Accuracy and Prognostic Value of American Heart Association–Recommended Depression Screening in Patients With Coronary Heart Disease

Data From the Heart and Soul Study

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Background—In 2008, the American Heart Association (AHA) recommended a 2-step screening method, consisting of the 2-item Patient Health Questionnaire (PHQ-2) followed by the 9-item Patient Health Questionnaire (PHQ-9), for identifying depression in cardiovascular patients. The accuracy and prognostic value of this screening method have not been evaluated.

Methods and Results—We administered the 2-step AHA-recommended screening algorithm to 1024 patients with stable coronary heart disease and calculated sensitivity and specificity against a gold standard interview for major depressive disorder. Subsequent cardiovascular events (myocardial infarction, stroke, transient ischemic attack, heart failure, or death) were determined during a mean of 6.27±2.11 years of follow-up. The AHA-recommended screening method had high specificity (0.91; 95% confidence interval, 0.89 to 0.93) but low sensitivity (0.52; 95% confidence interval, 0.46 to 0.59) for a diagnosis of major depressive disorder. Participants who screened positive on the AHA depression protocol had a 55% greater risk of events than those who screened negative (age-adjusted hazard ratio, 1.55; 95% confidence interval, 1.21 to 1.97; $P=0.0005$). After adjustment for age, sex, body mass index, history of myocardial infarction, hypertension, diabetes, heart failure, and high-density lipoprotein levels, screening positive remained associated with a 41% greater rate of cardiovascular events (hazard ratio, 1.41; 95% confidence interval, 1.10 to 1.81; $P=0.008$).

Conclusions—Among outpatients with stable coronary heart disease, the AHA-recommended depression screening protocol is highly specific for depression and identifies patients at risk for adverse cardiovascular outcomes. **(*Circ Cardiovasc Qual Outcomes*. 2011;4:533-540.)**

Key Words: cardiovascular diseases ■ diagnosis ■ prognosis ■ psychiatric comorbidity ■ risk factors

Major depressive disorder (MDD) is present in approximately 20% of patients with coronary heart disease (CHD).[1–3] Depressive symptoms are associated with adverse cardiovascular outcomes, independent of traditional risk factors and cardiac disease severity.[4–6] Given the public health burden of depression and its associated poor prognosis, along with the poor rate of recognition in patients with heart conditions,[7–9] the American Heart Association (AHA) has recommended routine screening for depression in all patients with CHD, using a 2-step screening method.[10] The first step consists of the administration of a yes/no version of the 2-item Patient Health Questionnaire (PHQ-2). Patients who screen negative in the first step receive no further screening. Patients who screen positive in the first step are subsequently administered the 9-item Patient Health Questionnaire (PHQ-9) to further evaluate their depressive symptom burden.

Previous studies have examined the test characteristics of other screening instruments for MDD in patients with CHD, including the PHQ-9, the PHQ-2, the Center for Epidemiological Studies Depression Scale, and the Hospital and Anxiety Depression Scale.[11–13] However, the sensitivity and specificity of the sequential screening method recommended by the AHA has not been evaluated. Therefore, in a prospective cohort of patients with established CHD, we sought to (1) examine the test characteristics of the AHA-recommended depression screening method as compared with a diagnostic interview for MDD and (2) evaluate the extent to which the

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AHA screen identifies patients at risk for adverse cardiovascular outcomes.

WHAT IS KNOWN

- Major depressive disorder is present in approximately 20% of patients with coronary heart disease, and depressive symptoms are associated with adverse cardiovascular outcomes, independent of traditional risk factors and disease severity.
- The American Heart Association has recommended a 2-step screening method for detecting depression in patients with coronary heart disease.

WHAT THE STUDY ADDS

- This article found that the American Heart Association–recommended screening method has high specificity (91%) but poor sensitivity (54%) as compared with a gold standard interview for depression.
- This article also demonstrated that a positive American Heart Association depression screen predicts adverse cardiovascular outcomes, regardless of the presence or absence of major depressive disorder.

