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Self-Rated Versus Objective Health Indicators as Predictors of Major Cardiovascular Events: The NHLBI-Sponsored Women's Ischemia Syndrome Evaluation

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Abstract

Objective: To determine the association between self-rated health and major cardiovascular events in a sample of women with suspected myocardial ischemia. Previous studies showed that self-rated health is a predictor of objective health outcomes, such as mortality.

Method: At baseline, 900 women rated their health on a 5-point scale ranging from poor to excellent as part of a protocol that included quantitative coronary angiography, cardiovascular disease (CVD) risk factor assessment, cardiac symptoms, psychotropic medication use, and functional impairment. Participants were followed for a maximum of 9 years (median, 5.9 years) to determine the prevalence of major CVD events (myocardial infarction, heart failure, stroke, and CVD-related death).

Results: A total of 354 (39.3% of sample) participants reported their health as either poor or fair. After adjusting for demographic factors, CVD risk factors, and coronary artery disease severity, women who rated their health as poor (hazard ratio, 2.1 [1.1–4.2]) or fair (hazard ratio, 2.0 [1.2–3.6]) experienced significantly shorter times to major CVD events compared with women who rated their health as excellent or very good. Further adjustment for functional impairment, however, attenuated the self-rated health relationships with major CVD events.

Conclusions: Among women with suspected myocardial ischemia, self-rated health predicted major CVD events independent of demographic factors, CVD risk factors, and angiogram-defined disease severity. However, functional impairment seemed to explain much of the self-rated health

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association. These results support the clinical utility of self-rated health scores in women and encourage a multidimensional approach to conceptualizing these measures.

Keywords

self-rated health; cardiovascular disease; women; prospective

INTRODUCTION

The relationship between self-rated health and prospectively measured health events is among the most consistent findings in the psychosomatic literature. Reviews of self-rated health research (1-3), for example, described statistically robust associations with mortality present in scores of studies dating back to the 1970s, with generally graded increases in risk observed across self-rated health categories, such as excellent, very good, good, fair, and poor.

From this previous self-rated health research, several trends are apparent. For example, multiple studies (4-6) demonstrated the consistency of self-rated health-mortality relationships across diverse ethnic populations and across patients with chronic medical conditions, such as cancer and cardiovascular disease (CVD). Factors, such as gender, socioeconomic status (SES), and patient's knowledge of their disease status, often moderate self-rated health associations with mortality, with men, higher SES groups, and those with known diseases showing stronger associations (7-10). Prior studies (11,12) also indicated that self-rated health associations are generally independent of other psychosocial characteristics in predicting mortality. Finally, adjusting for objective health indicators attenuates self-rated health relationships with mortality; however, the vast majority of studies (13-16) showed that self-rated health remains a statistically significant predictor. The latter findings suggested that self-rated health is capturing valid clinical information concerning patients' health status, but that these ratings also contain information beyond that typically yielded by objective health measures.

Despite this impressive empirical backing, self-rated health measures are unusual in several respects. The process by which patients appraise their health is complex (17), with some evidence suggesting that men and women emphasize different disease, symptom, and demographic factors in their health ratings (18,19). Moreover, self-rated health measurements contrast with other psychosocial characteristics in ways both psychometric and conceptual. Relative to lengthy mental health questionnaires, for instance, a single unbalanced Likert scale item (with three favorable options [excellent; very good; good] and two negative options [fair; poor]), serves as the basis of self-rated health scores. Similarly, although self-rated health-mortality relationships may approach the level of statistical consistency shown for depression (20,21) and SES (22,23) as predictors of health, the interpretation of these relationships diverges sharply. In contrast to low SES and depression —factors that may each precede and act as risk factors for end points, such as CVD development and mortality—self-rated health arguably results from disease status (2).

Conducted in a prospective study of women with suspected myocardial ischemia, the current investigation sought to expand on previous self-rated health findings. Specifically, we tested the hypothesis that self-rated health effects could be explained by using a combination of objective (disease presence and severity) and subjective (symptom severity, psychotropic medication use as a measure of significant depression and anxiety symptoms, and functional impairment) dimensions. Although numerous studies (24,25) supported relationships between self-rated health and clinical symptoms, symptomatic aspects of health are rarely sufficiently accounted for in studies addressing self-rated health-mortality relationships. The

Women's Ischemia Syndrome Evaluation (WISE) protocol, however, included comprehensive assessments of coronary artery disease status, functional impairment, and symptom severity, permitting a more rigorous test of this hypothesis, and granting the ability to assess what dimension of subjective symptoms might be most relevant to self-rated health.

