'Donnell, S., Cheung, R., Bennett, K., & Lagacé, C. (2016). The 2014 Survey on Living with Chronic Diseases in Canada on Mood and Anxiety Disorders: a methodological overview. *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice, 36(12), 275.*

- Olsen, S. J., Schirmer, H., Wilsgaard, T., Bønaa, K. H., & Hanssen, T. A. (2018). Cardiac rehabilitation and symptoms of anxiety and depression after percutaneous coronary intervention. *European Journal of Preventive Cardiology*, 25(10), 1017-1025.
- Oquendo, M. A., Kamali, M., Ellis, S. P., Grunebaum, M. F., Malone, K. M., Brodsky, B. S., . . . Mann, J. J. (2002). Adequacy of antidepressant treatment after discharge and the occurrence of suicidal acts in major depression: a prospective study. *American Journal of Psychiatry*, 159(10), 1746-1751.
- Orth-Gomér, K., & Leineweber, C. (2005). Multiple stressors and coronary disease in women: The Stockholm Female Coronary Risk Study. *Biological Psychology*, 69(1), 57-66.
- Pajak, A., Jankowski, P., Kotseva, K., Heidrich, J., de Smedt, D., De Bacquer, D., & Group, E. S. (2013). Depression, anxiety, and risk factor control in patients after hospitalization for coronary heart disease: the EUROASPIRE III Study. *European Journal of Preventive Cardiology*, 20(2), 331-340.
- Palacios, J., Khondoker, M., Mann, A., Tylee, A., & Hotopf, M. (2018). Depression and anxiety symptom trajectories in coronary heart disease: Associations with measures of disability and impact on 3-year health care costs. *Journal of Psychosomatic Research*, 104, 1-8.
- Palinkas, L. A., Wingard, D. L., & Barrett-Connor, E. (1990). Chronic illness and depressive symptoms in the elderly: a population-based study. *Journal of Clinical Epidemiology*, 43(11), 1131-1141.
- Parashar, S., Rumsfeld, J. S., Reid, K. J., Buchanan, D., Dawood, N., Khizer, S., . . . Vaccarino, V. (2009). Impact of depression on sex differences in outcome after



- myocardial infarction. *Circulation: Cardiovascular Quality and Outcomes*, 2(1), 33-40.
- Parker, G., & Brotchie, H. (2010). Gender differences in depression. *International Review of Psychiatry (Abingdon, England)*, 22(5), 429-436.
- Pathak, L. A., Shirodkar, S., Ruparelia, R., & Rajebahadur, J. (2017). Coronary artery disease in women. *Indian Heart Journal*, 69(4), 532-538.
- Pearson, C., Janz, T., & Ali, J. (2013). *Mental and substance use disorders in Canada*. Statistics Canada.
- Perk, J., De Backer, G., Gohlke, H., Graham, I., Reiner, Ž., Verschuren, M., . . . Cifkova, R. (2012). European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). *European Heart Journal*, 33(13), 1635-1701.
- Pogosova, N., Kotseva, K., De Bacquer, D., von Känel, R., De Smedt, D., Bruthans, J., & Dolzhenko, M. (2017). Psychosocial risk factors in relation to other cardiovascular risk factors in coronary heart disease: Results from the EUROASPIRE IV survey. A registry from the European Society of Cardiology. *European Journal of Preventive Cardiology*, 24(13), 1371-1380.
- Polsky, D., Doshi, J. A., Marcus, S., Oslin, D., Rothbard, A., Thomas, N., & Thompson, C. L. (2005). Long-term risk for depressive symptoms after a medical diagnosis. *Archives of Internal Medicine*, 165(11), 1260-1266.
- Poole, L., Dickens, C., & Steptoe, A. (2011). The puzzle of depression and acute coronary syndrome: reviewing the role of acute inflammation. *Journal of Psychosomatic Research*, 71(2), 61-68.

- Public Health Agency of Canada, P. (2018). *At-a-glance – How Healthy are Canadians? A brief update*. Retrieved from Ottawa, Ontario, Canada:  
<https://www.canada.ca/en/public-health/services/reports-publications/health-promotion-chronic-disease-prevention-canada-research-policy-practice/vol-38-no-10-2018/at-a-glance-healthy-canadians-update.html>
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385-401.
- Ramsawh, H., Raffa, S., Edelen, M. O., Rende, R., & Keller, M. (2009). Anxiety in middle adulthood: effects of age and time on the 14-year course of panic disorder, social phobia and generalized anxiety disorder. *Psychological Medicine, 39*(4), 615-624.
- Remes, O., Brayne, C., Linde, R., & Lafortune, L. (2016). A systematic review of reviews on the prevalence of anxiety disorders in adult populations. *Brain and Behavior, 6*(7), e00497.
- Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: a quantitative review of longitudinal studies. *Psychological Bulletin, 126*(1), 3.
- Roest, A. M., Martens, E. J., de Jonge, P., & Denollet, J. (2010). Anxiety and risk of incident coronary heart disease: a meta-analysis. *Journal of the American College of Cardiology, 56*(1), 38-46.
- Roest, A. M., Wardenaar, K. J., & de Jonge, P. (2016). Symptom and course heterogeneity of depressive symptoms and prognosis following myocardial infarction. *Health Psychology, 35*(5), 413.
- Ross, C. E. (2017). *Social causes of psychological distress*: Routledge.

- Ruo, B., Bertenthal, D., Sen, S., Bittner, V., Ireland, C. C., & Hlatky, M. A. (2006). Self-rated health among women with coronary disease: depression is as important as recent cardiovascular events. *American Heart Journal*, *152*(5), 1-7.
- Rutledge, T., Kenkre, T. S., Bittner, V., Krantz, D. S., Thompson, D. V., Linke, S. E., . . . Bairey Merz, C. N. (2013a). Anxiety associations with cardiac symptoms, angiographic disease severity, and healthcare utilization: The NHLBI-sponsored Women's Ischemia Syndrome Evaluation. *International Journal of Cardiology*, *168*(3), 2335-2340.
- Rutledge, T., Kenkre, T. S., Thompson, D. V., Bittner, V. A., Whittaker, K., Eastwood, J.-A., . . . Bairey Merz, C. N. (2016). Psychosocial predictors of long-term mortality among women with suspected myocardial ischemia: the NHLBI-sponsored Womens Ischemia Syndrome Evaluation. *Journal of Behavioral Medicine*, *39*(4), 687-693.
- Rutledge, T., Redwine, L. S., Linke, S. E., & Mills, P. J. (2013b). A meta-analysis of mental health treatments and cardiac rehabilitation for improving clinical outcomes and depression among patients with coronary heart disease. *Psychosomatic Medicine*, *75*(4), 335-349.
- Scherwitz, L., Perkins, L., Chesney, M., & Hughes, G. (1991). Cook-Medley Hostility scale and subsets: relationship to demographic and psychosocial characteristics in young adults in the CARDIA study. *Psychosomatic Medicine*, *53*(1), 36-49.
- Schmidt, M. M., Moura, M. R., Stochero, L., Gottschall, C. M., Quadros, A. S., Lopes, R. D., & Newby, L. K. (2013). Anger control and cardiovascular outcomes. *International Journal of Cardiology*, *168*(4), 4338-4339.

- Scott, K. M., Bruffaerts, R., Tsang, A., Ormel, J., Alonso, J., Angermeyer, M., . . . De Graaf, R. (2007). Depression–anxiety relationships with chronic physical conditions: results from the World Mental Health Surveys. *Journal of Affective Disorders, 103*(1-3), 113-120.
- Self, A., Thomas, J., & Randall, C. (2012). Measuring national well-being: Life in the UK. *Office for National Statistics, 1-52*.
- Shah, A. J., & Vaccarino, V. (2016). Psychosocial Risk Factors and Coronary Artery Disease.
- Silarova, B., Nagyova, I., Rosenberger, J., van Dijk, J. P., & Reijneveld, S. A. (2016). Sense of coherence as a mediator between hostility and health-related quality of life among coronary heart disease patients. *Heart & Lung - The Journal of Acute and Critical Care, 45*(2), 126-131.
- Silverstein, B. (1999). Gender Difference in the Prevalence of Clinical Depression: The Role Played by Depression Associated With Somatic Symptoms. *American Journal of Psychiatry, 156*(3), 480-482.
- Silverstein, B. (2002). Gender Differences in the Prevalence of Somatic Versus Pure Depression: A Replication. *American Journal of Psychiatry, 159*(6), 1051-1052.
- Smaardijk, V. R., Maas, A. H., Lodder, P., Kop, W. J., & Mommersteeg, P. M. (2020). Sex and gender-stratified risks of psychological factors for adverse clinical outcomes in patients with ischemic heart disease: A systematic review and meta-analysis. *International Journal of Cardiology, 302*, 21-29.
- Smith, T. W., & Frohm, K. D. (1985). What's so unhealthy about hostility? Construct validity and psychosocial correlates of the Cook and Medley Ho scale. *Health Psychology, 4*(6), 503.

- Sonnenberg, C. M., Beekman, A. T., Deeg, D. J., & van Tilburg, W. (2000). Sex differences in late-life depression. *Acta Psychiatrica Scandinavica*, *101*(4), 286-292.
- Spielberger, C., Gorsuch, R., Lushene, R., Vagg, P., & Jacobs, G. (1983). *Manual for the state-trait anxiety inventory*. Consulting Psychologists Press.
- Staniute, M., Brozaitiene, J., & Bunevicius, R. (2013). Effects of social support and stressful life events on health-related quality of life in coronary artery disease patients. *Journal of Cardiovascular Nursing*, *28*(1), 83-89.
- Statistics Canada. (2012). *Canadian Community Health Survey - Mental Health (CCHS)*. Ottawa, Ontario: Ontario MOHLTC.
- Statistics Canada. (2014). *Perceived life stress, 2014*. The Canadian Community Health Survey.
- Step toe, A., & Kivimäki, M. (2013). Stress and cardiovascular disease: an update on current knowledge. *Annual Review of Public Health*, *34*, 337-354.
- Stewart, R. A., Colquhoun, D. M., Marschner, S. L., Kirby, A. C., Simes, J., Nestel, P. J., . . . White, H. D. (2017). Persistent psychological distress and mortality in patients with stable coronary artery disease. *Heart*, *103*(23), 1860-1866.
- Stordal, E., Bjartveit Krüger, M., Dahl, N. H., Krüger, Ø., Mykletun, A., & Dahl, A. (2001). Depression in relation to age and gender in the general population: the Nord-Trøndelag Health Study (HUNT). *Acta Psychiatrica Scandinavica*, *104*(3), 210-216.
- Suls, J. (2018). Toxic affect: Are anger, anxiety, and depression independent risk factors for cardiovascular disease? *Emotion Review*, *10*(1), 6-17.

- Sunbul, M., Zincir, S. B., Durmus, E., Sunbul, E. A., Cengiz, F. F., Kivrak, T., . . . Sari, I. (2013). Anxiety and depression in patients with coronary artery disease. *Klinik Psikofarmakoloji Bülteni-Bulletin of Clinical Psychopharmacology*, 23(4), 345-352.
- The Canadian Community Health Survey. (2016). *Chronic Conditions, 2016*.
- Thielke, S., Diehr, P., & Unutzer, J. (2010). Prevalence, incidence, and persistence of major depressive symptoms in the Cardiovascular Health Study. *Aging & Mental Health*, 14(2), 168-176.
- Tully, Cosh, S. M., & Baumeister, H. (2014). The anxious heart in whose mind? A systematic review and meta-regression of factors associated with anxiety disorder diagnosis, treatment and morbidity risk in coronary heart disease. *Journal of Psychosomatic Research*, 77(6), 439-448.
- Tully, Winefield, H., Baker, R., Denollet, J., Pedersen, S., Wittert, G., & Turnbull, D. (2015). Depression, anxiety and major adverse cardiovascular and cerebrovascular events in patients following coronary artery bypass graft surgery: A five year longitudinal cohort study. *BioPsychoSocial Medicine*, 9(1), 14.
- Tully, P. J., & Baker, R. A. (2012). Depression, anxiety, and cardiac morbidity outcomes after coronary artery bypass surgery: a contemporary and practical review. *Journal of Geriatric Cardiology: JGC*, 9(2), 197.
- Tully, P. J., Harrison, N. J., Cheung, P., & Cosh, S. (2016). Anxiety and cardiovascular disease risk: a review. *Current Cardiology Reports*, 18(12), 120.
- Tully, P. J., & Higgins, R. (2014). Depression screening, assessment, and treatment for patients with coronary heart disease: A review for psychologists. *Australian Psychologist*, 49(6), 337-344.

- Uchino, B. N. (2006). Social support and health: a review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, 29(4), 377-387.
- Van Dam, N. T., & Earleywine, M. (2011). Validation of the Center for Epidemiologic Studies Depression Scale Revised (CESD-R): Pragmatic depression assessment in the general population. *Psychiatry Research*, 186(1), 128-132.
- Van de Velde, S., Bracke, P., & Levecque, K. (2010). Gender differences in depression in 23 European countries. Cross-national variation in the gender gap in depression. *Social Science & Medicine*, 71(2), 305-313.
- Versteeg, H., Hoogwegt, M. T., Hansen, T. B., Pedersen, S. S., Zwisler, A.-D., & Thygesen, L. C. (2013). Depression, not anxiety, is independently associated with 5-year hospitalizations and mortality in patients with ischemic heart disease. *Journal of Psychosomatic Research*, 75(6), 518-525.
- Versteeg, H., Roest, A. M., & Denollet, J. (2015). Persistent and fluctuating anxiety levels in the 18 months following acute myocardial infarction: the role of personality. *General Hospital Psychiatry*, 37(1), 1-6.
- Vilagut, G., Forero, C. G., Barbaglia, G., & Alonso, J. (2016). Screening for Depression in the General Population with the Center for Epidemiologic Studies Depression (CES-D): A Systematic Review with Meta-Analysis. *PloS one*, 11(5).
- Villamil, E., Huppert, F. A., & Melzer, D. (2006). Low prevalence of depression and anxiety is linked to statutory retirement ages rather than personal work exit: a national survey. *Psychological Medicine*, 36(7), 999-1009.

- Wade, T. J., & Cairney, J. (2000). The effect of sociodemographics, social stressors, health status and psychosocial resources on the age-depression relationship. *Canadian Journal of Public Health, 91*(4), 307-312.
- Wang, H. X., Leineweber, C., Kirkeeide, R., Svane, B., Schenck-Gustafsson, K., Theorell, T., & Orth-Gomér, K. (2007). Psychosocial stress and atherosclerosis: family and work stress accelerate progression of coronary disease in women. The Stockholm Female Coronary Angiography Study. *Journal of Internal Medicine, 261*(3), 245-254.
- Wang, M., Norris, C. M., Graham, M. M., Santana, M., Liang, Z., Awosoga, O., . . . Quan, H. (2019). Trajectories of perceived social support in acute coronary syndrome. *Quality of Life Research, 28*(5), 1365-1376.
- Wardenaar, K. J., Wanders, R. B., Roest, A. M., Meijer, R. R., & De Jonge, P. (2015). What does the beck depression inventory measure in myocardial infarction patients? a psychometric approach using item response theory and person-fit. *International Journal of Methods in Psychiatric Research, 24*(2), 130-142.
- Ware Jr, J. E. (2000). SF-36 health survey update. *Spine, 25*(24), 3130-3139.
- Whalley, B., Thompson, D. R., & Taylor, R. S. (2014). Psychological interventions for coronary heart disease: cochrane systematic review and meta-analysis. *International Journal of Behavioral Medicine, 21*(1), 109-121.
- Wong, J. M., Na, B., Regan, M. C., & Whooley, M. A. (2013). Hostility, health behaviors, and risk of recurrent events in patients with stable coronary heart disease: findings from the Heart and Soul Study. *Journal of the American Heart Association, 2*(5), e000052.
- Wu, Q., & Kling, J. M. (2016). Depression and the risk of myocardial infarction and coronary death: a meta-analysis of prospective cohort studies. *Medicine, 95*(6).



Xu, X., Bao, H., Strait, K., Spertus, J. A., Lichtman, J. H., D'onofrio, G., . . . Lorenze, N. P. (2015). Sex differences in perceived stress and early recovery in young and middle-aged patients with acute myocardial infarction. *Circulation, 131*(7), 614-623.

Xu, X., Bao, H., Strait, K. M., Edmondson, D. E., Davidson, K. W., Beltrame, J. F., . . . Brush, J. E. (2017). Perceived stress after acute myocardial infarction: a comparison between young and middle-aged women versus men. *Psychosomatic Medicine, 79*(1), 50.

Table 1.

*Participant characteristics (mean ± SD)*

	CAD men (N=499)	Non CVD men (N=253)	CAD women (N=145)	Non CVD women (N=332)	Healthy men (N=21)	Healthy women (N=17)	All participants (N=1267)
<b><i>Demographic variables</i></b>							
Age (years)*	60.80 (6.55)	59.35 (7.31)	62.50 (5.84)	59.70 (7.62)	52.19 (9.35)	54.53 (11.75)	60.19 (7.22)
Years of schooling*	14.07 (3.75)	15.31 (3.34)	12.78 (3.12)	14.43 (3.55)	16.05 (4.12)	15.82 (2.77)	14.32 (3.63)
Currently Working N (%)	182 (36.8%)	141 (54.4%)	38 (26%)	133 (39.5%)	16 (76.2%)	6 (35.3%)	516 (40.5%)
<i>Race N (%)<sup>a</sup></i>							
Caucasian	495 (99.2%)	246 (97.2%)	143 (98.6%)	328 (99.1%)	20 (95.2%)	17 (100.0%)	1249 (98.7%)
<i>First spoken language N (%)</i>							
French	468 (93.8%)	224 (88.5%)	137 (94.5%)	305 (91.9%)	21 (100.0%)	17 (100.0%)	1172 (92.5%)
English	8 (1.6%)	9 (3.6%)	3 (2.1%)	6 (1.8%)	0 (0.0%)	0 (0.0%)	26 (2.1%)
<i>Marital Status N (%)<sup>*</sup></i>							
Married/living with someone	380 (76.2%)	203 (80.2%)	85 (58.6%)	225 (67.8%)	20 (95.2%)	13 (76.5%)	926 (73.1%)

Separated, divorced, widowed	81 (16.2%)	29 (11.5%)	46 (31.7%)	66 (19.9%)	0 (0.0%)	2 (11.8%)	224 (17.7%)
Single	38 (7.6%)	21 (8.3%)	14 (9.7%)	41 (12.3%)	1 (4.8%)	2 (11.8%)	117 (9.2%)
<b><i>Annual family income n (%)<sup>b*</sup></i></b>							
≤ 34,999	70 (16.4%)	7 (3.3%)	49 (42.6%)	41 (15.5%)	1 (4.8%)	0 (0.0%)	168 (16.0%)
35,000- 74,999	177 (41.5%)	76 (35.5%)	52 (45.2%)	126 (29.2%)	4 (19.0%)	3 (27.3%)	438 (41.6%)
≥ 75,000	179 (42%)	131 (61.2%)	14 (12.2%)	98 (37%)	16 (76.2%)	8 (72.7%)	446 (42.4%)
<b><i>Health behaviours</i></b>							
Body Mass Index <sup>c*</sup>	29.53 (4.74)	29.07 (4.50)	28.79 (5.92)	27.98 (5.48)	27.19 (3.21)	25.60 (2.85)	28.86 (5.05)
Minutes of exercise /week (± SD) <sup>d*</sup>	294.43 (590.05)	280.63 (470.79)	154.34 (358.88)	165.69 (339.26)	302.37 (298.29)	243.26 (212.08)	240.88 (480.01)
Smoker n (%) <sup>a*</sup>	73 (14.6%)	27 (10.7%)	17 (11.7%)	20 (6.0%)	1 (4.8%)	2 (11.8%)	140 (11.1%)
Cigarettes/day <sup>a*</sup>	19.83 (17.20)	12.42 (14.47)	12.60 (13.62)	9.17 (12.81)	3.86 (6.32)	5.24 (7.76)	14.28 (15.70)
Glasses of alcohol/week <sup>c*</sup>	7.62 (10.17)	7.43 (7.44)	2.69 (5.23)	4.62 (6.17)	6.33 (5.08)	2.12 (2.89)	6.14 (8.29)
<b><i>Psychotropic medications</i></b>							

	66	24	29	50	0	4	173
Antidepressants*	(13.2%)	(9.5%)	(20.0%)	(15.1%)	(0.0%)	(23.5%)	(13.7%)
Anxiolytics*	68	26	45	54	0	1	194
	(13.6%)	(10.3%)	(31.0%)	(16.3%)	(0.0%)	(5.9%)	(15.3%)
<b><i>Past psychiatric diagnosis</i></b>							
Depressive disorders*	61	16	24	48	0	2	151
	(12.2%)	(6.3%)	(16.6%)	(14.5%)	(0.0%)	(11.8%)	(11.9%)
Anxiety disorders	18	8	7	13	0	0	46
	(3.6%)	(3.2%)	(4.8%)	(3.9%)	(0.0%)	(0.0%)	(3.6%)
Any psychiatric diagnosis*	74	23	29	55	0	2	183
	(14.8%)	(9.1%)	(20.0%)	(16.6%)	(0.0%)	(11.8%)	(14.4%)
<b><i>Physical Comorbidities</i></b>							
Hypertension <sup>c*</sup>	342	97	106	116	0	0	661
	(69.0%)	(38.5%)	(73.6%)	(35.3%)	(0.0%)	(0.0%)	(52.5%)
Diabetes <sup>c*</sup>	99	28	35	17	0	0	179
	(20.0%)	(11.1%)	(24.1%)	(5.1%)	(0.0%)	(0.0%)	(14.2%)
Hypercholesterolemia <sup>f*</sup>	478	158	129	131	0	0	896
	(96.2%)	(62.7%)	(89%)	(39.6%)	(0.0%)	(0.0%)	(70.9%)
Eczema	39	10	13	24	0	0	86
	(7.8%)	(3.8%)	(9.0%)	(7.1%)	(0%)	(0%)	(6.7%)
Asthma	27	20	19	34	1	0	101
	(5.4%)	(7.9%)	(13.1%)	(10.2%)	(4.8%)	(0%)	(7.9%)
Gastroesophageal Reflux Disease	82	43	41	34	0	2	202
	(16.4%)	(16.4%)	(28.3%)	(10.0%)	(0%)	(11.8%)	(15.7%)

Glaucoma	73 (14.6%)	40 (15.8%)	28 (19.3%)	71 (21.4%)	3 (14.3%)	1 (5.9%)	216 (17.0%)
Arthritis	187 (37.5%)	76 (30.0%)	86 (59.3%)	147 (44.3%)	0 (0.0%)	3 (17.6%)	499 (39.4%)

Note. CAD=Coronary Artery Disease, CV= Cardiovascular. Standard Deviations and % appear in parentheses below the means/number.