Methods

Study Design and Subject Recruitment

The Heart and Soul Study is a prospective cohort study that was designed to examine the mechanisms of association between depression and cardiovascular outcomes in patients with stable CHD. Details about recruitment have been previously reported.[6] In brief, patients with chronic CHD were identified for participation based on administrative records at two Department of Veterans Affairs Medical Centers (San Francisco Veterans Affairs Medical Center and the Veterans Affairs Palo Alto Health Care System), 1 university medical center (University of California, San Francisco), and 9 public health clinics (Community Health Network of San Francisco). Patients were eligible if they had CHD documented by at least 1 of the following: a history of a myocardial infarction, angiographic evidence of stenosis of 50% or greater in 1 or more coronary vessels, evidence of exercise-induced ischemia (by treadmill ECG or stress nuclear perfusion), or a history of coronary revascularization. We excluded individuals who had been hospitalized for an acute coronary event in the previous 6 months, who were unable to walk 1 block, or who were planning to leave the area within 3 years. A total of 1024 participants completed a baseline study examination (September 2000 to December 2002) and were followed annually by telephone interview for an average of 6.3 years. The study was approved by appropriate institutional review boards, and all subjects provided written, informed consent.

Depression

All patients completed several self-report screening instruments for depression, including a yes/no version of the 2-item Patient Health Questionnaire (yes/no PHQ-2; range, 0 to 2),[14] a multiple choice version of the 2-item Patient Health Questionnaire (MC PHQ-2; range, 0 to 6),[15] and the 9-item Patient Health Questionnaire (PHQ-9; range, 0 to 27).[16] It is important to note that the yes/no version of the PHQ-2 inquires about the presence of depressive symptoms in the past month, whereas the multiple-choice version of the PHQ-2 asks about depressive symptoms in the past 2 weeks (Figure 1). The yes/no version of the PHQ-2 was administered before the PHQ-9, as recommended by the AHA.[10] The multiple-choice version of the PHQ-2 consisted of the first 2 questions of the PHQ-9 and was thus administered as a part of the PHQ-9. The PHQ-9 incorporates each of the 9 DSM-IV criteria for MDD. All of these instruments have been validated separately in patients with CHD.[11,12] For the AHA-recommended screening method,[10] a positive depression screen was defined as a score $\geq$1 on the yes/no version of the PHQ-2 plus a score of $\geq$10 on the PHQ-9.[12] For completeness, we also evaluated the test characteristics of a positive depression screen defined as a score of $\geq$2 on the multiple-choice PHQ-2 plus a score of $\geq$10 on the PHQ-9. All versions of the PHQ-2 and PHQ-9 were completed by self-report questionnaire. Participants were also asked whether a doctor or nurse had ever told them they have depression.

As a gold standard, we ascertained the presence of MDD using the Computerized Diagnostic Interview Schedule (C-DIS) for DSM-IV. This is a structured diagnostic interview inquiring about the patient's mood over the past month, for which computerized administration has been validated.[6,17] The C-DIS was administered on the same day as administration of the depression screening instruments. Whether the C-DIS was administered before the PHQ or after the PHQ varied by participant and was not specified or recorded. Participants with a major depressive episode in the past month were informed of this diagnosis, instructed to discuss their symptoms with their primary care providers, and provided a list of local resources available for further evaluation and treatment.

Cardiovascular Events

After the baseline examination, we conducted annual telephone follow-up interviews with participants (or their proxy), asking specifically about hospitalization for "heart trouble." For any reported event, medical records, ECGs, death certificates, and coroner's reports were retrieved and reviewed by 2 independent, blinded adjudicators. In the event of disagreement, the adjudicators conferred, reconsidered their classification, and requested consultation from a third blinded adjudicator as necessary.