METHODS

Participant Recruitment and Entrance Criteria

Women were eligible for participation in the WISE study if they were >18 years and referred for a coronary angiogram as part of their regular medical care for chest pain symptoms or suspected myocardial ischemia (26). The WISE study was designed to evaluate the diagnostic reliability of cardiovascular testing in women with suspected ischemic heart disease by focusing on symptomatic women whose coronary artery disease (CAD) status was largely unknown. Exclusion criteria included major comorbidity compromising follow-up, pregnancy, contraindication to provocative diagnostic testing, cardiomyopathy, severe heart failure, recent myocardial infarction or revascularization procedures, significant valvular or congenital heart disease, and language barrier. Participants provided their written informed consent, and all participating sites obtained Institutional Review Board approval. Study enrollment, including 936 women, was completed between 1996 and 2000, with follow-up carried out over a median of 5.9 years (25^{th} percentile, 2.5 years; $75>^{th}$ percentile, 6.9 years; maximum, 9 years) after study entry.

Self-Rated Health

As part of the baseline assessment, participants completed a single item assessing their self-rated health on a 5-point Likert scale. Categories included poor, fair, good, very good, and excellent. This question format is identical to that used to assess self-rated health in large-scale studies, such as the National Health and Nutrition Examination Survey II.

Measurement of CAD

Quantitative analysis of coronary angiograms was performed at the WISE Angiographic Core Laboratory (Rhode Island Hospital, Providence, Rhode Island) by investigators blinded to all other subject data (27). Using the angiogram results, each participant was assigned a continuous coronary disease severity score based on a modified Gensini index (27). This severity score was developed with points assigned according to the category of severity of the stenosis (0–19, 20–49, 50–69, 70–89, 90–98, 99–100), adjusting for partial (any filling of the occluded vessel or its distal branches antegrade or retrograde via channels other than the original lumen) and complete collaterals. We adjusted scores according to lesion location, with more proximal lesions receiving higher weighting factors. Because women's angiogram procedures were not consistent as to whether they preceded or followed their WISE baseline evaluation, the baseline evaluation included a question assessing the participant's knowledge of her angiogram test results. We included this variable as an additional covariate in the primary analyses reported here.

Measurement of Clinical Outcomes

Follow-up consisted of a scripted telephone interview by an experienced clinical research coordinator at 6 weeks post baseline and annually thereafter to track the women's subsequent experiences of major CVD events. Previous research (28) has validated this method against medical records. If a woman died, we obtained documentation of the circumstances surrounding the death, including death certificates, hospital narratives, and/or

family accounts. A WISE mortality committee, blinded to diagnostic information, reviewed these records to classify the deaths as resulting from CVD or non-CVD causes.

A major CVD event was defined as nonfatal myocardial infarction, congestive heart failure, stroke, or death due to CVD causes. We also conducted a secondary analysis, using all-cause mortality as an outcome.

Cardiovascular Risk Factor Assessment

Major CVD risk factors assessed at baseline included smoking (defined as current versus not a current smoker), dyslipidemia, diabetes (insulin and noninsulin dependent), body mass index, and hypertension. Risk factor assessments included a combination of physical examination (body mass index) and self-report (smoking, dyslipidemia, diabetes, hypertension).

Cardiac Symptom Assessment

As part of the baseline protocol, participants completed a study-designed comprehensive symptom history questionnaire. This measure assessed multiple indicators of cardiac symptom severity, including shortness of breath and frequency of chest pain. Participants were coded dichotomously (yes/no) for shortness of breath based on whether this symptom was an indicator for their coronary angiogram procedure. We assessed the presence and frequency of participants' chest pain over the previous 6 weeks, using a single item, with responses ranging from "never" to "4 or more times daily."

Psychosocial Measures

Functional capacity was assessed, using the 12-item Duke Activity Status Index (DASI), wherein patients self-rated their ability to perform a variety of activities ranging from basic self-care to strenuous exercise. DASI scores are associated with objectively measured physical fitness levels (29), and lower scores on the DASI equate to lower functional capacity. We queried antidepressant and anxiolytic medication use in the past week as measures of depression and anxiety status. Specific types of agents (e.g., serotonin re-uptake inhibitors, tricyclics, benzodiazepines) were not assessed. Patients also reported their highest level of education as a measure of SES (coded on a categorical 1–8 scale ranging from "didn't go to school" to "doctoral degree [PhD, MD, JD, etc.]).

Statistical Analyses

Analysis of variance and χ^2 tests were employed to test for differences in demographic variables, knowledge of angiogram results, symptom measures, CVD risk factors, and CAD severity scores across participants categorized by self-rated health status. Tukey's honestly significant difference post hoc procedure was used to examine specific group differences in the case of significant F tests.

