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Psychological health and ischemic heart disease in women: A review of current evidence and clinical considerations across the healthspan

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Abstract

PURPOSE OF THE REVIEW: Psychological health encompasses a constellation of negative and positive factors – i.e., psychosocial stress, depression, anxiety, trauma, loneliness and social isolation, anger and hostility, optimism, and a sense of purpose. This narrative review presents current evidence for the intersection of psychological health, risk of ischemic heart disease (IHD), and IHD-related outcomes, with an emphasis on associations in women.

Recent Findings: For women, relations between psychological health and IHD reflect important sex and gender differences in biological and psychosocial factors. Although efforts devoted to understanding psychological health and IHD risk have varied by psychological factor – scientific evidence is strongest for depression, while anxiety, trauma, and positive psychological factors warrant more investigation – less optimal psychological health was consistently associated with an earlier and greater risk of IHD morbidity and mortality in women. Still, many past prospective studies of psychological factors and IHD risk had a limited representation of women, did not include analyses by sex, or failed to account for other influential, sex-specific factors. Thus, there are multiple pathways for further, rigorous investigation into psychological health-IHD associations, mechanisms, and empirically-supported psychological interventions to mitigate IHD risk among women.

Summary: Given the robust evidence linking psychological health with women's risk for IHD, implementing routine psychological assessment is recommended. Significant life events, developmental milestones specific to women, and IHD diagnoses or events could cue

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additional psychological assessment, which will mutually strengthen the evidence for integrated psychological and IHD care and delivery of that care to this vulnerable group.

Keywords

heart; ischemic heart disease; mental health; psychological health; women

Introduction

The World Health Organization defines psychological health as “a state of well-being in which an individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community”[1]. Also often referred to as mental health, psychological health is evaluated on a multidimensional spectrum from positive dimensions and well-being (e.g., happiness, optimism, sense of purpose and meaning) to negative dimensions and ill-being (e.g., depression, anxiety, hopelessness, pessimism) [2]. Psychological health encompasses both short-term emotional states and subclinical symptoms (e.g., psychological distress) and more lasting symptoms that meet diagnostic criteria for psychiatric disorders. Importantly, psychological health is a critical component of cardiovascular health (CVH), as it confers risk for ischemic heart disease (IHD) and other types of cardiovascular disease (CVD), especially among women [2–6]. Negative dimensions of psychological health are associated with the onset of cardiovascular risk factors (e.g., hypertension, obesity) and IHD (e.g., angina, acute myocardial infarction [MI]), greater risk for IHD incidence and progression, adverse outcomes following major acute cardiovascular events (MACE), and premature mortality [7–13]. In contrast, positive dimensions of psychological health are associated with better CVH and recovery following acute ischemic events [2, 14, 15].

The connection between psychological health and IHD among women is in part due to important sex and gender differences in women’s vulnerability to these conditions. Such differences are likely due, in part, to genetics, neurobiological factors including sex hormones, dopaminergic, noradrenergic, and serotoninergic systems, and regulation of those systems [16]. Simultaneously, the intersectionality of sex, gender, culture, and race that informs women’s lived experiences also influences psychological health, health behaviors, and social interactions, thus setting the stage for women’s health risk, outcomes, and quality of life. In contrast with sex, which is a biologically-determined category, the construct of gender refers to a person’s relationships and interactions based on their gender identity (i.e., marital/relationship status, family or local network, social support) [17]. Compared to men, women tend to be more disadvantaged in education, income, health literacy, and access to healthcare [18]. Women from socially and racially disadvantaged backgrounds have distinct experiences of stigma, stereotyping, and discrimination [19, 20]. Social and structural disparities due to sex and gender-related roles also directly and indirectly affect women’s psychological health and subsequent IHD risk [7, 21–23].

While psychological health is an important component of cardiac and vascular health, it is often overlooked during women’s healthcare interactions. Clinicians may feel rushed or lack the skills to assess psychological health. Patients, too, may feel uncomfortable or

uncertain about sharing psychological concerns with their providers [24]. Specific to IHD management, patients may not think it is appropriate to discuss psychosocial stress, other dimensions of their psychological health, psychiatric diagnoses, or treatment history with their cardiologist, and may worry that they will be judged or treated differently. The need for greater awareness of the psychological-CVH intersection among women and integration into cardiovascular care encourages this state-of-the-science review. We first review the most relevant studies and meta-analyses published in the last 10 years that included women, stratified by different psychological attributes. In the second section, we review evidence-based psychological treatment strategies and suggest approaches for incorporating psychological health into clinical practice. Ideally, the conclusions and identified questions will inspire further scientific advances and encourage the inclusion of psychological health in recommendations for IHD management across women's life course.

Negative Psychological Factors

Psychosocial Stress—Psychosocial stress is a normal aspect of daily life and more than half of patients with a diagnosis of IHD and other types of CVD report high levels of stress [25]. Women report greater stress burden than men – with more daily stress and chronic stress exposure (e.g., sex-based discrimination, socio-culturally constructed roles and identities, multiple role burden – as a partner, primary caregiver, financial provider, and a single and/or working parent [26–28]), and greater cumulative stress across the lifespan [29–33] – which may increase risk for IHD [34]. Additionally, standardized mental stress paradigms often provoke differential responses to stress among women. In some studies, women show distinct hormonal responses to acute stress [35, 36], and stress-induced myocardial ischemia (MSIMI) – assessed with myocardial perfusion imaging – is twice as common among women than men [10, 37–41]. Interestingly, MSIMI may go undetected among women (i.e., occur in a subclinical manner) as it is often not associated with anginal symptoms, electrocardiographic abnormalities, or the degree of atherosclerotic disease [42]. Sex-specific observational studies also demonstrate the contribution of MSIMI to future IHD risk. Women who showed peripheral microvascular dysfunction in response to a mental stressor at baseline had a 50% greater risk of MACE over 5 years compared to both women without this response and to men with a positive mental stress-induced response [10], underscoring the potential role of mental stress in women's distinct stress-related vulnerability to IHD. Still, more robust prospective investigations are required to determine how MSIMI and other acute physiological changes in response to mental stress predict IHD risk development among women.

Substantial observational evidence also highlights the importance of chronic psychosocial stress in vulnerability to IHD among women. An estimated 58% of patients with CVD report high levels of psychosocial stress. Prospective analyses from 6,508 participants in the Multi-Ethnic Study of Atherosclerosis (MESA; 53% women), revealed that lifetime discrimination in ≥2 areas compared with no reported discrimination was associated with a 28% greater risk for incident CVD [43]. Cross-sectional analyses from two cohorts of women with ischemia and no obstructive coronary artery disease (INOCA; n = 551 and 376, respectively) revealed that home and work stress in the first cohort, and financial stress in the second cohort, were associated with anginal or anginal-equivalent symptoms and functional impairment [44].

Other large prospective studies have corroborated the importance of job strain in predicting incident CVD, especially for women with low control or occupational skill [28, 45]. In the Variation In Recovery: Role of Gender on Outcomes of Young AMI Patients (VIRGO) study of young adults with a history of MI, marital stress was more commonly reported by women than men, and marital stress was associated with worse cardiac-specific quality of life, health status, and greater odds of angina and all-cause readmissions at 1-year post-MI, although results did not differ by sex [46]. Related to caregiving stress, a meta-analysis of 41 studies with a high proportion of women in the samples (52% to 100%), indicated that caregivers have a 2x greater vulnerability to incident CVD than non-caregivers, although sex-specific analyses were not reported [47]. Overall, psychosocial stress likely contributes to women's vulnerability to IHD, but further prospective research by sex is needed – particularly concerning relationships, caregiving, and discrimination – to determine the independent and cumulative contributions of social and structural stressors that adversely affect women, and which stress management or other interventions can mitigate risk for women.

Depression—Of the psychological health dimensions studied in association with IHD, the largest body of research pertains to the role of depression. Depression is one of the most common psychological conditions, which is distinguished by symptoms of persistent low mood, loss of interest or pleasure in normal activities, hopelessness, and undesirable changes to energy, appetite, weight, and sleep [48]. About 18% of adults will meet diagnostic criteria for depression in their lifetime, and depression is 2x more prevalent among women than men [49, 50]. Depression is observed in 1 out of 3 adults with IHD and the prevalence of depression is again at least 2x greater for women [51]. In addition to increased biological and psychosocial vulnerability to depression among women, depression is a well-known factor in women's risk for IHD [16, 52, 53], particularly among those who are younger [54]. In a prospective investigation of 3237 patients undergoing coronary angiography to diagnose CAD (34% women), women who were aged ≤55 years and who reported higher baseline symptoms of on the Patient Health Questionnaire (PHQ)-9 showed a greater risk of incident CAD and death across 3 years compared to same-aged women with lower depression symptoms. Furthermore, this association was more robust for younger women compared with same-aged men or women >55 years old [55]. Depression may also impact the uptake of guideline-concordant medical therapies among women. In a cohort study of 124,443 patients who underwent a percutaneous coronary intervention (33% women), adults with depression were 10-20% less likely to reach optimal adherence to guideline-directed medical therapies than those without depression. While there is significant observational research concerning depression and IHD among women, there is an underrepresentation of women in randomized clinical trials (RCT) of depression and IHD. In future trials, researchers should also consider the factors shared by women who are mutually at risk for depression, IHD, and adverse cardiovascular outcomes [56].

Anxiety—Anxiety is another prevalent psychological condition that an estimated 1 in 3 women and 1 in 5 men experience in their lifetime [57]. Like depression, anxiety is more common among patients who are diagnosed with CVD: 1 in 3 adults show clinically-significant symptoms of anxiety [25], and the prevalence is 2x greater in women versus

men [53, 58]. Moreover, women with INOCA may be more likely to have anxiety than those with other CVD [12, 58–60]. Although anxiety is highly comorbid with depression, it should be viewed as an independent risk factor for IHD among women and men. An investigation with data from 431,973 participants in the UK Biobank (55% women) showed that patients who were diagnosed with an anxiety disorder had a 72% greater independent risk of IHD and other CVD, and anxiety was associated with comparable risk to having a depression diagnosis [52]. Among women with IHD, anxiety appears to predict future adverse health outcomes. Based on a narrative review, women with elevated anxiety symptoms following MI show an increased risk for morbidity, rehospitalization, mortality, and worse quality of life [53]. While other findings concerning anxiety and IHD risk have been mixed [58], sex-specific analyses were often not conducted, which is problematic given the greater prevalence of anxiety in women versus men [61]. Although anxiety appears to be a risk factor for IHD among women, the underlying biological and psychosocial factors underlying these relations, require further study. Relatedly, investigations into anxiety as an aggregated category, may obscure important differences in specific types of anxiety disorders or subclinical anxiety symptoms that may affect IHD risk and prognosis [22]. Thus, our current knowledge about anxiety and IHD in women is only “the tip of the iceberg,” and more sex-specific studies are necessary to understand the influence of anxiety and related treatments in cardiovascular medicine [58].