Cardiovascular events were defined as heart failure, myocardial infarction, stroke, transient ischemic attack, or death. Heart failure was defined as hospitalization for a clinical syndrome involving at least 2 of the following: paroxysmal nocturnal dyspnea, orthopnea, elevated jugular venous pressure, pulmonary rales, third heart sound, and cardiomegaly or pulmonary edema on chest radiography. These signs and symptoms must have represented a clear change from the usual clinical status.[18] Nonfatal myocardial infarction was defined using standard criteria.[19] Stroke was defined as a new neurological deficit not known to be secondary to brain trauma, tumor, infection, or other cause. Transient ischemic attack was defined as a focal neurological deficit (in the absence of head trauma) lasting more than 30 seconds and no longer than 24 hours, with rapid evolution of the symptoms to the maximal level of deficit in less than 5 minutes and subsequent complete resolution. Death was determined by death certificates and coroner reports.

Other Patient Characteristics

Age, sex, race, education, and medical history were determined by self-report questionnaire. We measured height and weight and calculated body mass index (kg/m^2). Participants were instructed to bring their medication bottles to their appointment, and study personnel recorded all current medications. Medications were categorized using Epocrates Rx (San Mateo, CA). All participants underwent resting echocardiography using an Acuson Sequoia Ultrasound System (Mountain View, CA). We obtained standard 2-dimensional views and performed planimetry with a computerized digitization system to determine left ventricular ejection fraction. We categorized participants as having diastolic dysfunction if their mitral inflow ratio of peak early-to-late diastolic filling velocity was more than 0.75 and if the velocity time integral in their pulmonary vein was greater during diastole than during systole.[18] Fasting venous blood samples were drawn to determine low- and high-density lipoprotein cholesterol levels.

To evaluate the role of health behaviors in the risk of cardiovascular events associated with a positive AHA depression screen, we measured smoking, alcohol use, medication adherence, and physical activity. Smoking and alcohol use were determined by self-report

PHQ-2 yes/no version[14]

Question	Response options (score): Yes	No
1) During the past month, have you often been bothered by feeling down, depressed, or hopeless?	(1)	(0)
2) During the past month, have you often been bothered by little interest or pleasure in doing things?	(1)	(0)

PHQ-9[16] **(Questions 1 and 2 constitute the PHQ-2 multiple-choice version**[15]**)**

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Response options (score): Not at all	Several days	More than half the days	Nearly every day
1) Little interest or pleasure in doing things.	(0)	(1)	(2)	(3)
2) Feeling down, depressed, or hopeless.	(0)	(1)	(2)	(3)
3) Trouble falling or staying asleep, or sleeping too much.	(0)	(1)	(2)	(3)
4) Feeling tired or having little energy	(0)	(1)	(2)	(3)
5) Poor appetite or overeating.	(0)	(1)	(2)	(3)
6) Feeling bad about yourself, or that you are a failure or have let yourself or your family down.	(0)	(1)	(2)	(3)
7) Trouble concentrating on things, such as reading the newspaper or watching television.	(0)	(1)	(2)	(3)
8) Moving or speaking so slowly that other people could have noticed. Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual.	(0)	(1)	(2)	(3)
9) Thoughts that you would be better off dead or hurting yourself in some way.	(0)	(1)	(2)	(3)

Figure 1. Patient Health Questionnaires as administered in the Heart and Soul Study.

questionnaire. To assess medication adherence, we asked: "In the past month, how often did you take your medications as the doctor prescribed?" We defined medication nonadherence as taking prescribed medications ≤75% of the time.[20] To assess physical activity, we asked "Which of the following statements best describes how physically active you have been during the last month, that is, done activities such as 15 to 20 minutes of brisk walking, swimming, general conditioning, or recreational sports?" Participants chose from one of the following 6 categories: not at all active, a little active (1 to 2 times per month), fairly active (3 to 4 times per month), quite active (1 to 2 times per week), very active (3 to 4 times per week), or extremely active (5 or more times per week). Participants who reported that they were not at all or a little active were considered physically inactive. All data on health behaviors were collected at baseline.