We conducted the primary study analyses in sequential order. We examined the unadjusted relationship between self-rated health and major CVD events, using a Kaplan-Meier analysis. Next, we examined the relationship between self-rated health and major CVD events after adjusting for demographic variables, CVD risk factors, and CAD severity scores. We coded education as a dichotomous variable for primary analyses, coded as high school education or less versus greater than a high school education (60% versus 40% of the sample self-identified in these two categories, respectively). Subsequently, we examined interrelationships between self-rated health and subjective dimensions (cardiac symptoms, functional capacity, and psychotropic medication use). Finally, we assessed self-rated health relationships with major CVD events after adjusting for both objective and subjective health dimensions.

Relationships between self-rated health and major CVD events were completed, using Cox proportional hazards regression. Because just 6% of patients endorsed "excellent" health, we merged the "excellent" and "very good" self-rated health categories, and this combined category served as the reference group in all Cox regression analyses. CAD severity scores were log transformed due to significant skewness in their raw form. We also adjusted for prior self-reported history of congestive heart failure or myocardial infarction; however, these factors had no impact on the results and are not displayed in our final models. Statistical significance was declared at $p < .05$. All statistical analyses were completed, using PASW Statistics 17.0 (www.SPSS.com).

RESULTS

Among the 936 WISE study participants, 900 had complete data on CVD risk factors, CAD severity scores, and demographic variables, symptom measures, self-rated health, and follow-up information. Table 1 provides a description of these participants. A breakdown of the self-rated health distribution showed that 10.2%, 29.1%, 35.2%, and 25.4% fell into the poor, fair, good, and very good/excellent categories, respectively. Widespread differences were apparent in the variables listed in Table 1, with participants in the poor and fair self-rated health categories faring worse on rates of CVD risk factors, cardiac symptoms, levels of functional impairment, and use of antidepressant and anxiolytic medications. Those with lower self-rated health also reported significantly lower levels of education and had a greater likelihood of belonging to a non-Caucasian ethnic group.

Self-Rated Health and Major CVD Events and Mortality

Among the 900 WISE participants, 192 experienced a major CVD event (33 myocardial infarctions, 64 heart failure events, and 44 strokes), including 95 deaths (58 cardiovascular-related). Note that events were not independent (e.g., a fatal stroke counted as both a major CVD event and a total/CVD death). Unadjusted major CVD event rates by self-rated health over follow-up occurred among 10.9%, 21.1%, 24.4% and 39.1% of the very good/excellent, good, fair, and poor participant categories, respectively. In an age-adjusted Cox regression model predicting time to major CVD events, self-rated health was a highly significant predictor (hazard ratio [HR], 1.5; 95% confidence interval [CI], 1.3–1.7). Participants rating their health as poor (HR, 5.3; 95% CI, 2.9–9.3), fair (HR, 3.6; 95% CI, 2.2–6.1), and good (HR, 2.3; 95% CI, 1.4–3.9) experienced significantly greater risk relative to those in the combined very good and excellent self-rated health categories.

After adjustment for age, education level, ethnicity, CAD severity scores, and CVD risk factors, the poor and fair self-rated health categories remained highly significant predictors of major CVD events (HR, 1.3; 95% CI, 1.1–1.4). Diabetes (HR, 2.0; 95% CI, 1.4–3.0), CAD severity scores (HR, 1.8; 95% CI, 1.4–2.2), dyslipidemia (HR, 1.9; 95% CI, 1.3–2.7), and current smoking status (HR, 1.7; 95% CI, 1.1–2.6) were also reliable predictors in the adjusted model. A more detailed description of adjusted self-rated health associations is shown in Table 2, along with a further breakdown of self-rated health associations after separate adjustment for psychotropic medication use, cardiac symptoms, and functional impairment. The latter models indicated that self-rated health associations with major CVD events were independent of psychotropic medication use and cardiac symptoms but substantially attenuated by functional impairment scores. Table 3 presents covariate adjusted self-rated health associations separately with the total and CVD death outcome categories.

Adjusting for antidepressant and anxiolytic use had negligible impact on the self-rated health effects, with both the fair (HR, 1.8; 95% CI, 1.02–3.2) and poor (HR, 2.0; 95% CI, 1.01–3.9) ratings remaining significant predictors of major CVD events. A similar pattern held true regarding the cardiac symptom severity measures (chest pain frequency and

shortness of breath), with neither cardiac symptom measure statistically related to major CVD events, whereas fair (HR, 2.0; 95% CI, 1.2–3.6) and poor (HR, 2.1; 95% CI, 1.1–4.1) self-rated health remained significant predictors. In contrast, self-rated health no longer approached significance after controlling for DASI scores. Specifically, higher functional status was associated with a reduced risk of major CVD events (HR, 0.97; 95% CI, 0.96–0.99, per point increase on the DASI scale). In this model, the fair (HR, 1.5; 95% CI, 0.83–2.7) and poor (HR, 1.5; 95% CI, 0.72–3.1) self-rated health categories were reduced to nonsignificance, with approximately 50% reductions in the magnitudes of the HR values (Table 2) compared with those observed in the demographic and CVD risk factor-adjusted model.