Trauma and Posttraumatic Stress Disorder—Trauma – including adverse experiences in childhood (e.g., abuse, neglect) and adulthood (e.g., sexual harassment, assault, military sexual trauma) – is common among women [62], and is also associated with a greater likelihood of CVD [63–65]. Posttraumatic stress disorder (PTSD) is defined as the experience of a psychologically distressing event or trauma that produces feelings of intense fear and helplessness [57]. PTSD may similarly attributable to one’s social circumstances or context [66]. Symptoms include negative mood changes or cognitions, hyperarousal, intrusive thoughts and memories, avoidance of reminders and activities associated with the trauma, and sensations of re-experiencing traumatic events (e.g., via flashbacks and nightmares). Like trauma, a PTSD diagnosis or clinically significant self-reported symptoms of PTSD are each associated with increased risk for IHD and other CVD compared to adults without a PTSD diagnosis or with low symptoms [64, 67–71], and the magnitude of attributable risk appears to be similar by sex. Few studies of PTSD and incident IHD have been pursued with women exclusively. Among these is a retrospective cohort study of 398,769 U.S. women Veterans with and without PTSD, in which a PTSD diagnosis was associated with a 44% increased risk of incident IHD over 17 years [72]. Altogether trauma and PTSD are likely involved in women’s distinct risk for IHD. Yet, as women are disproportionately affected by trauma and PTSD, replicating, and extending this work is paramount. If and how treatment for PTSD affects women’s IHD risk is also unknown.

Loneliness and Social Isolation—Loneliness is defined as the subjective distressing feeling of being alone or separated. Social isolation is characterized as having few social relationships or infrequent social interactions [73]. Extensive research shows that loneliness, social isolation or even just inadequate social support, are associated with a greater risk for incident IHD [59, 74–77]. Social isolation and loneliness are also significant factors among

women with IHD. In cross-sectional studies of patients with CAD, low perceived social support from women's friends and family was associated with mental and physical fatigue [78], social isolation was related to less self-care [77, 79], low social support reported by patients in cardiac rehabilitation reported worse health-related quality of life [80], and women who reported loneliness had a nearly 3x greater risk of 1-year, all-cause mortality versus those who did not report loneliness [81]. The type of social support received is also critical. In a national study of 3,006 men and women aged 75+ who were hospitalized for MI (44% women), low versus high informational support (i.e., knowledge or advice) was associated with a 22% greater risk of readmission and low versus high emotional support (i.e., receiving expressions of empathy and caring) was associated with a 43% greater risk of mortality [82]. In patients with established CVD, social isolation has been associated with an increased risk of all-cause mortality for women and men [74, 83]. Other prospective findings have been mixed, with no relations among women [84]. Thus, social isolation and loneliness appear to be detrimental to women and men with IHD, but further sex-specific analyses should be pursued in demographically diverse samples.

Anger and Hostility—Anger "consists of feelings that vary in intensity, from mild irritation or annoyance to intense fury and rage"[85] and is measured as a state, trait, or one's ability to express their anger. Hostility is, "a complex set of feelings and attitudes that motivate aggressive and often vindictive behavior."[86] Anger and hostility are related constructs, which are likely involved in the onset of acute cardiovascular events [87]. Clinical research studies including myocardial perfusion imaging show that anger provokes MSIMI among both women and men [88]. Based on data from the multinational INTERHEART Study, out of 12,461 patients with a history of MI (24% women), 14% reported experiencing anger or emotional upset in the 1 hour before their event, comparable to the proportion who engaged in physical activity prior to MI [89]. Those who experienced anger or emotional upset had a >2x greater odds of MI, with no effect modification by sex. Prospective investigations have yielded some evidence supporting the roles of anger and hostility in predicting IHD risk. Data from a 10-year prospective study of 1,593 U.S. adults (54% women) showed that baseline hostility and anger expression were associated with CVD-related mortality, but sex did not moderate this association [90]. There is also speculation that anger and hostility affect IHD risk less for women than men [91–94], or not at all [13], although studies have often included a higher proportion of men or failed to assess for differences by sex. As observed with other dimensions of psychological health, further prospective analyses of anger, hostility, and IHD risk should be conducted with women.

Positive Psychological Factors: An Emerging Area

Contemporary approaches to investigating psychological health and CVH have increasingly focused on positive psychological dimensions – optimism, well-being, purpose, gratitude, happiness, sense of purpose, positive affect, and ikigai (i.e., a Japanese concept meaning a motivating force that provides a sense of purpose) – to determine the potential salubrious effects [14, 15, 95–99]. Despite disparate definitions, optimism is consistently and independently related to IHD risk and related-mortality, and these associations are robust for women and men [14, 100]. For example, using 8 years of prospective data from

70,021 women participating in the Nurses' Health Study, optimism was associated with a 38% lower risk of CVD-related mortality [101]. In another prospective study of 664 men and women aged ≤65 years (15% women), optimism during MI-related hospitalization was associated with a lower risk of mortality over the next 20 years [102]. Unfortunately, sex-stratified analyses were not conducted. Moreover, it is not clear if people who are healthier or recovering more optimally post-MI are simply more optimistic. Evidence reflecting other positive constructs and IHD risk is more sparse, and associations by sex are often not pursued. In a prospective investigation of 126,255 participants in the U.K. Biobank who were free of IHD at baseline (55% women), those with the lowest psychological wellbeing score (based on happiness, life satisfaction, depression, and neuroticism) had the greatest risk for CAD 12 years later, with a stronger association in women [103]. As observed with other negative, psychological constructs, additional longitudinal data will help to determine which positive psychological factors protect women's CVH.

Psychological Treatment and Interventions

Building on the vast literature supporting psychological factors in women's IHD risk, there are excellent, evidence-based behavioral and pharmacological treatments for managing stress, depression, anxiety, PTSD and related psychological factors (e.g., cognitive behavioral therapy [CBT], interpersonal therapy [IPT], mindfulness-based stress reduction, selective serotonin reuptake inhibitors [SSRIs] serotonin and norepinephrine reuptake inhibitors [SNRIs]), including in the context of IHD prevention [104]. Among behavioral treatment options, CBT has been the most studied in RCTs of patients at risk for or diagnosed with IHD. CBT is an empirically validated psychotherapy that is efficacious for targeting depression, anxiety, and PTSD in women and men [105–108]. In a recent review and meta-analysis of RCTs among patients with CAD, CBT was effective in reducing depression symptoms, especially in the 1-3 months post-intervention, with promising results for longer follow-up (6 months post-intervention) [109]. CBT is also more effective when delivered at moderate and high frequencies (i.e., defined as 8-12 or >13 sessions). A second meta-analysis showed that CBT is associated with a reduced risk of cardiovascular events, MI, and angina duration and intensity [110]. Finally, a Cochrane review and meta-analysis of RCTs investigating effects of CBT and other varied behavioral interventions among patients with IHD, showed that psychological interventions were associated with a 21% lower risk of cardiovascular mortality across 12 years [111]. While most RCTs have focused on CBT to mitigate psychological concerns, there is growing interest in bolstering positive psychological factors – e.g., targeting optimism, gratitude, resiliency, and happiness. Meta-analyses have shown that positive interventions are effective in improving distress and well-being among women and men with CVD [112, 113], which is certainly an area for scientific growth.

Combining behavioral and pharmacotherapy appears to be most effective for managing psychological health in relation to IHD, and receiving both treatments versus only one type of treatment is associated with lower healthcare utilization and all-cause mortality among patients with IHD [114]. Based on decades of data, SSRIs are well-regarded as safe to use in patients with IHD: SSRIs are less cardiotoxic than the earlier class of tricyclics, and are less likely to cause dependency than benzodiazepines; but there is mixed data

about their short- and long-term cardiovascular effects [105, 115]. A number of well-known RCTs have included combined behavioral and pharmacological interventions, primarily among patients with depression – the Enhancing Recovery in Coronary Heart Disease Patients (ENRICHD) Trial targeted major depression after MI, the Coronary Patients Evaluation Study (COPES)[116] and the Comparison of Depression Interventions after Acute Coronary Syndrome (CODIACS) Vanguard Trial each investigated depression among post-ACS patients [117], the Bypassing the Blues (BtB) Trial was designed to mitigate depression following CABG [118], and the Canadian Cardiac Randomized Evaluation of Antidepressant and Psychotherapy Efficacy (CREATE) Trial focused on patients with CAD and depression [119]. Based on these and other studies of single modalities, the strongest evidence from RCTs supports the use of behavioral treatments – especially CBT, care coordination, and cardiac rehabilitation/exercise combined with pharmacotherapy – together with pharmacotherapy to treat psychological health [105]. Still, there is a paucity of evidence that psychological treatment can prevent IHD overall, including insufficient data from women. Regrettably, many RCTs have small sample sizes and included a low proportion of women and minorities, and the subsequent meta-analyses have often neglected to (or been unable to) report sex-stratified findings [120–123]. Thus, it remains unknown if a given behavioral and/or pharmacological intervention is effective in dually addressing psychological health and IHD risk, and if effects differ by sex. Rigorous trials that dually prioritize both the recruitment of women from diverse racial, ethnic, and socioeconomic backgrounds, and sex-specific reporting of results are needed [111]. To guide these efforts, results from earlier trials must be explored for women and men separately.