Statistical Analysis

To examine the test characteristics of the AHA-recommended screening instrument as compared with the diagnostic interview for MDD, we calculated sensitivity, specificity, positive and negative predictive values, and positive and negative likelihood ratios using standard formulas.

The positive likelihood ratio was calculated as the probability of a positive screening result, given a positive diagnostic interview for MDD (sensitivity), divided by the probability of a positive screening result, given a negative diagnostic interview for MDD (1-specificity). The negative likelihood ratio was calculated as the probability of a negative screening result, given a positive diagnostic interview for MDD (1-sensitivity), divided by the probability of a negative screening result, given a negative diagnostic interview for MDD (specificity). Thus the positive likelihood ratio indicates how well a positive screening result rules in a diagnosis of MDD, based on the diagnostic interview, with a higher ratio indicating that a screen effectively rules in the diagnosis of MDD. Similarly, the negative likelihood ratio indicates how well a negative screening result rules out a diagnosis of MDD, with a smaller ratio indicating that a screen effectively rules out the diagnosis of MDD. We also calculated these test characteristics for subgroups stratified by sex, age, and self-reported history of depression. To determine the added value of administering the PHQ-2 yes/no screen before the PHQ-9 (as recommended by the AHA), we compared the number of participants with positive and negative depression screening tests, based on either or both of these instruments. To evaluate the association between a positive AHA screen and subsequent cardiovascular events, we used Cox proportional hazards models adjusted

Table 1. Baseline Characteristics of 1024 Participants With Stable Coronary Heart Disease, by Positive or Negative American Heart Association–Recommended Depression Screen

Variable	n (%) or Mean±SD		
	Screen+ (n=187)	Screen− (n=837)	*P* Value*
Demographic characteristics			
Age, y	62.5±11.9	67.8±10.4	<0.0001
Male	142 (76)	698 (83)	0.02
White	106 (57)	509 (61)	0.29
High school graduate	157 (84)	734 (88)	0.14
Body mass index, kg/m^2	29.43±5.67	28.16±5.21	0.003
Comorbid conditions			
Hypertension	143 (77)	580 (69)	0.04
Myocardial infarction	113 (61)	434 (52)	0.02
Stroke	31 (17)	117 (14)	0.34
Revascularization	102 (55)	500 (60)	0.21
Congestive heart failure	47 (25)	132 (16)	0.002
Diabetes mellitus	64 (34)	201 (24)	0.004
Chronic obstructive pulmonary disease	37 (20)	126 (15)	0.10
Kidney disease	24 (13)	71 (9)	0.06
Cardiac disease severity and risk factors			
Resting left ventricular ejection fraction	0.61±0.09	0.62±0.10	0.19
Diastolic dysfunction	18 (11)	98 (13)	0.49
Low-density lipoprotein, mg/dL	107±36	104±33	0.23
High-density lipoprotein, mg/dL	44±14	46±14	0.01
Medication use			
Aspirin	142 (76)	650 (78)	0.61
β-blocker	111 (59)	482 (58)	0.66
Renin-angiotensin system inhibitor	96 (51)	428 (51)	0.96
Antidepressant use	72 (39)	116 (14)	<0.0001
Health behaviors			
Regular alcohol use	53 (28)	240 (29)	0.91
Current smoking	62 (34)	139 (17)	<0.0001
Medication nonadherence	27 (15)	56 (7)	0.0004
Physical inactivity	108 (58)	263 (32)	<0.0001

Screen+ is defined as Patient Health Questionnaire (PHQ)-2 (Yes/No) ≥1 and PHQ-9 ≥10; Screen−, PHQ-2 (Yes/No) <1 or PHQ-9 <10.

**P* values are based on 2-tailed calculations, with the null hypothesis being a lack of significant difference between the 2 groups of participants with regard to each variable specified.

for difference in baseline characteristics (at $P<0.05$) between those with and without a positive AHA screen for depression. To determine whether health behaviors were responsible for this association, we further adjusted for smoking, medication adherence, and physical activity. Finally, we compared the annual rate of subsequent cardiovascular events in patients who were true-positives, false-positives, true-negatives and false-negatives for MDD. The proportional hazards assumption was verified for all models. Analyses were performed with Microsoft Excel and Statistical Analysis Software (SAS), version 9.2 (Cary, NC). All tests were 2-tailed.