DISCUSSION

Consistent with previous studies, self-rated health was a significant predictor of major cardiovascular events and all-cause mortality in a sample of women with suspected myocardial ischemia. Participants who rated their health as poor or fair showed roughly two-fold increases in risk over a median 5.9 years of follow-up compared with those who rated their health as very good or excellent. This magnitude of risk rivaled the effects of established CVD risk factors, such as diabetes and dyslipidemia in this sample. These findings suggest that self-rated health can be a useful addition to women's objective medical status information in projecting future health risk, despite some prior studies (7,10) indicating that self-rated health is a less effective predictor of health events in women relative to men.

Beyond the replicated findings of self-rated health predicting mortality after adjustment for objective health indicators, this study sought to extend previous literature in several ways. First, unlike nearly all previous efforts, we were able to include a specific measure of CAD severity as a covariate, as all WISE women underwent coronary angiogram at baseline. We are aware of only one previous publication on the link between self-rated health and mortality that included a comparable measure of CAD severity (13). The observation that self-rated health continued to predict major CVD events despite adjustment for angiogram results, CVD risk factors, and demographic factors supports prior findings that self-rated health captures health information beyond laboratory test results and reinforces our decision to examine associations between self-rated health and subjective aspects of disease.

As a follow-up to our initial hypothesis, we examined the relationships among self-rated health and several dimensions of disease-related symptoms, including a pair of cardiac symptom severity indicators (chest pain frequency and shortness of breath), antidepressant and anxiolytic use, and functional impairment. Self-rated health scores correlated strongly with each of these symptomatic dimensions—findings that are consistent with a variety of previous studies (30-33) linking self-rated health to mood, pain, exercise capacity, and job stress characteristics in noncardiac samples.

Although self-rated health continued to predict cardiovascular-related death and major CVD events in the WISE sample even after further adjustment for cardiac symptoms and antidepressant and anxiolytic use, it failed to do so after adjusting for functional impairment scores. Instead, DASI scores showed independent associations with major CVD events, and their inclusion as covariates obviated the self-rated health associations. The attenuation of self-rated health as a predictor of major CVD events when adjusting for functional impairment scores favors the conclusion that impairment secondary to women's medical status explains much of the relationship between self-rated health and CVD outcomes.

Interpreting our finding that self-rated health relationships with CVD outcomes were attributable to a combination of objective disease status and symptomatic factors poses some challenge. Reviews of the substantial self-rated health-mortality literature (1-3) emphasize the statistical independence of self-rated health measures, yet most of these prospective studies controlled for only medical conditions, demographic factors, and disease severity rather than symptomatic aspects of disease. Many other studies (34-36) have demonstrated the importance of symptom burden and impairment in understanding self-rated health scores but did not include mortality or other objective health outcomes. As a result, the present findings are novel in describing self-rated health effects in the context of a study protocol thoroughly assessing both objective and subjective dimensions of medical illness among women.

This study, however, is not the first to show that covariate adjustment can reduce or eliminate self-rated health relationships with health events. Thombs and colleagues (36), for example, recently reported bivariate associations between self-rated health and 12-month mortality in an acute coronary syndrome sample that became nonsignificant on subsequent adjustment for disease severity and depression. However, the short-term follow-up of that study permitted only an assessment of total mortality, unlike the current findings that described cardiovascular-specific outcomes in women. In addition, in a large study of primarily male CAD patients led by Bosworth et al. (13), self-rated health relationships with CAD-related mortality showed substantial attenuation after controlling for medical comorbidities, depression, and functional impairment (including the DASI) but remained significantly predictive. The latter manuscript did not report gender-specific results.

Several clinical implications are available from these data. In this clinical sample of women, we found that self-rated health scores most closely overlapped with functional impairment status; as such, self-rated health measures may offer providers insight into the functional disease impact of patients not captured by traditional biomedical measures. We could envision a practical two-step approach in clinic, including the single-item self-rated health question as a screening tool and, for those self-identifying in the poor/fair categories, completing a more comprehensive assessment of functional impairment, such as the DASI. Our results suggest that reliance on standard CVD risk factors and disease severity measures underestimates clinical event risk among women with fair and poor self-rated health. For providers assessing self-rated health, therefore, an inference is that the latter groups (39.3% of the WISE sample) may warrant additional attention to functional aspects of their health, more frequent follow-up, or more aggressive risk factor modification to improve health outcomes. Finally, our results may support a particular clinical role for self-rated health measures among women presenting to cardiology settings. The gender discrepancy in the sensitivity and specificity of standard cardiac symptoms and ischemia tests is well documented (26), with the possible outcome being less aggressive assessment and treatment among women (37). Self-rated health measures may offer an additional tool for providers to use in gauging the clinical risk of symptomatic patients similar to those participating in WISE.

