

Optimism and Cardiovascular Health: Multi-Ethnic Study of Atherosclerosis (MESA)

Rosalba Hernandez, PhD

Kiarri N. Kershaw, PhD

Juned Siddique, DrPH

Julia K. Boehm, PhD

Laura D. Kubzansky, PhD, MPH

Ana Diez-Roux, MD, PhD, MPH

Hongyan Ning, MD, MS

Donald M. Lloyd-Jones, MD, ScM

Objectives: We examined the association between optimism and cardiovascular health (CVH).

Methods: We used data collected from adults aged 52-84 who participated in the Multi-Ethnic Study of Atherosclerosis (MESA) (N = 5134) during the first follow-up visit (2002-2004). Multinomial logistic regression was used to examine associations of optimism with ideal and intermediate CVH (with reference being poor CVH), after adjusting for socio-demographic factors and psychological ill-being. **Results:** Participants in the highest quartile of optimism were more likely to have intermediate [OR = 1.51, 95% CI = 1.25, 1.82] and ideal [OR = 1.92, 95% CI = 1.30, 2.85] CVH when compared to the least optimistic group. Individual CVH metrics of diet, physical activity, body mass index, smoking, blood sugar, and total cholesterol contributed to the overall association. **Conclusions:** We offer evidence for a cross-sectional association between optimism and CVH.

Key words: well-being; optimism; cardiovascular health

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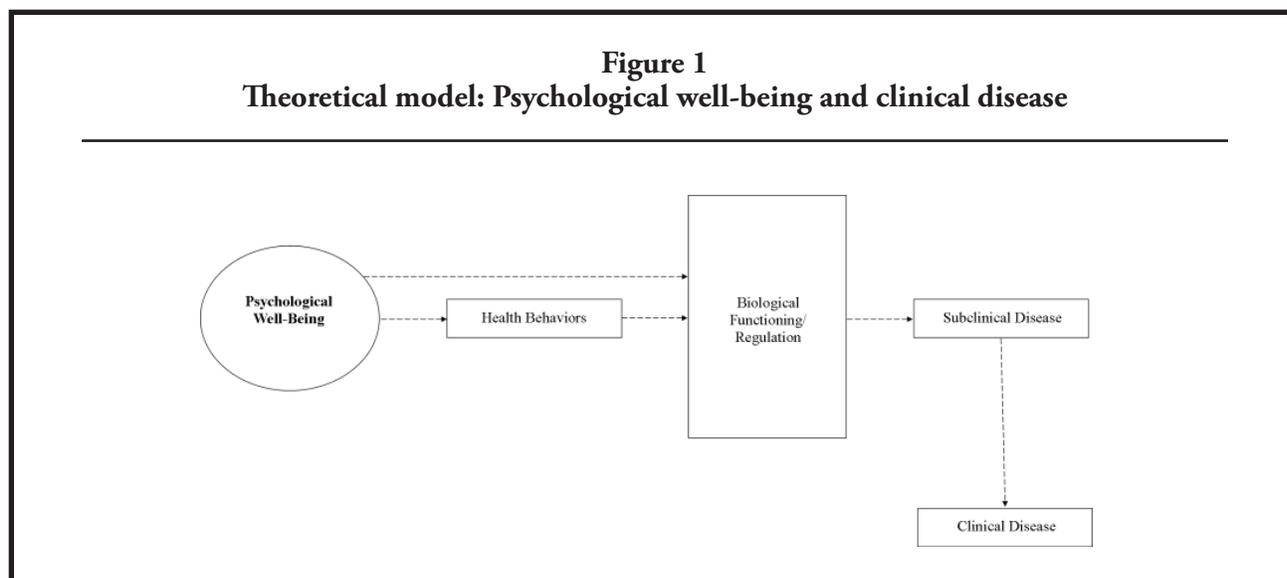
A paradigm shift in cardiovascular epidemiology has occurred from a focus on the singular examination of cardiovascular disease (CVD) risk factors to assessment and consideration of factors involved in the maintenance and promotion of overall cardiovascular health (CVH).^{1,2} In its document—*Strategic Impact Goal Through 2020 and Beyond*—the American Heart Association (AHA) seeks a 20% improvement in CVH among all Americans within a 10-year timespan, ie, by the year 2020.² As defined using AHA standards, CVH is assessed through consideration of 7 metrics categorized as health behaviors (diet, smoking,

physical activity, BMI) and health factors (blood pressure, blood sugar, total cholesterol). Empirical evidence is accumulating to suggest that favorable CVH profiles are associated with reduced all-cause and cardiac-related mortality,³ decreased cancer incidence,⁴ enhanced cognitive functioning,⁵ and greater quality of life.