Results

Based on the AHA depression screening protocol, 187 participants screened positive (117 with MDD and 69 without MDD) and 837 screened negative (106 with MDD and 730 without MDD) for depression. Two participants did not complete the C-DIS interview for MDD. As compared with the 837 participants who screened negative, the 187 participants who screened positive for depression were younger, less likely to be male, and more likely to have a history of hypertension, myocardial infarction, congestive heart failure, or diabetes (Table 1). Participants with positive depression screens also had a higher mean body mass index and higher mean high-density lipoprotein levels compared with those with negative depression screens. Finally, participants with positive depression screens were more likely to smoke, to report medication nonadherence, and to be physically inactive when compared with participants with negative depression screens.

AHA-Recommended Screen Versus Structured Interview

As compared with the structured diagnostic interview for MDD, the AHA-recommended screening method had low sensitivity (0.52) but high specificity (0.91) and high negative predictive value (0.87). In contrast, the PHQ-2 alone had high sensitivity and low specificity (Table 2). The yes/no version of the PHQ-2 had a sensitivity of 0.90 and a specificity of 0.69, whereas the multiple-choice version of the PHQ-2 had a sensitivity of 0.82 and specificity of 0.79. The AHA-recommended screen had similar test characteristics in men versus women and in younger versus older patients (Table 3). However, specificity was lower (and sensitivity higher) in patients with (versus without) a self-reported history of depression.

AHA-Recommended Screen Versus PHQ-9 Alone

Test characteristics for the AHA screen and for the PHQ-9 alone were similar (Table 2). Of the 199 participants who had a PHQ-9 score of ≥10, 187 (94%) screened positive on the yes/no version of the PHQ-2 and 12 (6%) did not screen positive on the PHQ-2. Of the 825 participants who screened negative on the PHQ-9, 259 (31%) screened positive on the yes/no version of the PHQ-2 and 566 (69%) screened negative on the PHQ-2. Use of the sequential screening method (PHQ-2 followed by the PHQ-9) would have enabled 566 participants (55% of sample) to avoid completing the full PHQ-9 and missed 12 patients with significant depressive symptoms (Table 4).

Table 2. Test Characteristics of Patient Health Questionnaire Depression Screening Instruments as Compared With a Diagnostic Interview for Major Depressive Disorder in 1022 Participants

	PHQ-2 (Y/N)	PHQ-2 (MC)	PHQ-2 (Y/N) +PHQ-9 (AHA Screen)	PHQ-2 (MC) +PHQ-9	PHQ-9 Alone
Cut-point	≥1	≥2	≥1 + ≥10	≥2 + ≥10	≥10
Reference	14	15	10	15,16	16
Sensitivity (95% CI)	90 (86–94)	82 (77–87)	52 (46–59)	50 (44–57)	54 (47–61)
Specificity (95% CI)	69 (66–73)	79 (76–82)	91 (89–93)	92 (90–94)	90 (88–92)
Positive predictive value	45 (40–50)	52 (47–57)	63 (56–70)	63 (56–70)	61 (54–68)
Negative predictive value	96 (95–98)	94 (92–96)	87 (85–90)	87 (85–89)	88 (85–90)
Positive likelihood ratio	2.9	3.9	5.8	6.3	5.4
Negative likelihood ratio	0.14	0.23	0.53	0.54	0.51

Y/N indicates yes/no version of Patient Health Questionnaire (PHQ)-2; MC, multiple choice version of PHQ-2; AHA, American Heart Association; and CI, confidence interval.