Mechanisms of Psychological Factors and IHD in Women

The proposed pathophysiological mechanisms that underlie psychological-IHD associations among adults include both behavioral and biological pathways, and sex differences in these pathways have previously been reviewed in depth [54, 124–127]. To summarize, psychological health can influence cardiovascular risk via cardiometabolic metrics and related behaviors (e.g., blood pressure, diet, exercise, sleep, smoking, obesity, adherence), immune system regulation and inflammatory responses, the autonomic nervous system and neuroendocrine system, platelet aggregation and endothelial function, and genetic factors [54]. Among these systems, three mechanistic pathways are notable. First, negative psychological factors may alter primary stress-responsive systems – the hypothalamic-pituitary-adrenal (HPA) axis, sympathetic-adrenal-medullary (SAM) system, and sympathetic nervous system (SNS) – provoking subsequent changes in blood pressure, lipid, and glucose regulation, which can then promote atherosclerosis [128]. In a second pathway, women's psychological risk profile may promote vulnerability to abnormal coronary vasomotion and microvascular disease [129]. Women are more likely to show MSIMI and other distinct physiological changes in response to mental stress [10, 38, 39], which may directly lead to epicardial and microcirculatory dysfunction. Third, women's psychological health may affect their IHD risk via estrogen regulation. Estrogen protects against atherosclerosis by regulating lipid levels, promoting endothelium dependent vasodilation, enhancing bioavailability of nitric oxide from endothelial cells, and contributing to beneficial hemostatic effects [130]. Conversely, circulating estrogens can promote inflammation to a greater extent among women [126]. Women who experience

significant psychosocial stress and other psychological health concerns show changes in estrogen physiology – e.g., ovarian dysfunction and hypoestrogenism [130]. Other emerging cardiovascular risk factors for women include age at menarche; polycystic ovarian syndrome; pregnancy-related factors (e.g., parity, gravidity, and infertility) and conditions of pregnancy (e.g., hypertensive disorders of pregnancy and gestational diabetes); menopause and related symptoms; and autoimmune conditions [131, 132]. Ultimately, this knowledge base evokes more questions than answers about the mechanisms linking women's psychological health with risk for IHD and further large scale investigations are essential to describe the multisystem biological and behavioral mechanisms specific to women.

Clinical Applications for Psychological Management Across Cardiovascular Health

To optimally assess and support IHD prevention for women, in line with the American Heart Association's 'Life's Essential 8' approach [3] – i.e., addressing diet, physical activity, sleep, nicotine exposure, weight, blood pressure, lipids, and glucose – equal attention should be paid to a ninth domain – addressing psychological health [2] (see Figure 1).

Primordial and primary IHD prevention could begin in adolescence and young adulthood, when psychological health concerns become more common for younger women versus their male peers [133, 134], and include education about psychological symptoms and awareness along with risk factors for future IHD. Throughout younger, middle, and late adulthood women's psychological health could then be addressed in concert with CVH, guided by a biological and biographical framework that includes a woman's family history, lived experiences and current social circumstances, menstrual history, pregnancy, menopause, and changes due to aging [135, 136].

An initial step to address women's psychological health in IHD prevention and management across their healthspan involves routine and uniform screening, particularly for negative psychological factors – psychosocial stress, depression, anxiety, trauma or PTSD, social isolation or loneliness, or anger [137]. Notably, since 2002 the U.S. Preventive Service Task Force has highlighted the burden of depression in health and healthcare and the importance of depression screening among all adults [138]. More recently, the USPSTF recommended separate screening for anxiety [139]. Although depression and anxiety disproportionately affect women in general and those with IHD [49, 51, 58], regrettably this care remains the exception in cardiovascular medicine rather than the norm. Consideration of positive psychological attributes – happiness, meaning, and purpose – is also valuable for conceptualizing women's IHD risk profile, factors affecting their motivation and confidence in IHD risk factor management, or adherence to treatment plans [112, 113]; women who show greater psychological well-being are more likely to engage in healthy lifestyle behaviors and are better equipped to manage stressful life events [2]. Brief, validated screeners are available to efficiently assess psychological health among women and their results are associated with IHD incidence and outcomes [73, 137]. Some of the most well-known measures include the 4- or 10-item Perceived Stress Scale [140]; the Patient Health Questionnaire (PHQ-2 or PHQ-9) or the National Institutes of Health's (NIH) Patient-Reported Outcomes Measurement Information System (PROMIS®) 4-item measure

for depression [141, 142]; the Generalized Anxiety Disorder measure (GAD-2 or GAD-7) or the 4-item PROMIS screener for anxiety [142, 143]; the 8-item Short Post-Traumatic Stress Disorder Rating Interview (SPRINT) [144]; the NIH Toolbox 5-item Loneliness Measure [145]; the 5-item PROMIS Emotional Distress/Anger measure [142]; and the NIH Toolbox's 5-item General Life Satisfaction or 4-item Meaning and Purpose measures [145].

While there is no clinical biomarker of psychological distress or well-being, using screeners can prompt discussion, referrals, and interventions to aid and mitigate women's psychological symptoms, efforts that may directly or indirectly improve inflammation and autonomic nervous system regulation, and can then have salutary CVH benefits (e.g., lower blood pressure; better endothelial function) [54, 93, 128]. Symptoms that meet diagnostic criteria for a psychiatric disorder should prompt referral to a behavioral medicine or mental health provider, or to a multidisciplinary integrated prevention team that holistically manages CVH – ideally including a clinician with behavioral health expertise. A whole-person care approach can help patients and providers alike to draw connections between psychological health, cardiovascular risk factors, and anginal symptoms – with attention to underlying genetic, biological, and sociocultural factors that may be sex-specific. As a standard of care, shared decision making should be used to balance any tradeoffs in treatment for psychological health with IHD risk management for women [146, 147].

In addition to regular screening for psychological health, specific milestones in a woman's development should prompt discussion of psychological health in relation to CVD risk and management. For example, a diagnosis of polycystic ovarian syndrome or premature menopause – both risk factors for IHD [148, 149] – can be associated with depression, anxiety, and psychosocial stress [150, 151]. As another example, assessing psychological health in the pre-, ante-, and postpartum periods is helpful to identify and address postpartum stress, depression, anxiety, or PTSD and may help to support healthy lifestyle behaviors throughout adjustment to parenthood and the childbearing years [152]. Women with lower symptoms of antepartum depression are more likely to exercise regularly and throughout pregnancy and have a lower risk for hypertensive disorders of pregnancy [153, 154]. Reciprocally, women who experience hypertension, preeclampsia, or eclampsia are also at risk for postpartum depression, adverse pregnancy outcomes, and future cardiovascular events [155, 156]. Thus, a hypertension diagnosis should flag an in-depth assessment of cardiovascular risk *including* psychological health. In the menopausal years, hormonal shifts can dually promote vulnerability to psychological distress and cardiovascular instability [157, 158]. Blood pressure and cholesterol increase in women, and there is an emergence of endothelial and microvascular dysfunction [159]. How these biological shifts share common pathways with psychological health, or how psychological health and CVH interact with one another, is likely complex [41, 129, 160]. Addressing both factors simultaneously is important for managing new cardiovascular risk factors and symptoms and to support psychological wellbeing through this transitional period. Finally, as women age, there is a higher risk for IHD, as well as diastolic dysfunction complicated by heart failure, and atrial fibrillation [161–163]. Women tend to live longer than men and may find themselves at an increased risk for social isolation [164]. This experience may limit physical activity and social support, increase sedentary time, and lead to symptoms of depression and loneliness. Thus, there are ample, obvious opportunities for assessing and

managing psychological health in tandem with IHD to provide more holistic cardiovascular care and to preserve CVH for women.

Conclusion

The present state of the science concerning psychological health and IHD in women is robust. Substantial data reinforces the important links between various psychological factors and related diagnoses with IHD risk and outcomes [2]. Gaps in this literature are also perceptible. While the behavioral pathways and biological mechanisms are complex and show clear differences for women compared to men [8, 59], many prospective studies of psychological health and IHD have had a limited representation of women, did not include analyses by sex even when powered to do so, or failed to account for sex-specific biological and psychosocial factors. Further investigation into these sex-specific associations, mechanisms, and the effects of empirically supported psychological interventions is required to improve the evidence base for treating interrelated psychological health and IHD outcomes among women. Even without such data, there are already many opportunities to address women's psychological health within the scope of IHD prevention. Significant or adverse life events, pregnancy, parenthood, menopause, retirement, or other aging milestones, along with any new cardiovascular diagnosis or event could cue a brief psychological assessment. Standardizing and implementing uniform and routine clinical assessment of psychological health is required to support this intersection of women's health risk. Finally, establishing integrated team models can lead to more high-value interactions between women who are at risk for IHD and cardiovascular medicine providers, and ultimately, to improved outcomes throughout the course of a woman's healthspan.

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References

1. World Health Organization.Mental health: Strengthening our response. [https://cdn.ymaws.com/www.safestates.org/resource/resmgr/connections_lab/glossary_citation/mental_health_strengthening.pdf]
2. Levine GN, Cohen BE, Commodore-Mensah Y, Fleury J, Huffman JC, Khalid U, et al. Psychological health, well-being, and the mind-heart-body connection: a scientific statement from the American Heart Association. Circulation. 2021;143(10):e763–e783. 10.1161/CIR.0000000000000947 [PubMed: 33486973]
3. Lloyd-Jones DM, Allen NB, Anderson CA, Black T, Brewer LC, Foraker RE, et al. Life's essential 8: updating and enhancing the American Heart Association's construct of cardiovascular health: a presidential advisory from the American Heart Association. Circulation. 2022;146(5):e18–e43. 10.1161/CIR.0000000000001078 [PubMed: 35766027]
4. Virani SS, Newby LK, Arnold SV, Bittner V, Brewer LC, Demeter SH, et al. 2023 AHA/ACC/ACCP/ASPC/NLA/PCNA guideline for the management of patients with chronic coronary disease: a report of the American Heart Association/American College of Cardiology Joint

Committee on Clinical Practice Guidelines. J Am Coll Cardiol. 2023;148:e9–e119. 10.1161/CIR.0000000000001168