<sup>a</sup>N=1266, <sup>b</sup>N=1052, <sup>c</sup>N=1262, <sup>d</sup>N=1085, <sup>e</sup>N=1259, <sup>f</sup>N=1263

\* $p < .05$ .

Table 2.

*Mean ( $\pm$  SD) psychological distress scores*

<i>Psychological variables</i>		CAD men	Non-CV men	CAD women	Non-CV women	Healthy men	Healthy women
<b>CES-D</b>	<b>T1</b>	4.99 (6.40)	5.24 (6.98)	8.55 (8.67)	5.00 (5.83)	3.05 (4.04)	2.31 (3.82)
	<b>T2</b>	6.48 (7.99)	6.00 (7.25)	8.80 (7.72)	6.61 (7.40)	2.76 (3.49)	3.31 (3.82)
	<b>N</b>	491	248	136	323	21	16
<b>STAI-S</b>	<b>T1</b>	33.29 (9.30)	33.46 (9.75)	37.59 (10.56)	33.21 (8.59)	30.06 (7.82)	29.20 (7.52)
	<b>T2</b>	28.82 (7.74)	28.32 (7.26)	30.83 (8.79)	29.50 (6.98)	25.78 (5.09)	25.40 (6.02)
	<b>N</b>	401	211	109	287	18	10
<b>CMHo</b>	<b>T1</b>	14.08 (6.30)	13.63 (5.99)	13.56 (5.87)	12.42 (5.62)	10.75 (4.88)	11.38 (6.12)
	<b>T2</b>	14.57 (6.19)	13.81 (6.27)	14.11 (5.46)	13.01 (5.59)	11.57 (5.78)	12.31 (7.07)
	<b>N</b>	489	250	138	321	21	16
<b>PSI</b>	<b>T1</b>	27.56 (15.78)	29.95 (17.89)	36.95 (19.25)	30.10 (15.84)	24.21 (12.71)	24.91 (12.57)
	<b>T2</b>	26.04 (14.85)	27.21 (15.88)	33.46 (15.82)	30.91 (15.92)	24.97 (15.23)	26.67 (12.85)
	<b>N</b>	400	211	109	289	19	12
<b>Social Support</b>	<b>T1</b>	19.53 (6.10)	20.58 (6.01)	18.74 (6.40)	20.44 (5.60)	21.95 (5.98)	24.17 (3.90)
	<b>T2</b>	20.44 (5.84)	22.19 (5.62)	20.55 (5.98)	22.10 (4.99)	23.68 (4.26)	24.58 (3.60)
	<b>N</b>	395	210	108	288	19	12

Note. CAD=Coronary Artery Disease, CV= Cardiovascular, CESD-R=Center for Epidemiologic Studies Depression Scale-Revised, STAI=State-Trait Anxiety Inventory, CMHo= Cook Medley Hostility Inventory, PSI= Perceived Stress Index, Social Support Questionnaire

Table 3.

*N (%) of individuals meeting clinically significant cut-offs for each psychological variable*

<b>Psychological variables</b>		CAD men	Non-CV men	CAD women	Non-CV women	Total participants with CAD or other illness	Healthy men	Healthy women
<b>Depression</b>								
T1	33 (6.7%)	17 (6.8%)	24 (17.0%)	20 (6.1%)	94 (7.7%)	0 (0.0%)	0 (0.0%)	
T2	61 (12.3%)	20 (8.0%)	27 (19.1%)	34 (10.3%)	142 (11.7%)	0 (0.0%)	0 (0.0%)	
N	496	250	141	329	1216	21	17	
<b>State Anxiety</b>								
T1	101 (25.0%)	54 (25.4%)	47 (41.6%)	66 (22.6%)	268 (26.2%)	2 (11.1%)	1 (9.1%)	
T2	45 (11.1%)	15 (7.0%)	19 (16.8%)	36 (12.3%)	115 (11.3%)	0 (0.0%)	0 (0.0%)	
N	404	213	113	292	1022	18	11	
<b>Perceived Stress</b>								
T1	67 (16.6%)	43 (20.2%)	40 (35.4%)	53 (18.0%)	203 (19.8%)	0 (0.0%)	1 (7.7%)	
T2	43 (10.7%)	34 (16.0%)	29 (25.7%)	57 (19.4%)	163 (15.9%)	3 (15.8%)	1 (7.7%)	
N	403	213	113	294	1023	19	13	

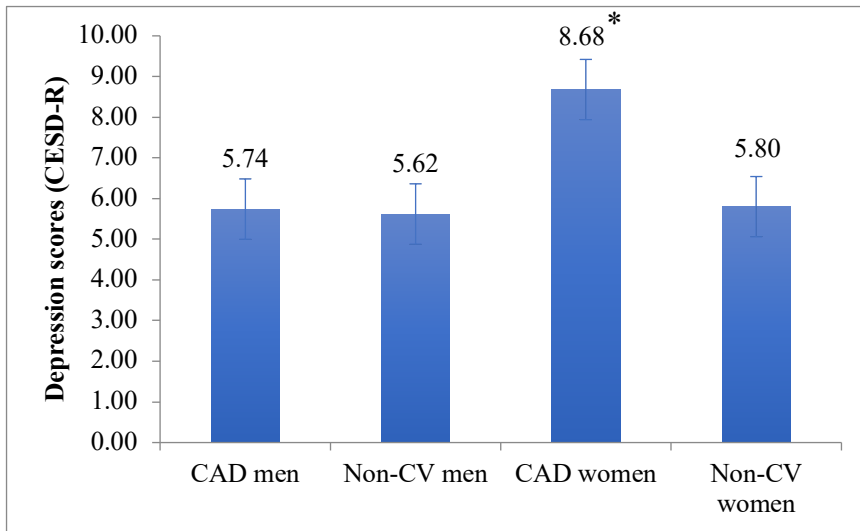
<b>Combined</b>	T1	129	75	68	93	365	2	2
<b>Psychological</b>		(25.9%)	(29.8%)	(47.2%)	(28.2%)	(29.8%)	(9.5%)	(11.8%)
<b>Distress</b>	T2	109	47	56	92	306	3	3
		(21.9%)	(18.7%)	(38.9%)	(27.9%)	(24.9%)	(14.3%)	(17.6%)
	N	498	252	144	330	1224	21	17
<b>Combined</b>								
<b>Psychological</b>	T1	191	93	90	146	520	2	5
<b>Distress and</b>		(38.4%)	(36.9%)	(62.5%)	(44.2%)	(42.5%)	(9.5%)	(29.4%)
<b>use of</b>	T2	167	67	80	146	460	3	8
<b>psychotropics</b>		(33.5%)	(26.6%)	(55.6%)	(44.2%)	(37.6%)	(14.3%)	(47.1%)
	N	498	252	144	330	1224	21	17

Note. CAD=Coronary Artery Disease, CV= Cardiovascular, CESD-R=Center for Epidemiologic Studies Depression Scale-Revised (clinical cut-off  $\geq 16$ ), STAI=State-Trait Anxiety Inventory (clinical cut-off  $\geq 39$ ), PSI= Perceived Stress Index (clinical cut-off  $\geq 0.45$ )



## Figure Captions

**Figure 1:** Mean Depression Score among Men and Women with and without coronary artery disease (CAD) Averaged over Time (controlling for covariates). CAD women reported significantly more symptoms of depression across both time points compared to men and compared to women with non-cardiovascular (CV) disease (all p's <0.01).



*Fig 1.* Mean Depression Score among Men and Women with and without coronary artery disease (CAD) Averaged over Time (controlling for covariates). CAD women reported significantly more symptoms of depression across both time points compared to men, and compared to women with non-cardiovascular (CV) disease (all p's < 0.01).

## SUPPLEMENTAL MATERIAL

### **Severity of psychological distress over five years differs as a function of sex and presence of coronary artery disease**

#### *Supplemental Digital Content 1*

##### **Post hoc analyses**

Healthy participants were not included in the main analyses given the very small sample size (N=38) and vastly different sociodemographic (age, education, income, work status), lifestyle and other characteristics. Their data is included in tables as points of reference only.

Analyses examining those who did and did not return the anxiety/stress/social support questionnaires at baseline found no significant group differences on sociodemographic nor psychological (depression, hostility) variables.

Additional analyses were performed to better understand the specific vulnerability of women with CAD. Sex by Time by CAD status ANOVAs were repeated on the CES-D and PSQ subscales while controlling for covariates as per main analyses to determine whether greater depression and stress observed in CAD women mostly reflected higher reports of somatic symptoms. To increase normality, scores for the CES-D and PSQ subscales were log or sqrt-transformed where indicated.

Significant Sex by CAD status interactions ( $p$ 's <0.05) were observed across all but two (thinking and suicidal ideation) of the CES-D subscales (see Supplemental Table 4), with women with CAD scoring significantly higher than other groups ( $p$ 's <0.05) for sadness, appetite, sleep, and guilt. Women with CAD scored significantly higher than non-CV men and

women for fatigue, higher than non-CV women for anhedonia, and higher than men with CAD for agitation ( $p$ 's  $<0.05$ ).

On the PSQ subscales, Time by Sex by CAD status interactions ( $p$ 's  $<0.05$ ) were observed for “Overloaded”, “Irritability”, “Lack of Joy”, and “Tension”; Sex by CAD interactions ( $p$ 's  $<0.05$ ) were found for “Fatigue” and “Harassment”; and significant Sex differences for “Worries” ( $p < 0.05$ ) (see Supplemental Table 5). At T1, CAD women reported more “Lack of Joy”, “Fatigue”, “Tension” than other groups and they reported more “Irritability” and “Worries” than CAD men ( $p$ 's  $<0.05$ ). Furthermore, men with CAD feeling less “Harassment” and “Overloaded” than other groups ( $p$ 's  $<0.05$ ). At T2, men with CAD reported feeling less “Harassment”, “Overloaded”, “Irritability”, and “Tension” than both CAD and non-CV women, and less “Fatigue” and “Worries” than CAD women ( $p$ 's  $<0.05$ ). Furthermore, CAD and Non-CV women reported more symptoms for “Overloaded” and “Irritability” than non-CV men ( $p$ 's  $<0.05$ ). No significance was found for the lack of joy PSQ subscale at T2.

As greater psychological distress in women vs. men with CAD may reflect a more recent CAD event or more chronic disease, sex differences in time since first or last coronary event/procedure were examined in those having had such occurrences. Independent samples  $t$ -tests showed that women and men had a similar time lapse since their most recent CAD event/procedure ( $6.27 \pm 6.10$  years for women vs.  $6.62 \pm 5.72$  years for men;  $t(636) = 0.78$ ,  $p = 0.435$ ,  $d = 0.07$ ). Men, however, reported their first cardiac event/procedure earlier, having occurred  $8.78 \pm 7.25$  years prior to study onset compared to  $7.48 \pm 7.14$  years in women ( $t(636) = 2.15$ ,  $p = 0.032$ ,  $d = 0.20$ ). Furthermore, we examined whether there were sex differences

regarding the number of CAD events/procedures (log transformed) prior to study onset. Independent samples t-tests showed that men with CAD had slightly, though significantly more CAD events/procedures before study onset than women with CAD ( $2.17 \pm 1.22$  vs  $1.87 \pm 1.17$ ;  $t(223.21) = 3.38, p = 0.001, d = 0.36$ ).

In order to see whether participants with CAD reporting clinically significant distress had experienced a cardiac event closer in time prior to each psychological assessment, independent samples t-tests were performed. Significant distress was defined as meeting clinically significant symptoms of either depression, anxiety, or moderate-high stress. Participants reporting clinically significant distress at study entry generally had a CAD event/procedure more recently compared to participants without clinical distress ( $5.82 \pm 5.76$  vs.  $6.88 \pm 5.81$  years;  $t(634) = 2.43, p = 0.015, d = 0.21$ ); however, this difference was significant among men ( $t(492) = 3.08, p = 0.002, d = 0.32$ ) but not women ( $t(140) = -.532, p = 0.596, d = 0.09$ ). Similar findings were observed at time 2 ( $2.18 \pm 1.36$  vs.  $2.86 \pm 1.52$  years since recent event/procedure;  $t(87) = 2.12, p = 0.037, d = 0.67$ ).

Changes in employment status were examined given decreases in symptoms of anxiety and perceived stress over follow-up among participants. More patients were retired at follow-up (73%) compared to study entry (60%) in all groups (all  $p$ 's < 0.05). At time 1, more non-CVD men were currently working compared to all groups, and more non-CVD women were currently working compared to women with CAD. At time 2, more non-CVD men were currently employed compared to men and women with CAD.

Supplemental Table 4. Mean ( $\pm$  SD) scores on the individual depression subscales

<i>Psychological variables</i>		<b>CAD men</b>	<b>Non-CV men</b>	<b>CAD women</b>	<b>Non-CV women</b>
<b>Sadness (Dysphoria)</b>	<b>T1</b>	0.40 (0.67)	0.47 (0.75)	0.83 (0.88)	0.45 (0.69)
	<b>T2</b>	0.56 (0.79)	0.52 (0.77)	0.85 (0.83)	0.67 (0.80)
<b>Loss of Interest (Anhedonia)</b>	<b>T1</b>	0.35 (0.60)	0.31 (0.60)	0.48 (0.69)	0.25 (0.51)
	<b>T2</b>	0.42 (0.67)	0.32 (0.58)	0.56 (0.71)	0.35 (0.64)
<b>Appetite</b>	<b>T1</b>	0.14 (0.40)	0.13 (0.39)	0.34 (0.62)	0.14 (0.40)
	<b>T2</b>	0.16 (0.45)	0.10 (0.37)	0.32 (0.63)	0.16 (0.46)
<b>Sleep</b>	<b>T1</b>	0.85 (0.81)	0.88 (0.78)	1.24 (0.82)	0.92 (0.79)
	<b>T2</b>	0.91 (0.83)	0.99 (0.81)	1.21 (0.85)	0.97 (0.81)
<b>Thinking / concentration</b>	<b>T1</b>	0.37 (0.64)	0.38 (0.65)	0.55 (0.76)	0.35 (0.62)
	<b>T2</b>	0.45 (0.71)	0.44 (0.70)	0.51 (0.68)	0.47 (0.70)
<b>Guilt (Worthlessness)</b>	<b>T1</b>	0.10 (0.35)	0.11 (0.36)	0.30 (0.56)	0.11 (0.35)
	<b>T2</b>	0.14 (0.44)	0.15 (0.46)	0.26 (0.51)	0.20 (0.50)
<b>Tired (fatigue)</b>	<b>T1</b>	0.71 (0.75)	0.65 (0.75)	0.92 (0.76)	0.69 (0.75)
	<b>T2</b>	0.83 (0.78)	0.78 (0.76)	1.02 (0.82)	0.78 (0.77)
<b>Movement (Agitation)</b>	<b>T1</b>	0.43 (0.62)	0.49 (0.64)	0.64 (0.69)	0.48 (0.63)
	<b>T2</b>	0.58 (0.69)	0.58 (0.66)	0.77 (0.72)	0.65 (0.70)
<b>Suicidal ideation</b>	<b>T1</b>	0.04 (0.24)	0.07 (0.30)	0.08 (0.36)	0.04 (0.21)
	<b>T2</b>	0.06 (0.30)	0.05 (0.25)	0.06 (0.27)	0.02 (0.17)

Note. CAD=Coronary Artery Disease, CV=Cardiovascular

Controlling for age, marital status, years of education, household income, BMI, smoking status, weekly alcohol consumption, anxiolytic or antidepressant use, past psychiatric diagnosis.

Supplemental Table 5. Mean ( $\pm$  SD) Perceived Stress Questionnaire (PSQ) subscale scores

<i>Psychological variables</i>		<b>CAD men</b>	<b>Non-CV men</b>	<b>CAD women</b>	<b>Non-CV women</b>
<b>Harassment</b>	<b>T1</b>	0.79 (0.13)	0.83 (0.13)	0.86 (0.14)	0.83 (0.13)
	<b>T2</b>	0.79 (0.13)	0.82 (0.13)	0.84 (0.13)	0.84 (0.13)
<b>Overloaded</b>	<b>T1</b>	0.84 (0.15)	0.87 (0.15)	0.91 (0.14)	0.88 (0.14)
	<b>T2</b>	0.84 (0.14)	0.84 (0.15)	0.89 (0.14)	0.88 (0.15)
<b>Irritability</b>	<b>T1</b>	1.94 (0.32)	1.95 (0.34)	2.09 (0.33)	1.95 (0.29)
	<b>T2</b>	1.89 (0.30)	1.89 (0.34)	2.02 (0.29)	1.97 (0.28)
<b>Lack joy</b>	<b>T1</b>	1.11 (0.13)	1.11 (0.13)	1.16 (0.13)	1.12 (0.12)
	<b>T2</b>	1.10 (0.13)	1.10 (0.13)	1.14 (0.11)	1.12 (0.11)
<b>Fatigue</b>	<b>T1</b>	0.89 (0.14)	0.89 (0.14)	0.96 (0.14)	0.89 (0.13)
	<b>T2</b>	0.87 (0.14)	0.88 (0.13)	0.93 (0.13)	0.90 (0.14)
<b>Worries</b>	<b>T1</b>	0.91 (0.13)	0.93 (0.14)	0.97 (0.15)	0.93 (0.13)
	<b>T2</b>	0.91 (0.13)	0.91 (0.13)	0.95 (0.13)	0.94 (0.13)
<b>Tension</b>	<b>T1</b>	0.83 (0.14)	0.84 (0.15)	0.90 (0.15)	0.85 (0.13)
	<b>T2</b>	0.81 (0.13)	0.82 (0.14)	0.89 (0.13)	0.87 (0.13)

Note. CAD=Coronary Artery Disease, CV=Cardiovascular

Controlling for age, marital status, years of education, household income, BMI, smoking status, weekly alcohol consumption, anxiolytic or antidepressant use, past psychiatric diagnosis.

## Discussion

The current investigation sought to evaluate whether psychological distress among individuals with CAD was more severe and/or persistent compared to those suffering from other non-life threatening health issues, and whether such differences were further affected by their sex. Psychological distress, more specifically self-reported symptoms of depression, anxiety, stress, hostility, as well as perceived low social support, was evaluated over a  $\pm$  5-year follow-up. Our study indicates that distress among women with CAD was particularly high and persistent over time.

Our results demonstrated an elevated degree of psychological distress in both patients with CAD and non-CVD conditions at study entry. Prevalence of distress was much higher than that reported among the general population (*Canadian Community Health Survey [2002]*, 2002; Gadalla, 2008; Lazzarino, Hamer, Stamatakis, & Steptoe, 2013; Statistics Canada, 2014; The Canadian Community Health Survey, 2016).

While elevated overall in our “patient” groups, the prevalence, severity, and/or evolution of distress was found to differ as a function of several characteristics, namely participants’ sex, CV status, and/or the dimension of distress examined. The results of our investigation are in line with the literature as greater distress was also found among individuals with CAD as compared with non-CV patients (30.6% vs. 28.7%). Indeed, the limited data to date suggests that the prevalence or severity of depression or anxiety is higher in CAD patients versus those with other lower-mortality illnesses (asthma, cataracts, diabetes, glaucoma, hypertension, rheumatoid conditions, viral hepatitis) (Bayat et al., 2011; Clarke & Currie, 2009; Gadalla, 2008; Scott et al., 2007). Participants reported relatively high social support, which was slightly but



significantly greater among non-CV participants. High levels of social support have been reported among patients with CAD in some (Kähkönen et al., 2017; Leifheit-Limson et al., 2012; Leifheit-Limson et al., 2010; Wang et al., 2019) but not all studies (Berkman et al., 2003; Lett et al., 2007). While greater hostility in CAD patients compared to healthy individuals has previously been found (Meesters et al., 1994; Moser et al., 2010; Wong et al., 2013), in the current investigation CAD participants were not more hostile as compared to individuals suffering from other non-CV disorders.