Cardiovascular Events

Follow-up data were available for 1020 (>99%) of the 1024 participants. During a mean of 6.27±2.11 years of follow-up, a total of 409 participants had cardiovascular events, including 118 who had a myocardial infarction, 56 who had a stroke or transient ischemic attack, 161 who had a hospitalization for heart failure, and 310 who died. The age-adjusted annual rate of events was 10% in participants who screened positive for depression and 6.3% in those who screened negative for depression (hazard ratio [HR], 1.55; 95% confidence interval [CI], 1.21 to 1.97; P=0.0005). The association between a positive AHA depression screen and subsequent risk of cardiovascular events remained significant after adjustment for age, sex, body mass index, history of myocardial infarction, hypertension, diabetes, heart failure, and high-density lipoprotein level (HR, 1.41; 95% CI, 1.10 to 1.81; P=0.008). This association was no longer present after further adjustment for health behaviors including smoking, physical inactivity and medication nonadherence (HR, 1.14; 95% CI, 0.88 to 1.49; P=0.32).

To further evaluate the prognostic value of the AHA depression screen, we divided participants into true-positives (+AHA screen, +MDD), false-positives (+AHA screen, −MDD), true-negatives (−AHA screen,-MDD), and false-negatives (−AHA screen, +MDD) (Table 5 and Figure 2). Due to missing C-DIS current depression information from 2 of the 1020 participants with follow-up information available, this evaluation included data from 1018 participants. As compared with the 727 true-negative participants, we observed an increased risk of cardiovascular events in the 69 false-positive participants (age-adjusted HR, 1.45; 95% CI, 1.02 to 2.07; P=0.04) but not in the 105 false-negative participants (age-adjusted HR, 0.89; 95% CI, 0.61 to 1.30; P=0.55). The 69 false-positive participants were not at significantly increased risk after adjustment for potential confounding variables (HR, 1.20; 95% CI, 0.84 to 1.73; P=0.31) (Table 5).

Discussion

We evaluated the test characteristics and prognostic value of the AHA-recommended screening method for depression in 1024 patients with established CHD. Although its sensitivity was limited, the 2-step screening process was highly specific (91%) and had a high negative predictive value (87%) for a diagnosis of MDD. Participants who screened positive had a 41% greater long-term risk of cardiovascular events (myocardial infarction, stroke, transient ischemic attack, heart failure, or death) than those who did not screen positive, regardless of their interview-based diagnosis of MDD. This increased risk was not explained by differences in patient demographics, disease severity, or traditional cardiovascular risk factors. These results suggest that, although the AHA-

Table 3. Test Characteristics of American Heart Association–Recommended Screening Instrument (as Compared With Diagnostic Interview for Major Depressive Disorder) in Different Subgroups

	Men	Women	Age <65 y	Age ≥65 y	Self-Reported History of Depression	No Self-Reported History of Depression
No. of participants	838	184	420	602	305	716
Sensitivity (95% CI)	52 (44–60)	54 (41–66)	57 (48–65)	45 (34–56)	55 (47–62)	46 (32–61)
Specificity (95% CI)	91 (89–93)	92 (87–98)	88 (84–92)	93 (91–96)	77 (70–85)	94 (92–96)
Positive predictive value	57 (49–66)	80 (67–93)	69 (60–78)	53 (41–65)	75 (67–83)	40 (27–53)
Negative predictive value	89 (87–92)	78 (70–85)	80 (76–85)	91 (88–94)	58 (50–65)	96 (94–97)
Positive likelihood ratio	5.8	6.8	4.8	6.4	2.4	7.7
Negative likelihood ratio	0.5	0.5	0.5	0.6	0.6	0.6

CI indicates confidence interval.

Table 4. Congruency Between PHQ-2 and PHQ-9 Screening Results

	PHQ-9		
	Positive (≥10)	Negative (<10)	Total
PHQ-2 (yes/no)			
Positive (≥1)	187	259	446
Negative (<1)	12	566	578
Total	199	825	1024

PHQ indicates Patient Health Questionnaire.

recommended screening method does not capture all CHD patients with a comorbid diagnosis of MDD, it does identify patients at higher risk for adverse cardiovascular outcomes.