The importance of the self-rated health-CVD relationship is partially dependent on the percentage of women who met the criteria for the poor/fair health categories associated with greater CVD outcomes. In the WISE sample, 39.3% of participants self-identified with these two categories, indicating that perceptions of poor health may be widespread among women presenting to cardiologists with symptoms consistent with myocardial ischemia. These percentages are much larger than those reported by women in general population studies (38), such as the Behavioral Risk Factor Surveillance System in which 13.5% of women self-rated their health in the poor/fair categories and the National Health Interview Survey in which 16.9% self-rated their health in the poor/fair categories. However, the 39.3% of WISE

participants in the poor/fair health categories approximated the percentage (42%) reported in the same categories of the aforementioned study (13) of patients with established CAD.

Self-rated health, although statistically independent of angiographic CAD severity and CVD risk factors in predicting CVD outcomes, strongly reflected CVD risk factor status. Table 1, for instance, revealed that those in the poor/fair health categories were about 75% more likely to be diabetic or hypertensive, and more than twice as likely to be current smokers relative to those in the very good/excellent groups. The same pattern held regarding the symptom dimensions, with the poor/fair groups again reporting roughly two-fold greater rates of cardiac symptoms and antidepressant/anxiolytic use and higher levels of functional impairment as measured by the DASI. However, when added as covariates in our statistical models, functional status, but not psychotropic use, CAD severity, symptoms, or CAD risk factors, substantially attenuated the relationship between self-rated health and CVD outcomes. These findings suggest that this relationship in women is influenced by functional factors measured by the DASI, and they support broader attention to functional impairment dimensions in cardiology practice settings.

Study Limitations

The results presented in this paper are derived from a sample comprised exclusively of clinically symptomatic women, among whom approximately 40% had obstructive CAD based on quantitative angiogram results (31). This sample characteristic differs substantially from many previous studies on self-rated health in which participant inclusion has been based on objective disease status rather than the presence of disease symptoms. As a result, the relationship between symptom measures and self-rated health may be stronger in WISE than in samples with less functional impairment. We also assessed self-rated health at only a single time point, whereas some studies (39) indicated that improved prediction models result from tracking changes in self-rated health over time. Due to fewer events in the analyses using the all-cause mortality and CVD mortality event categories versus the combined clinical outcomes end point, the weaker pattern of self-rated health relationships with the mortality events may have resulted from reduced statistical power rather than a lack of association. Moreover, our psychotropic medications variables are not equivalent to symptom severity measures, and different results might result using validated depression and anxiety questionnaires. The WISE protocol did include questionnaire measures of depression and anxiety; however, because these measures were not included in the baseline evaluation until late in the first year of recruitment, we are missing data on 300 to 400 women, and we chose in this paper to rely on depression and anxiety variables for which we had complete data. Completing the study analyses with this subgroup, in which the depression and anxiety questionnaire scores replaced the psychotropic medications, had no substantial impact on the findings.

Summary

In a sample of women with suspected myocardial ischemia, self-rated health predicted major CVD events and all-cause mortality over a median 5.9 years of follow-up even after adjusting for demographic factors, depression and anxiety medication use, CVD risk factors, cardiac symptoms, and CAD severity measured via coronary angiogram. However, we further observed that the degree of functional impairment explained much of the self-rated health relationship with major CV events. These findings suggest that self-rated health measures in women capture both objective medical status information and subjective elements, reflecting the degree of impact of the women’s medical conditions.

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Glossary

CAD	coronary artery disease
CVD	cardiovascular disease
DASI	Duke Activity Status Index
HR	hazard ratio
SES	socioeconomic status
WISE	Women's Ischemia Syndrome Evaluation.