Most significantly, with the exception of hostility, women with CAD were particularly and chronically vulnerable to psychological distress. Although we had expected anxiety, depression, and stress to be generally greater among women than men across both patient groups, it was the women with CAD who reported the most severe symptoms of and fell within the clinical range for these psychological factors more frequently. Moreover, the prevalence of distress at study entry among women with CAD was similar to that reported in the literature for depression (15-20%) and anxiety (37-47%) among patients with CAD (Bunevicius et al., 2013; Moser et al., 2010; Steptoe et al., 2013; Tully & Higgins, 2014). Previous investigations have also reported that female CAD patients report more severe symptoms of depression (Aburuz & Al-Dweik, 2018; Chaudhary, Kumar, Wander, Mishra, & Sharma, 2014; Mitchell et al., 2005; Mommersteeg et al., 2017; Parashar et al., 2009), anxiety (Bayat et al., 2011; Chaudhary et al., 2014; Mommersteeg et al., 2017), and stress (Xu et al., 2017) as compared to male CAD patients, indicated by higher scores on questionnaires.

We further found that symptoms of psychological distress persisted over time. Our findings demonstrated a particular increase in intensity and prevalence of depressive symptoms, similar to what has been found in some previous investigations (Burker et al., 1995; Jovanova

et al., 2016; Kroemeke, 2016; Murphy et al., 2014; Murphy et al., 2008b; Palacios et al., 2018; Polsky et al., 2005). Numerous investigations specifically using the CES-D in community samples and the general population, have reported an increase in symptoms of depression with age (Beekman et al., 1995; Mirowsky & Ross, 1992; Mojtabai & Olfson, 2004; Murrell, Himmelfarb, & Wright, 1983; Schieman et al., 2002; Stordal et al., 2001; Thielke, Diehr, & Unutzer, 2010). It has been suggested that increases in depression may reflect risk factors for depression that are more common with older age, including worsening illness, loneliness, or loss of social support (Beekman et al., 1995). In this study, however, perceived social support remained stable across time, consistent with the few investigations that have prospectively followed changes in social support among patients post-MI (Dhand, Longstreth Jr, Chaves, & Dhamoon, 2018; Wang et al., 2019).

In contrast to depressive symptoms, anxiety and stress decreased in our sample over time. Reductions over time in these symptoms have been noted in patients with CAD in a few (Murphy et al., 2008a; Murphy et al., 2008b; Olsen et al., 2018; Tran et al., 2019; Xu et al., 2017) but not all studies (Versteeg et al., 2015). Some researchers have suggested that the decreases in the severity of anxiety with age that have been reported in the general population and individuals with chronic physical conditions may, in part, reflect the waning societal and work demands (Scott et al., 2007; Villamil, Huppert, & Melzer, 2006).

Notably, our results highlighted the extent to which distress remained elevated in women with CAD despite also being prescribed the most anxiolytics (27.6% vs <13%) at follow-up. Of the few studies that examined sex differences in the course of psychological distress in patients with CAD, most did not find significant sex differences in the course of symptoms of depression (Murphy et al., 2008a; Murphy et al., 2014), anxiety (Murphy et al., 2008a; Murphy et al., 2014),

and stress (Xu et al., 2017). Two others, however, did report a higher proportion of women among participants who were identified as having chronically high anxiety (Olsen et al., 2018; Palacios et al., 2018). These findings suggest the need for repeated screening for distress and tailoring of the psychosocial services offered, particularly for women with CAD, as psychotropic treatment is clearly insufficient.

### **Are Women with CAD Particularly Vulnerable?**

Greater severity and chronicity of distress in CAD women in the current investigation may have several explanations. Drory and colleagues have suggested that women with CAD may have fewer age-related personal and social resources, including the lack of a permanent partner, to cope with CAD events compared to men (Drory et al., 2003). The life circumstances of the CAD women in the current sample may have contributed to their greater distress. Indeed, they reported a lower income, and were more frequently living alone, single, divorced or widowed. These factors are known to be associated with higher levels of anxiety disorders, depression, perceived stress (Grant et al., 2009; Sonnenberg, Beekman, Deeg, & van Tilburg, 2000; Van de Velde, Bracke, & Levecque, 2010; Xu et al., 2015), as well as physical health status in patients with CAD, particularly in female patients (Doering et al., 2011; Drory et al., 2003; Horsten, Mittleman, Wamala, Schenck-Gustafsson, & Orth-Gomer, 2000; Manfredini et al., 2017; Orth-Gomér & Leineweber, 2005; Orth-Gomér et al., 2009; Staniute et al., 2013; Wang et al., 2007). Moreover, a literature review of 26 studies found that women reported receiving less help with household activities from informal caregivers (Kristofferzon et al., 2003). In fact, while perceived social support was reported similar between men and women in our study, woman may have had less access to support within the home as they were more frequently living alone. However, the differences in distress levels between men and women

with CAD remained when we controlled for these sociodemographic variables (age, marital status, years of education, household income), suggesting that other factors may be responsible for these group effects. It is true, though, that these demographic characteristics might have affected patient's psychological health over time (residual effects) that are not accounted for by statistical methods.

It has been suggested that a higher vulnerability for psychological distress among women may result from less information given to them post-CAD event around how to resume normal activities (Drory et al., 2003; Kristofferzon et al., 2003). A literature review of 41 studies found that women reported receiving less informational support, including information about CAD and rehabilitation (Kristofferzon et al., 2003). We did not examine levels of informational support received by patients' health care providers in the current study and cannot speak to this possibility.

Poorer physical functioning, quality of life, CAD outcomes, and rehospitalization have been noted in women with CAD compared to men (Garavalia et al., 2007; Parashar et al., 2009; Pathak et al., 2017). Illness severity can impact the persistence and severity of psychological distress (van Melle et al., 2005). Moreover, women are often diagnosed later in the disease trajectory compared to men, when they are older, and their disease is more severe or complicated by other co-morbidities (Bergeison & Tommaso, 1995; Drory et al., 2003; Khan et al., 1990; Loop et al., 1983; Pathak et al., 2017; Penckofer et al., 1990; Weaver et al., 1996). This may contribute to greater distress in women with CAD (Feng et al., 2019; Tan et al., 2016).

Furthermore, significant data demonstrates a higher heritability for fear, phobias, and depression among girls and women compared to their male counterparts (Kendler, Gardner, Neale, & Prescott, 2001; McLean & Anderson, 2009; Silberg et al., 1999). Nonetheless, in the

current investigation, women with non-CV illnesses were not particularly more distressed than the men with or without CVD, which does not support the idea that sex-based genetic factors played a particularly salient role in explaining the results.

Alternatively, it is possible that distress may have been underestimated in men, particularly the CAD men. Gender differences in socialization could contribute to under-reporting of psychological symptoms of distress, or gender differences in the etiological factors contributing to anxiety or depression (Parker & Brotchie, 2010; McLean & Anderson, 2009). Indeed, less distress in the men might reflect sociological differences in expected gender roles (Pederson & Vogel, 2007) and less social reinforcement of emotional expression and concerns, other than perhaps anger (McLean et al., 2009).

Moreover, the expression of distress such as anxiety and depression are less tolerated in men as it is not consistent with the male gender role (McLean et al., 2009; Pederson & Vogel, 2007). Men that are depressed might more frequently engage in denial or inhibition of emotional expression (Eisler & Blalock, 1991), as well as more irritable mood and externalizing aggressive and destructive behaviours (e.g. including substance abuse, gambling, risky behaviour, violence) to cope with life difficulties and distress (Angst et al., 2002; Blanco, Hasin, Petry, Stinson, & Grant, 2006; Brownhill, Wilhelm, Barclay, & Schmied, 2005; Eisler et al., 1991; Marcus et al., 2005; Parker & Brotchie, 2010; Robbins, Monahan, & Silver, 2003; Sonnenberg et al., 2000; World Health Organization, 2014). For example, the amount of alcohol-attributable mortality is higher in men (7.6%) than women (4%), mirroring the difference in drinking patterns and quantity between men and women (World Health Organization, 2014). Consistent with this, men in our sample reported drinking alcohol and smoking significantly more than women. Furthermore, higher rates of anger/aggression and risk taking have been reported in

men who also report traditional symptoms of depression (Martin, Neighbors, & Griffith, 2013). In fact, anger and irritability may be more typical of depressive symptoms in many men rather than depressed affect (Addis, 2008; Winkler, Pjrek, & Kasper, 2005).

Unfortunately, these more masculine-typical behaviors are not reflected in most questionnaires of depression or anxiety. This makes the assessment of distress in men more difficult and emphasizes the need to develop gender-specific tools to measure distress. Similar rates of depression were found in a nationally representative mental health survey that used two of the few questionnaires (the Gotland Male Depression Scale and the Male Symptoms Scale) that have been developed to include masculine-type symptoms of depression (Martin et al., 2013). Thus, measurements used to typically assess depression may lead to under diagnosis among men and associated reports of greater distress among women when using traditional symptom scales or interviews due to both underreporting that may be influenced by expected gender norms and measurements that may not be sensitive to how distress is experienced or expressed in men (Beekman et al., 1995; Comstock & Helsing, 1977; Eaton & Kessler, 1981; Murrell et al., 1983; Piccinelli & Wilkinson, 2000; Radloff, 1977).

A recent study by Call and colleagues (2018), using data from 2,382 male respondents in the National Comorbidity Survey Replication, reported an increased rate of help seeking for depression in men presenting traditional symptoms of depression, but this was not found in those with masculine-typical symptoms (stress, irritability, aggression, risky behaviors, hyperactivity, and substance abuse). This is all the more a concern given the fact that while diagnosis of depression is twice more likely in women, suicide is approximately four times more likely in men, reflecting a high degree of psychological distress in men that is not presently well identified nor treated (Beautrais, 2002; Oquendo et al., 2002; Public Health Agency of Canada,

2006). Higher levels of hostility, alcohol consumption, and smoking among the men compared to women in the current study may denote greater distress than indicated by questionnaires. Finally, it is possible that less distress in our men with CAD may reflect a survival effect, with distressed men having been more likely to have died prematurely compared to those with little or no distress (Carney & Freedland, 2017; Celano et al., 2015; Lichtman et al., 2014; Wu et al., 2016).

### **Importance of the Results**

Although clinical practice guidelines have recommended the routine screening for psychological distress in cardiac patients (Colquhoun et al., 2013; Lichtman et al., 2008), evidence suggests that symptoms of depression, anxiety and stress are persistent, underrecognized and undertreated in patients with CAD (Amin, Jones, Nugent, Rumsfeld, & Spertus, 2006; Bradley & Rumsfeld, 2015; Huffman et al., 2006; Ziegelstein et al., 2005) and other populations with somatic illness (Andreoulakis, Hyphantis, Kandylis, & Iacovides, 2012; Anyfanti et al., 2016; Cole et al., 2007; Deeks, Gibson-Helm, & Teede, 2010).

In our own investigation, 18.6% of individuals who presented clinically significant symptoms of anxiety or depression at study onset had received a prior psychiatric diagnosis while 35.6% were currently on psychotropic medication. In a study by Huffman and colleagues (2006), 74 acute MI inpatients were screened within 72 hours of acute MI (through Beck Depression Inventory (BDI-II), Beck Anxiety Inventory (BAI), and assessment by the study psychiatrist), and found that according to patient's medical records, healthcare providers (e.g. medical residents and nurse practitioners) consistently under-recognized distress. More specifically, healthcare providers failed to recognize 69% of patients with elevated symptoms

of anxiety (BAI score  $\geq 10$ ), 50% with anxiety disorders (psychiatrists' clinical assessment), and 85% patients with elevated symptoms of depression (BDI-II score  $\geq 10$ ) or a current major depressive disorder (psychiatrists' clinical assessment) (Huffman et al., 2006). Additionally, they found that healthcare providers considerably undertreated depression, as 89% of the patients with current depression were not prescribed antidepressant treatment (Huffman et al., 2006). Similarly, in a study among 803 individuals with a CAD diagnosis, only a minority of patients with distress (36-54.5% of those with significant symptoms of anxiety or depression) received interventions targeting these symptoms over the three-year follow-up period (Palacios et al., 2018). According to a recent study, up to 70% of patients with CAD and comorbid depression (according to the PHQ-9) are not diagnosed according to data collected in a multicenter cohort TRIUMPH (Translational Research Investigating Underlying Disparities in Acute Myocardial Infarction Patients Health) study (Smolderen et al., 2017). In this latter study, patients whose depression went unrecognized and untreated had higher 1-year mortality rates than those without depression (10.8% versus 6.1%), while those with recognized depression had similar rates to those without depression (6.1% versus 6.7%) (Smolderen et al., 2017). It has been suggested that healthcare providers primary focus on physical symptoms as well as the lack of standardized screening are the main causes for the under diagnosis of psychological disorders in cardiac patients (Janeway, 2009).

This is concerning as symptoms of depression (Dickens, Cherrington, & McGowan, 2012; Horsten et al., 2000; Tully, Baker, Turnbull, Winefield, & Knight, 2009), anxiety (Dickens et al., 2006; Höfer, Doering, Rumpold, Oldridge, & Benzer, 2006), and stress (Orth-Gomér et al., 2009; Staniute et al., 2013; Wang et al., 2007) undermine general health, health-related quality of life, and social role functioning in CAD patients, regardless of baseline health-



related quality of life or the severity of the CAD. For example, depression or depressive symptoms are significant risk factors for functional decline (difficulty performing instrumental activities of daily living) over 5 years among older adults with stable CAD (Sin and colleagues, 2015). Furthermore, depression is independently related to an increased cumulative number of hospitalizations (Incidence rate ratio [IRR] = 2.00) and length of cardiac-related hospitalizations (IRR = 3.69) for individuals with CAD (Versteeg et al., 2013).

Several lifestyle changes (low fat diet, physical activity, smoking cessation, reduction in alcohol consumption) are essential to reduce adverse outcomes in CAD patients and patients with other illnesses. Good medication adherence (Ho et al., 2006), cardiac rehabilitation attendance (Beauchamp et al., 2013; Mampuya, 2012), smoking cessation (Critchley & Capewell, 2003), physical activity (Iestra et al., 2005), and diet changes that reduce fat intake (Iestra et al., 2005) decrease risk of CAD events and all-cause mortality. Poorer adherence to medical recommendations (e.g. including use of medications as prescribed) and fewer changes in the various health behaviours just previously mentioned, have been reported among patients with symptoms of psychological distress (Cohen, Edmondson, & Kronish, 2015; Dempe et al., 2013; Doyle et al., 2014; Kronish et al., 2006; Murphy, Higgins, & Jackson, 2015; Vilchinsky et al., 2018). For example, in a cross-sectional study of 606 patients with CAD, compared to non-depressed patients, those with depressive symptoms (HADS-D=11–21) or anxiety symptoms (HADS-A  $\geq$  11) had a 3.6 and 3.2 times higher risk of medication nonadherence (Morisky Medical Adherence Scale (MMAS)= 2–4 points) respectively, with combined anxiety and depressive symptoms increasing the risk to 4.4 times higher (Dempe et al., 2013). Moreover, a meta-analysis of 28 prospective studies reported that compared to non-depressed CAD

patients, those that were depressed (indicated by diagnostic interview, validated scales, or antidepressant prescription) were less likely to quit smoking (Doyle et al., 2014).

Furthermore, psychological distress has previously been associated with increased risks for future morbidity and mortality in patients with health conditions (Arnold et al., 2012; Richardson et al., 2012). In fact, depression or depressive symptoms are significant risk factors for cardiovascular morbidity, all-cause mortality and/or cardiovascular mortality in patients with CAD (Wu and Kling, 2016; Versteeg et al., 2013; Carney & Freedland, 2017; Lichtman et al., 2014; Tully & Higgins, 2014; Steptoe & Kivimäki, 2013; Suls, 2018). According to one meta-analysis of 29 studies (N=16,889), depression (defined as either depressive disorder or elevated symptoms of depression) increased risk for recurrent cardiac events (OR, 1.59; 95% CI, 1.37–1.85;  $P<.001$ ), as well as all-cause [(OR, 2.25; 95% CI, 1.73–2.93;  $P<.001$ ) and cardiovascular mortality (OR, 2.71; 95% CI, 1.68–4.36;  $P<.001$ ) (Meijer et al., 2011). A recent longitudinal study among 1,928 patients with angiographically documented CAD, followed up for a median of 6.4 years, indicated an increased risk of sudden cardiac death among patients with symptoms of depression, independently of other clinical risk factors and left ventricular function (Lahtinen et al., 2018).

Empirical evidence also identifies anxiety as an independent risk factor for future cardiac morbidity and mortality in CAD patients (Celano et al., 2015; Suls, 2018). In fact, among women undergoing a coronary angiogram for suspected CAD (myocardial ischemia), STAI scores or presence of anxiety treatment history predicted greater angina frequency, night-time angina, and higher rates of shortness of breath, and anxiolytic use predicted higher rates of night-time angina, nitroglycerine use, hospitalizations for chest pain and coronary catheterization 5.9-years later (Rutledge et al., 2013a). Anxiety disorders have also been independently associated

with a greater risk for major adverse cardiac events in prospective cohort studies (Martens al., 2010; Frasure-Smith et al., 2008).

Similarly, stress has been identified as a risk factor for worse prognosis in CAD patients. For example, work stress increases risk for recurrent CAD by 65% among patients after their first CAD event (for meta-analysis, refer to Li et al., 2015). Likewise, higher levels of stressful life events were associated with more severe CAD (Bagheri et al., 2016).

Little is known regarding sex differences in the association between psychological distress and cardiac prognosis in patients with CAD. While a meta-analysis of 55 prospective studies examining the risk of psychological distress (depression, anxiety, anger/hostility, type A behavior pattern, type D personality, posttraumatic stress) for disease severity in men and women with CAD (N=227,647 women and 321,894 men) reported a greater association between psychological distress and cardiac prognosis in men (Smaardijk, Maas, Lodder, Kop, & Mommersteeg, 2020), four studies that were not included in the former analysis found psychological distress (depression, anxiety, anger/hostility, perceived stress, posttraumatic stress,) to be more detrimental to women's prognosis (Aburuz et al., 2018; Frasure-Smith, Lespérance, & Talajic, 1995; Parashar et al., 2009; Pimple et al., 2019). For example, in a prospective multicentre study by Parashar and colleagues (2009) (N=2,411 post-MI, 807 women) depressive symptoms (Patient Health Questionnaire) contributed to a higher risk of rehospitalization and angina in women compared to men, which is of clinical significance as angina is an important contributing factor to women's mortality (Hemingway et al., 2006) and functional status (Kimble et al., 2003).

Thus, psychological distress entails a significant human and societal cost in patients with CAD and the management of their disease. These findings support the importance of

psychological interventions to manage these symptoms. This will be further discussed within the clinical implications of our study.

### **Clinical Implications**

Our findings of significant psychological symptoms among our participants with and without CVD that persisted despite a five-year interval and psychopharmacological treatment in some suggests that patient distress is currently not being efficiently attended to or treated. Therefore, psychotropic medication, when prescribed, is clearly insufficient.

In order to improve the management of health issues and patient quality of life, medical practitioners should take into consideration the potentially chronic course of psychological distress among patients living with CAD and other chronic illnesses, with a particular attention to women with CAD who may be particularly at risk. Indeed, in addition to routine screening of patients long-term and monitoring of distress, the risk stratification of higher risk patients, such as women with CAD, toward more thorough follow-ups and treatments may improve patient health outcomes. In addition to repeated screening for distress, referral for complementary psychosocial interventions is required in those for whom distress is significant. This could help reduce the considerable personal, and societal costs associated with persistent distress related to delayed return to work (Haschke et al., 2012) and increased healthcare utilization (Baumeister et al., 2015; Finegold et al., 2013; Menzin et al., 2008).

Interventions for depression (e.g. cognitive behavioral therapy (CBT), behavior therapy, interpersonal psychotherapy), problem-solving therapy, psychodynamic therapy) and anxiety (CBT, behavior therapy, problem-solving therapy, social skills training, relaxation training) exist and have proven efficacious in reducing symptoms in the general population (Acarturk,

Cuijpers, van Straten, & de Graaf, 2009; Ayers, Sorrell, Thorp, & Wetherell, 2007; Butler, Chapman, Forman, & Beck, 2006; Cuijpers et al., 2014; Cuijpers, van Straten, & Smit, 2006; Deacon & Abramowitz, 2004; Mayo-Wilson et al., 2014). CBT has been the most tested in the general population with regards to its effectiveness in preventing relapse of depressive and anxiety disorders compared to medications, and data suggests that this psychological intervention is indeed significantly better in reducing the risk of relapse or recurrence (Biesheuvel-Leliefeld et al., 2015; Gloaguen, Cottraux, Cucherat, & Blackburn, 1998; Hollon, Stewart, & Strunk, 2006; Nierenberg, Petersen, & Alpert, 2003; Power, Simpson, Swanson, & Wallace, 1990; Rouillon, 2004; Roy-Byrne et al., 2010).

