



Is Optimism a Protective Factor for Cardiovascular Disease?

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Abstract

Purpose of Review Does optimism contribute to superior cardiovascular health? We examined prospective studies investigating the connections between optimism and cardiovascular health and examining the biological and behavioral mechanisms that may mediate such connections.

Recent Findings Optimism, independent of sociodemographic, medical, and negative psychological factors, has been prospectively associated with a lower risk of cardiovascular disease and lower rates of cardiac and all-cause mortality. The mechanisms by which optimism may prevent cardiovascular disease remain unclear, but one mechanism may be through health behaviors. Indeed, optimism has been linked with physical activity, healthy diet, and smoking cessation, all of which are associated with better cardiovascular health.

Summary Additional studies are needed to: (1) understand the relationships between more dynamic measures of optimism and health outcomes, (2) delineate the mechanisms underlying the relationships between optimism and cardiovascular health, and (3) assess the potential for interventions to modify optimism.

Keywords Optimism · Cardiac health · Cardiovascular disease · Mortality · Positive psychology · Wellbeing · Health behaviors

Introduction

Psychological factors play an important role in cardiovascular health. Negative psychological syndromes, such as depression and anxiety disorders, have received the most attention, given their consistent links to the development and progression of cardiovascular disease (CVD) [1–4]. However, recently there has been an increasing focus on the relationship between positive psychological well-being and cardiovascular health [5•, 6, 7•, 8]. Psychological well-being comprises a broad group of positive psychological constructs,

including optimism, gratitude, happiness, positive affect, and life purpose. Well-being constructs are prospectively and independently associated with a reduced risk of poor health outcomes, including mortality, in both healthy and medically ill populations [9••, 10]. Importantly, well-being is not simply the ‘opposite’ of depression or distress—optimism and depression, for example, are only modestly inversely correlated [11]—and numerous studies have found that the beneficial effects of psychological well-being on health-related outcomes are above and beyond the adverse effects of negative psychological constructs, like depression [5•, 12, 13].

Of the well-being constructs, optimism—and its relationship to cardiac health—has been studied most frequently [5•, 6, 14]. Optimism, defined as confidence and hopefulness for positive future outcomes and a general belief that good things will happen in life [15, 16], is typically measured by self-report instruments, such as the Life Orientation Test-Revised (LOT-R) [17]. A large and growing body of prospective studies in diverse populations of individuals with [12, 18] or without [19] CVD has examined relationships between optimism (measured via the LOT-R or other instruments) and cardiac outcomes including incident cardiac events [19], stroke [20], heart failure [21], carotid atherosclerosis [22], and all-cause mortality [8].

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In this narrative review, we synthesize studies to examine three important questions. First, is optimism prospectively associated with the development of CVD and adverse cardiac outcomes (e.g., cardiac events or mortality)? Second, is this relationship independent of sociodemographic factors, medical risk factors, and the effects of negative psychological factors such as depression and anxiety? Finally, what are the potential mechanisms that may explain the relationships between optimism and cardiovascular health?

Methodology

To answer these questions, we conducted searches of relevant databases (PubMed, PSYCInfo, and Google Scholar) between February 2021 and April 2021 using search terms that included *optimism*, *optimistic explanatory style*, *cardiovascular events*, *stroke*, *coronary artery disease*, *coronary heart disease*, *ischemic heart disease*, and *cardiovascular disease*. We also reviewed the reference lists of seminal review articles [1, 5•, 9••, 19, 23•] describing the relationship between well-being and cardiovascular health.

We largely focused on prospective observational studies that examined the relationship between optimism, measured at one or multiple time points, and a subsequent measure of cardiovascular disease and health.

Results

The synthesis of data from our searches are organized by study population (i.e., initially healthy persons or populations with existing illness) and outcome as follows:

Development of Cardiac Disease in Initially Healthy Populations

Several studies have examined the role of optimism in the development of CVD in otherwise healthy individuals. In a 2009 systematic review and meta-analysis of 8 cross-sectional or prospective studies (N = 589), optimism was significantly associated with a reduced risk of developing heart disease (ES 0.25; 95% CI 0.12–0.37; $p = 0.002$) [23•]. Additionally, in a study of 3188 young adults, optimism was associated with better cardiovascular health scores ($B = 0.07$; 95% CI 0.04–0.11; $p \leq 0.001$) over a 10-year follow-up period after adjusting for sociodemographic characteristics, health behaviors, and health status — this finding held true after adjusting for baseline depression diagnosis ($B = 0.07$; 95% CI 0.03–0.10; $p \leq 0.001$) [14].