REFERENCES

1. Benyamini Y, Idler EL. Community studies reporting association between self-rated health and mortality: additional studies, 1995 to 1998. Res Aging. 1999; 21:392–401.
2. Jylha M. What is self-rated health and why does it predict mortality? Towards a unified conceptual model. Soc Sci Med. 2009; 69:307–16. [PubMed: 19520474]
3. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Soc Behav. 1997; 38:21–37. [PubMed: 9097506]
4. Bosworth H, Siegler I, Brummett B, Barefoot J, Williams R, Clapp-Channing N, Mark D. The association between self-rated health and mortality in a well-characterized sample of coronary artery disease patients. Med Care. 1999; 37:1226–36. [PubMed: 10599604]
5. Fleishman JA, Crystal S. Functional status transitions and survival in HIV disease: evidence from the AIDS Costs and Service Utilization Survey. Med Care. 1998; 36:533–43. [PubMed: 9544593]
6. Idler E, Leventhal H, McLaughlin J, Leventhal E. In sickness but not in health: self-ratings, identity, and mortality. J Health Soc Behav. 2004; 45:336–56. [PubMed: 15595511]
7. Deeg DJ, Kriegsman DM. Concepts of self-rated health: specifying the gender difference in mortality risk. Gerontologist. 2003; 43:376–86. [PubMed: 12810902]
8. Dowd JB, Zajacova A. Does the predictive power of self-rated health for subsequent mortality risk vary by socioeconomic status in the US? Int J Epidemiol. 2007; 36:1214–21. [PubMed: 17971388]
9. Benjamins MR, Hummer RA, Eberstein IW, Nam CB. Self-reported health and adult mortality risk: an analysis of cause-specific mortality. Soc Sci Med. 2004; 59:1297–306. [PubMed: 15210100]
10. Okamoto K, Momose Y, Fujino A, Osawa Y. Gender differences in the relationship between self-rated health (SRH) and 6-year mortality risks among the elderly in Japan. Arch Gerontol Geriatr. 2008; 47:311–7. [PubMed: 17936378]
11. McEwen LN, Kim C, Haan MN, Ghosh D, Lantz PM, Thompson TJ, Herman WH. Are health-related quality-of-life and self-rated health associated with mortality? Insights from Translating Research Into Action for Diabetes (TRIAD). Prim Care Diabetes. 2009; 3:37–42. [PubMed: 19269911]
12. Farkas J, Nabb S, Zaletel-Kragelj L, Cleland JG, Lainscak M. Self-rated health and mortality in patients with chronic heart failure. Eur J Heart Fail. 2009; 11:518–24. [PubMed: 19329804]
13. Bosworth HB, Siegler IC, Brummett BH, Barefoot JC, Williams RB, Clapp-Channing NE, Mark DB. The association between self-rated health and mortality in a well-characterized sample of coronary artery disease patients. Med Care. 1999; 37:1226–36. [PubMed: 10599604]

14. Thong MS, Kaptein AA, Benyamini Y, Krediet RT, Boeschoten EW, Dekker FW, Netherlands Cooperative Study on the Adequacy of Dialysis (NECOSAD) Study Group. Association between a self-rated health question and mortality in young and old dialysis patients: a cohort study. Am J Kidney Dis. 2008; 52:111–7. [PubMed: 18511166]
15. Mason C, Katzmarzyk PT, Craig CL, Gauvin L. Mortality and self-rated health in Canada. J Phys Act Health. 2007; 4:423–33. [PubMed: 18209233]
16. DeSalvo KB, Bloser N, Reynolds K, He J, Muntner P. Mortality prediction with a single general self-rated health question. J Gen Intern Med. 2006; 21:267–75. [PubMed: 16336622]
17. Krause NM, Jay GM. What do global self-rated health items measure? Med Care. 1994; 32:930–42. [PubMed: 8090045]
18. Molarius A, Berglund K, Eriksson C, Lambe M, Nordström E, Eriksson HG, Feldman I. Socioeconomic conditions, lifestyle factors, and self-rated health among men and women in Sweden. Eur J Public Health. 2007; 17:125–33. [PubMed: 16751631]
19. Molarius A, Janson S. Self-rated health, chronic diseases, and symptoms among middle-aged and elderly men and women. J Clin Epidemiol. 2002; 55:364–70. [PubMed: 11927204]
20. Kamphuis MH, Geerlings MI, Giampaoli S, Nissinen A, Grobbee DE, Kromhout D. The association of depression with cardiovascular mortality is partly explained by health status. The FINE Study. J Affect Disord. 2009; 114:184–92. [PubMed: 18694600]
21. Janszky I, Lekander M, Blom M, Georgiades A, Ahnve S. Self-rated health and vital exhaustion, but not depression, is related to inflammation in women with coronary heart disease. Brain Behav Immun. 2005; 19:555–63. [PubMed: 16214026]
22. Kennedy BP, Kawachi I, Glass R, Prothrow-Stith D. Income distribution, socioeconomic status, and self rated health in the United States: multi-level analysis. BMJ. 1998; 317:917–21. [PubMed: 9756809]
23. Wen M, Hawkley LC, Cacioppo JT. Objective and perceived neighborhood environment, individual SES and psychosocial factors, and self-rated health: an analysis of older adults in Cook County, Illinois. Soc Sci Med. 2006; 63:2575–90. [PubMed: 16905230]
24. Mäntyselkä PT, Turunen JH, Ahonen RS, Kumpusalo EA. Chronic pain and poor self-rated health. JAMA. 2003; 290:2435–42. [PubMed: 14612480]
25. Molarius A, Janson S. Self-rated health, chronic diseases, and symptoms among middle-aged and elderly men and women. J Clin Epidemiol. 2002; 55:364–70. [PubMed: 11927204]
26. Bairey Merz CN, Kelsey SF, Pepine CJ, Reichek N, Reis SE, Rogers WJ, Sharaf BL, Sopko G. The Women's Ischemia Syndrome Evaluation (WISE) study: protocol design, methodology, and feasibility report. J Am Coll Cardiol. 1999; 33:1453–61. [PubMed: 10334408]
27. Sharaf BL, Pepine CJ, Kerensky RA, Reis SE, Reichek N, Rogers WJ, Sopko G, Kelsey SF, Holubkov R, Olson M, Miele NJ, Williams DO, Bairey Merz CN. Detailed angiographic analysis of women with suspected ischemic chest pain (pilot phase data from the NHLBI-sponsored Women's Ischemia Syndrome Evaluation [WISE] study angiographic core laboratory). Am J Cardiol. 2001; 87:937–41. [PubMed: 11305981]
28. Mahoney EM, Jurkovitz CT, Chu H, Becker ER, Culler S, Kosinski AS, Robertson DH, Alexander C, Nag S, Cook JR, Demopoulos LA, DiBattiste PM, Cannon CP, Weintraub WS. Cost and cost effectiveness of an early invasive vs conservative strategy for the treatment of unstable angina and non-ST-segment elevation myocardial infarction. JAMA. 2002; 288:1851–8. [PubMed: 12377083]
29. Hlatky MA, Boineau RE, Higginbotham MB, Lee KL, Mark DB, Califf RM, Cobb FR, Pryor DB. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). Am J Cardiol. 1989; 64:651–4. [PubMed: 2782256]
30. Weinberger MI, Raue PJ, Meyers BS, Bruce ML. Predictors of new onset depression in medically ill, disabled older adults at 1 year follow-up. Am J Geriatr Psychiatry. 2009; 17:802–9. [PubMed: 19700952]
31. Eriksen J, Sjøgren P, Bruera E, Ekholm O, Rasmussen NK. Critical issues on opioids in chronic non-cancer pain: an epidemiological study. Pain. 2006; 125:172–9. [PubMed: 16842922]
32. Shirom A, Toker S, Berliner S, Shapira I, Melamed S. The effects of physical fitness and feeling vigorous on self-rated health. Health Psychol. 2008; 27:567–75. [PubMed: 18823183]