CBT and interpersonal psychotherapy have also been studied within the CAD population (Berkman et al., 2003; Colquhoun et al., 2013; Freedland et al., 2009; Gulliksson et al., 2011; Koszycki, Lafontaine, Frasura-Smith, Swenson, & Lespérance, 2004; Lespérance et al., 2007; Lett, Davidson, & Blumenthal, 2005) and other medical populations (Chan, 2005; Cimpean & Drake, 2011; Geenen, Newman, Bossema, Vriezেকolk, & Boelen, 2012; Peveler, Carson, & Rodin, 2002; Snoek & Skinner, 2002; van Straten, Geraedts, Verdonck-de Leeuw, Andersson, & Cuijpers, 2010; Yorke, Fleming, & Shuldham, 2007). For example, a meta-analysis by Welton and colleagues (2009) suggest that psychological interventions with behavioural and/or cognitive components are effective at reducing depression scores in CAD patients. A randomized controlled clinical trial by Gulliksson and colleagues, in 362 patients discharged from the hospital after a CAD event within the past 12 months, further found that a CBT intervention program decreased the risk of morbidity (recurrent CVD and recurrent acute myocardial infarction) and mortality over a mean of 94 months follow-up (Gulliksson et al., 2011). However, other data did not support the notion that psychological interventions improve

cardiac outcomes and all-cause mortality (Baumeister, Hutter, & Bengel, 2011; Berkman et al., 2003; Thombs et al., 2013; Whalley et al., 2014). For example, a systematic review and meta-analysis of randomized trials (psychological interventions on CAD patients with 6-month follow-up) concluded no significant impact on all-cause mortality and CVD morbidity, though they were effective in treating symptoms of depression and anxiety (Whalley et al., 2014). However, the study by Gulliksson et al. (2011) has a very different follow-up period compared to the studies included in the latter meta-analysis by Whalley et al. (2014), thus there may be no benefit for cardiac outcomes and all-cause mortality in short term but be present in the long term.

While psychological interventions (e.g. CBT or interpersonal psychotherapy) in patients with CAD take more time to demonstrate improvements in quality of life and psychological status compared to psychotropic medication, the resulting ameliorations are maintained long-term (Baumeister et al., 2011; Janssen et al., 2013; Lett et al., 2005; Linden, 2000; Welton, Caldwell, Adamopoulos, & Vedhara, 2009). Stress management interventions also appear to be of significant promise, with similar or greater efficacy than cardiovascular rehabilitation programs or treatment as usual in improving both psychological and physical symptoms in patients with CAD, consequently reducing morbidity and mortality (Blumenthal et al., 2005; Blumenthal et al., 2016; Freedland et al., 2009; Rutledge, Redwine, Linke, & Mills, 2013; Steptoe et al., 2013). Successful treatment for depression has positive implications for health-related quality of life in patients with CAD, and identifying depressive symptoms in patients could assist in directing resources for those with an increased risk of worse health-related quality of life (Stafford, Berk, Reddy, & Jackson, 2007).

In sum, symptoms of psychological distress in CAD patients are common, adversely affect prognosis and can be effectively treated in cardiac patients. Our results indicate the need for repeated screening and monitoring of symptoms of distress long-term, as well as complementary psychosocial interventions offered because patient distress is not being efficiently attended to or treated. Notably, our results emphasize the importance of taking specific preventative measures for women with CAD.

### **Limitations of the Study**

Several factors may limit the conclusions that can be drawn from the current results. Firstly, the sample was not representative of the general population but was rather drawn from the hospital cohort. This was done because we are particularly interested in a CAD population. Moreover, this method gave us access to individuals interested in participating in research who had already completed psychological and lifestyle questionnaires, and provided us with a rich background of health history information. The majority of participants were French Canadian and Caucasian, thus limiting the generalizability of findings to individuals of different cultures.

Given the demanding nature of the study protocols in both the MHI hospital cohort and in BEL-AGE, psychological distress was based on self-report questionnaires, rather than on clinical interviews. Self-report evaluations are common in epidemiological research. Over-reporting or underreporting of symptoms due to concerns about social desirability are possible although participants were asked to answer questionnaires as honestly as possible. Nonetheless, the importance of distress to disease development, progression, and/or mortality has been shown not only in individuals meeting diagnostic criteria for psychological disorders (Carney & Freedland, 2017; Chang et al., 2017; Davidson, Alcántara, & Miller, 2018; De Hert, Detraux, &

Vancampfort, 2018; Hernandez et al., 2018; Lichtman et al., 2014; Martens et al., 2010; Tully, Harrison, Cheung, & Cosh, 2016; Tully & Higgins, 2014; Versteeg et al., 2013), but also in those showing even mild symptoms of distress on questionnaires (Bagheri et al., 2016; Celano et al., 2015; De Hert et al., 2018; Martin-Subero et al., 2017; Stewart et al., 2017; Tully, Cosh, et al., 2014; Tully & Higgins, 2014) in both men (who may have been perhaps more likely to underreport) and women. Relatedly, many measures used to evaluate distress may not sufficiently reflect the symptom and behavioural profile of distressed men. This may also have been the case in the current study. Although we did look at the prevalence of patients using psychotropic medications as an additional indicator, it is known that men are less likely to seek psychological and medical care (Andrews, Issakidis, & Carter, 2001; Galdas, Cheater, & Marshall, 2005; Husaini, Moore, & Cain, 1994; Piccinelli & Wilkinson, 2000; Smith, Braunack-Mayer, & Wittert, 2006; Wills & DePaulo, 1991). Using another measurement of distress such as the Gotland Male Depression Scale (GMDS) (Zierau, Bille, Rutz, & Bech, 2002), the Masculine Depression Scale (Magovcevic & Addis, 2008), or Male Depression Risk Scale (MDRS-22) (Rice, Fallon, Aucote, & Möller-Leimkühler, 2013) which have been shown more sensitive to men's symptomatology, in combination with the self-report questionnaires, may add important and more complete information, and should be considered for the future.

While greater distress at study entry was related to a greater likelihood of cardiac events (MI, CABG, or PCI) before and after study entry in CAD patients, more information as to the severity of patients' illness (e.g. LVEF) might have helped assess whether aspects of physical status contributed to psychological distress severity, type and course.

For many participants at study onset, questionnaires on anxiety, stress, and social support were completed within the privacy of their own home as compared to in-lab at follow-up. The



different evaluation procedures at baseline and follow-up may have led to participants under-reporting their distress at follow-up due to greater concerns regarding social desirability. This is unlikely however, as depression further increased at follow-up. Nonetheless, because some questionnaires were completed at home at baseline, a number of participants (16.7%) never returned them, and led to missing data for anxiety, perceived stress and social support. A non-random profile of missing data could have biased the results. However, those who did and did not return all questionnaires did not differ with respect to sex, age, BMI, years of education, marital status, income, ethnicity, weekly alcohol consumption, nor on cigarettes smoked per day. This is important as these variables have been associated with levels of distress in the general population and in CAD patients (Akhtar-Danesh & Landeen, 2007; Jorm et al., 1999; Kähkönen et al., 2017; Lavie & Milani, 2002; Plaisier et al., 2007). They also did not differ on the measures of depression and hostility (completely in-lab at baseline). It is thus unlikely that our results were significantly impacted by the missing data for these participants.

### **Strengths of the Study**

A major strength of the study included the repeated evaluation of several psychological risk factors for CAD over a five-year period. This allowed us to determine patterns of psychological distress over time and highlight the stability of clinically important distress in this group of patients. While the course of depression over time had been examined to a certain extent, the literature on anxiety, stress, hostility, and social support was limited.

The current investigation corroborated existing literature on the prevalence, course, and sex differences of psychological distress in patients with CAD. It further contributed new

knowledge regarding the quantitative and qualitative difference of CAD patients with similar aged patients experiencing other health challenges recruited from a similar environment.

The large sample size and purposeful recruitment of women allowed sex differences to be examined. This study contributes to the evidence that psychological distress is highly prevalent among patients suffering from a somatic illness and further highlights the significance and severity of psychological symptoms in women with CAD, identifying them as a particularly vulnerable population.

Presence of CAD was operationalized more strictly than often done in the literature and excluded symptoms of angina in the absence of verified coronary occlusion. This ensures that all of our CAD patients were indeed truly suffering from CAD. Many previous studies included the presence of angina even though many patients have non-cardiac chest pain (Tully & Higgins, 2014; Versteeg et al., 2013). Our individuals without CVD were also more exclusive as they did not include individuals who had any other cardiovascular disease or symptoms. Many studies have compared CAD patients to population norms or to “healthy individuals”. However, in the latter case, healthy usually only meant that participants did not have CAD. Consequently, previous comparison groups may include a mix of very healthy individuals and individuals with different illnesses. Additionally, all participants were recruited from the same environment, reducing the influence of extraneous environmental or demographic differences.

Lastly, well-validated measures were used to assess the psychological constructs. Moreover, additional information was obtained at both time-points, on previous diagnosis and treatment for psychological/psychiatric reasons, and use of psychotropic medication. Analyses controlled for many potential confounders, including sociodemographic and lifestyle habits that had previously been associated with psychological distress. Supplemental analyses further

permitted us to support or not the various hypotheses emitted as a function of our results. For example, results on the subscales of depression and perceived stress suggested that the higher prevalence of depression and stress in patient groups were not inflated by greater somatic complaints.

## **Future Directions**

### ***Research***

Additional research is required to understand further why women with CAD reported significantly higher severity, prevalence, and chronicity of psychological distress than men. Illness severity can impact the persistence and severity of psychological distress among patients with CAD (van Melle et al., 2005). It may be that women with CAD had a greater severity of their CAD, given they are often diagnosed later in the disease trajectory compared to men. Budget permitting, future investigations could include measures of CAD severity (e.g. LVEF) when examining sex differences in psychological distress to evaluate the role of disease severity on distress. Given the higher rates of disability among women with CAD than men (Pinsky, Jette, Branch, Kannel, & Feinleib, 1990), whether greater disability impacted distress levels should also be examined. This could entail a questionnaire to measure disability (12-Item Short-Form Health Survey (Ware, Kosinski, & Keller, 1996) or the Sheehan Disability (Sheehan, Harnett-Sheehan, & Raj, 1996)) and the number of work days missed due to illness/disability. A Canadian study by Norris and colleagues (2004) reported worse health related quality of life (exertional capacity, anginal stability, anginal frequency, quality of life and treatment satisfaction was measured with the Seattle Angina Questionnaire) at one-year follow-up among women with CAD compared to men (Norris et al., 2004). It would also be important to examine

sex differences in which factors influence health related quality of life, including factors of psychological distress.

In order to avoid under-evaluation of distress in men, it would be valuable to include gender-specific tools that incorporate masculine-specific behaviours of distress. A more precise evaluation of distress in men and women would then be possible in this population. Continued validation of these questionnaires is still required, as is research on when and to whom to administer them. It would be of interest to administer traditional symptoms and masculine-specific questionnaires to men and women to test their sensitivity and specificity. Once this has been established, it could still be pertinent to include both questionnaires for men and women as some women may also be high on masculinity and express their distress through masculine-typical symptoms.

Patients with CAD reported slightly more hostility than non-CV patients in the current investigation. In a study among initially healthy 296 community-dwelling older adults, Stewart and colleagues (2010) identified baseline hostility (measured by the Cook–Medley Hostility scale) as a predictor of increases in depressive symptoms (Beck Depression Inventory-II) and proposed that hostility may at least partially contribute to the development of adverse cardiac outcomes by triggering or maintaining depressive symptoms (Stewart Fitzgerald, & Kamarck, 2010). Given the increase of symptoms of depression in patients in our study, particularly for women with CAD, it would be interesting to study the extent hostility contributes to increases or maintenance of depressive symptomology prospectively and whether the extent to which the contribution of hostility on depression differs based on patient's sex. In order to do this, we could follow-up our patients with non-CVD and healthy individuals and see who develops CAD, and examine whether hostility level predicts whether patients develop clinically significant

levels of depression or an increase in symptoms of depression. This would help stratify patients at risk for depressive symptoms, and further inform us on whether the inclusion of treatment modalities targeting hostility within psychosocial interventions for distress in CAD patients could be useful to prevent or reduce depressive symptoms in men and women.

Both the level and course of social support has not been comprehensively studied in patients with CAD. Our study found generally stable levels of perceived support among patients over the five-year period. Although a review found that women reported receiving less social support 1-year post-MI compared to men (Kristofferzon et al., 2003), we did not find any sex differences. It was surprising that women with CAD did not report lower levels of social support than the other groups given the severity of psychological distress they were experiencing. Several studies have reported that low social support negatively impacts psychological distress and cardiac prognosis within this population (Frasure-Smith et al., 2000; Leifheit-Limson et al., 2010; Muhammad et al., 2014; Murphy et al., 2014; Murphy et al., 2008b). It would be interesting to replicate these findings regarding the moderating or mediating role of social support on the associations between psychological distress at study entry and psychological and medical outcomes such as hospitalizations, events, mortality at follow-up (obtained through our access to RAMQ/MED-ECHO data). Additionally, it would be important to examine whether these impacts are further moderated by the sex or CAD status of patients. Moreover, a study that intervened to improve social support has been shown to be beneficial for improving symptoms of depression (Berkman et al., 2003). Therefore, applying mental health interventions that use patient's existing social support network, such as collaborative care, may possibly be used and be beneficial in this population given the stable level of support that was perceived by patients in our study. The effectiveness of these interventions would need to be studied. We could study

this by examining the impact of collaborative care or cardiac rehabilitation programs that include patients' partners or support network on physical and psychological health outcomes compared to those who do not include this attention to social support.

Minority groups may have greater unrecognized psychological distress by their health care providers. Diagnostic recognition for psychological disorders has been shown to vary by race/ethnicity, with distressed minorities (e.g. African American and Hispanic) being less frequently diagnosed (Akincigil et al., 2012; Simpson, Krishnan, Kunik, & Ruiz, 2007). Lower rates of detecting depression were found in African American and Hispanic American patients than Caucasian patients in a cross-sectional study as part of the Medical Outcomes Study (19,309 patients and 349 internists and family physicians) (Borowsky et al., 2000). A cross-sectional study reported that 75% of patients hospitalized with acute coronary syndrome (N=1,181) with moderate to severe symptoms of depression were unrecognized by their healthcare providers identified through detailed reviews of hospital records (Amin et al., 2006). One of the characteristics associated with unrecognized depressive symptoms included race (minorities vs Caucasians; odds ratio [OR] = 6.73, [CI] 2.62-19.33) (Amin et al., 2006). Although some studies have examined ethnic/race differences of psychological distress and its treatment within patient populations the United States (Catz, Gore-Felton, & McClure, 2002; Eng et al., 2011; Margaretten, Julian, Katz, & Yelin, 2011; Waldman et al., 2009), it would be important to examine these differences in Canada, in particular among the Indigenous, immigrant, and refugee minority populations. These minority groups are exposed to different psychosocial stressors (violence, substance use, poverty, homelessness, racism) (Ahmad, Ali, & Stewart, 2005; Anderson & Collins, 2014; Cohen & Maclean, 2004; Hyman, 2009; Iwasaki, Bartlett, & O'neil, 2004) that may impact their medical recovery and prognosis, including the

development and persistence of psychological distress. This was not possible within our study as most patients and visitors at the Montreal Heart Institute were Caucasian.

Moreover, psychological disorders (mood disorder, anxiety disorder, and substance use disorder) have been shown in some population research to have variable courses according to ethnic origins, with Hispanics reporting more persistent mood disorders, and non-Hispanic blacks reporting more persistent mood and anxiety disorders (Breslau, Kendler, Su, Gaxiola-Aguilar, & Kessler, 2005). Although some studies among CAD patients have not found significant differences in the severity or prevalence of elevated depressive symptoms as a function of race (Chinese vs Malay vs Indian, and African Americans vs Caucasian) (Eng et al., 2011; Waldman et al., 2009), a difference in the rate of antidepressant prescription was noted in one study (Waldman et al., 2009). More specifically, a greater rate of antidepressant prescription was found among Caucasians compared to African Americans with CAD (21% vs 11.7%) (Waldman et al., 2009). These researchers suggested that although African Americans present a similar prevalence of depressive symptoms, they are less likely to be prescribed antidepressants by clinicians. Similarly, a study in the American general population have suggested that clinicians' prescription treatment varies according to ethnic/racial group, with minorities (African Americans, Hispanics) less likely to receive appropriate treatment for depression (Akincigil et al., 2012; Melfi, Croghan, Hanna, & Robinson, 2000; Simpson et al., 2007). A study of 13,065 Medicaid patients found that at initial depression diagnosis African Americans were less frequently prescribed antidepressants than Caucasians (27.2% vs 44.0%), and Caucasians were more likely to be prescribed selective serotonin reuptake inhibitors than tricyclic antidepressants compared to African Americans (Melfi et al., 2000). How do these racial or cultural differences in course or treatment of distress influence prognosis of CAD or

other illnesses? A study among 2,481 patients with MI (973 Caucasian men, 424 minority men, 674 Caucasian women, 410 minority women) and either major or minor depression and/or low social support, reported the CBT psychological intervention to be effective in reducing total mortality and cardiac events in Caucasian men but not in other groups (Caucasian women, African American, Hispanic, Asian, and American Indian) (Schneiderman et al., 2004). Therefore, it would also be important to identify which components of interventions are more effective in different ethnic populations. This could contribute to more effective treatment options while reducing health disparities. In order to do so, it would be necessary to recruit individuals outside of the MHI Cohort, in several hospitals/research institutes and even interprovincially, in order to obtain a suitable sample that includes minority populations.

Positive psychological wellbeing (e.g. positive emotions or thoughts such as positive affect, purpose in life, optimism, and happiness) has been demonstrated to encourage longevity and positive health outcomes among healthy populations (Diener & Chan, 2011). A growing literature suggests that these positive psychological factors are independently associated with a lower risk of chronic illness (Avvenuti, Baiardini, & Giardini, 2016; Schiavon, Marchetti, Gurgel, Busnello, & Reppold, 2017), including CVD, and may promote cardiovascular health and quality of life (reduction in inflammatory and coagulation factors, promotion of healthy behaviours, adaptive coping strategies and thinking) (Avvenuti et al., 2016; Chida & Steptoe, 2008; Conversano et al., 2010; Duque, Brown, Celano, Healy, & Huffman, 2019; Fredrickson, 2000; Kubzansky et al., 2018; Sin, 2016; Vázquez, Hervás, Rahona, & Gómez, 2009).

Although previous studies have suggested a relationship between positive psychological well-being and cardiovascular outcomes (Kubzansky et al., 2018), the design of interventions



using these positive elements require further study. Indeed, most psychological intervention research in cardiology has focused on psychological distress (e.g. depression, anxiety, stress).

Firstly, in order to target the most efficient positive elements to use in interventions, it is necessary to clarify which elements have the strongest associations with cardiovascular health and prognosis, and at what ages can positive psychological factors have the greatest effects on health outcomes. In order to do so, a rigorous prospective investigation of pathways linking psychological well-being with cardiovascular outcomes should be conducted. It would be important to examine various positive factors as there is evidence that the extent to which positive psychological factors effect health outcomes varies according to the constructs examined (Boehm & Kubzansky, 2012). We can use self-report questionnaires that have been most commonly used to study positive psychological factors in populations with chronic illness, such as the 6-item Life Orientation Test-Revised (Scheier, Carver, & Bridges, 1994) for optimism, and the 10-item positive affect subscale of the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988). Researchers have suggested that in order to measure CVD biomarkers of daily life it would be important for future investigations to include repeated assessments of daily well-being, in combination with minimally-invasive ambulatory measures of psychophysiology (e.g. saliva, heart rate variability, blood pressure) (Diener & Chan, 2011; Sin, 2016). As positive psychology interventions have not been well-studied in cardiac patients in clinical care settings, intervention trials are required to assess how to adapt these interventions for cardiac patients and examine whether they improve cardiovascular or mental health outcomes.

Lastly, highlighting the importance of routine screening for psychological distress long term in patients is one of the important clinical implications of this study. Indeed, as the data

demonstrating the associations between psychological factors and cardiac prognosis have been well-established, a focus on research for prevention should be encouraged. However, an evaluation of the risks and benefits of screening years after the acute cardiac event on symptoms of distress and disease prognosis remains to be done.

### ***Knowledge Transfer***

#### *Analysis of the context and objectives*

The prevalence of psychological distress among stable CAD patients and patients with chronic illness is high and adversely impacts the progression of the disease. Yet, there is a lack in awareness of the chronicity and importance of psychological distress in female CAD patients among primary health practitioners and cardiologists, as well as the general public, which is impeding patient care. The current Canadian Cardiovascular Society guidelines for managing stable CAD includes life-style changes, medication, and medical procedures (Mancini et al., 2014) but neglects long-term screening for psychological distress and its' non-pharmacological treatment options.

Our results comparing CAD patients with other patient types can aid to inform public health policy, including decisions about where to spend public funds. In fact, findings from the current and previous research suggest that it may be prudent to stratify higher risk patients, such as women with CAD, toward more thorough follow-ups and treatments, in addition to long term routine screening and the accessibility to mental health professionals for all patients when necessary. Indeed, the decision makers may not be aware of the importance of treating psychological distress compared to the treatment of physical symptoms of CAD and other non-life-threatening illness, which leads to a financial burden on society and the government. The

majority of these costs reflect those incurred as a result of short- and long-term disability associated with CAD (Robitaille et al., 2014). Evidence demonstrates an association between the psychological distress in patients with CAD and cardiac rehospitalization and recurrent cardiac events and cardiac-related mortality compared to those without distress, with rehospitalization costs being significantly higher in distressed patients (\$9,504 versus \$2,146) (Allison et al., 1995). Therefore, it would be essential to change the current policies concerning the management of this disease.

The goal of this future knowledge transfer project is to raise awareness of this issue among health practitioners (general practitioners/cardiologists), policy makers and managers within the health system, and the general public. This project would aim to help transfer the knowledge required to understand and raise awareness about the current necessity of screening and attending to psychological risk factors to improve medical prognosis among both patients with CAD and patients with non-CVD illnesses.