There have been numerous prospective studies examining relationships between optimism and the development of different types of cardiovascular disease [19]. For example,

optimism has been linked to a reduced risk of developing atherosclerosis. In an epidemiological study of 209 middle-aged healthy premenopausal women, optimistic women were less likely to show progression of carotid artery disease measured via mean carotid intima medial thickness ($B = 0.17$, $p < 0.007$) measured over 3 years in mid-life compared to pessimistic women even after adjusting for medication use, lifestyle and biological covariates [24]. Also, optimism has been linked to a reduced risk of being diagnosed with coronary heart disease (CHD) or heart failure in several longitudinal studies [21, 25–27]. In one study of 1739 adults, moderate levels of optimism were associated with a lower 10-year risk (HR 0.58; 95% CI 0.34–0.99; $p = 0.047$) of incident coronary heart disease, adjusting for age, sex, cardiovascular risk factors, and negative and positive affect [25]. Similarly, a prospective observational study of 6808 older adults found dispositional optimism to be linked to lower rates (OR 0.74; 95% CI 0.63–0.85) of incident heart failure over a four-year period after controlling for sociodemographic, behavioral, biological, and psychological covariates [21]. Hence, optimism has consistently been linked to the development of CVD in general, and CHD and heart failure specifically, independent of sociodemographic, behavioral, and negative psychological factors including depression.

Major Cardiac Events and/or Mortality in Initially Healthy Populations

Several studies over the past two decades have examined associations between optimism, major adverse cardiac events, and CVD-related death [19, 22]. In a systematic review and meta-analysis of 15 studies (total N = 229,391), optimism was linked with a lower risk of all-cause mortality (relative risk [RR] 0.86; 95% CI, 0.80–0.92; $p < 0.001$) and a decreased risk of cardiovascular events (RR 0.65; 95% CI, 0.51–0.78; $p < 0.001$) over a mean follow-up period of 13.8 years, independent of depression and other potential confounders [19]. This review included one seminal analysis of data from the Women's Health Initiative, in which 97,253 women without CVD were followed for eight years. In this analysis, optimism was associated with lower risk of coronary heart disease (myocardial infarction, angina, percutaneous coronary angioplasty, or coronary artery bypass surgery; adjusted hazard ratio [AHR]: 0.91, 95% CI 0.83 to 0.99) and lower risk of cardiac mortality (AHR 0.70, 95% CI 0.55 to 0.90), independent of cardiac risk factors (e.g., age, hypertension, high cholesterol, smoking, and diabetes mellitus), sociodemographic factors, physical activity, and other relevant variables [7•].

Optimism has also consistently been associated with a reduced risk of cardiovascular and all-cause mortality in

prospective cohort studies of individuals without CVD disease [8, 19, 27–29]. For example, in a longitudinal study of 545 older men, aged 64–84 years with no pre-existing CVD or cancer, dispositional optimism was associated with an inverse risk of cardiovascular death (HR 0.45, 95% CI 0.29–0.68) after adjusting for traditional cardiovascular risk factors, sociodemographics and depression [27]. Similarly, in a prospective analysis of data from the Nurses' Health Study ($n = 70,021$), a higher degree of optimism was associated with a lower risk of all-cause mortality (HR 0.91; 95% CI 0.85–0.97) after adjusting for sociodemographic confounders, health behaviors, health conditions, and depression [8]. Overall, the evidence consistently suggests that optimism lowers the risk of a variety of major cardiac events or mortality in previously healthy individuals.

Cardiac Events, Mortality, and Other Health Markers in Patients with Heart Disease

Alongside these studies in healthy persons, additional studies have examined relationships between optimism and cardiovascular health in patients with existing heart disease [5, 19, 30–33]. For example, optimism appears to be protective of recurrent events in the six months following an acute cardiac event or cardiac surgery — in a prospective study of 164 patients hospitalized for acute coronary syndrome (ACS), optimism 2 weeks post-ACS (baseline) was associated with lower rates of cardiac readmissions at 6 months post ACS, after controlling for age, sex, and medical comorbidity ($N = 164$; HR 0.92; 95% CI 0.86–0.98) [12]. Similarly, in a prospective study of 309 middle-aged patients who underwent elective coronary artery bypass graft surgery, those with greater overall optimism were significantly less likely to be re-hospitalized 6 months post surgery for a broad range of complications (e.g., angina, myocardial infarction, infection), independent of traditional sociodemographic and medical variables [34].