33. Sacker A, Bartley MJ, Frith D, Fitzpatrick RM, Marmot MG. The relationship between job strain and coronary heart disease: evidence from an English sample of the working male population. Psychol Med. 2001; 31:279–90. [PubMed: 11232915]

34. Grov EK, Fosså SD, Dahl AA. Is somatic comorbidity associated with more somatic symptoms, mental distress, or unhealthy lifestyle in elderly cancer survivors? J Cancer Surviv. 2009; 3:109–16. [PubMed: 19241174]

35. Stewart ST, Woodward RM, Rosen AB, Cutler DM. The impact of symptoms and impairments on overall health in US national health data. Med Care. 2008; 46:954–62. [PubMed: 18725850]

36. Thombs BD, Ziegelstein RC, Stewart DE, Abbey SE, Parakh K, Grace SL. Usefulness of a single-item general self-rated health question to predict mortality 12 months after an acute coronary syndrome. Eur J Cardiovasc Prev Rehabil. 2008; 15:479–81. [PubMed: 18677175]

37. Bairey Merz N, Bonow RO, Sopko G, Balaban RS, Cannon RO 3rd, Gordon D, Hand MM, Hayes SN, Lewis JF, Long T, Manolio TA, Maseri A, Nabel EG, Desvigne Nickens P, Pepine CJ, Redberg RF, Rossouw JE, Selker HP, Shaw LJ, Waters DD, National Heart, Lung and Blood Institute; American College of Cardiology Foundation. National Heart Lung Blood Institute (NHLBI) Women's Ischemia Syndrome Evaluation workshop executive summary. Circulation. 2004; 109:805–7. [PubMed: 14970120]

38. Salomon JA, Nordhagen S, Oza S, Murray CJ. Are Americans feeling less healthy? The puzzle of trends in self-rated health. Am J Epidemiol. 2009; 170:343–51. [PubMed: 19564169]

39. Gerber Y, Benyamini Y, Goldbourt U, Drory Y. Prognostic importance and long-term determinants of self-rated health after initial acute myocardial infarction. Med Care. 2009; 47:342–9. [PubMed: 19194331]

TABLE 1

Demographic, Cardiovascular Disease Risk Factors, Cardiac Symptoms, Antidepressant Use, and Functional Status by Participant's Self-Rated Health (*n* = 900)