The AHA-recommended screen exemplifies the challenge of striving toward both high sensitivity and high specificity. When the goal of screening is to identify CHD patients with comorbid MDD, the AHA-recommended protocol appropriately diagnosed patients with MDD based on its high specificity (91%) and negative predictive value (87%). However, given its poor sensitivity (52%) and positive predictive value (63%), the instrument missed almost half of patients who had MDD, based on the diagnostic interview. In rounded terms, the AHA-recommended screening method accurately identified MDD in about 10% of patients (true-positives) and ruled out MDD in about 70% of patients with CHD (true-negatives). However, it also missed MDD in roughly 10% of patients (false-negatives) and incorrectly categorized roughly 10% of patients as having MDD (false-positives). Given that there is always a tradeoff between sensitivity and specificity, the similar number of false-positives and false-negatives suggests that the AHA-recommended cut-points are reasonable. Increasing the PHQ-2 or PHQ-9 cut-point for depression would reduce the number of false-positives but increase the number of false-negatives. Likewise, decreasing the PHQ-2 or PHQ-9 cut-point would reduce the number of false-negatives but increase the number of false-positives.

Of note, the test characteristics of the AHA-recommended screen (PHQ-2 followed by PHQ-9) were similar to those of the PHQ-9 alone.[11–13] Both screening instruments were relatively poor at detecting MDD but reasonably accurate when identifying MDD. Although administering the PHQ-9 to all participants would have detected an additional 12 participants with significant depressive symptoms (1% of study sample; 6% of patients with PHQ-9 ≥10), using the 2-step approach would have enabled 55% of participants to avoid the PHQ-9. Thus, the advantage of using the 2-step AHA-recommended screen is that it "rules out" depression in more than half of patients using only 2 (yes/no) questions that take <1 minute to complete.[14]

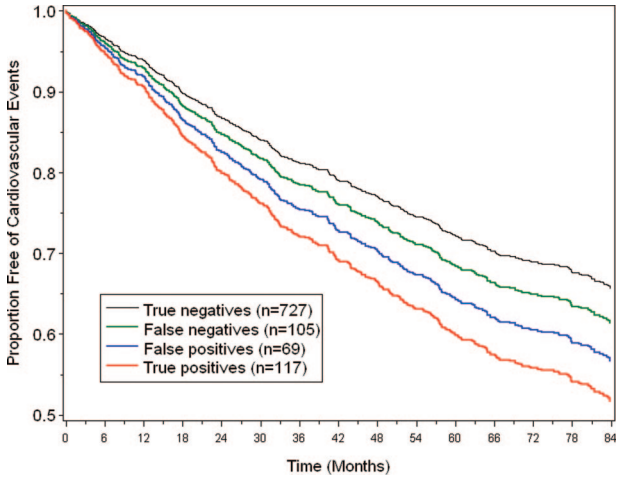

Figure 2. Age-adjusted survival free of cardiovascular events by depression status.

Participants who screened positive on the AHA protocol showed an increased risk of cardiovascular events that could not be explained by demographics or traditional risk factors. Thus, the AHA protocol appears to be capable of risk stratifying CHD patients, based on comorbid depressive symptoms, regardless of whether these patients also have a formal diagnosis of MDD. As expected based on the results of previous studies,[6] smoking, medication nonadherence, and physical inactivity were more prevalent in those who had a positive screen, and their increased risk of events was primarily explained by these health behaviors.[6,21,22] By using

Table 5. Association Between Depression Status and Cardiovascular Events Based on Results of American Heart Association–Recommended Screening Instrument and Diagnostic Interview for Major Depressive Disorder

	No. of Participants	Age-Adjusted Annual Rate of Events	Age-Adjusted HR (95% CI)	*P* Value	Fully Adjusted* HR (95% CI)	*P* Value
True-negatives (screen−, MDD−)	727	6.3%	1.0 (reference)		1.0 (reference)	
False-negatives (screen−, MDD+)	105	7.3%	0.89 (0.61–1.30)	0.55	0.99 (0.68–1.44)	0.96
False-positives (screen+, MDD−)	69	8.6%	1.45 (1.02–2.07)	0.04	1.20 (0.84–1.73)	0.31
True-positives (screen+, MDD+)	117	10.0%	1.56 (1.14–2.14)	0.005	1.60 (1.16–2.21)	0.004

HR indicates hazard ratio; CI, confidence interval; and MDD, major depressive disorder.