#### *The structure of the knowledge transfer approach*

Experts in cardiology and psychology should participate in advisory committees and aid in development of several knowledge transfer strategies (e.g. training, workshop/seminar, conference, and a practical guide). The leaders (i.e. chiefs of the department) of the field of cardiology, will want extensive information before agreeing to departmental changes. Therefore, a workshop/seminar provided by researchers from universities and other research institutes would be ideal as a method of preference for the presentation of the content. For the cardiologists and general practitioners who may not have a lot of time available, a brief training session could be provided by researchers from universities and other research institutes, as well

as a practical guide created by a knowledge broker (with the input of the leaders of the field of cardiology) that they could read when they have time would be ideal.

Secondly, health system policy makers/decision-makers/managers of the health system are not aware of the issue and may not have a lot of spare time yet have an interest in maintaining the trust of the public as well as improving the prevention of these chronic diseases in order to reduce societal costs. Using empirically validated evidence, communicated through a policy brief that is written by the knowledge broker and is short and in layman's terms would be the preference of the presentation of the content as the governmental deciders may not necessarily have the educational background to understand scientific jargon (Dobbins, DeCorby, & Twiddy, 2004). This policy brief will raise awareness about the problem and the hope is that it will motivate the decision makers to support the establishment of a new practice. In particular it is important to emphasize the short-term monetary investment that could be applied from governmental agency's budget for prevention, the simple technology necessary (questionnaires), and the long-term benefits.

Lastly, the general public is not aware of this issue of chronic and severe distress in patients, yet they have a personal interest in their own health or the health of loved ones. The goal is to inform the general public so they can make informed decisions if they must consult a health practitioner. The general public is generally receptive to health-related information and data from a study by Murphy and colleagues (2015) among 160 cardiac patients, suggests that over 80% of patients have an interest in receiving information about what emotional symptoms to expect after a cardiac event (Murphy et al., 2015b). Having a celebrity (e.g. a mental health activist) aid in the communication of knowledge to the general public would help gain attention (Kite, Foley, Grunseit, & Freeman, 2016). A quick and simple explanation would be of

preference, which can be done by broadcasting an informational video through the Ministry of Health and Social Services (MSSS), the media, and social media (on hospital, governmental, media, or mental health activists' pages). Posting on social media would get a discussion going online and help with the accessibility of this health information to rural communities. Lastly, it is important to provide accessible public talks by experts, that can also be recorded and posted online, which provide information on distress, its impact, and methods of dealing or reducing distress (including suggestions for resources for those in need).

## **Conclusion**

In sum, the analyses conducted as part of this master's thesis sought to evaluate the severity and course of psychological distress in individuals with and without CAD and whether sex differences exist in the prevalence and evolution of psychological morbidity. The results demonstrated that psychological distress was prevalent among individuals suffering from diverse health conditions, though women with CAD were particularly and chronically depressed, anxious, and stressed despite being prescribed more psychotropic medications than men. Furthermore, symptoms of psychological distress persisted over time, which has been associated with adverse health and quality of life outcomes in both patients with health conditions (Arnold et al., 2012; Richardson et al., 2012) and patients with CAD (Horsten et al., 2000; Orth-Gomér & Leineweber, 2005; Orth-Gomér et al., 2009; Staniute et al., 2013). These findings suggest the need for repeated screening for distress and tailoring of the psychosocial services offered, particularly for women with CAD, as psychotropic treatment is clearly insufficient. Interdisciplinary collaboration between mental health practitioners and

cardiologists would be ideal and could permit better evaluation and care of psychological distress within standard practice.

## References

- Aburuz, M. E., & Al-Dweik, G. (2018). Depressive Symptoms and Complications Early after Acute Myocardial Infarction: Gender Differences. *The Open Nursing Journal, 12*(1), 205-214.
- Acarturk, C., Cuijpers, P., van Straten, A., & de Graaf, R. (2009). Psychological treatment of social anxiety disorder: a meta-analysis. *Psychological Medicine, 39*(2), 241-254.
- Addis, M. E. (2008). Gender and depression in men. *Clinical Psychology: Science and Practice, 15*(3), 153-168.
- Ahmad, F., Ali, M., & Stewart, D. E. (2005). Spousal-abuse among Canadian immigrant women. *Journal of Immigrant and Minority Health, 7*(4), 239-246.
- Ahto, M., Isoaho, R., Puolijoki, H., Laippala, P., Romo, M., & Kivelä, S. (1998). Functional abilities of elderly coronary heart disease patients. *Aging Clinical and Experimental Research, 10*(2), 127-136.
- Akhtar-Danesh, N., & Landeen, J. (2007). Relation between depression and sociodemographic factors. *International Journal of Mental Health Systems, 1*(1), 4.
- Akimova, E., Akimov, M. Y., Gakova, E., Kayumova, M., Gafarov, V., & Kuznetsov, V. (2017). Associations between high levels of hostility and coronary heart disease in an open urban population among 25-64-year-old men. *Terapevticheskii Arkhiv, 89*(1), 28-31.
- Akincigil, A., Olfson, M., Siegel, M., Zurlo, K. A., Walkup, J. T., & Crystal, S. (2012). Racial and ethnic disparities in depression care in community-dwelling elderly in the United States. *American Journal of Public Health, 102*(2), 319-328.

- Al-Abbudi, S. J., Lami, F. H., & Wady, Z. A. (2018). Prevalence and Assessment of Severity of Depression Among Ischemic Heart Disease Patients Attending Outpatient Cardiology Department Baghdad Teaching Hospital, Baghdad, Iraq. *Journal of Psychiatry, 21*, 438.
- Allison, T. G., Williams, D. E., Miller, T. D., Patten, C. A., Bailey, K. R., Squires, R. W., & Gau, G. T. (1995). *Medical and economic costs of psychologic distress in patients with coronary artery disease*. In *Mayo Clinic Proceedings*, 70 (8), 734-742.
- Almeida, O. P., Beer, C., Lautenschlager, N. T., Arnolda, L., Alfonso, H., & Flicker, L. (2012). Two-year course of cognitive function and mood in adults with congestive heart failure and coronary artery disease: the Heart-Mind Study. *International Psychogeriatrics, 24*(1), 38-47.
- Amin, A. A., Jones, A. M., Nugent, K., Rumsfeld, J. S., & Spertus, J. A. (2006). The prevalence of unrecognized depression in patients with acute coronary syndrome. *American Heart Journal, 152*(5), 928-934.
- Anderson, J. T., & Collins, D. (2014). Prevalence and causes of urban homelessness among indigenous peoples: a three-country scoping review. *Housing Studies, 29*(7), 959-976.
- Andreoulakis, E., Hyphantis, T., Kandylis, D., & Iacovides, A. (2012). Depression in diabetes mellitus: a comprehensive review. *Hippokratia, 16*(3), 205.
- Andrews, G., Issakidis, C., & Carter, G. (2001). Shortfall in mental health service utilisation. *The British Journal of Psychiatry, 179*(5), 417-425.
- Angst, J., Gamma, A., Gastpar, M., Lépine, J.-P., Mendlewicz, J., & Tylee, A. (2002). Gender differences in depression. *European Archives of Psychiatry and Clinical Neuroscience, 252*(5), 201-209.



- Anyfanti, P., Gavriilaki, E., Pyrpasopoulou, A., Triantafyllou, G., Triantafyllou, A., Chatzimichailidou, S., . . . Douma, S. (2016). Depression, anxiety, and quality of life in a large cohort of patients with rheumatic diseases: common, yet undertreated. *Clinical Rheumatology*, 35(3), 733-739.
- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (revised 4th edition).
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders : DSM-5* (5th edition).
- Arnold, S. V., Smolderen, K. G., Buchanan, D. M., Li, Y., & Spertus, J. A. (2012). Perceived stress in myocardial infarction: long-term mortality and health status outcomes. *Journal of the American College of Cardiology*, 60(18), 1756-1763.
- Avvenuti, G., Baiardini, I., & Giardini, A. (2016). Optimism's explicative role for chronic diseases. *Frontiers in Psychology*, 7, 295.
- Ayers, C. R., Sorrell, J. T., Thorp, S. R., & Wetherell, J. L. (2007). Evidence-based psychological treatments for late-life anxiety. *Psychology and Aging*, 22(1), 8.
- Bagheri, B., Meshkini, F., Dinarvand, K., Alikhani, Z., Haysom, M., & Rasouli, M. (2016). Life psychosocial stresses and coronary artery disease. *International Journal of Preventive Medicine*, 7, 106.
- Balog, P., Janszky, I., Leineweber, C., Blom, M., Wamala, S. P., & Orth-Gom e, K. (2003). Depressive symptoms in relation to marital and work stress in women with and without coronary heart disease. The Stockholm Female Coronary Risk Study. *Journal of Psychosomatic Research*, 54(2), 113-119.

- Bankier, B., Januzzi, J. L., & Littman, A. B. (2004). The high prevalence of multiple psychiatric disorders in stable outpatients with coronary heart disease. *Psychosomatic Medicine*, 66(5), 645-650.
- Barefoot, J. C., Peterson, B. L., Dahlstrom, W. G., Siegler, I. C., Anderson, N. B., & Williams Jr, R. B. (1991). Hostility patterns and health implications: correlates of Cook-Medley Hostility Scale scores in a national survey. *Health Psychology*, 10(1), 18.
- Barnason, S., Zimmerman, L., Nieveen, J., Schulz, P., & Young, L. (2012). Patient recovery and transitions after hospitalization for acute cardiac events: An integrative review. *Journal of Cardiovascular Nursing*, 27(2), 175-191.
- Barth, J., Schneider, S., & Von Känel, R. (2010). Lack of social support in the etiology and the prognosis of coronary heart disease: a systematic review and meta-analysis. *Psychosomatic Medicine*, 72(3), 229-238.
- Baumeister, H., Haschke, A., Munzinger, M., Hutter, N., & Tully, P. J. (2015). Inpatient and outpatient costs in patients with coronary artery disease and mental disorders: a systematic review. *BioPsychoSocial Medicine*, 9(1), 11.
- Baumeister, H., Hutter, N., & Bengel, J. (2011). Psychological and pharmacological interventions for depression in patients with coronary artery disease. *The Cochrane Library*, 9.
- Bayat, N., Alishiri, G. H., Salimzadeh, A., Izadi, M., Saleh, D. K., Lankarani, M. M., & Assari, S. (2011). Symptoms of anxiety and depression: A comparison among patients with different chronic conditions. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences*, 16(11), 1441.

- Beauchamp, A., Worcester, M., Ng, A., Murphy, B., Tatoulis, J., Grigg, L., . . . Goble, A. (2013). Attendance at cardiac rehabilitation is associated with lower all-cause mortality after 14 years of follow-up. *Heart, 99*(9), 620-625.
- Beautrais, A. L. (2002). Gender issues in youth suicidal behaviour. *Emergency Medicine, 14*(1), 35-42.
- Beekman, A. T., Deeg, D. J., van Tilburg, T., Smit, J. H., Hooijer, C., & van Tilburg, W. (1995). Major and minor depression in later life: a study of prevalence and risk factors. *Journal of Affective Disorders, 36*(1), 65-75.
- Belkic, K. L., Landsbergis, P. A., Schnall, P. L., & Baker, D. (2004). Is job strain a major source of cardiovascular disease risk? *Scandinavian Journal of Work, Environment & Health, 30*(2), 85-128.
- Bergeison, B. A., & Tommaso, C. L. (1995). Gender differences in clinical evaluation and triage in coronary artery disease. *Chest, 108*(6), 1510-1513.
- Berkman, L. F., Blumenthal, J., Burg, M., Carney, R. M., Catellier, D., Cowan, M. J., . . . Jaffee, A. (2003). Effects of treating depression and low perceived social support on clinical events after myocardial infarction: the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) Randomized Trial. *Journal of the American Medical Association, 289*(23), 3106-3116.
- Biesheuvel-Leliefeld, K. E., Kok, G. D., Bockting, C. L., Cuijpers, P., Hollon, S. D., van Marwijk, H. W., & Smit, F. (2015). Effectiveness of psychological interventions in preventing recurrence of depressive disorder: meta-analysis and meta-regression. *Journal of Affective Disorders, 174*(15), 400-410.

- Blanco, C., Hasin, D. S., Petry, N., Stinson, F. S., & Grant, B. F. (2006). Sex differences in subclinical and DSM-IV pathological gambling: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychological Medicine*, *36*(7), 943-953.
- Blumenthal, J. A., Sherwood, A., Babyak, M. A., Watkins, L. L., Waugh, R., Georgiades, A., . . . Hinderliter, A. (2005). Effects of exercise and stress management training on markers of cardiovascular risk in patients with ischemic heart disease: a randomized controlled trial. *Journal of the American Medical Association*, *293*(13), 1626-1634.
- Blumenthal, J. A., Sherwood, A., Smith, P. J., Watkins, L., Mabe, S., Kraus, W. E., . . . Hinderliter, A. (2016). Enhancing cardiac rehabilitation with stress management training: a randomized, clinical efficacy trial. *Circulation*, *133*(14), 1341-1350.
- Boehm, J. K., & Kubzansky, L. D. (2012). The heart's content: the association between positive psychological well-being and cardiovascular health. *Psychological Bulletin*, *138*(4), 655.
- Borowsky, S. J., Rubenstein, L. V., Meredith, L. S., Camp, P., Jackson-Triche, M., & Wells, K. B. (2000). Who is at risk of nondetection of mental health problems in primary care? *Journal of General Internal Medicine*, *15*(6), 381-388.
- Boutin-Foster, C. (2008). An item-level analysis of the Center for Epidemiologic Studies Depression Scale (CES-D) by race and ethnicity in patients with coronary artery disease. *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences*, *23*(10), 1034-1039.
- Bradley, S. M., & Rumsfeld, J. S. (2015). Depression and cardiovascular disease. *Trends in Cardiovascular Medicine*, *25*(7), 614-622.

- Breslau, J., Kendler, K. S., Su, M., Gaxiola-Aguilar, S., & Kessler, R. C. (2005). Lifetime risk and persistence of psychiatric disorders across ethnic groups in the United States. *Psychological Medicine*, 35(3), 317-327.
- Britton, A., Brunner, E., Kivimaki, M., & Shipley, M. J. (2011). Limitations to functioning and independent living after the onset of coronary heart disease: what is the role of lifestyle factors and obesity? *The European Journal of Public Health*, 22(6), 831-835.
- Brownhill, S., Wilhelm, K., Barclay, L., & Schmied, V. (2005). 'Big build': hidden depression in men. *Australian and New Zealand Journal of Psychiatry*, 39(10), 921-931.
- Bunevicius, A., Staniute, M., Brozaitiene, J., Pop, V. J., Neverauskas, J., & Bunevicius, R. (2013). Screening for anxiety disorders in patients with coronary artery disease. *Health and Quality of Life Outcomes*, 11(1), 37.
- Burker, E. J., Blumenthal, J. A., Feldman, M., Burnett, R., White, W., Smith, L. R., . . . Reves, J. (1995). Depression in male and female patients undergoing cardiac surgery. *British Journal of Clinical Psychology*, 34(1), 119-128.
- Butler, A. C., Chapman, J. E., Forman, E. M., & Beck, A. T. (2006). The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clinical Psychology Review*, 26(1), 17-31.
- Canadian Community Health Survey [2002]*. (2002). Ontario Share File: Ontario MOHLTC
- Carney, R. M., & Freedland, K. E. (2017). Depression and coronary heart disease. *Nature Reviews Cardiology*, 14(3), 145.
- Catz, S. L., Gore-Felton, C., & McClure, J. B. (2002). Psychological distress among minority and low-income women living with HIV. *Behavioral Medicine*, 28(2), 53-60.

- Celano, C. M., Millstein, R. A., Bedoya, C. A., Healy, B. C., Roest, A. M., & Huffman, J. C. (2015). Association between anxiety and mortality in patients with coronary artery disease: A meta-analysis. *American Heart Journal*, *170*(6), 1105-1115.
- Chan, R. T.-W. (2005). Interpersonal psychotherapy as a treatment model for depressed adolescents with chronic medical problems. *Clinical Child Psychology and Psychiatry*, *10*(1), 88-101.
- Chang, W. H., Lee, I. H., Chen, W. T., Chen, P. S., Yang, Y. K., & Chen, K. C. (2017). Coexisting geriatric anxiety and depressive disorders may increase the risk of ischemic heart disease mortality—a nationwide longitudinal cohort study. *International Journal of Geriatric Psychiatry*, *32*(12), e25-e33.
- Charlson, F. J., Stapelberg, N. J., Baxter, A. J., & Whiteford, H. A. (2011). Should global burden of disease estimates include depression as a risk factor for coronary heart disease? *BMC Medicine*, *9*(1), 47.
- Chaudhary, R., Kumar, P., Wander, G., Mishra, B., & Sharma, A. (2014). Psychiatric manifestations among cardiac patients: A hospital based study. *Education*, *60*(25), 1.
- Chida, Y., & Steptoe, A. (2008). Positive psychological well-being and mortality: a quantitative review of prospective observational studies. *Psychosomatic Medicine*, *70*(7), 741-756.
- Chida, Y., & Steptoe, A. (2009). The association of anger and hostility with future coronary heart disease: a meta-analytic review of prospective evidence. *Journal of the American College of Cardiology*, *53*(11), 936-946.
- Cimpean, D., & Drake, R. (2011). Treating co-morbid chronic medical conditions and anxiety/depression. *Epidemiology and Psychiatric Sciences*, *20*(2), 141-150.

- Clarke, D. M., & Currie, K. C. (2009). Depression, anxiety and their relationship with chronic diseases: a review of the epidemiology, risk and treatment evidence. *Medical Journal of Australia*, 190(7), S54.
- Cohen, B. E., Edmondson, D., & Kronish, I. M. (2015). State of the art review: depression, stress, anxiety, and cardiovascular disease. *American Journal of Hypertension*, 28(11), 1295-1302.
- Cohen, M. M., & Maclean, H. (2004). Violence against Canadian women. *BMC Women's Health*, 4(1), S22.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385-396.
- Cole, A., Lee, P., Hughes, D., Deegan, P., Waldek, S., & Lachmann, R. (2007). Depression in adults with Fabry disease: A common and under-diagnosed problem. *Journal of Inherited Metabolic Disease: Official Journal of the Society for the Study of Inborn Errors of Metabolism*, 30(6), 943-951.
- Collins, M. M., Corcoran, P., & Perry, I. J. (2009). Anxiety and depression symptoms in patients with diabetes. *Diabetic Medicine*, 26(2), 153-161.
- Colquhoun, D. M., Bunker, S. J., Clarke, D. M., Glozier, N., Hare, D. L., Hickie, I. B., . . . Wilson, A. (2013). Screening, referral and treatment for depression in patients with coronary heart disease. *Medical Journal of Australia*, 198(9), 483-484.
- Comstock, G. W., & Helsing, K. J. (1977). Symptoms of depression in two communities. *Psychological Medicine*, 6(4), 551-563.
- Consedine, N. S., Magai, C., & Chin, S. (2004). Hostility and anxiety differentially predict cardiovascular disease in men and women. *Sex Roles*, 50(1-2), 63-75.

- Contrada, R. J., Boulifard, D. A., Idler, E. L., Krause, T. J., & Labouvie, E. W. (2006). Course of depressive symptoms in patients undergoing heart surgery: Confirmatory analysis of the factor pattern and latent mean structure of the Center for Epidemiologic Studies Depression Scale. *Psychosomatic Medicine*, *68*(6), 922-930.
- Conversano, C., Rotondo, A., Lensi, E., Della Vista, O., Arpone, F., & Reda, M. A. (2010). Optimism and its impact on mental and physical well-being. *Clinical Practice and Epidemiology in Mental Health*, *6*, 25-29.
- Cook, W. W., & Medley, D. M. (1954). Proposed hostility and pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology*, *38*(6), 414.
- Cooper, C., Parry, G., Saul, C., Morice, A., Hutchcroft, B., Moore, J., & Esmonde, L. (2007). Anxiety and panic fear in adults with asthma: prevalence in primary care. *BMC Family Practice*, *8*(1), 62.
- Critchley, J. A., & Capewell, S. (2003). Mortality risk reduction associated with smoking cessation in patients with coronary heart disease: a systematic review. *Journal of the American Medical Association*, *290*(1), 86-97.
- Cuijpers, P., Sijbrandij, M., Koole, S., Huibers, M., Berking, M., & Andersson, G. (2014). Psychological treatment of generalized anxiety disorder: a meta-analysis. *Clinical Psychology Review*, *34*(2), 130-140.
- Cuijpers, P., van Straten, A., & Smit, F. (2006). Psychological treatment of late-life depression: a meta-analysis of randomized controlled trials. *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences*, *21*(12), 1139-1149.



- D'Antono, B., Moskowitz, D., & Nigam, A. (2013). The metabolic costs of hostility in healthy adult men and women: cross-sectional and prospective analyses. *Journal of Psychosomatic Research*, 75(3), 262-269.
- Damen, N. L., Versteeg, H., Serruys, P. W., van Geuns, R.-J. M., van Domburg, R. T., Pedersen, S. S., & Boersma, E. (2015). Cardiac patients who completed a longitudinal psychosocial study had a different clinical and psychosocial baseline profile than patients who dropped out prematurely. *European Journal of Preventive Cardiology*, 22(2), 196-199.
- Davey, G. (2010). *The encyclopaedic dictionary of psychology*. In. Retrieved from <http://www.credoreference.com/book/hodderdpsyc>
- Davidson, K. W., Alcántara, C., & Miller, G. E. (2018). Selected psychological comorbidities in coronary heart disease: Challenges and grand opportunities. *American Psychologist*, 73(8), 1019.
- De Hert, M., Detraux, J., & Vancampfort, D. (2018). The intriguing relationship between coronary heart disease and mental disorders. *Dialogues in Clinical Neuroscience*, 20(1), 31.
- Deacon, B. J., & Abramowitz, J. S. (2004). Cognitive and behavioral treatments for anxiety disorders: A review of meta-analytic findings. *Journal of Clinical Psychology*, 60(4), 429-441.
- Deeks, A. A., Gibson-Helm, M. E., & Teede, H. J. (2010). Anxiety and depression in polycystic ovary syndrome: a comprehensive investigation. *Fertility and Sterility*, 93(7), 2421-2423.