Variable	Poor (*n* = 92)	Fair (*n* = 262)	Good (*n* = 317)	Very Good/Excellent (*n* = 229)	*p*
Age, mean (SD)	56.6 (11.6)	57.1 (12.3)	59.4 (11.2)	59.1 (10.8)	.03
Education (% < high school)	28.6	26.1	21.2	8.3	<.001b[c]
Race (% non-Caucasian)	26.1	29.4	17.4	7.0	<.001b[c]
CAD severity score Age, mean (SD)[a]	16.1 (15.1)	14.6 (14.3)	16.0 (16.0)	12.9 (13.0)	.08
Diabetes (%)	39.1	34.9	23.8	9.6	<.001[c]
Body mass index Age, mean (SD)	30.1 (7.0)	30.1 (6.8)	30.1 (6.4)	28.1 (6.2)	.003[b]
Dyslipidemia (%)	61.0	65.6	49.8	45.5	<.001[b]
Hypertension (%)	73.6	70.9	55.7	45.9	<.001[c]
Current smoker (%)	26.1	24.0	19.3	12.2	<.001[b]
DASI Age, mean (SD)	10.7 (9.5)	14.5 (11.5)	20.8 (13.2)	29.6 (15.3)	<.001[c]
Antidepressant use (%)	26.1	24.8	15.8	9.6	<.001[b]
Anxiolytic use (%)	27.2	23.2	18.3	14.9	.03[b]
Shortness of breath (%)	69.6	66.8	57.7	42.0	<.001[b]
Daily chest pain (%)	50.0	45.4	35.6	28.8	<.001[b]

SD = standard deviation; CAD = coronary artery disease; DASI = Duke Activity Status Index.

[a] CAD severity scores shown in non-log transformed format. The *F* test, however, was conducted using the log-transformed version.

[b] Very good/excellent groups differ from fair/poor groups.

[c] Good/very good/excellent groups differ from fair/poor groups.

TABLE 2

Covariate-Adjusted Relationship Between Self-Rated Health and Major Cardiovascular (CVD) Events (CVD-Related Death, Heart Failure, Myocardial Infarction, or Stroke; $n = 900$)[a]

		HR	95% CI	*p*
1.	Adjusted for demographic and CVD risk factors[b]			
	Self-rated health (good)	1.7	0.98–2.9	.06
	Self-rated health (fair)	2.0	1.2–3.6	.01
	Self-rated health (poor)	2.1	1.1–4.2	.03
2.	Adjusted for demographic and CVD risk factors plus current use of antidepressant/ anxiolytic medication[c]			
	Self-rated health (good)	1.6	0.94–2.7	.09
	Self-rated health (fair)	1.8	1.02–3.2	.01
	Self-rated health (poor)	2.0	1.01–3.9	.03
3.	Adjusted for demographic and CVD risk factors plus cardiac symptoms[d]			
	Self-rated health (good)	1.6	0.95–2.8	.08
	Self-rated health (fair)	2.0	1.2–3.6	.01
	Self-rated health (poor)	2.1	1.1–4.1	.03
4.	Adjusted for demographic and CVD risk factors plus functional status[e]			
	Self-rated health (good)	1.3	0.78–2.3	.28
	Self-rated health (fair)	1.5	0.83–2.7	.16
	Self-rated health (poor)	1.5	0.72–3.1	.28

CVD = cardiovascular disease; HR = hazard ratio; CI = confidence interval.

[a] The combined excellent/very good self-rated health group served as the reference group for the analysis.

[b] Included age, education level (≤ high school versus > high school), ethnicity, coronary artery disease severity scores, diabetes status, hypertension status, dyslipidemia status, current smoking status, body mass index, and knowledge of angiogram results.

[c] Based on self-reported use of medications for anxiety or depression in past week.

[d] Included chest pain frequency and shortness of breath.

[e] Defined by scores on the Duke Activity Status Index.

TABLE 3

Covariate-Adjusted Relationship Between Self-Rated Health and Total and Cardiovascular Disease Mortality Outcomes; $n = 900$[a]

		HR[b]	95% CI	*p*
1.	Total mortality ($n = 95$ deaths)			
	Self-rated health (good)	1.4	0.70–2.6	.36
	Self-rated health (fair)	1.4	0.65–2.8	.41
	Self-rated health (poor)	3.1	1.4–6.6	.004
1.	CVD deaths ($n = 58$ deaths)			
	Self-rated health (good)	1.6	0.60–4.0	.36
	Self-rated health (fair)	1.8	0.70–4.8	.25
	Self-rated health (poor)	2.9	0.99–8.6	.05

HR = hazard ratio; CI = confidence interval; CVD = cardiovascular disease.

[a] Covariates included age, education level (≤ high school versus > high school), ethnicity, CAD severity scores, diabetes status, hypertension status, dyslipidemia status, current smoking status, body mass index, and knowledge of angiogram results.

[b] The combined excellent/very good self-rated health group served as the reference group for the analysis.