5. O'Neil A, Russell JD, Murphy B. How does mental health impact women's heart health? Heart Lung Circ. 2021;30(1):59–68. 10.1016/j.hlc.2020.05.111 [PubMed: 32665170]
6. Majidi M, Eslami V, Ghorbani P, Foroughi M. Are women more susceptible to ischemic heart disease compared to men? A literature overview. J Geriatr Cardiol 2021;18(4):289–296. 10.11909/j.issn.1671-5411.2021.04.004 [PubMed: 33995508]
7. Connelly PJ, Azizi Z, Alipour P, Delles C, Pilote L, Raparelli V. The importance of gender to understand sex differences in cardiovascular disease. Can J Cardiol. 2021;37(5):699–710. 10.1016/j.cjca.2021.02.005 [PubMed: 33592281]
8. Olsson A, Mohammad MA, Rylance R, Platonov PG, Sparv D, Erlinge D. Sex differences in potential triggers of myocardial infarction. Eur Heart J Open. 2023;3(2):oead011. 10.1093/ehjopen/oead011 [PubMed: 37006409]
9. Seligowski AV, Ressler KJ. Sex differences in the co-occurrence of PTSD and cardiovascular disease. Psychiatric Annals. 2022;52(1):26–30. 10.3928/00485713-20211226-01
10. Sullivan S, Young A, Garcia M, Almuwaqqat Z, Moazzami K, Hammadah M, et al. Sex differences in vascular response to mental stress and adverse cardiovascular events among patients with ischemic heart disease. Arterioscler Thromb Vasc Biol. 2023;43(4):e112–e120. 10.1161/ATVBAHA.122.318576 [PubMed: 36857628]
11. Vaccarino V, Badimon L, Corti R, De Wit C, Dorobantu M, Hall A, et al. Ischaemic heart disease in women: are there sex differences in pathophysiology and risk factors? Position paper from the working group on coronary pathophysiology and microcirculation of the European Society of Cardiology. Cardiovasc Res. 2011;90(1):9–17. 10.1093/cvr/cvq394 [PubMed: 21159671]
12. Smaardijk VR, Lodder P, Kop WJ, van Gennep B, Maas AH, Mommersteeg PM. Sex- and gender-stratified risks of psychological factors for incident ischemic heart disease: systematic review and meta-analysis. J Am Heart Assoc. 2019;8(9):e010859. 10.1161/JAHA.118.010859 [PubMed: 31030598]
13. Smaardijk VR, Maas AH, Lodder P, Kop WJ, Mommersteeg PM. Sex and gender-stratified risks of psychological factors for adverse clinical outcomes in patients with ischemic heart disease: A systematic review and meta-analysis. Int J Cardiol. 2020;302:21–29. 10.1016/j.ijcard.2019.12.014 [PubMed: 31937453]
14. Boehm JK, Kubzansky LD. Positive psychological well-being and cardiovascular disease. In: Handbook of Cardiovascular Behavioral Medicine. Springer; 2022: 541–569.
15. Kubzansky LD, Huffman JC, Boehm JK, Hernandez R, Kim ES, Koga HK, et al. Positive psychological well-being and cardiovascular disease: JACC health promotion series. J Am Coll Cardiol. 2018;72(12):1382–1396. 10.1016/j.jacc.2018.07.042 [PubMed: 30213332]
16. Labaka A, Goñi-Balentziaga O, Lebeña A, Pérez-Tejada J. Biological sex differences in depression: a systematic review. Biol Res Nurs. 2018;20(4):383–392. 10.1177/1099800418776082 [PubMed: 29759000]
17. Supraja T, Bhargavi C, Chandra PS. Stress among women—causes and consequences; 2020.
18. Vogel B, Acevedo M, Appelman Y, Merz CNB, Chieffo A, Figtree GA, et al. The Lancet women and cardiovascular disease Commission: reducing the global burden by 2030. Lancet. 2021;397(10292):2385–2438. 10.1016/S0140-6736(21)00684-X [PubMed: 34010613]
19. Brewer LC, Svatikova A, Mulvagh SL. The challenges of prevention, diagnosis and treatment of ischemic heart disease in women. Cardiovasc Drugs Ther. 2015;29(4):355–368. 10.1007/s10557-015-6607-4 [PubMed: 26210899]
20. Sullivan S, Young A, Garcia M, Almuwaqqat Z, Moazzami K, Hammadah M, et al. Gender disparities between neighborhood social vulnerability and psychological distress among patients with heart disease. J Womens Health. 2022;31(10):1440–1449. 10.1089/jwh.2021.0505
21. Espnes GA, Nguyen C, Byrne D. Gender differences in psychological risk factors for development of heart disease, vol. 24; 2016.
22. Pelletier R, Khan NA, Cox J, Daskalopoulou SS, Eisenberg MJ, Bacon SL, et al. Sex versus gender-related characteristics: which predicts outcome after acute coronary syndrome in the young? J Am Coll Cardiol. 2016;67(2):127–135. 10.1016/j.jacc.2015.10.067 [PubMed: 26791057]

23. Tomaszewski M, Topyła W, Kijewski BG, Miotła P, Waciński P. Does gender influence the outcome of ischemic heart disease? Prz Menopauzalny. 2019;18(1):51–56. 10.5114/pm.2019.84158 [PubMed: 31114459]
24. Collopy CM, Cosh SM, Tully PJ. Screening and referral is not enough: a qualitative exploration of barriers to access and uptake of mental health services in patients with cardiovascular diseases. BMC Health Serv Res. 2021;21(1):1–11. 10.1186/s12913-020-06030-7 [PubMed: 33388053]
25. Karami N, Kazeminia M, Karami A, Salimi Y, Ziapour A, Janjani P. Global prevalence of depression, anxiety, and stress in cardiac patients: A systematic review and meta-analysis. J Affect Disord. 2022. 10.1016/j.jad.2022.12.055
26. Schmitt MT, Branscombe NR, Kobrynowicz D, Owen S. Perceiving discrimination against one's gender group has different implications for well-being in women and men. Pers Soc Psychol Bull. 2002;28(2):197–210. 10.1177/0146167202282006
27. Li J, Zhang M, Loerbroks A, Angerer P, Siegrist J. Work stress and the risk of recurrent coronary heart disease events: A systematic review and meta-analysis. Int J Occup Med Environ Health. 2015;28(1):8–19. 10.2478/s13382-014-0303-7 [PubMed: 26159942]
28. Power N, Deschênes SS, Ferri F, Schmitz N. Job strain and the incidence of heart diseases: A prospective community study in Quebec, Canada. J Psychosom Res. 2020;139:110268. 10.1016/j.jpsychores.2020.110268 [PubMed: 33069052]
29. Bynum L, Griffin T, Riding D, Wynkoop K, Anda R, Edwards V, et al. Adverse childhood experiences reported by adults-five states, 2009. MMWR Morb Mortal Wkly Rep. 2010;59(49):1609–1613. [PubMed: 21160456]
30. Soares ALG, Hammerton G, Howe LD, Rich-Edwards J, Halligan S, Fraser A. Sex differences in the association between childhood maltreatment and cardiovascular disease in the UK Biobank. Heart. 2020;106(17):1310–1316. 10.1136/heartjnl-2019-316320 [PubMed: 32665362]
31. Obi IE, McPherson KC, Pollock JS. Childhood adversity and mechanistic links to hypertension risk in adulthood. Br J Pharmacol. 2019;176(12):1932–1950. 10.1111/bph.14576 [PubMed: 30656638]
32. Suglia SF, Koenen KC, Boynton-Jarrett R, Chan PS, Clark CJ, Danese A, et al. Childhood and adolescent adversity and cardiometabolic outcomes: a scientific statement from the American Heart Association. Circulation. 2018;137(5):e15–e28. 10.1161/CIR.0000000000000536 [PubMed: 29254928]
33. Supraja T, Bhargavi C, Chandra PS. Stress among women-Causes and consequences. In: Stress and Struggles The Comprehensive Book on Stress, Mental Health and Mental Illness. Coventary, England and Bengaluru, India: Indo-UK Stress and Mental Health Group; 2020: 427–449.
34. Helman TJ, Headrick JP, Stapelberg NJ, Braidy N. The sex-dependent response to psychosocial stress and ischaemic heart disease. Front Cardiovasc Med. 2023;10:1072042. 10.3389/fcvm.2023.1072042 [PubMed: 37153459]
35. Heck AL, Handa RJ. Sex differences in the hypothalamic–pituitary–adrenal axis' response to stress: an important role for gonadal hormones. Neuropsychopharmacology. 2019;44(1):45–58. 10.1038/s41386-018-0167-9 [PubMed: 30111811]
36. Brown EG, Gallagher S, Creaven AM. Loneliness and acute stress reactivity: A systematic review of psychophysiological studies. Psychophysiology. 2018;55(5):e13031. 10.1111/psyp.13031 [PubMed: 29152761]
37. van der Meer RE, Maas AH. The role of mental stress in ischaemia with no obstructive coronary artery disease and coronary vasomotor disorders. Eur Cardiol. 2021;16. 10.15420/ecr.2021.20
38. Vaccarino V, Wilmot K, Mheid IA, Ramadan R, Pimple P, Shah AJ, et al. Sex differences in mental stress-induced myocardial ischemia in patients with coronary heart disease. J Am Heart Assoc. 2016;5(9):e003630. 10.1161/jaha.116.003630 [PubMed: 27559072]
39. Vaccarino V, Shah AJ, Rooks C, Ibeanu I, Nye JA, Pimple P, et al. Sex differences in mental stress-induced myocardial ischemia in young survivors of an acute myocardial infarction. Psychosom Med. 2014;76(3):171. 10.1097/psy.0000000000000045 [PubMed: 24608039]
40. Vaccarino V, Sullivan S, Hammadah M, Wilmot K, Al Mheid I, Ramadan R, et al. Mental stress–induced-myocardial ischemia in young patients with recent myocardial

infarction: sex differences and mechanisms. Circulation. 2018;137(8):794–805. 10.1161/circulationaha.117.030849 [PubMed: 29459465]