- Dempe, C., Jünger, J., Hoppe, S., Katzenberger, M.-L., Möltner, A., Ladwig, K.-H., . . . Schultz, J.-H. (2013). Association of anxious and depressive symptoms with medication nonadherence in patients with stable coronary artery disease. *Journal of Psychosomatic Research, 74*(2), 122-127.
- Dhand, A., Longstreth Jr, W., Chaves, P. H., & Dhamoon, M. S. (2018). Social Network Trajectories in Myocardial Infarction Versus Ischemic Stroke. *Journal of the American Heart Association, 7*(8), e008029.
- Dickens, C., Cherrington, A., & McGowan, L. (2012). Depression and health-related quality of life in people with coronary heart disease: a systematic review. *European Journal of Cardiovascular Nursing, 11*(3), 265-275.
- Dickens, C. M., McGowan, L., Percival, C., Tomenson, B., Cotter, L., Heagerty, A., & Creed, F. H. (2006). Contribution of depression and anxiety to impaired health-related quality of life following first myocardial infarction. *The British Journal of Psychiatry, 189*(4), 367-372.
- Diener, E., & Chan, M. Y. (2011). Happy people live longer: Subjective well-being contributes to health and longevity. *Applied Psychology: Health and Well-Being, 3*(1), 1-43.
- Dobbins, M., DeCorby, K., & Twiddy, T. (2004). A knowledge transfer strategy for public health decision makers. *Worldviews on Evidence-Based Nursing, 1*(2), 120-128.
- Doering, L. V., McKinley, S., Riegel, B., Moser, D. K., Meischke, H., Pelter, M. M., & Dracup, K. (2011). Gender-specific characteristics of individuals with depressive symptoms and coronary heart disease. *Heart & Lung: The Journal of Acute and Critical Care, 40*(3), e4-e14.

- Dowlatshahi, E. A., Wakkee, M., Arends, L. R., & Nijsten, T. (2014). The prevalence and odds of depressive symptoms and clinical depression in psoriasis patients: a systematic review and meta-analysis. *Journal of Investigative Dermatology*, *134*(6), 1542-1551.
- Doyle, F., McGee, H., Conroy, R., Conradi, H. J., Meijer, E., Steeds, A., . . . Jonge, d. P. (2015). Systematic Review and Individual Patient Data Meta-Analysis of Sex Differences in Depression and Prognosis in Persons With Myocardial Infarction: A MINDMAPS Study. *Psychosomatic Medicine*, *77*(4), 419-428.
- Doyle, F., Rohde, D., Rutkowska, A., Morgan, K., Cousins, G., & McGee, H. (2014). Systematic review and meta-analysis of the impact of depression on subsequent smoking cessation in patients with coronary heart disease: 1990 to 2013. *Psychosomatic Medicine*, *76*(1), 44-57.
- Dozois, D. J. A., Ahnberg, J. L., & Dobson, K. S. (1998). Psychometric Evaluation of the Beck Depression Inventory-II. *Psychological Assessment*, *10*(2), 83-89.
- Dragano, N., Siegrist, J., Nyberg, S. T., Lunau, T., Fransson, E. I., Alfredsson, L., . . . Erbel, R. (2017). Effort–reward imbalance at work and incident coronary heart disease: A multicohort study of 90,164 individuals. *Epidemiology (Cambridge, Mass.)*, *28*(4), 619.
- Drory, Y., Kravetz, S., Hirschberger, G., & Israel Study Group on First Acute Myocardial Infarction. (2003). Long-term mental health of women after a first acute myocardial infarction. *Archives of Physical Medicine and Rehabilitation*, *84*(10), 1492-1498.
- Drory, Y., Kravetz, S., & Hirschberger, G. (2002). Long-term mental health of men after a first acute myocardial infarction. *Archives of Physical Medicine and Rehabilitation*, *83*(3), 352-359.

- Dupre, M. E., Nelson, A., Lynch, S. M., Granger, B. B., Xu, H., Churchill, E., . . . Peterson, E. D. (2017). Socioeconomic, Psychosocial and Behavioral Characteristics of Patients Hospitalized With Cardiovascular Disease. *The American Journal of the Medical Sciences, 354*(6), 565-572.
- Duque, L., Brown, L., Celano, C. M., Healy, B., & Huffman, J. C. (2019). Is it better to cultivate positive affect or optimism? Predicting improvements in medical adherence following a positive psychology intervention in patients with acute coronary syndrome. *General Hospital Psychiatry.*
- Eaton, W., & Kessler, L. G. (1981). Rates of symptoms of depression in a national sample. *American Journal of Epidemiology, 114*(4), 528-538.
- Egede, L.E. (2007). Major depression in individuals with chronic medical disorders: prevalence, correlates and association with health resource utilization, lost productivity and functional disability. *General Hospital Psychiatry, 29*(5), 409-416.
- Eisler, R. M., & Blalock, J. A. (1991). Masculine gender role stress: Implications for the assessment of men. *Clinical Psychology Review, 11*(1), 45-60.
- Eng, H., Yean, L., Das, S., Letchmi, S., Yee, K., Bakar, R., . . . Choy, C. (2011). Anxiety and Depression in Patients with Coronary Heart Disease: A Study in a Tertiary Hospital. *Iranian Journal of Medical Sciences, 36*(3), 201-206.
- Engelbreton, T. O., & Matthews, K. A. (1992). Dimensions of hostility in men, women, and boys: relationships to personality and cardiovascular responses to stress. *Psychosomatic Medicine, 54*(3), 311-323.
- Everson-Rose, S. A., Clark, C. J., & Henderson, K. M. (2013). Hostility, Cynical. In *Encyclopedia of Behavioral Medicine* (pp. 993-994): Springer.

- Feng, L., Li, L., Liu, W., Yang, J., Wang, Q., Shi, L., & Luo, M. (2019). Prevalence of depression in myocardial infarction: A PRISMA-compliant meta-analysis. *Medicine*, 98(8), e14596.
- Ferrario, M. M., Veronesi, G., Bertù, L., Grassi, G., & Cesana, G. (2017). Job strain and the incidence of coronary heart diseases: does the association differ among occupational classes? A contribution from a pooled analysis of Northern Italian cohorts. *BMJ Open*, 7(1), e014119.
- Finegold, J. A., Asaria, P., & Francis, D. P. (2013). Mortality from ischaemic heart disease by country, region, and age: statistics from World Health Organisation and United Nations. *International Journal of Cardiology*, 168(2), 934-945.
- Frasure-Smith, N., & Lespérance, F. (2010). Depression and cardiac risk: present status and future directions. *Postgraduate Medical Journal*, 86, 193-196.
- Frasure-Smith, N., Lespérance, F., Gravel, G., Masson, A., Juneau, M., Talajic, M., & Bourassa, M. G. (2000). Social support, depression, and mortality during the first year after myocardial infarction. *Circulation*, 101(16), 1919-1924.
- Frasure-Smith, N., Lespérance, F., & Talajic, M. (1995). The Impact of Negative Emotions on Prognosis Following Myocardial Infarction: Is It More Than Depression? *Health Psychology*, 14(5), 388-398.
- Fredrickson, B. L. (2000). Cultivating positive emotions to optimize health and well-being. *Prevention & Treatment*, 3(1), 1a.
- Freedland, K. E., Skala, J. A., Carney, R. M., Rubin, E. H., Lustman, P. J., Dávila-Román, V. G., . . . Hogue, C. W. (2009). Treatment of depression after coronary artery bypass surgery: a randomized controlled trial. *Archives of General Psychiatry*, 66(4), 387-396.

- Gadalla, T. (2008). Association of comorbid mood disorders and chronic illness with disability and quality of life in Ontario, Canada. *Chronic Diseases in Canada*, 28(4), 148-154.
- Galdas, P. M., Cheater, F., & Marshall, P. (2005). Men and health help-seeking behaviour: literature review. *Journal of Advanced Nursing*, 49(6), 616-623.
- Gan, Y., Gong, Y., Tong, X., Sun, H., Cong, Y., Dong, X., . . . Deng, J. (2014). Depression and the risk of coronary heart disease: a meta-analysis of prospective cohort studies. *BMC Psychiatry*, 14(1), 371.
- Garavalia, L. S., Decker, C., Reid, K. J., Lichtman, J. H., Parashar, S., Vaccarino, V., . . . Spertus, J. A. (2007). Does health status differ between men and women in early recovery after myocardial infarction? *Journal of Women's Health*, 16(1), 93-101.
- Geenen, R., Newman, S., Bossema, E. R., Vriezekolk, J. E., & Boelen, P. A. (2012). Psychological interventions for patients with rheumatic diseases and anxiety or depression. *Best practice & research Clinical Rheumatology*, 26(3), 305-319.
- Gloaguen, V., Cottraux, J., Cucherat, M., & Blackburn, I.-M. (1998). A meta-analysis of the effects of cognitive therapy in depressed patients. *Journal of Affective Disorders*, 49(1), 59-72.
- Grant, B. F., Goldstein, R. B., Chou, S. P., Huang, B., Stinson, F. S., Dawson, D. A., . . . Pickering, R. P. (2009). Sociodemographic and psychopathologic predictors of first incidence of DSM-IV substance use, mood and anxiety disorders: results from the Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions. *Molecular Psychiatry*, 14(11), 1051.
- Guimaraes, P. O., Granger, C. B., Stebbins, A., Chiswell, K., Held, C., Hochman, J. S., . . . Stewart, R. A. (2017). Sex differences in clinical characteristics, psychosocial factors,

and outcomes among patients with stable coronary heart disease: insights from the STABILITY (Stabilization of Atherosclerotic Plaque by Initiation of Darapladib Therapy) trial. *Journal of the American Heart Association*, 6(9), e006695.

Gulliksson, M., Burell, G., Vessby, B., Lundin, L., Toss, H., & Svärdsudd, K. (2011). Randomized controlled trial of cognitive behavioral therapy vs standard treatment to prevent recurrent cardiovascular events in patients with coronary heart disease: Secondary Prevention in Uppsala Primary Health Care project (SUPRIM). *Archives of Internal Medicine*, 171(2), 134-140.

Hansson, G. K. (2005). Inflammation, atherosclerosis, and coronary artery disease. *New England Journal of Medicine*, 352(16), 1685-1695.

Haschke, A., Hutter, N., & Baumeister, H. (2012). Indirect costs in patients with coronary artery disease and mental disorders: a systematic review and meta-analysis. *International Journal of Occupational Medicine and Environmental Health*, 25(4), 319-329.

Heinrichs, M., Baumgartner, T., Kirschbaum, C., & Ehlert, U. (2003). Social support and oxytocin interact to suppress cortisol and subjective responses to psychosocial stress. *Biological Psychiatry*, 54(12), 1389-1398.

Hemingway, H., McCallum, A., Shipley, M., Manderbacka, K., Martikainen, P., & Keskimäki, I. (2006). Incidence and Prognostic Implications of Stable Angina Pectoris Among Women and Men. *Journal of the American Medical Association*, 295(12), 1404-1411.

- Hernandez, R., Bassett, S. M., Boughton, S. W., Schuette, S. A., Shiu, E. W., & Moskowitz, J. T. (2018). Psychological well-being and physical health: Associations, mechanisms, and future directions. *Emotion Review, 10*(1), 18-29.
- Ho, P. M., Spertus, J. A., Masoudi, F. A., Reid, K. J., Peterson, E. D., Magid, D. J., . . . Rumsfeld, J. S. (2006). Impact of medication therapy discontinuation on mortality after myocardial infarction. *Archives of Internal Medicine, 166*(17), 1842-1847.
- Höfer, S., Doering, S., Rumpold, G., Oldridge, N., & Benzer, W. (2006). Determinants of health-related quality of life in patients with coronary artery disease. *European Journal of Cardiovascular Prevention & Rehabilitation, 13*(3), 398-406.
- Hollon, S. D., Stewart, M. O., & Strunk, D. (2006). Enduring effects for cognitive behavior therapy in the treatment of depression and anxiety. *Annual Review of Psychology, 57*, 285-315.
- Holmes, T. H., & Rahe, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research, 11*(2), 213-218.
- Horsten, M., Mittleman, M., Wamala, S., Schenck-Gustafsson, K., & Orth-Gomer, K. (2000). Depressive symptoms and lack of social integration in relation to prognosis of CHD in middle-aged women. The Stockholm Female Coronary Risk Study. *European Heart Journal, 21*(13), 1072-1080.
- Huffman, J. C., Smith, F. A., Blais, M. A., Beiser, M. E., Januzzi, J. L., & Fricchione, G. L. (2006). Recognition and treatment of depression and anxiety in patients with acute myocardial infarction. *The American Journal of Cardiology, 98*(3), 319-324.



- Husaini, B. A., Moore, S. T., & Cain, V. A. (1994). Psychiatric Symptoms and Help-Seeking Behavior Among the Elderly: An Analysis of Racial and Gender Differences. *Journal of Gerontological Social Work, 21*(3/4), 177.
- Hyman, I. (2009). Racism as a determinant of immigrant health. *Ottawa: Strategic Initiatives and Innovations Directorate of the Public Health Agency of Canada.*
- Iestra, J., Kromhout, D., Van der Schouw, Y., Grobbee, D., Boshuizen, H., & Van Staveren, W. (2005). Effect size estimates of lifestyle and dietary changes on all-cause mortality in coronary artery disease patients: a systematic review. *Circulation, 112*(6), 924-934.
- Iwasaki, Y., Bartlett, J., & O'neil, J. (2004). An examination of stress among Aboriginal women and men with diabetes in Manitoba, Canada. *Ethnicity & Health, 9*(2), 189-212.
- Izawa, S., Eto, Y., Yamada, K. C., Nakano, M., Yamada, H., Nagayama, M., . . . Nomura, S. (2011). Cynical hostility, anger expression style, and acute myocardial infarction in middle-aged Japanese men. *Behavioral Medicine, 37*(3), 81-86.
- Janeway, D. (2009). An integrated approach to the diagnosis and treatment of anxiety within the practice of cardiology. *Cardiology in Review, 17*(1), 36-43.
- Janssen, V., Gucht, V. D., Dusseldorp, E., & Maes, S. (2013). Lifestyle modification programmes for patients with coronary heart disease: a systematic review and meta-analysis of randomized controlled trials. *European Journal of Preventive Cardiology, 20*(4), 620-640.
- Jorm, A. F., Rodgers, B., Jacomb, P. A., Christensen, H., Henderson, S., & Korten, A. E. (1999). Smoking and mental health: results from a community survey. *Medical Journal of Australia, 170*(2), 74-77.

- Jovanova, O., Luik, A. I., Leening, M. J., Noordam, R., Aarts, N., Hofman, A., . . . Tiemeier, H. (2016). The long-term risk of recognized and unrecognized myocardial infarction for depression in older men. *Psychological Medicine, 46*(9), 1951-1960.
- Kähkönen, O., Kankkunen, P., Miettinen, H., Lamidi, M. L., & Saaranen, T. (2017). Perceived social support following percutaneous coronary intervention is a crucial factor in patients with coronary heart disease. *Journal of Clinical Nursing, 26*(9-10), 1264-1280.
- Kendler, K. S., Gardner, C., Neale, M., & Prescott, C. (2001). Genetic risk factors for major depression in men and women: similar or different heritabilities and same or partly distinct genes? *Psychological Medicine, 31*(4), 605-616.
- Khan, S. S., Nessim, S., Gray, R., Czer, L. S., Chaux, A., & Matloff, J. (1990). Increased mortality of women in coronary artery bypass surgery: evidence for referral bias. *Annals of Internal Medicine, 112*(8), 561-567.
- Kimble, P. L., McGuire, B. D., Dunbar, B. S., Fazio, S. S., De, S. A., Weintraub, S. W., & Strickland, S. O. (2003). Gender differences in pain characteristics of chronic stable angina and perceived physical limitation in patients with coronary artery disease. *Pain, 101*(12), 45-53.
- Kite, J., Foley, B. C., Grunseit, A. C., & Freeman, B. (2016). Please like me: Facebook and public health communication. *PloS one, 11*(9), e0162765.
- Kivimäki, M., Head, J., Ferrie, J. E., Brunner, E., Marmot, M. G., Vahtera, J., & Shipley, M. J. (2006). Why is evidence on job strain and coronary heart disease mixed? An illustration of measurement challenges in the Whitehall II study. *Psychosomatic Medicine, 68*(3), 398-401.

- Kivimäki, M., Nyberg, S. T., Batty, G. D., Fransson, E. I., Heikkilä, K., Alfredsson, L., . . . Casini, A. (2012). Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data. *The Lancet*, *380*(9852), 1491-1497.
- Knight, R. G., Waal-Manning, H. J., & Spears, G. F. (1983). Some norms and reliability data for the State--Trait Anxiety Inventory and the Zung Self-Rating Depression scale. *The British Journal of Clinical Psychology*, *22*(Pt 4), 245-249.
- Knox, S. S., Siegmund, K. D., Weidner, G., Ellison, R. C., Adelman, A., & Paton, C. (1998). Hostility, social support, and coronary heart disease in the National Heart, Lung, and Blood Institute Family Heart Study. *The American Journal of Cardiology*, *82*(10), 1192-1196.
- Kohli, P., Whelton, S. P., Hsu, S., Yancy, C. W., Stone, N. J., Chrispin, J., . . . Martin, S. S. (2014). Clinician's guide to the updated ABCs of cardiovascular disease prevention. *Journal of the American Heart Association*, *3*(5), e001098.
- Koszycki, D., Lafontaine, S., Frasura-Smith, N., Swenson, R., & Lespérance, F. (2004). An open-label trial of interpersonal psychotherapy in depressed patients with coronary disease. *Psychosomatics*, *45*(4), 319-324.
- Kristofferzon, M.-L., Löfmark, R., & Carlsson, M. (2003). Myocardial infarction: gender differences in coping and social support. *Journal of Advanced Nursing*, *44*(4), 360-374.
- Kroemeke, A. (2016). Depressive symptom trajectories over a 6-year period following myocardial infarction: predictive function of cognitive appraisal and coping. *Journal of Behavioral Medicine*, *39*(2), 181-191.

- Kroenke, K., & Spitzer, R. L. (1998). Gender Differences in the Reporting of Physical and Somatoform Symptoms. *Psychosomatic Medicine*, *60*(2), 150-155.
- Kronish, I. M., Rieckmann, N., Halm, E. A., Shimbo, D., Vorchheimer, D., Haas, D. C., & Davidson, K. W. (2006). Persistent depression affects adherence to secondary prevention behaviors after acute coronary syndromes. *Journal of General Internal Medicine*, *21*(11), 1178-1183.
- Kronmal, R. A., McClelland, R. L., Detrano, R., Shea, S., Lima, J. A., Cushman, M., . . . Burke, G. L. (2007). Risk factors for the progression of coronary artery calcification in asymptomatic subjects: results from the Multi-Ethnic Study of Atherosclerosis (MESA). *Circulation*, *115*(21), 2722-2730.
- Kubzansky, L. D., Huffman, J. C., Boehm, J. K., Hernandez, R., Kim, E. S., Koga, H. K., . . . Labarthe, D. R. (2018). Positive psychological well-being and cardiovascular disease: JACC health promotion series. *Journal of the American College of Cardiology*, *72*(12), 1382-1396.
- Lahtinen, M., Kiviniemi, A. M., Junttila, M. J., Kääriäinen, M., Huikuri, H. V., & Tulppo, M. P. (2018). Depressive Symptoms and Risk for Sudden Cardiac Death in Stable Coronary Artery Disease. *The American Journal of Cardiology*, *122*(5), 749-755.
- Lavie, C. J., & Milani, R. V. (2002). Impact of aging on hostility in coronary patients and effects of cardiac rehabilitation and exercise training in elderly. *Journal of the American College of Cardiology*, *39*, 151-151.
- Lazarus, R. S. (1966). Psychological stress and the coping process.
- Lazzarino, A. I., Hamer, M., Stamatakis, E., & Steptoe, A. (2013). The combined association of psychological distress and socioeconomic status with all-cause mortality: a national

- cohort study. *Journal of the American Medical Association Internal Medicine*, 173(1), 22-27.
- Leifheit-Limson, E. C., Reid, K. J., Kasl, S. V., Lin, H., Buchanan, D. M., Jones, P. G., . . . Lichtman, J. H. (2012). Changes in social support within the early recovery period and outcomes after acute myocardial infarction. *Journal of Psychosomatic Research*, 73(1), 35-41.
- Leifheit-Limson, E. C., Reid, K. J., Kasl, S. V., Lin, H., Jones, P. G., Buchanan, D. M., . . . Lichtman, J. H. (2010). The role of social support in health status and depressive symptoms after acute myocardial infarction: evidence for a stronger relationship among women. *Circulation: Cardiovascular Quality and Outcomes*, 3(2), 143-150.
- Lespérance, F., Frasere-Smith, N., Koszycki, D., Laliberté, M.-A., van Zyl, L. T., Baker, B., . . . Dorian, P. (2007). Effects of citalopram and interpersonal psychotherapy on depression in patients with coronary artery disease: the Canadian Cardiac Randomized Evaluation of Antidepressant and Psychotherapy Efficacy (CREATE) trial. *Journal of the American Medical Association*, 297(4), 367-379.
- Lett, H. S., Blumenthal, J. A., Babyak, M. A., Catellier, D. J., Carney, R. M., Berkman, L. F., . . . Schneiderman, N. (2007). Social support and prognosis in patients at increased psychosocial risk recovering from myocardial infarction. *Health Psychology : Official Journal of the Division of Health Psychology, American Psychological Association*, 26(4), 418-427.
- Lett, H. S., Davidson, J., & Blumenthal, J. A. (2005). Nonpharmacologic Treatments for Depression in Patients With Coronary Heart Disease. *Psychosomatic Medicine*, 67 Suppl 1, S58-S62.