Optimism also appears to protect against recurrent events over longer periods. For example, in a study of 664 patients hospitalized for a myocardial infarction, higher levels of optimism were associated with reduced mortality (adjusted HR 0.67; 95% CI, 0.47–0.95) over a two-decade follow-up period after adjustment for sociodemographic, clinical, and psychosocial variables [18]. Hence, for patients with established heart disease, optimism seems to be protective against a variety of adverse medical events (e.g., infection rates), cardiovascular events (e.g., CHD mortality), and cardiovascular related healthcare utilization (e.g., readmissions, hospitalizations) in both the short- and long term.

Mechanisms Linking Optimism and Cardiovascular Disease

Optimism has the potential to confer reduced cardiovascular risk through both biological and behavioral processes [35–38]. Although data on biological links of positive psychological well-being and cardiac health has been inconsistent [6, 39], some studies have found that optimism has been associated with beneficial effects on inflammation, endothelial function, and cardiac reactivity to stressful events [40, 41]. In a cross-sectional study of 529 non-Hispanic white and 421 non-Hispanic black individuals without CVD, dispositional optimism was associated with lower levels of interleukin-6 (a marker of inflammation; $B = -0.03$, $p = 0.02$), insulin ($B = -0.02$, $p = 0.01$), and triglycerides ($B = -0.02$, $p = 0.04$), and higher levels of high density lipoprotein ($B = 0.42$, $p = 0.03$), independent of age, gender, parent education, body mass index, smoking, and pubertal stage [41]. Similarly, in an analysis of longitudinal data from the Normative Aging Study ($N = 746$), higher optimism was associated with lower levels of interleukin-6 and soluble intercellular adhesion molecule-1, a marker of endothelial dysfunction [42].

Optimism has also been associated with reduced activity of the hypothalamic–pituitary–adrenal axis. In a study that examined the associations of dispositional optimism with diurnal salivary cortisol in 543 healthy adults, optimism was associated with a reduced cortisol awakening response (consistent with less stress), independent of age, sex, employment grade, body mass index, smoking status, depressive symptoms, and time of awakening ($\beta = -0.12$, $p \leq 0.05$) [43]. Though research in this area is limited [44], these findings suggest that optimism is related to several biological processes—including reduced inflammation, improved endothelial function, and reduced hypothalamic–pituitary–adrenal axis activity—that are associated with improved cardiovascular health. Further research is needed to confirm such findings and more precisely illuminate these mechanisms.

There is more data supporting health behaviors (e.g., physical activity, smoking cessation, preventative screening, medication adherence) as a mechanistic link between optimism and cardiovascular health [45–48]. Several studies have found that optimism is associated with a greater likelihood of engaging in physical activity, even after adjusting for sociodemographic, disease, and psychological factors [12, 47, 49, 50]. For example, in a prospective study that followed 61,756 postmenopausal women for 6 years, the most optimistic women (highest quartile on the LOT-R) compared to the least optimistic women (lowest quartile) were 15% more likely to report engaging in vigorous exercise (OR 1.15; 95% CI 1.06–1.24; $p < 0.001$), after adjusting

for baseline sociodemographic variables, health conditions and behaviors (smoking, alcohol intake), and depressive symptoms [51].

In addition to physical activity, optimism also has been linked to a lower risk of smoking and higher likelihood of smoking cessation. For example, in a cohort study of 736 young adolescents, individuals with lower levels of optimism and hope were more likely to be smokers 7–10 months after initial data collection even after adjusting for sociodemographic and baseline smoking status [52]. In another analysis of data from two prospective observational clinical studies of 369 patients admitted with a documented ACS to an urban general hospital, optimism predicted a reduction in smoking independent of age, sex, ethnicity, socioeconomic status (SES), history of depression, Global Risk of Acute Coronary Event risk score, and study sample to account for two study samples 12 months after ACS (OR 0.84, 95% CI=0.73–0.96, $p=0.01$) [13].