*Adjusted for age, sex, body mass index, history of hypertension, myocardial infarction, diabetes, heart failure, and high-density lipoprotein.

an instrument that can identify CHD patients whose depressive symptoms and associated adverse health behaviors put them at risk of subsequent cardiovascular events, clinicians can further prioritize and personalize the treatment of these patients. A potential treatment strategy might involve integrating behavioral interventions that could both treat depressive symptoms and promote lifestyle modifications, such as exercise classes, smoking cessation programs, and monitoring of medication adherence.[23–25]

Interestingly, patients with a false-negative screen (approximately 10% of participants) were not at increased risk for adverse cardiovascular events, suggesting that their MDD diagnoses did not influence cardiac prognosis. This is consistent with our previous findings that the diagnosis of MDD (as measured by the C-DIS) was not predictive of cardiovascular events.[6] One possible reason for the lack of association between MDD and cardiovascular events is that the somewhat arbitrary DSM cut-point of 5 or more symptoms may be less important for cardiovascular prognosis than the frequency or severity of fewer symptoms. Another possibility is that some participants may have felt more comfortable endorsing depressive symptoms on an anonymous questionnaire rather than in a face-to-face interview. Although we can only speculate as to why participants with false-positive screens had more adverse events than did participants with false-negative screens, our findings suggest that the AHA depression screen not only detects MDD but also provides prognostic information beyond that which is provided by the diagnostic interview. This finding adds utility to the AHA screen and additionally makes the presence of false-negative screens less worrisome in terms of cardiac prognosis. However, MDD remains a burdensome condition that deserves treatment regardless of its prognostic importance.

Screening for depression can improve both depression and cardiovascular outcomes in patients with coronary heart disease when it is combined with staff-assisted care supports.[26–29] However, it is important to note that depression screening has no proven benefit on either depression or cardiovascular outcomes when staff-assisted care supports are not in place.[11] Recent reports by the Cochrane collaboration and US Preventive Services task force have concluded that depression screening should only occur when a designated depression care manager, in consultation with a supervising psychiatrist, is available to work closely with the patient's provider to offer patient activation, follow-up, symptom monitoring, and treatment intensification, when necessary.[30–33] These findings highlight the importance of ensuring appropriate patient follow-up when administering the AHA depression screen.

Our study benefited from a large number of participants and minimal loss to follow-up. However, a number of limitations must also be considered. First, most study participants were older men, with almost half recruited from VA medical centers. It follows that the calculated test characteristics of this screen may not generalize to other patient populations. Likewise, the test characteristics of the AHA screen may differ in patients with acute coronary syndrome versus stable CHD. Second, the small number of false-positives (n=69) limited our assessment of this important subgroup. Finally, we were unable to determine whether repeated screening might be more accurate or prognostic than 1-time screening.

In summary, the AHA-recommended depression screen not only detects MDD but also provides prognostic information beyond that which is provided by a structured diagnostic interview for MDD. This latter characteristic could allow clinicians to better risk-stratify CHD patients, thus ensuring that patients with comorbid depressive symptoms receive appropriate care. It is important to note that depression screening alone has no benefit in the absence of staff-assisted care supports.[32,33] Nevertheless, the AHA screening method has the potential to advance the quality of both the psychiatric and cardiovascular care provided for this vulnerable population of CHD patients by providing a tool to both recognize depression and better stratify risk of adverse cardiovascular outcomes.

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Disclosures

None.

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