- Li, J., Zhang, M., Loerbroks, A., Angerer, P., & Siegrist, J. (2015). Work stress and the risk of recurrent coronary heart disease events: A systematic review and meta-analysis. *International Journal of Occupational Medicine and Environmental Health*, 1-12.
- Lichtman, J. H., Bigger Jr, J. T., Blumenthal, J. A., Frasure-Smith, N., Kaufmann, P. G., Lespérance, F. o., . . . Froelicher, E. S. (2008). Depression and coronary heart disease: recommendations for screening, referral, and treatment: a science advisory from the American Heart Association Prevention Committee of the Council on Cardiovascular Nursing, Council on Clinical Cardiology, Council on Epidemiology and Prevention, and Interdisciplinary Council on Quality of Care and Outcomes Research: endorsed by the American Psychiatric Association. *Circulation*, 118(17), 1768-1775.
- Lichtman, J. H., Froelicher, E. S., Blumenthal, J. A., Carney, R. M., Doering, L. V., Frasure-Smith, N., . . . Stroke, N. (2014). Depression as a risk factor for poor prognosis among patients with acute coronary syndrome: systematic review and recommendations: a scientific statement from the American Heart Association. *Circulation*, 129(12), 1350-1369.
- Linden, W. (2000). Psychological treatments in cardiac rehabilitation: review of rationales and outcomes. *Journal of Psychosomatic Research*, 48(4-5), 443-454.
- Loop, F. D., Golding, L. R., Macmillan, J. P., Cosgrove, D. M., Lytle, B. W., & Sheldon, W. C. (1983). Coronary artery surgery in women compared with men: analyses of risks and long-term results. *Journal of the American College of Cardiology*, 1(2 Part 1), 383-390.
- Lucinda, L. B., Prosdócimo, A. C. M. G., Carvalho, K. A. T. d., Francisco, J. C., Baena, C. P., Olandoski, M., . . . Guarita-Souza, L. C. (2015). Evaluation of the prevalence of stress

and its phases in acute myocardial infarction in patients active in the labor market.

*Brazilian Journal of Cardiovascular Surgery*, 30(1), 16-23.

Magovcevic, M., & Addis, M. E. (2008). The Masculine Depression Scale: development and psychometric evaluation. *Psychology of Men & Masculinity*, 9(3), 117.

Mampuya, W. M. (2012). Cardiac rehabilitation past, present and future: an overview.

*Cardiovascular Diagnosis and Therapy*, 2(1), 38.

Mancini, G. J., Gosselin, G., Chow, B., Kostuk, W., Stone, J., Yvorchuk, K. J., . . . Tardif, J.-C. (2014). Canadian Cardiovascular Society guidelines for the diagnosis and management of stable ischemic heart disease. *Canadian Journal of Cardiology*, 30(8), 837-849.

Manfredini, R., De Giorgi, A., Tiseo, R., Boari, B., Cappadona, R., Salmi, R., . . . Fabbian, F. (2017). Marital Status, Cardiovascular Diseases, and Cardiovascular Risk Factors: A Review of the Evidence. *Journal of Women's Health*, 26(6), 624-632.

Marcus, S. M., Young, E. A., Kerber, K. B., Kornstein, S., Farabaugh, A. H., Mitchell, J., . . . Rush, A. J. (2005). Gender differences in depression: findings from the STAR\* D study. *Journal of Affective Disorders*, 87(2-3), 141-150.

Margaretten, M., Julian, L., Katz, P., & Yelin, E. (2011). Depression in patients with rheumatoid arthritis: description, causes and mechanisms. *International Journal of Clinical Rheumatology*, 6(6), 617.

Marino, B. S., Tomlinson, R. S., Drotar, D., Claybon, E. S., Aguirre, A., Ittenbach, R., . . . Shea, J. A. (2009). Quality-of-life concerns differ among patients, parents, and medical providers in children and adolescents with congenital and acquired heart disease. *Pediatrics*, 123(4), e708-e715.

- Martens, E. J., de Jonge, P., Na, B., Cohen, B. E., Lett, H., & Whooley, M. A. (2010). Scared to death? Generalized anxiety disorder and cardiovascular events in patients with stable coronary heart disease: The Heart and Soul Study. *Archives of General Psychiatry*, 67(7), 750-758.
- Martin, E. A. (2015). *Concise medical dictionary*: Oxford University Press, USA.
- Martin, L. A., Neighbors, H. W., & Griffith, D. M. (2013). The experience of symptoms of depression in men vs women: analysis of the National Comorbidity Survey Replication. *Journal of the American Medical Association Psychiatry*, 70(10), 1100-1106.
- Martin-Subero, M., Kroenke, K., Diez-Quevedo, C., Rangil, T., de Antonio, M., Morillas, R. M., . . . Planas, R. (2017). Depression as measured by PHQ-9 versus clinical diagnosis as an independent predictor of long-term mortality in a prospective cohort of medical inpatients. *Psychosomatic Medicine*, 79(3), 273-282.
- Matcham, F., Rayner, L., Steer, S., & Hotopf, M. (2013). The prevalence of depression in rheumatoid arthritis: a systematic review and meta-analysis. *Rheumatology*, 52(12), 2136-2148.
- Mayo-Wilson, E., Dias, S., Mavranouzouli, I., Kew, K., Clark, D. M., Ades, A., & Pilling, S. (2014). Psychological and pharmacological interventions for social anxiety disorder in adults: a systematic review and network meta-analysis. *The Lancet Psychiatry*, 1(5), 368-376.
- McLean, C. P., & Anderson, E. R. (2009). Brave men and timid women? A review of the gender differences in fear and anxiety. *Clinical Psychology Review*, 29(6), 496-505.



- Meesters, C. M., & Smulders, J. (1994). Hostility and myocardial infarction in men. *Journal of Psychosomatic Research*, 38(7), 727-734.
- Meijer, A., Conradi, H., Bos, E., Anselmino, M., Carney, R., Denollet, J., . . . Hosseini, S. (2013). Adjusted prognostic association of depression following myocardial infarction with mortality and cardiovascular events: individual patient data meta-analysis. *The British Journal of Psychiatry*, 203(2), 90-102.
- Meijer, A., Conradi, H. J., Bos, E. H., Thombs, B. D., van Melle, J. P., & de Jonge, P. (2011). Prognostic association of depression following myocardial infarction with mortality and cardiovascular events: a meta-analysis of 25 years of research. *General Hospital Psychiatry*, 33(3), 203-216.
- Melfi, C. A., Croghan, T. W., Hanna, M. P., & Robinson, R. L. (2000). Racial variation in antidepressant treatment in a Medicaid population. *The Journal of Clinical Psychiatry*.
- Menzin, J., Wygant, G., Hauch, O., Jackel, J., & Friedman, M. (2008). One-year costs of ischemic heart disease among patients with acute coronary syndromes: findings from a multi-employer claims database. *Current Medical Research and Opinion*, 24(2), 461-468.
- Miller, T. Q., Smith, T. W., Turner, C. W., Guijarro, M. L., & Hallet, A. J. (1996). Meta-analytic review of research on hostility and physical health. *Psychological Bulletin*, 119(2), 322.
- Mitchell, R. H., Robertson, E., Harvey, P. J., Nolan, R., Rodin, G., Romans, S., . . . Stewart, D. E. (2005). Sex differences in depression after coronary artery bypass graft surgery. *American Heart Journal*, 150(5), 1017-1025.

- Mommersteeg, P. M., Arts, L., Zijlstra, W., Widdershoven, J. W., Aarnoudse, W., & Denollet, J. (2017). Impaired Health Status, Psychological Distress, and Personality in Women and Men With Nonobstructive Coronary Artery Disease: Sex and Gender Differences: The TWIST (Tweesteden Mild Stenosis) Study. *Circulation. Cardiovascular Quality and Outcomes*, *10*(2), e003387.
- Mosack, V., & Steinke, E. E. (2009). Trends in sexual concerns after myocardial infarction. *Journal of Cardiovascular Nursing*, *24*(2), 162-170.
- Moser, D. K., Dracup, K., Evangelista, L. S., Zambroski, C. H., Lennie, T. A., Chung, M. L., . . . Heo, S. (2010). Comparison of prevalence of symptoms of depression, anxiety, and hostility in elderly patients with heart failure, myocardial infarction, and a coronary artery bypass graft. *Heart & Lung : the Journal of Critical Care*, *39*(5), 378-385.
- Mostofsky, E., Penner, E. A., & Mittleman, M. A. (2014). Outbursts of anger as a trigger of acute cardiovascular events: a systematic review and meta-analysis. *European Heart Journal*, *35*(21), 1404-1410.
- Muhammad, I. M. S. O. R., He, H.-G., Koh, K., Thompson, D. R., Kowitlawakul, Y., & Wang, W. (2014). Health-related quality of life and its predictors among outpatients with coronary heart disease in Singapore. *Applied Nursing Research*, *27*(3), 175-180.
- Murphy, B. M., Elliott, P. C., Higgins, R. O., Le Grande, M. R., Worcester, M. U., Goble, A. J., & Tatoulis, J. (2008a). Anxiety and depression after coronary artery bypass graft surgery: most get better, some get worse. *European journal of cardiovascular prevention and rehabilitation : official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology*, *15*(4), 434-440.

- Murphy, B. M., Elliott, P. C., Worcester, M. U. C., Higgins, R. O., Grande, M. R., Roberts, S. B., & Goble, A. J. (2008b). Trajectories and predictors of anxiety and depression in women during the 12 months following an acute cardiac event. *British Journal of Health Psychology, 13*(1), 135-153.
- Murphy, B., Ludeman, D., Elliott, P., Judd, F., Humphreys, J., Edington, J., . . . Worcester, M. (2014). Red flags for persistent or worsening anxiety and depression after an acute cardiac event: a 6-month longitudinal study in regional and rural Australia. *European Journal of Preventive Cardiology, 21*(9), 1079-1089.
- Murphy, B. M., Higgins, R. O., & Jackson, A. C. (2015a). Anxiety, depression, and psychological adjustment after an acute cardiac event. *Handbook of Psychocardiology*, 1-21.
- Murphy, B. M., Higgins, R. O., Jackson, A. C., Edington, J., Jackson, A., & Worcester, M. U. (2015b). Patients want to know about the 'cardiac blues'. *Australian Family Physician, 44*(11), 826-832.
- Murrell, S. A., Himmelfarb, S., & Wright, K. (1983). Prevalence of depression and its correlates in older adults. *American Journal of Epidemiology, 117*(2), 173-185.
- Najafi Ghezeljeh, T., Yadavar Nikraves, M., & Emami, A. (2014). Coronary heart disease patients transitioning to a normal life: perspectives and stages identified through a grounded theory approach. *Journal of Clinical Nursing, 23*(3-4), 571-585.
- National Population Health Survey, 1998-1999: household component Health Reports* (2000).
- Neill, W. A., Branch, L. G., De Jong, G., Smith, N. E., Hogan, C. A., Corcoran, P. J., . . . Osberg, S. (1985). Cardiac disability: the impact of coronary heart disease on patients' daily activities. *Archives of Internal Medicine, 145*(9), 1642-1647.

- Nierenberg, A. A., Petersen, T. J., & Alpert, J. E. (2003). Prevention of relapse and recurrence in depression: the role of long-term pharmacotherapy and psychotherapy. *Journal of Clinical Psychiatry, 64*(15), 13-17.
- Oldridge, N. B., & Stump, T. E. (2004). Heart disease, comorbidity, and activity limitation in community-dwelling elderly. *European Journal of Cardiovascular Prevention & Rehabilitation, 11*(5), 427-434.
- Olsen, S. J., Schirmer, H., Wilsgaard, T., Bønaa, K. H., & Hanssen, T. A. (2018). Cardiac rehabilitation and symptoms of anxiety and depression after percutaneous coronary intervention. *European Journal of Preventive Cardiology, 25*(10), 1017-1025.
- Oquendo, M. A., Kamali, M., Ellis, S. P., Grunebaum, M. F., Malone, K. M., Brodsky, B. S., . . . Mann, J. J. (2002). Adequacy of antidepressant treatment after discharge and the occurrence of suicidal acts in major depression: a prospective study. *American Journal of Psychiatry, 159*(10), 1746-1751.
- Orth-Gomér, K., & Leineweber, C. (2005). Multiple stressors and coronary disease in women: The Stockholm Female Coronary Risk Study. *Biological Psychology, 69*(1), 57-66.
- Orth-Gomér, K., Schneiderman, N., Wang, H. X., Walldin, C., Blom, M., & Jernberg, T. (2009). Stress reduction prolongs life in women with coronary disease: the Stockholm Women's Intervention Trial for Coronary Heart Disease (SWITCHD). *Circulation Cardiovascular Quality and Outcomes, 2*(1), 25-32.
- Pająk, A., Jankowski, P., Kotseva, K., Heidrich, J., de Smedt, D., De Bacquer, D., & Group, E. S. (2013). Depression, anxiety, and risk factor control in patients after hospitalization

- for coronary heart disease: the EUROASPIRE III Study. *European Journal of Preventive Cardiology*, 20(2), 331-340.
- Palacios, J., Khondoker, M., Mann, A., Tylee, A., & Hotopf, M. (2018). Depression and anxiety symptom trajectories in coronary heart disease: Associations with measures of disability and impact on 3-year health care costs. *Journal of Psychosomatic Research*, 104, 1-8.
- Palinkas, L. A., Wingard, D. L., & Barrett-Connor, E. (1990). Chronic illness and depressive symptoms in the elderly: a population-based study. *Journal of Clinical Epidemiology*, 43(11), 1131-1141.
- Panagioti, M., Scott, C., Blakemore, A., & Coventry, P. A. (2014). Overview of the prevalence, impact, and management of depression and anxiety in chronic obstructive pulmonary disease. *International Journal of Chronic Obstructive Pulmonary Disease*, 9, 1289-1306.
- Parashar, S., Rumsfeld, J. S., Reid, K. J., Buchanan, D., Dawood, N., Khizer, S., . . . Vaccarino, V. (2009). Impact of depression on sex differences in outcome after myocardial infarction. *Circulation: Cardiovascular Quality and Outcomes*, 2(1), 33-40.
- Parker, G., & Brotchie, H. (2010). Gender differences in depression. *International Review of Psychiatry*, 22(5), 429-436.
- Pathak, L. A., Shirodkar, S., Ruparelia, R., & Rajebahadur, J. (2017). Coronary artery disease in women. *Indian Heart Journal*, 69(4), 532-538.

- Patra, J., Popova, S., Rehm, J., Bondy, S., Flint, R., & Giesbrecht, N. (2007). Economic cost of chronic disease in Canada. *Ontario Chronic Disease Prevention Alliance and the Ontario Public Health Association, 16*.
- Pearson, C., Janz, T., & Ali, J. (2013). Mental and substance use disorders in Canada. In: Statistics Canada Ottawa.
- Pederson, E. L., & Vogel, D. L. (2007). Male gender role conflict and willingness to seek counseling: Testing a mediation model on college-aged men. *Journal of Counseling Psychology, 54*(4), 373.
- Penckofer, S., & Holm, K. (1990). Women undergoing coronary artery bypass surgery: physiological and psychosocial perspectives. *Cardio-vascular Nursing, 26*(3), 13-18.
- Perk, J., De Backer, G., Gohlke, H., Graham, I., Reiner, Ž., Verschuren, M., . . . Cifkova, R. (2012). European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). *European Heart Journal, 33*(13), 1635-1701.
- Peterson, J. C., Allegrante, J. P., Pirraglia, P. A., Robbins, L., Lane, K. P., Boschert, K. A., & Charlson, M. E. (2010). Living with heart disease after angioplasty: a qualitative study of patients who have been successful or unsuccessful in multiple behavior change. *Heart & Lung: The Journal of Acute and Critical Care, 39*(2), 105-115.
- Peveler, R., Carson, A., & Rodin, G. (2002). Depression in medical patients. *BMJ, 325*(7356), 149-152.
- Piccinelli, M., & Wilkinson, G. (2000). Gender differences in depression. Critical review. *The British Journal of Psychiatry : the Journal of Mental Science, 177*, 486-492.
- Pinsky, J. L., Jette, A. M., Branch, L. G., Kannel, W. B., & Feinleib, M. (1990). The Framingham Disability Study: relationship of various coronary heart disease

- manifestations to disability in older persons living in the community. *American Journal of Public Health*, 80(11), 1363-1367.
- Plaisier, I., de Bruijn, J. G. M., de Graaf, R., Have, M. T., Beekman, A. T. F., & Penninx, B. W. J. H. (2007). The contribution of working conditions and social support to the onset of depressive and anxiety disorders among male and female employees. *Social Science & Medicine*, 64(2), 401-410.
- Pogosova, N., Kotseva, K., De Bacquer, D., von Känel, R., De Smedt, D., Bruthans, J., & Dolzhenko, M. (2017). Psychosocial risk factors in relation to other cardiovascular risk factors in coronary heart disease: Results from the EUROASPIRE IV survey. A registry from the European Society of Cardiology. *European Journal of Preventive Cardiology*, 24(13), 1371-1380.
- Polsky, D., Doshi, J. A., Marcus, S., Oslin, D., Rothbard, A., Thomas, N., & Thompson, C. L. (2005). Long-term risk for depressive symptoms after a medical diagnosis. *Archives of Internal Medicine*, 165(11), 1260-1266.
- Poole, L., Dickens, C., & Steptoe, A. (2011). The puzzle of depression and acute coronary syndrome: reviewing the role of acute inflammation. *Journal of Psychosomatic Research*, 71(2), 61-68.
- Power, K., Simpson, R., Swanson, V., & Wallace, L. (1990). Controlled comparison of pharmacological and psychological treatment of generalized anxiety disorder in primary care. *British Journal of General Practice*, 40(336), 289-294.
- Pragle, A. S., & Salahshor, S. (2018). Identifying and managing depression in patients with coronary artery disease. *Journal of the American Academy of PAs*, 31(5), 12-18.

- Presciutti, A., Verma, J., Pavol, M., Anbarasan, D., Falo, C., Brodie, D., . . . Claassen, J. (2018). Posttraumatic stress and depressive symptoms characterize cardiac arrest survivors' perceived recovery at hospital discharge. *General Hospital Psychiatry*, *53*, 108-113.
- Price, A. E. (2004). Heart disease and work. *Heart*, *90*(9), 1077-1084.
- Public Health Agency of Canada. (2006). The human face of mental health and mental illness in Canada 2006. In: Minister of Public Works and Government Services Canada Ottawa, ON.
- Public Health Agency of Canada, P. (2018). *Report from the Canadian Chronic Disease Surveillance System: Heart Disease in Canada, 2018*. Retrieved from Ottawa, Ontario, Canada.
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385-401.
- Randall, G., Molloy, G. J., & Steptoe, A. (2009). The impact of an acute cardiac event on the partners of patients: a systematic review. *Health Psychology Review*, *3*(1), 1-84.
- Rice, S. M., Fallon, B. J., Aucote, H. M., & Möller-Leimkühler, A. M. (2013). Development and preliminary validation of the male depression risk scale: Furthering the assessment of depression in men. *Journal of Affective Disorders*, *151*(3), 950-958.
- Richardson, S., Shaffer, J. A., Falzon, L., Krupka, D., Davidson, K. W., & Edmondson, D. (2012). Meta-analysis of perceived stress and its association with incident coronary heart disease. *The American Journal of Cardiology*, *110*(12), 1711-1716.
- Robbins, P. C., Monahan, J., & Silver, E. (2003). Mental disorder, violence, and gender. *Law and Human Behavior*, *27*(6), 561-571.