Lastly, several studies have reported the association between optimism and dietary choices that have been linked to improved cardiovascular health [53]. For example, in the analysis of data from two observational studies of 369 patients who had experienced an acute coronary syndrome (ACS), optimism—measured within one month of ACS—was prospectively associated with a higher proportion of patients eating five or more servings of fruit and vegetables per day at 12 months post-ACS (adjusted OR 1.13, 95% CI=0.13–1.23, $p=0.007$) [13]. Additionally, in a prospective longitudinal study of 773 elderly men, dispositional optimism, assessed every 5 years over a 15-year period, was associated with greater intake of fruits ($B=0.06$; 95% CI 0.01 to 0.10; $p=0.013$) and vegetables ($B=0.06$; 95% CI 0.01 to 0.10; $p=0.013$) after controlling for sociodemographics and disease factors [50]. Overall, the evidence supporting the potential role of health promoting behaviors (i.e., physical activity, smoking cessation, and consumption of healthier diets) as a viable mechanism by which optimism is associated with better cardiovascular health outcomes is robust in both healthy individuals and those with cardiac disease.

Discussion

Overall, across these prospective, observational studies, optimism has been consistently and prospectively associated with a lower risk of CVD development, cardiac events, and mortality among individuals with and without pre-existing illness. Though covariate control has been variable, in many studies, these relationships have persisted after controlling for sociodemographic factors and medical comorbidities. In addition, several studies have found that these relationships remain after adjusting for the adverse effects of negative psychological factors including depression and/or anxiety.

Finally, both biological processes and behavioral factors may help to explain the relationships between optimism and cardiovascular health, with greater evidence for the mediating effects of health behaviors.

Despite the growing body of research examining the relationships between optimism and cardiovascular health, several areas may benefit from further study. First, there has been limited exploration of the biological mechanisms by which optimism is associated with cardiac health [6, 39]. Additional studies to clarify the strength and directionality of these relationships may both improve understanding and identify potential treatment targets to improve cardiovascular health. Second, optimism has been somewhat inconsistently defined and measured across studies. The LOT-R [17], a measure of dispositional optimism [23•], has been used most frequently, and most studies that use the LOT-R have examined the relationship between overall LOT-R score (the sum of the optimism and pessimism sub-scores) and health outcomes. However, there is evidence that optimism and pessimism may be distinct constructs [54, 55], and it remains unclear which of these constructs is more strongly related to cardiovascular health [32, 33]. Finally, some studies have begun to examine dynamic and/or health-related measures of optimism [56], such as state optimism or outcome expectancies in the context of cardiovascular surgery [47]. Further research to develop measures of state or health-related optimism and assess their relationships to health outcomes are important, as these may be targeted by psychological interventions to promote cardiovascular health.

If evidence-based interventions that consistently and substantially increase optimism are developed, further research into the effects of these interventions on cardiovascular health can be assessed. Preliminary research in cardiac populations suggests that well-being interventions (focused on both optimism and broader aspects of psychological well-being), both alone and in combination with established behavioral interventions, can improve health behavior adherence (e.g., physical activity) and biological markers of cardiovascular health [57, 58••, 59–62]. However, no studies to date have examined the impact of these interventions on cardiovascular outcomes, such as hospitalizations or major adverse cardiac events. Much more research is needed to assess these optimism-promoting interventions in large trials and to determine whether they can be translated to diverse, real-world clinical populations and still provide benefit.

This review should be interpreted with several limitations in mind. First, this is not a systematic review, and it is possible that we may have missed additional studies that have examined the association of optimism and cardiovascular health outcomes. Second, although we were holistic in our selection of studies and specifically searched for studies that failed to find a relationship between optimism and cardiac health, nearly all available studies found optimism to have beneficial

health effects. While this may be a testament to the strength of this relationship, it also raises the possibility of publication bias. Third, the characteristics of studies included in our review had varying sample sizes in a wide range of patient populations, used a wide range of measures for optimism and clinical outcomes, and used variable approaches to covariate adjustment. Hence, the heterogeneity of studies should be considered in the interpretation of our findings.

Conclusions

Optimism has been consistently and prospectively associated with improved cardiovascular health independent of relevant medical and psychosocial factors, including the negative effects of depression. Both biological and behavioral mechanisms have been proposed to explain these relationships, though much of this work is preliminary. Additional studies are needed to utilize more dynamic measures of optimism, to further understand the mechanisms underlying the benefits of optimism, and to assess the effects of well-being interventions on cardiovascular health.

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Compliance of Ethical Standards

Conflict of Interest Dr. Celano has received salary support from BioXcel Pharmaceuticals and honoraria for talks to Sunovion Pharmaceuticals on topics unrelated to this research.

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The other authors declare that they have no conflict of interest.

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