41. Vaccarino V, Shah AJ, Mehta PK, Pearce B, Raggi P, Bremner JD, et al. Brain-heart connections in stress and cardiovascular disease: Implications for the cardiac patient. Atherosclerosis. 2021;328:74–82. 10.1016/j.atherosclerosis.2021.05.020 [PubMed: 34102426]
42. Wei J, Rooks C, Ramadan R, Shah AJ, Bremner JD, Quyyumi AA, et al. Meta-analysis of mental stress–induced myocardial ischemia and subsequent cardiac events in patients with coronary artery disease. Am J Cardiol. 2014;114(2):187–192. 10.1016/j.amjcard.2014.04.022 [PubMed: 24856319]
43. Everson-Rose SA, Lutsey PL, Roetker NS, Lewis TT, Kershaw KN, Alonso A, et al. Perceived discrimination and incident cardiovascular events: the Multi-Ethnic Study of Atherosclerosis. Am J Epidemiol. 2015;182(3):225–234. 10.1093/aje/kwv035 [PubMed: 26085044]
44. Gomez MA, Merz NB, Eastwood JA, Pepine CJ, Handberg EM, Bittner V, et al. Psychological stress, cardiac symptoms, and cardiovascular risk in women with suspected ischaemia but no obstructive coronary disease. Stress Health. 2020;36(3):264–273. 10.1002/smi.2928 [PubMed: 31957961]
45. Feng M-Y, Wang H-X, Zhuo L-B, Yao W, Hao C-F, Pei J-J. Work-related stress and occurrence of cardiovascular disease: A 13-year prospective study. J Occup Environ Med. 2022;64(11):927–933. 10.1097/jom.0000000000002645 [PubMed: 35902362]
46. Zhu C, Dreyer RP, Li F, Spatz ES, Caraballo-Cordovez C, Mahajan S, et al. Impact of marital stress on 1-year health outcomes among young adults with acute myocardial infarction. J Am Heart Assoc. 2023;12(17):e030031. 10.1161/jaha.123.030031 [PubMed: 37589125]
47. Ahn S, Esquivel JH, Davis EM, Logan JG, Chung ML. Cardiovascular disease incidence and risk in family caregivers of adults with chronic conditions: a systematic review. J Cardiovasc Nurs. 2022;37(3):E47–E60. 10.1097/jcn.0000000000000816 [PubMed: 33938535]
48. Hasin DS, Sarvet AL, Meyers JL, Saha TD, Ruan WJ, Stohl M, et al. Epidemiology of adult DSM-5 major depressive disorder and its specifiers in the United States. JAMA Psychiatry. 2018;75(4):336–346. 10.1001/jamapsychiatry.2017.4602 [PubMed: 29450462]
49. National Lee B., State-Level, and County-Level Prevalence Estimates of Adults Aged≥ 18 Years Self-Reporting a Lifetime Diagnosis of Depression—United States, 2020. MMWR Morbidity and Mortality Weekly Report. 2023;72.
50. World Health Organization.Depressive disorder (depression) [https://www.who.int/news-room/fact-sheets/detail/depression]
51. Buckland SA, Pozehl B, Yates B. Depressive symptoms in women with Coronary Heart Disease: A systematic review of the longitudinal literature. J Cardiovasc Nurs. 2019;34(1):52–59. 10.1097/jcn.0000000000000533 [PubMed: 30138156]
52. Nakada S, Ho FK, Celis-Morales C, Jackson CA, Pell JP. Individual and joint associations of anxiety disorder and depression with cardiovascular disease: A UK Biobank prospective cohort study. Eur Psychiatry. 2023;66(1):e54. 10.1192/j.eurpsy.2023.2425 [PubMed: 37403371]
53. Liblik K, Mulvagh SL, Hindmarch CC, Alavi N, Johri AM. Depression and anxiety following acute myocardial infarction in women. Trends Cardiovasc Med. 2022;32(6):341–347. 10.1016/j.tcm.2021.07.005 [PubMed: 34363978]
54. Rome D, Sales A, Leeds R, Usseglio J, Cornelius T, Monk C, et al. A narrative review of the association between depression and heart disease among women: Prevalence, mechanisms of action, and treatment. Curr Atheroscler Rep. 2022;24(9):709–720. 10.1007/s11883-022-01048-0 [PubMed: 35751731]
55. Shah AJ, Ghasemzadeh N, Zaragoza-Macias E, Patel R, Eapen DJ, Neeland IJ, et al. Sex and age differences in the association of depression with obstructive coronary artery disease and adverse cardiovascular events. J Am Heart Assoc. 2014;3(3):e000741. 10.1161/jaha.113.000741 [PubMed: 24943475]
56. Barry MJ, Nicholson WK, Silverstein M, Chelmow D, Coker TR, Davidson KW, et al. Screening for Depression and Suicide Risk in Adults: US Preventive Services Task Force Recommendation Statement. JAMA. 2023;329(23):2057–2067. 10.1001/jama.2023.9297 [PubMed: 37338872]

57. American Psychiatric Association D, Association AP. Diagnostic and statistical manual of mental disorders: DSM-5, vol. 5: American Psychiatric Association Washington, DC; 2013.
58. Bouchard K, Coutinho T, Tulloch H. Cardiovascular disease prognosis among women with anxiety: Just the tip of the iceberg? Eur J Prev Cardiol. 2023:zwad246. 10.1093/eurjpc/zwad246 [PubMed: 37494721]
59. Mommersteeg PM, Widdershoven JW, Kop WJ. Sex and gender differences in psychosocial risk factors for ischemic heart disease. In: Manual of Gynecardiology. Edited by Maas A, (eds) BMC: Springer, Cham; 2017: 203–220. 10.1007/978-3-319-54960-6_13
60. Sara JD, Ahmad A, Toya T, Suarez Pardo L, Lerman LO, Lerman A. Anxiety disorders are associated with coronary endothelial dysfunction in women with chest pain and nonobstructive coronary artery disease. J Am Heart Assoc. 2021;10(17):e021722. 10.1161/JAHA.121.021722 [PubMed: 34459240]
61. Deschênes SS, Burns RJ, Schmitz N. Anxiety and depression symptom comorbidity and the risk of heart disease: a prospective community-based cohort study. Psychosom Med. 2020;82(3):296–304. 10.1097/PSY.0000000000000790 [PubMed: 32058463]
62. Li SH, Graham BM. Why are women so vulnerable to anxiety, trauma-related and stress-related disorders? The potential role of sex hormones. Lancet Psychiatry. 2017;4(1):73–82. 10.1016/s2215-0366(16)30358-3 [PubMed: 27856395]
63. Jakubowski KP, Murray V, Stokes N, Thurston RC. Sexual violence and cardiovascular disease risk: A systematic review and meta-analysis. Maturitas. 2021;153:48–60. 10.1016/j.maturitas.2021.07.014 [PubMed: 34654528]
64. Sumner JA, Kubzansky LD, Elkind MS, Roberts AL, Agnew-Blais J, Chen Q, et al. Trauma exposure and posttraumatic stress disorder symptoms predict onset of cardiovascular events in women. Circulation. 2015;132(4):251–259. 10.1161/circulationaha.114.014492 [PubMed: 26124186]
65••. Thurston RC, Chang Y, Matthews KA, Harlow S, El Khoudary SR, Janssen I, et al. Interpersonal trauma and risk of incident cardiovascular disease events among women. J Am Heart Assoc. 2022;11(7):e024724. 10.1161/jaha.121.024724 [PubMed: 35322675] In a prospective study of interpersonal violence and associations with risk for IHD and other CVD among women, those with a history of childhood abuse and intimate partner violence had up to a 2x greater, adjusted risk of CVD across 4 years compared to women without this history.
66. Hobfoll SE, Gaffey AE, Wagner LM. PTSD and the influence of context: The self as a social mirror. J Pers. 2020;88(1):76–87. 10.1111/jopy.12439 [PubMed: 30298916]
67. Gradus JL, Farkas DK, Svensson E, Ehrenstein V, Lash TL, Milstein A, et al. Associations between stress disorders and cardiovascular disease events in the Danish population. BMJ Open. 2015;5(12):e009334. 10.1136/bmjopen-2015-009334
68. Gilsanz P, Winning A, Koenen KC, Roberts AL, Sumner JA, Chen Q, et al. Post-traumatic stress disorder symptom duration and remission in relation to cardiovascular disease risk among a large cohort of women. Psychol Med. 2017;47(8):1370–1378. 10.1017/s0033291716003378 [PubMed: 28052776]
69. Song H, Fang F, Arnberg FK, Mataix-Cols D, de la Cruz LF, Almqvist C, et al. Stress related disorders and risk of cardiovascular disease: population based, sibling controlled cohort study. BMJ. 2019;365. 10.1136/bmj.l1255
70. Remch M, Laskaris Z, Flory J, Mora-McLaughlin C, Morabia A. Post-traumatic stress disorder and cardiovascular diseases: A cohort study of men and women involved in cleaning the debris of the world trade center complex. Circulation: Cardiovascular Quality and Outcomes. 2018;11(7):e004572. 10.1161/circoutcomes.117.004572 [PubMed: 29991645]
71. Kim K, Tsai AC, Sumner JA, Jung SJ. Posttraumatic stress disorder, cardiovascular disease outcomes and the modifying role of socioeconomic status. J Affect Disord. 2022;319:555–561. 10.1016/j.jad.2022.09.117 [PubMed: 36174781]
72. Ebrahimi R, Lynch KE, Beckham JC, Dennis PA, Viernes B, Tseng C-H, et al. Association of posttraumatic stress disorder and incident ischemic heart disease in women veterans. JAMA Cardiol. 2021;6(6):642–651. 10.1001/jamacardio.2021.0227 [PubMed: 33729463]