- Robitaille, C., Dai, S., & Waters, C. (2014). Ischemic heart disease prevalence and incidence in Canada. *Canadian Journal of Cardiology*, 30(10), S75-S76.
- Roest, A. M., Martens, E. J., de Jonge, P., & Denollet, J. (2010). Anxiety and risk of incident coronary heart disease: a meta-analysis. *Journal of the American College of Cardiology*, 56(1), 38-46.
- Roth, G. A., Johnson, C., Abajobir, A., Abd-Allah, F., Abera, S. F., Abyu, G., . . . Alam, K. (2017). Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015. *Journal of the American College of Cardiology*, 23715.
- Rothenbacher, D., Jaensch, A., Mons, U., Hahmann, H., Becker, T., Koenig, W., & Brenner, H. (2015). Prognostic value of one-year course of symptoms of anxiety and depression in patients with coronary heart disease: Role of physical activity and unmet medical need. *European Journal of Preventive Cardiology*, 22(9), 1129-1138.
- Rouillon, F. (2004). Long term therapy of generalized anxiety disorder. *European Psychiatry*, 19(2), 96-101.
- Roy-Byrne, P., Craske, M. G., Sullivan, G., Rose, R. D., Edlund, M. J., Lang, A. J., . . . Golinelli, D. (2010). Delivery of evidence-based treatment for multiple anxiety disorders in primary care: a randomized controlled trial. *Journal of the American Medical Association*, 303(19), 1921-1928.
- Ruo, B., Bertenthal, D., Sen, S., Bittner, V., Ireland, C. C., & Hlatky, M. A. (2006). Self-rated health among women with coronary disease: depression is as important as recent cardiovascular events. *American Heart Journal*, 152(5), 1-7.
- Rutledge, T., Kenkre, T. S., Bittner, V., Krantz, D. S., Thompson, D. V., Linke, S. E., . . . Bairey Merz, C. N. (2013a). Anxiety associations with cardiac symptoms,

- angiographic disease severity, and healthcare utilization: the NHLBI-sponsored Women's Ischemia Syndrome Evaluation. *International Journal of Cardiology*, 168(3), 2335-2340.
- Rutledge, T., Kenkre, T. S., Thompson, D. V., Bittner, V. A., Whittaker, K., Eastwood, J.-A., . . . Bairey Merz, C. N. (2016). Psychosocial predictors of long-term mortality among women with suspected myocardial ischemia: the NHLBI-sponsored Women's Ischemia Syndrome Evaluation. *Journal of Behavioral Medicine*, 39(4), 687-693.
- Rutledge, T., Redwine, L. S., Linke, S. E., & Mills, P. J. (2013b). A meta-analysis of mental health treatments and cardiac rehabilitation for improving clinical outcomes and depression among patients with coronary heart disease. *Psychosomatic Medicine*, 75(4), 335-349.
- Schaich, A., Westermair, A. L., Munz, M., Nitsche, S., Willenborg, B., Willenborg, C., . . . Schweiger, U. (2018). Mental health and psychosocial functioning over the lifespan of German patients undergoing cardiac catheterization for coronary artery disease. *Frontiers in Psychiatry*, 9, 338.
- Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, 67(6), 1063.
- Scherwitz, L., Perkins, L., Chesney, M., & Hughes, G. (1991). Cook-Medley Hostility scale and subsets: relationship to demographic and psychosocial characteristics in young adults in the CARDIA study. *Psychosomatic Medicine*, 53(1), 36-49.

- Schiavon, C. C., Marchetti, E., Gurgel, L. G., Busnello, F. M., & Reppold, C. T. (2017). Optimism and hope in chronic disease: a systematic review. *Frontiers in Psychology*, 7, 2022.
- Schmidt, M. M., Moura, M. R., Stochero, L., Gottschall, C. M., Quadros, A. S., Lopes, R. D., & Newby, L. K. (2013). Anger control and cardiovascular outcomes. *International Journal of Cardiology*, 168(4), 4338-4339.
- Schneiderman, G. N., Saab, J. P., Catellier, H. D., Powell, F. L., Debusk, B. R., Williams, M. R., . . . Kaufmann, G. P. (2004). Psychosocial Treatment Within Sex by Ethnicity Subgroups in the Enhancing Recovery in Coronary Heart Disease Clinical Trial. *Psychosomatic Medicine*, 66(4), 475-483.
- Scott, K. M., Bruffaerts, R., Tsang, A., Ormel, J., Alonso, J., Angermeyer, M., . . . De Graaf, R. (2007). Depression–anxiety relationships with chronic physical conditions: results from the World Mental Health Surveys. *Journal of Affective Disorders*, 103(1-3), 113-120.
- Shah, A. J., & Vaccarino, V. (2016). Psychosocial risk factors and coronary artery disease. In *Psychotherapy for Ischemic Heart Disease* (pp. 29-44): Springer.
- Shanmugasagaram, S., Russell, K. L., Kovacs, A. H., Stewart, D. E., & Grace, S. L. (2012). Gender and sex differences in prevalence of major depression in coronary artery disease patients: a meta-analysis. *Maturitas*, 73(4), 305-311.
- Sheehan, D. V., Harnett-Sheehan, K., & Raj, B. A. (1996). The measurement of disability. *International Clinical Psychopharmacology*, 11 Suppl 3, 89.
- Shen, B.-J., & Gau, J.-T. (2017). Influence of Depression and Hostility on Exercise Tolerance and Improvement in Patients with Coronary Heart Disease. *International Journal of*

*Behavioral Medicine : Official Journal of the International Society of Behavioral Medicine*, 24(2), 312-320.

Silberg, J., Pickles, A., Rutter, M., Hewitt, J., Simonoff, E., Maes, H., . . . Eaves, L. (1999). The influence of genetic factors and life stress on depression among adolescent girls. *Archives of General Psychiatry*, 56(3), 225-232.

Simpson, S. M., Krishnan, L. L., Kunik, M. E., & Ruiz, P. (2007). Racial disparities in diagnosis and treatment of depression: a literature review. *Psychiatric Quarterly*, 78(1), 3-14.

Sin, N. L. (2016). The protective role of positive well-being in cardiovascular disease: review of current evidence, mechanisms, and clinical implications. *Current Cardiology Reports*, 18(11), 106.

Sin, N. L., Kumar, A. D., Gehi, A. K., & Whooley, M. A. (2016). Direction of association between depressive symptoms and lifestyle behaviors in patients with coronary heart disease: the Heart and Soul Study. *Annals of Behavioral Medicine*, 50(4), 523-532.

Smaardijk, V. R., Maas, A. H., Lodder, P., Kop, W. J., & Mommersteeg, P. M. (2020). Sex and gender-stratified risks of psychological factors for adverse clinical outcomes in patients with ischemic heart disease: A systematic review and meta-analysis. *International Journal of Cardiology*, 302, 21-29.

Smeijers, L., Mostofsky, E., Tofler, G. H., Muller, J. E., Kop, W. J., & Mittleman, M. A. (2017). Anxiety and anger immediately prior to myocardial infarction and long-term mortality: Characteristics of high-risk patients. *Journal of Psychosomatic Research*, 93, 19-27.

- Smith, J., Braunack-Mayer, A., & Wittert, G. (2006). What do we know about men's help-seeking and health service use? *Medical Journal of Australia*, 184, 81–83.
- Smolderen, K. G., Buchanan, D. M., Gosch, K., Whooley, M., Chan, P. S., Vaccarino, V., . . . Spertus, J. A. (2017). Depression treatment and 1-year mortality after acute myocardial infarction: insights from the TRIUMPH registry (Translational Research Investigating Underlying Disparities in Acute Myocardial Infarction Patients' Health Status). *Circulation*, 135(18), 1681-1689.
- Snoek, F., & Skinner, T. (2002). Psychological counselling in problematic diabetes: does it help? *Diabetic Medicine*, 19(4), 265-273.
- Sonnenberg, C. M., Beekman, A. T., Deeg, D. J., & van Tilburg, W. (2000). Sex differences in late-life depression. *Acta Psychiatrica Scandinavica*, 101(4), 286-292.
- St-Jean, K., D'Antono, B., & Dupuis, G. (2005). Psychological Distress and Exertional Angina in Men and Women Undergoing Thallium Scintigraphy. *Journal of Behavioral Medicine*, 28(6), 527-536.
- Stafford, L., Berk, M., Reddy, P., & Jackson, H. J. (2007). Comorbid depression and health-related quality of life in patients with coronary artery disease. *Journal of Psychosomatic Research*, 62(4), 401-410.
- Staniute, M., Brozaitiene, J., & Bunevicius, R. (2013). Effects of social support and stressful life events on health-related quality of life in coronary artery disease patients. *Journal of Cardiovascular Nursing*, 28(1), 83-89.
- Statistics Canada. (2014). *Perceived life stress, 2014*. The Canadian Community Health Survey.

- Statistics Canada. (2019). Deaths, by cause, Chapter IX: Diseases of the circulatory system (I00 to I99).
- Steptoe, A., & Kivimäki, M. (2012). Stress and cardiovascular disease. *Nature Reviews Cardiology*, 9(6), 360.
- Steptoe, A., & Kivimäki, M. (2013). Stress and cardiovascular disease: an update on current knowledge. *Annual Review of Public Health*, 34, 337-354.
- Stewart, J. C., Fitzgerald, G. J., & Kamarck, T. W. (2010). Hostility now, depression later? Longitudinal associations among emotional risk factors for coronary artery disease. *Annals of Behavioral Medicine*, 39(3), 258-266.
- Stewart, M., Davidson, K., Meade, D., Hirth, A., & Makrides, L. (2000). Myocardial infarction: survivors' and spouses' stress, coping, and support. *Journal of Advanced Nursing*, 31(6), 1351-1360.
- Stewart, R. A., Colquhoun, D. M., Marschner, S. L., Kirby, A. C., Simes, J., Nestel, P. J., . . . White, H. D. (2017). Persistent psychological distress and mortality in patients with stable coronary artery disease. *Heart*, 103(23), 1860-1866.
- Suls, J. (2018). Toxic affect: Are anger, anxiety, and depression independent risk factors for cardiovascular disease? *Emotion Review*, 10(1), 6-17.
- Sunbul, M., Zincir, S. B., Durmus, E., Sunbul, E. A., Cengiz, F. F., Kivrak, T., . . . Sari, I. (2013). Anxiety and depression in patients with coronary artery disease. *Bulletin of Clinical Psychopharmacology*, 23(4), 345-352.
- Tan, Y. C., Sinclair, H., Ghoorah, K., Teoh, X., Mehran, R., & Kunadian, V. (2016). Gender differences in outcomes in patients with acute coronary syndrome in the current era: A review. *European Heart Journal: Acute Cardiovascular Care*, 5(7), 51-60.

- The Canadian Community Health Survey. (2016). *Chronic Conditions, 2016*.
- Thériault, L., Stonebridge, C., & Browarski, S. (2010). *The Canadian Heart Health Strategy: Risk Factors and Future Cost Implications*. Retrieved from Canada:  
[https://sencanada.ca/content/sen/committee/412/SOCI/Briefs/2015-05-07ReportCdnCardiovascularSociety-AddInfoConferenceBoardofCanada\\_e.pdf](https://sencanada.ca/content/sen/committee/412/SOCI/Briefs/2015-05-07ReportCdnCardiovascularSociety-AddInfoConferenceBoardofCanada_e.pdf)
- Thielke, S., Diehr, P., & Unutzer, J. (2010). Prevalence, incidence, and persistence of major depressive symptoms in the Cardiovascular Health Study. *Aging & Mental Health, 14*(2), 168-176.
- Thombs, B. D., Bass, E. B., Ford, D. E., Stewart, K. J., Tsilidis, K. K., Patel, U., . . . Ziegelstein, R. C. (2006). Prevalence of Depression in Survivors of Acute Myocardial Infarction. *Journal of General Internal Medicine, 21*(1), 30-38.
- Thombs, B. D., Roseman, M., Coyne, J. C., de Jonge, P., Delisle, V. C., Arthurs, E., . . . Ziegelstein, R. C. (2013). Does evidence support the American Heart Association's recommendation to screen patients for depression in cardiovascular care? An updated systematic review. *PloS one, 8*(1), e52654.
- Tindle, H. A., Chang, Y.-F., Kuller, L. H., Manson, J. E., Robinson, J. G., Rosal, M. C., . . . Matthews, K. A. (2009). Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women's Health Initiative. *Circulation, 120*(8), 656-662.
- Tran, H. V., Gore, J. M., Darling, C. E., Ash, A. S., Kiefe, C. I., & Goldberg, R. J. (2019). Clinically significant ventricular arrhythmias and progression of depression and anxiety following an acute coronary syndrome. *Journal of Psychosomatic Research, 117*, 54-62.

- Tully, P. J., Baker, R. A., Turnbull, D. A., Winefield, H. R., & Knight, J. L. (2009). Negative emotions and quality of life six months after cardiac surgery: the dominant role of depression not anxiety symptoms. *Journal of Behavioral Medicine, 32*(6), 510.
- Tully, P. J., Cosh, S. M., & Baumeister, H. (2014). The anxious heart in whose mind? A systematic review and meta-regression of factors associated with anxiety disorder diagnosis, treatment and morbidity risk in coronary heart disease. *Journal of Psychosomatic Research, 77*(6), 439-448.
- Tully, P. J., Harrison, N. J., Cheung, P., & Cosh, S. (2016). Anxiety and cardiovascular disease risk: a review. *Current Cardiology Reports, 18*(12), 120.
- Tully, P. J., & Higgins, R. (2014). Depression screening, assessment, and treatment for patients with coronary heart disease: A review for psychologists. *Australian Psychologist, 49*(6), 337-344.
- Tully, P. J., Winefield, H. R., Baker, R. A., Denollet, J., Pedersen, S. S., Wittert, G. A., & Turnbull, D. A. (2015). Depression, anxiety and major adverse cardiovascular and cerebrovascular events in patients following coronary artery bypass graft surgery: a five year longitudinal cohort study. *BioPsychoSocial Medicine, 9*(1), 14.
- Uchino, B. N. (2006). Social support and health: a review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine, 29*(4), 377-387.
- Vaccarino, V., Lin, Z. Q., Kasl, S. V., Mattera, J. A., Roumanis, S. A., Abramson, J. L., & Krumholz, H. M. (2003). Gender differences in recovery after coronary artery bypass surgery. *Journal of the American College of Cardiology, 41*(2), 307-314.



- Valtorta, N. K., Kanaan, M., Gilbody, S., Ronzi, S., & Hanratty, B. (2016). Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart, 102*(13), 1009-1016.
- Van de Velde, S., Bracke, P., & Levecque, K. (2010). Gender differences in depression in 23 European countries. Cross-national variation in the gender gap in depression. *Social Science & Medicine, 71*(2), 305-313.
- van Melle, J. P., de Jonge, P., Ormel, J., Crijns, H. J., van Veldhuisen, D. J., Honig, A., . . . van den Berg, M. P. (2005). Relationship between left ventricular dysfunction and depression following myocardial infarction: data from the MIND-IT. *European Heart Journal, 26*(24), 2650-2656.
- Van Melle, P. J., De Jonge, A. P., Spijkerman, G. P. T., Tijssen, J. J., Ormel, H. S. J., Van Veldhuisen, P. D., . . . Van Den Berg, P. M. (2004). Prognostic Association of Depression Following Myocardial Infarction With Mortality and Cardiovascular Events: A Meta-analysis. *Psychosomatic Medicine, 66*(6), 814-822.
- van Montfort, E., Denollet, J., Vermunt, J. K., Widdershoven, J., & Kupper, N. (2017). The tense, the hostile and the distressed: multidimensional psychosocial risk profiles based on the ESC interview in coronary artery disease patients-the THORESCI study. *General Hospital Psychiatry, 47*, 103-111.
- van Straten, A., Geraedts, A., Verdonck-de Leeuw, I., Andersson, G., & Cuijpers, P. (2010). Psychological treatment of depressive symptoms in patients with medical disorders: a meta-analysis. *Journal of Psychosomatic Research, 69*(1), 23-32.
- VandenBos, G. R., & American Psychological, A. (2015). *APA dictionary of psychology* (Second Edition.): Washington, DC : American Psychological Association.

- Vázquez, C., Hervás, G., Rahona, J. J., & Gómez, D. (2009). Psychological well-being and health. Contributions of positive psychology. *Annuary of Clinical and Health Psychology*, 5(2009), 15-27.
- Versteeg, H., Hoogwegt, M. T., Hansen, T. B., Pedersen, S. S., Zwisler, A.-D., & Thygesen, L. C. (2013). Depression, not anxiety, is independently associated with 5-year hospitalizations and mortality in patients with ischemic heart disease. *Journal of Psychosomatic Research*, 75(6), 518-525.
- Versteeg, H., Roest, A. M., & Denollet, J. (2015). Persistent and fluctuating anxiety levels in the 18 months following acute myocardial infarction: the role of personality. *General Hospital Psychiatry*, 37(1), 1-6.
- Vilchinsky, N., Reges, O., Leibowitz, M., Khaskia, A., Mosseri, M., & Kark, J. D. (2018). Symptoms of Depression and Anxiety as Barriers to Participation in Cardiac Rehabilitation Programs Among Arab and Jewish Patients in Israel. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 38(3), 163-169.
- Villamil, E., Huppert, F. A., & Melzer, D. (2006). Low prevalence of depression and anxiety is linked to statutory retirement ages rather than personal work exit: a national survey. *Psychological Medicine*, 36(7), 999-1009.
- Vos, T., Barber, R. M., Bell, B., Bertozzi-Villa, A., Biryukov, S., Bolliger, I., . . . Dicker, D. (2015). Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 386(9995), 743-800.

- Waldman, S. V., Blumenthal, J. A., Babyak, M. A., Sherwood, A., Sketch, M., Davidson, J., & Watkins, L. L. (2009). Ethnic differences in the treatment of depression in patients with ischemic heart disease. *American Heart Journal*, *157*(1), 77-83.
- Wang, H. X., Leineweber, C., Kirkeeide, R., Svane, B., Schenck-Gustafsson, K., Theorell, T., & Orth-Gomér, K. (2007). Psychosocial stress and atherosclerosis: family and work stress accelerate progression of coronary disease in women. The Stockholm Female Coronary Angiography Study. *Journal of Internal Medicine*, *261*(3), 245-254.
- Wang, M., Norris, C. M., Graham, M. M., Santana, M., Liang, Z., Awosoga, O., . . . Quan, H. (2019). Trajectories of perceived social support in acute coronary syndrome. *Quality of Life Research*, 1-12.
- Wardenaar, K. J., Wanders, R. B., Roest, A. M., Meijer, R. R., & De Jonge, P. (2015). What does the beck depression inventory measure in myocardial infarction patients? a psychometric approach using item response theory and person-fit. *International Journal of Methods in Psychiatric Research*, *24*(2), 130-142.
- Ware, E. J., Kosinski, D. M., & Keller, D. S. (1996). A 12-Item Short-Form Health Survey: Construction of Scales and Preliminary Tests of Reliability and Validity. *Medical Care*, *34*(3), 220-233.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063.
- Weaver, W. D., White, H. D., Wilcox, R. G., Aylward, P. E., Morris, D., Guerci, A., . . . Sadowski, Z. (1996). Comparisons of characteristics and outcomes among women and

- men with acute myocardial infarction treated with thrombolytic therapy. *Journal of the American Medical Association*, 275(10), 777-782.
- Welton, N. J., Caldwell, D., Adamopoulos, E., & Vedhara, K. (2009). Mixed treatment comparison meta-analysis of complex interventions: psychological interventions in coronary heart disease. *American Journal of Epidemiology*, 169(9), 1158-1165.
- Whalley, B., Thompson, D. R., & Taylor, R. S. (2014). Psychological interventions for coronary heart disease: cochrane systematic review and meta-analysis. *International Journal of Behavioral Medicine*, 21(1), 109-121.
- Wills, T. A., & DePaulo, B. M. (1991). Interpersonal analysis of the help-seeking process. *Handbook of Social and Clinical Psychology*, 162, 350-375.
- Winkler, D., Pjrek, E., & Kasper, S. (2005). Gender-specific symptoms of depression and anger attacks. *Journal of Men's Health and Gender*, 3(1), 19-24.
- Wittchen, H., Jakobi, F., Klose, M., & Ryl, L. (2010). Gesundheitsberichterstattung des Bundes; Heft 51: Depressive Erkrankungen. Robert Koch-Institut, Berlin.
- Wong, J. M., Na, B., Regan, M. C., & Whooley, M. A. (2013). Hostility, health behaviors, and risk of recurrent events in patients with stable coronary heart disease: findings from the Heart and Soul Study. *Journal of the American Heart Association*, 2(5), e000052.
- World Health Organization. (2014). *Global status report on alcohol and health, 2014*. Geneva: World Health Organization.
- Wu, Q., & Kling, J. M. (2016). Depression and the risk of myocardial infarction and coronary death: a meta-analysis of prospective cohort studies. *Medicine*, 95(6), e2815.

- Xu, X., Bao, H., Strait, K., Spertus, J. A., Lichtman, J. H., D'onofrio, G., . . . Lorenze, N. P. (2015). Sex differences in perceived stress and early recovery in young and middle-aged patients with acute myocardial infarction. *Circulation, 131*(7), 614-623.
- Xu, X., Bao, H., Strait, K. M., Edmondson, D. E., Davidson, K. W., Beltrame, J. F., . . . Brush, J. E. (2017). Perceived stress after acute myocardial infarction: a comparison between young and middle-aged women versus men. *Psychosomatic Medicine, 79*(1), 50.
- Yorke, J., Fleming, S. L., & Shuldham, C. (2007). Psychological interventions for adults with asthma: a systematic review. *Respiratory Medicine, 101*(1), 1-14.
- Yusuf, S., Hawken, S., Ôunpuu, S., Dans, T., Avezum, A., Lanas, F., . . . Varigos, J. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *The Lancet, 364*(9438), 937-952.
- Ziegelstein, R. C., Kim, S. Y., Kao, D., Fauerbach, J. A., Thombs, B. D., McCann, U., . . . Bush, D. E. (2005). Can doctors and nurses recognize depression in patients hospitalized with an acute myocardial infarction in the absence of formal screening? *Psychosomatic Medicine, 67*(3), 393-397.
- Zierau, F., Bille, A., Rutz, W., & Bech, P. (2002). The Gotland Male Depression Scale: A validity study in patients with alcohol use disorder. *Nordic Journal of Psychiatry, 56*(4), 265-271.