73. Gaffey AE, Goldstein CM, Hays MM, Lee SY, Gaalema DE. Psychological risk factors in cardiac rehabilitation: Anxiety, depression, Social isolation, and anger/hostility. J Cardiopulm Rehabil Prev. 2023:10.1097. 10.1097/hcr.0000000000000828
74. Long RM, Terracciano A, Sutin AR, Creaven A-M, Gerstorf D, D'Arcy-Bewick S, et al. Loneliness, social isolation, and living alone associations with mortality risk in individuals living with cardiovascular disease: a systematic review, meta-analysis, and meta-regression. Psychosom Med. 2023;85(1):8–17. 10.1097/psy.0000000000001151 [PubMed: 36441849]
75. Sharma T, Padala PR, Mehta JL. Loneliness and social isolation: determinants of cardiovascular outcomes. Curr Cardiol Rev. 2021;17(6):37–44. 10.2174/1573403x17666210129101845
76. Gan T, Yang J, Jiang L, Gao Y. Living alone and cardiovascular outcomes: a meta-analysis of 11 cohort studies. Psychol Health Med. 2023;28(3):719–731. 10.1080/13548506.2021.1975784 [PubMed: 34477038]
77. Bucholz EM, Strait KM, Dreyer RP, Geda M, Spatz ES, Bueno H, et al. Effect of low perceived social support on health outcomes in young patients with acute myocardial infarction: results from the variation in recovery: role of gender on outcomes of young AMI patients (VIRGO) study. J Am Heart Assoc. 2014;3(5):e001252. 10.1161/jaha.114.001252 [PubMed: 25271209]
78. Kazukauskiene N, Bunevicius A, Gecaite-Stonciene J, Burkauskas J. Fatigue, social support, and depression in individuals with coronary artery disease. Front Psychol. 2021;12:732795. 10.3389/fpsyg.2021.732795 [PubMed: 34744903]
79. Babygeetha A, Devineni D. Social support and adherence to self-care behavior among patients with coronary heart disease and heart failure: A systematic review. Eur J Psychol. 2023. 10.23668/psycharchives.13180
80. Staniute M, Brozaitiene J, Bunevicius R. Effects of social support and stressful life events on health-related quality of life in coronary artery disease patients. J Cardiovasc Nurs. 2013;28(1):83–89. 10.1097/jcn.0b013e318233e69d [PubMed: 22067721]
81. Christensen AV, Juel K, Ekholm O, Thrysøe L, Thorup CB, Borregaard B, et al. Significantly increased risk of all-cause mortality among cardiac patients feeling lonely. Heart. 2020;106(2):140–146. 10.1136/heartjnl-2019-315460 [PubMed: 31685646]
82. Green YS, Hajduk AM, Song X, Krumholz HM, Sinha SK, Chaudhry SI. Usefulness of social support in older adults after hospitalization for acute myocardial infarction (from the SILVER-AMI study). Am J Cardiol. 2020;125(3):313–319. 10.1016/j.amjcard.2019.10.038 [PubMed: 31787249]
83. Yu B, Steptoe A, Chen L-J, Chen Y-H, Lin C-H, Ku P-W. Social isolation, loneliness, and all-cause mortality in patients with cardiovascular disease: a 10-year follow-up study. Psychosom Med. 2020;82(2):208–214. 10.1097/psy.0000000000000777 [PubMed: 31842061]
84. Rutledge T, Kenkre TS, Thompson DV, Bittner VA, Whittaker K, Eastwood J-A, et al. Psychosocial predictors of long-term mortality among women with suspected myocardial ischemia: the NHLBI-sponsored Women's Ischemia Syndrome Evaluation. J Behav Med. 2016;39:687–693. 10.1007/s10865-016-9737-7 [PubMed: 27017335]
85. Spielberger C, Jacobs G, Russell S, Crane R. Assessment of anger: The state-trait anger scale. In: Advances in Personality Assessment. Edited by Butcher JN, CD S, vol. 2; 1983: 161–189.
86. Spielberger CD. State-Trait anger expression inventory. In: Corsini Encyclopedia of Psychology. 2010: 1–1. 10.1002/9780470479216.corpsy0942
87. Mostofsky E, Penner EA, Mittleman MA. Outbursts of anger as a trigger of acute cardiovascular events: a systematic review and meta-analysis. Eur Heart J. 2014;35(21):1404–1410. 10.1093/eurheartj/ehu033 [PubMed: 24591550]
88. Pimple P, Shah A, Rooks C, Bremner JD, Nye J, Ibeanu I, et al. Association between anger and mental stress–induced myocardial ischemia. Am Heart J. 2015;169(1):115–121. e112. 10.1016/j.ahj.2014.07.031 [PubMed: 25497256]
89. Smyth A, O'Donnell M, Lamelas P, Teo K, Rangarajan S, Yusuf S. Physical activity and anger or emotional upset as triggers of acute myocardial infarction: the INTERHEART study. Circulation. 2016;134(15):1059–1067. 10.1161/circulationaha.116.023142 [PubMed: 27753614]
90. Hostility Assari S., anger, and cardiovascular mortality among Blacks and Whites. Res Cardiovasc Med. 2017;6(1):1–9. 10.5812/cardiovascmed.34029

91. Barefoot JC, Williams RB. Hostility and health. In: Handbook of behavioral medicine: Methods and applications. Edited by Steptoe A, Freedland K, Jennings JR, Llabre MM, Manuck SB, (Eds.) SE: Springer Science + Business Media.; 2022: 169–183.

92. Mehta PK, Wei J, Wenger NK. Ischemic heart disease in women: a focus on risk factors. Trends in cardiovascular medicine. 2015;25(2):140–151. [PubMed: 25453985]

93. Suls J. Anger and the heart: perspectives on cardiac risk, mechanisms and interventions. Prog Cardiovasc Dis. 2013;55(6):538–547. 10.1016/j.pcad.2013.03.002 [PubMed: 23621963]

94. van Montfort E, Denollet J, Vermunt JK, Widdershoven J, Kupper N. The tense, the hostile and the distressed: multidimensional psychosocial risk profiles based on the ESC interview in coronary artery disease patients-the THORESCI study. Gen Hosp Psychiatry. 2017;47:103–111. 10.1016/j.genhosppsych.2017.05.006 [PubMed: 28807133]

95. Huffman JC, Legler SR, Boehm JK. Positive psychological well-being and health in patients with heart disease: a brief review. Future Cardiol. 2017;13(5):443–450. 10.2217/fca-2017-0016 [PubMed: 28828901]

96. Labarthe DR, Kubzansky LD, Boehm JK, Lloyd-Jones DM, Berry JD, Seligman ME. Positive cardiovascular health: a timely convergence. J Am Coll Cardiol. 2016;68(8):860–867. 10.1016/j.jacc.2016.03.608 [PubMed: 27539179]

97. Amonoo HL, Celano CM, Sadlonova M, Huffman JC. Is optimism a protective factor for cardiovascular disease? Curr Cardiol Rep. 2021;23:1–7. 10.1007/s11886-021-01590-4

98. Vos J Cardiovascular disease and meaning in life: A systematic literature review and conceptual model. Palliat Support Care. 2021;19(3):367–376. 10.1017/s1478951520001261 [PubMed: 33960285]

99. Cousin L, Redwine L, Bricker C, Kip K, Buck H. Effect of gratitude on cardiovascular health outcomes: a state-of-the-science review. J Pos Psychol. 2021;16(3):348–355. 10.1080/17439760.2020.1716054

100. Krittanawong C, Maitra NS, Virk HUH, Fogg S, Wang Z, Kaplin S, et al. Association of optimism with cardiovascular events and all-cause mortality: systematic review and meta-analysis. Am J Med. 2022;135(7):856–863. e852. 10.1016/j.amjmed.2021.12.023 [PubMed: 35123934]

101. Kim ES, Hagan KA, Grodstein F, DeMeo DL, De Vivo I, Kubzansky LD. Optimism and cause-specific mortality: a prospective cohort study. Am J Epidemiol. 2017;185(1):21–29. 10.1093/aje/kww182 [PubMed: 27927621]

102. Weiss-Faratci N, Lurie I, Benyamini Y, Cohen G, Goldbourt U, Gerber Y. Optimism during hospitalization for first acute myocardial infarction and long-term mortality risk: a prospective cohort study. Mayo Clin Proc. 2017;92(1):49–56. 10.1016/j.mayocp.2016.09.014 [PubMed: 27876316]

103••. Sun Y, Zhang H, Wang B, Chen C, Chen Y, Chen Y, et al. Joint exposure to positive affect, life satisfaction, broad depression, and neuroticism and risk of cardiovascular diseases: A prospective cohort study. Atherosclerosis. 2022;359:44–51. 10.1016/j.atherosclerosis.2022.08.007 [PubMed: 36055801] Using a large sample from the UK Biobank, participants with the lowest psychological wellbeing score (calculated from happiness, life satisfaction, depression, and neuroticism) had the greatest adjusted risk of CVD over 12 years of follow-up. The psychological-CVD association was significantly greater for women than men and was consistent when accounting for one's genetic risk.

104. Kahl KG, Stapel B, Correll CU. Psychological and psychopharmacological interventions in psychocardiology. Front Psychiatry. 2022;13:831359. 10.3389/fpsyt.2022.831359 [PubMed: 35370809]

105. Cavanagh CE, Gaffey AE, Rosman L, Burg MM. Intervention research on therapies that aim to treat depression and cardiovascular disease. In: Cardiovascular Implications of Stress and Depression. Elsevier; 2020: 61–84. 10.1016/B978-0-12-815015-3.00004-0

106. Watkins LE, Sprang KR, Rothbaum BO. Treating PTSD: A review of evidence-based psychotherapy interventions. Front Behav Neurosci. 2018;12:258. 10.3389/fnbeh.2018.00258 [PubMed: 30450043]

107. van den Berk Clark C, Kansara V, Fedorova M, Ju T, Renirie T, Lee J, et al. How does PTSD treatment affect cardiovascular, diabetes and metabolic disease risk factors and outcomes? A systematic review. J Psychosom Res 2022;157:110793. 10.1016/j.jpsychores.2022.110793 [PubMed: 35339907]
108. Reavell J, Hopkinson M, Clarkesmith D, Lane DA. Effectiveness of cognitive behavioral therapy for depression and anxiety in patients with cardiovascular disease: a systematic review and meta-analysis. Psychosom Med. 2018;80(8):742–753. 10.1097/psy.0000000000000626 [PubMed: 30281027]
109. Nuraeni A, Suryani S, Trisyani Y, Sofiatin Y. Efficacy of Cognitive Behavior Therapy in Reducing Depression among Patients with Coronary Heart Disease: An Updated Systematic Review and Meta-Analysis of RCTs. Healthcare. 2023;11(7):943. 10.3390/healthcare11070943 [PubMed: 37046869]
110. Magán I, Jurado-Barba R, Casado L, Barnum H, Jeon A, Hernandez AV, et al. Efficacy of psychological interventions on clinical outcomes of coronary artery disease: Systematic review and meta-analysis. J Psychosom Res. 2022;153:110710. 10.1016/j.jpsychores.2021.110710 [PubMed: 34999380]
111. Richards SH, Anderson L, Jenkinson CE, Whalley B, Rees K, Davies P, et al. Psychological interventions for coronary heart disease: Cochrane systematic review and meta-analysis. Eur J Prev Cardiol. 2020;25(3):247–259. 10.1177/2047487317739978
112. Tönis KJ, Kraiss JT, Linssen GC, Bohlmeijer ET. The effects of positive psychology interventions on well-being and distress in patients with cardiovascular diseases: A systematic review and meta-analysis. J Psychosom Res. 2023:111328. 10.1016/j.jpsychores.2023.111328 [PubMed: 37098284]
113. Feig EH, Madva EN, Millstein RA, Zambrano J, Amonoo HL, Longley RM, et al. Can positive psychological interventions improve health behaviors? A systematic review of the literature. Prev Med. 2022;163:107214. 10.1016/j.ypmed.2022.107214 [PubMed: 35998764]
114. Carmin CN, Ownby RL, Fonanella C, Steelesmith D, Binkley PF. Association of mental health treatment on outcomes in patients with heart failure and ischemic heart disease. medRxiv. 2023:2023.2005. 2023.23290426. 10.1101/2023.05.23.23290426
115. Gaffey AE, Rosman L, Burg MM, Haskell SG, Brandt CA, Skanderson M, et al. Posttraumatic stress disorder, antidepressant use, and hemorrhagic stroke in young men and women: a 13-year cohort study. Stroke. 2021;52(1):121–129. 10.1161/strokeaha.120.030379 [PubMed: 33297868]
116. Davidson KW, Rieckmann N, Clemow L, Schwartz JE, Shimbo D, Medina V, et al. Enhanced depression care for patients with acute coronary syndrome and persistent depressive symptoms: coronary psychosocial evaluation studies randomized controlled trial. Arch Intern Med. 2010;170(7):600–608. 10.1001/archinternmed.2010.29 [PubMed: 20386003]
117. Davidson KW, Bigger JT, Burg MM, Carney RM, Chaplin WF, Czajkowski S, et al. Centralized, stepped, patient preference–based treatment for patients with post–acute coronary syndrome depression: CODIACS vanguard randomized controlled trial. JAMA Intern Med. 2013;173(11):997–1004. 10.1001/jamainternmed.2013.915 [PubMed: 23471421]
118. Rollman BL, Belnap BH. The Bypassing the Blues trial: Collaborative care for post-CABG depression and implications for future research. Cleve Clin J Med. 2011;78(Suppl 1):S4–12. 10.3949/ccjm.78.s1.01 [PubMed: 21972329]
119. Lespérance F, Frasure-Smith N, Koszycki D, Laliberté M-A, van Zyl LT, Baker B, et al. 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. Jama. 2007;297(4):367–379. 10.1001/jama.297.4.367 [PubMed: 17244833]
120. Raparelli V, Wright CX, Corica B, Sharma G, Lindley K, Brackett A, et al. Interventions targeted to address social determinants of health in ischemic heart disease: a sex-and gender-oriented scoping review. Can J Cardiol. 2022;38(12):1881–1892. 10.1016/j.cjca.2022.06.025 [PubMed: 35809812]
121. Greenman P, Jetté J, Green-Demers I, Grenier J. Sad and worried hearts: A psychological treatment for clinically significant depression, anxiety, and post-traumatic stress in patients with cardiac disease. Int J Clin Cardiol. 2015;2:1–9. 10.23937/2378-2951/1410037

122. Biondi-Zoccai G, Mazza M, Roever L, van Dixhoorn J, Frati G, Abbate A. Evidence-based psychotherapy in ischemic heart disease: Umbrella review and updated meta-analysis. In: Psychotherapy for Ischemic Heart Disease: An Evidence-based Clinical Approach. Edited by Roncella A, (eds) PC: Springer, Cham; 2016: 131–158. 10.1007/978-3-319-33214-7_10

123. Li Y-N, Buys N, Ferguson S, Li Z-J, Sun J. Effectiveness of cognitive behavioral therapy-based interventions on health outcomes in patients with coronary heart disease: a meta-analysis. World J Psychiatry. 2021;11(11):1147. 10.5498/wjp.v11.i11.1147 [PubMed: 34888180]

124. Vaccarino V, Badimon L, Bremner JD, Cenko E, Cubedo J, Dorobantu M, et al. Depression and coronary heart disease: 2018 position paper of the ESC working group on coronary pathophysiology and microcirculation. Eur Heart J. 2020;41(17):1687–1696. 10.1093/eurheartj/ehy913 [PubMed: 30698764]

125. Sobhani K, Nieves Castro DK, Fu Q, Gottlieb RA, Van Eyk JE, Noel Bairey Merz C. Sex differences in ischemic heart disease and heart failure biomarkers. Biol Sex Diff. 2018;9(1):1–13. 10.1186/s13293-018-0201-y

126. Bucciarelli V, Caterino AL, Bianco F, Caputi CG, Salerni S, Sciomer S, et al. Depression and cardiovascular disease: The deep blue sea of women's heart. Trends Cardiovasc Med. 2020;30(3):170–176. 10.1016/j.tcm.2019.05.001 [PubMed: 31109802]

127. Aggarwal NR, Patel HN, Mehta LS, Sanghani RM, Lundberg GP, Lewis SJ, et al. Sex differences in ischemic heart disease: advances, obstacles, and next steps. Circ: Cardiovasc Qual Outcomes. 2018;11(2):e004437. 10.1161/circoutcomes.117.004437 [PubMed: 29449443]

128. Sumner JA, Cleveland S, Chen T, Gradus JL. Psychological and biological mechanisms linking trauma with cardiovascular disease risk. Transl Psychiatry. 2023;13(1):25. 10.1038/s41398-023-02330-8 [PubMed: 36707505]

129. Vaccarino V, Bremner JD. Behavioral, emotional and neurobiological determinants of coronary heart disease risk in women. Neurosci Biobehav Rev. 2017;74:297–309. 10.1016/j.neubiorev.2016.04.023 [PubMed: 27496672]

130. Humphries KH, Izadnegahdar M, Sedlak T, Saw J, Johnston N, Schenck-Gustafsson K, et al. Sex differences in cardiovascular disease–impact on care and outcomes. Front Neuroendocrinol. 2017;46:46–70. 10.1016/j.yfrne.2017.04.001 [PubMed: 28428055]

131. Carberry J, Aubiniere-Robb L, Kamdar A, Lomholt-Welch H, Berry C. Reappraising Ischemic Heart Disease in Women. Reviews in Cardiovascular Medicine. 2023;24(4):118.

132. Kazzi B, Shankar B, Elder-Odame P, Tokgözoğlu LS, Sierra-Galan LM, Michos ED. A Woman's Heart: Improving uptake and awareness of cardiovascular screening for middle-aged populations. Int J Womens Health. 2023;15:1171–1183. 10.2147/ijwh.s328441 [PubMed: 37520181]

133. Salk RH, Hyde JS, Abramson LY. Gender differences in depression in representative national samples: Meta-analyses of diagnoses and symptoms. Psych Bull. 2017;143(8):783–822. 10.1037/bul0000102

134. Beesdo K, Knappe S, Pine DS. Anxiety and anxiety disorders in children and adolescents: developmental issues and implications for DSM-V. Psychiatr Clin North Am. 2009;32(3):483–524. 10.1016/j.psc.2009.06.002 [PubMed: 19716988]

135. Wenger NK, Lloyd-Jones DM, Elkind MS, Fonarow GC, Warner JJ, Alger HM, et al. Call to action for cardiovascular disease in women: epidemiology, awareness, access, and delivery of equitable health care: a presidential advisory from the American Heart Association. Circulation. 2022;145(23):e1059–e1071. 10.1161/cir.0000000000001071 [PubMed: 35531777]

136. Brown HL, Warner JJ, Gianos E, Gulati M, Hill AJ, Hollier LM, et al. Promoting risk identification and reduction of cardiovascular disease in women through collaboration with obstetricians and gynecologists: a presidential advisory from the American Heart Association and the American College of Obstetricians and Gynecologists. Circulation. 2018;137(24):e843–e852. 10.1161/cir.0000000000000582 [PubMed: 29748185]

137•. Gaffey AE, Gathright EC, Fletcher LM, Goldstein CM. Screening for psychological distress and risk of cardiovascular disease and related mortality: A systematized review, meta-analysis, and case for prevention. J Cardiopulm Rehabil Prev. 2022;42(6):404–415. 10.1097/hcr.0000000000000751 [PubMed: 36342683] This meta-analytic investigation aggregated results from recent studies examining psychological distress captured with rapid, validated screeners only and first-onset CVD among adults. Overall, psychological distress was associated with a

28% enhanced risk for incident CVD. More than half of the total sample were women but testing the associations specific women was not possible since few prospective studies reported results by sex.

138. Pignone MP, Gaynes BN, Rushton JL, Burchell CM, Orleans CT, Mulrow CD, et al. Screening for depression in adults: a summary of the evidence for the US Preventive Services Task Force. Ann Intern Med. 2002;136(10):765–776. 10.7326/0003-4819-136-10-200205210-00013 [PubMed: 12020146]
139. Barry MJ, Nicholson WK, Silverstein M, Coker TR, Davidson KW, Davis EM, et al. Screening for anxiety disorders in adults: US Preventive Services Task Force recommendation statement. JAMA. 2023. 10.1001/jama.2023.9301
140. Harris KM, Gaffey AE, Schwartz JE, Krantz DS, Burg MM. The Perceived Stress Scale as a Measure of Stress: Decomposing Score Variance in Longitudinal Behavioral Medicine Studies. Ann Behav Med. 2023;57(10):846–854. 10.1093/abm/kaad015 [PubMed: 37084792]
141. Levis B, Sun Y, He C, Wu Y, Krishnan A, Bhandari PM, et al. Accuracy of the PHQ-2 alone and in combination with the PHQ-9 for screening to detect major depression: systematic review and meta-analysis. JAMA. 2020;323(22):2290–2300. 10.1001/jama.2020.6504 [PubMed: 32515813]
142. Pilkonis PA, Choi SW, Reise SP, Stover AM, Riley WT, Cella D, et al. Item banks for measuring emotional distress from the Patient-Reported Outcomes Measurement Information System (PROMIS®): depression, anxiety, and anger. Assessment. 2011;18(3):263–283. 10.1177/1073191111411667 [PubMed: 21697139]
143. Plummer F, Manea L, Trepel D, McMillan D. Screening for anxiety disorders with the GAD-7 and GAD-2: a systematic review and diagnostic metaanalysis. Gen Hosp Psychiatry. 2016;39:24–31. 10.1016/j.genhosppsych.2015.11.005 [PubMed: 26719105]
144. Connor KM, Davidson JR. SPRINT: A brief global assessment of post-traumatic stress disorder. Int Clin Psychopharmacol. 2001;16(5):279–284. 10.1097/00004850-200109000-00005 [PubMed: 11552771]
145. Salsman JM, Butt Z, Pilkonis PA, Cyranowski JM, Zill N, Hendrie HC, et al. Emotion assessment using the NIH Toolbox. Neurology. 2013;80(11 Supplement 3):S76–S86. 10.1212/wnl.0b013e3182872e11 [PubMed: 23479549]
146. Gaffey AE, Harris KM, Mena-Hurtado C, Sinha R, Jacoby DL, Smolderen KG. The Yale Roadmap for Health Psychology and Integrated Cardiovascular Care. Health Psychol. 2022. 10.1037/hea0001152
147. Hess EP, Coylewright M, Frosch DL, Shah ND. Implementation of shared decision making in cardiovascular care: past, present, and future. Circ: Cardiovasc Qual Outcomes. 2014;7(5):797–803. 10.1161/circoutcomes.113.000351 [PubMed: 25052074]
148. Gunning M, Fauser B. Are women with polycystic ovary syndrome at increased cardiovascular disease risk later in life? Climacteric. 2017;20(3):222–227. 10.1080/13697137.2017.1316256 [PubMed: 28457146]
149. Honigberg MC, Zekavat SM, Aragam K, Finneran P, Klarin D, Bhatt DL, et al. Association of premature natural and surgical menopause with incident cardiovascular disease. Jama. 2019;322(24):2411–2421. 10.1001/jama.2019.19191 [PubMed: 31738818]
150. Shuster LT, Rhodes DJ, Gostout BS, Grossardt BR, Rocca WA. Premature menopause or early menopause: long-term health consequences. Maturitas. 2010;65(2):161–166. [PubMed: 19733988]
151. Behboodi Moghadam Z, Fereidooni B, Saffari M, Montazeri A. Measures of health-related quality of life in PCOS women: a systematic review. Int J Womens Health. 2018:397–408. 10.2147/ijwh.s165794 [PubMed: 30123008]
152. Obrochta CA, Chambers C, Bandoli G. Psychological distress in pregnancy and postpartum. Women Birth. 2020;33(6):583–591. 10.1016/j.wombi.2020.01.009 [PubMed: 32035798]
153. Loprinzi PD, Fitzgerald EM, Cardinal BJ. Physical activity and depression symptoms among pregnant women from the National Health and Nutrition Examination Survey 2005–2006. J Obstet Gynecol Neonatal Nurs. 2012;41(2):227–235. 10.1111/j.1552-6909.2012.01340.x

154. Qiu C, Williams MA, Calderon-Margalit R, Cripe SM, Sorensen TK. Preeclampsia risk in relation to maternal mood and anxiety disorders diagnosed before or during early pregnancy. Am J Hypertens. 2009;22(4):397–402. 10.1038/ajh.2008.366 [PubMed: 19197246]

155. Roberts L, Davis GK, Homer CS. Depression, anxiety, and post-traumatic stress disorder following a hypertensive disorder of pregnancy: a narrative literature review. Front Cardiovasc Med. 2019;6:147. 10.3389/fcvm.2019.00147 [PubMed: 31649935]

156. Benschop L, Duvekot JJ, van Lennep JER. Future risk of cardiovascular disease risk factors and events in women after a hypertensive disorder of pregnancy. Heart. 2019;105(16):1273–1278. 10.1136/heartjnl-2018-313453 [PubMed: 31175138]

157. Muka T, Oliver-Williams C, Colpani V, Kunutsor S, Chowdhury S, Chowdhury R, et al. Association of vasomotor and other menopausal symptoms with risk of cardiovascular disease: a systematic review and meta-analysis. PloS One. 2016;11(6):e0157417. 10.1371/journal.pone.0157417 [PubMed: 27315068]

158. Bauld R, Brown RF. Stress, psychological distress, psychosocial factors, menopause symptoms and physical health in women. Maturitas. 2009;62(2):160–165. [PubMed: 19167176]

159. Nair AR, Pillai AJ, Nair N. Cardiovascular changes in menopause. Curr Cardiol Rev. 2021;17(4). 10.2174/1573403x16666201106141811

160. Yang H-J, Koh E, Kang Y. Susceptibility of women to cardiovascular disease and the prevention potential of mind–body intervention by changes in neural circuits and cardiovascular physiology. Biomolecules. 2021;11(5):708. 10.3390/biom11050708 [PubMed: 34068722]

161. Mehta PK, Wei J, Wenger NK. Ischemic heart disease in women: a focus on risk factors. Trends Cardiovasc Med. 2015;25(2):140–151. 10.1016/j.tcm.2014.10.005 [PubMed: 25453985]

162. Deswal A Diastolic dysfunction and diastolic heart failure: mechanisms and epidemiology. Current Cardiol Rep. 2005;7(3):178–183. 10.1007/s11886-005-0074-7

163. Volgman AS, Benjamin EJ, Curtis AB, Fang MC, Lindley KJ, Naccarelli GV, et al. Women and atrial fibrillation. J Cardiovasc Electrophsyiol. 2021;32(10):2793–2807. 10.1111/jce.14838

164. Umberson D, Lin Z, Cha H. Gender and social isolation across the life course. J Health Soc Behav. 2022;63(3):319–335. 10.1177/00221465221109634 [PubMed: 35856404]

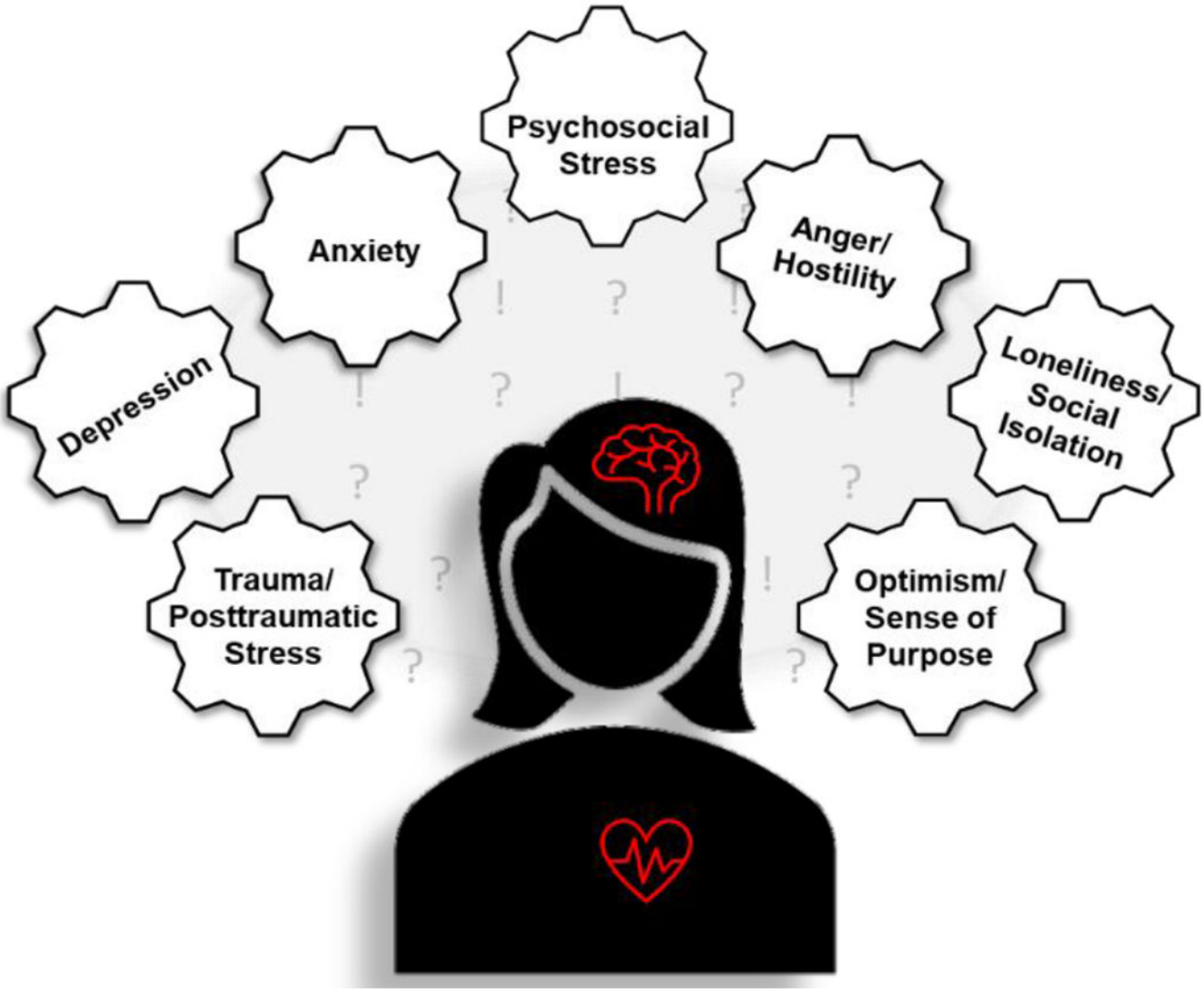

Fig. 1.

Psychological health – which consists of interrelated, negative and positive factors – influences women's risk for ischemic heart disease (IHD). Psychological factors with the most robust evidence in relation to IHD risk and outcomes among women are depicted. To help mitigate risk for IHD risk and outcomes, women's psychological health should be assessed and managed in concert with their cardiovascular health.