Researchers have argued for an important relationship between psychological traits and heart health. Historically, researchers have examined the role of poor psychological functioning as increasing risk of adverse cardiovascular outcomes (eg, depression and anxiety), but more recently positive

Rosalba Hernandez, Assistant Professor, School of Social Work, University of Illinois at Urbana-Champaign, Urbana, IL. Kiarri N. Kershaw, Assistant Professor, Department of Preventive Medicine, Northwestern University, Feinberg School of Medicine, Chicago, IL. Juned Siddique, Associate Professor, Department of Preventive Medicine, Northwestern University, Feinberg School of Medicine, Chicago, IL. Julia K. Boehm, Assistant Professor, Department of Psychology, Chapman University, Orange CA. Laura D. Kubzansky, Professor, School of Public Health, Harvard, Boston, MA. Ana Diez-Roux, Dean, School of Public Health, Drexel University, Philadelphia, PA. Hongyan Ning, Biostatistician, Department of Preventive Medicine, Northwestern University, Feinberg School of Medicine, Chicago, IL. Donald M. Lloyd-Jones, Professor, Department of Preventive Medicine, Northwestern University Feinberg School of Medicine, Chicago, IL.
Correspondence Dr Hernandez; rberna17@illinois.edu

Figure 1
Theoretical model: Psychological well-being and clinical disease



psychological characteristics such as dispositional optimism have been considered as possibly conferring protective effects for heart health. Defined as possessing positive outcome expectancy for future events across life domains, dispositional optimism appears to be important for CVD-related outcomes given its positive influence on physiological regulation (eg, favorable profiles for inflammatory and hemostatic factors) and promotion of healthy lifestyle choices (eg, physical activity).^{6,7} When CVD risk factor and health behavior measures are considered individually in cross-sectional and prospective observational studies, positive psychological well-being emerges as a strong predictor for engagement in physical activity,^{8,9} healthy food consumption,^{9,10} abstinence from tobacco use,¹¹ and favorable physiological functioning when measuring blood pressure,¹²⁻¹⁴ glycosylated hemoglobin,¹⁵ triglycerides,^{13,16,17} and body mass index (BMI).^{6,10,18,19} Dispositional optimism has been identified as a potential causal factor for CVD and related outcomes, with evident reduction in risk for coronary heart disease (CHD) with increasing optimism levels.^{20,21} Prospective studies indicate that optimism is associated with a 50% reduction in CVD risk.⁶ To our knowledge, no study has examined the association between optimism and the new multicomponent construct of CVH, which offers a novel multisystem exploration that may support a biobehavioral pathway through which well-being influences risk for CHD events and mortality (Figure 1). Consideration of the new construct of CVH

additionally counters the existing scientific discipline that emphasizes disease states by underscoring that health is not the mere absence of disease and that exploration of health assets and protective factors is of import. This new paradigm accentuates primordial prevention instead of disease onset.

Using data from the Multi-Ethnic Study of Atherosclerosis (MESA), a large multi-center cohort study, we examined the cross-sectional association between optimism and CVH. We hypothesized that persons with higher optimism levels were more likely to have favorable CVH profiles independent of socio-demographic factors and psychological ill-being (eg, depressive symptoms). The socio-demographic and mental health factors were identified as covariates given their potential to confound the main relationship of interest, with final selection informed by a published systematic review documenting important covariates when considering cardiac health in the context of positive psychological well-being.²²

METHODS

Study Population and Data Source

MESA is a large multi-center cohort study aiming to conduct an in-depth assessment of subclinical CVD, with particular emphasis on its progression and associated risk factors. Details of the MESA recruitment and study protocol have been published previously.¹¹ Briefly, original study enrollment occurred from July 2000 to August 2002 across 6

US regions (Baltimore City and Baltimore County, Maryland; Chicago, Illinois; Forsyth County, North Carolina; Los Angeles County, California; New York, New York; and St. Paul, Minnesota), with inclusion of a total of 6814 adults between the ages of 45-84. Those with a previous history of symptomatic/clinical CVD were excluded during baseline enrollment. A heterogeneous racial/ethnic composition was achieved with distribution as follows: 38% white, 28% African-American, 22% Hispanic/Latino, and 12% Chinese. Participants have been followed across an 11-year timespan, with repeat measures taken at 1.5 to 2-year intervals. There have been 4 repeat assessments to date. Unless noted otherwise, this study used data collected during the first follow-up visit (2002-2004).

Analyses for the current study involved 5134 adults. Of the 6233 persons who attended the first follow-up visit, we excluded those who were missing data across main variables of interest, ie, dispositional optimism (N = 56) and persons with incomplete information needed to categorize the 7 CVH metrics (N = 980). Persons also were excluded if they reported an incident CVD-related event prior to the first follow-up visit (N = 63).

Study Measures

Optimism. The Life Orientation Test-Revised (LOT-R) was completed at the first follow-up visit (2002-2004) and used to assess levels of dispositional optimism. The LOT-R is a 6-item self-administered questionnaire with possible scores ranging from 6 (least optimistic) to 24 (most optimistic).^{23,24} The scale includes 3 positively worded items (eg, I'm always optimistic about my future) and 3 negatively worded items (eg, I hardly expect things to go my way) that are rated on a 4-point Likert scale with response options ranging from "a lot like me" to "not at all like me." Responses for the negatively worded items were reverse-coded prior to calculation of a composite score, with higher scores indicative of greater optimism. Because optimism is characterized by endorsement and rejection across positively and negatively worded items, we did not consider the 3-item subscales of the LOT-R, but instead, decided on unidimensional treatment as recommended.^{25,26} Given the lack of clinically-based cutoffs for the LOT-R, quartiles were created as this resulted in more equitable dis-

tribution of participants across scores; previous studies using the MESA cohort have employed use of quartiles.⁷ Adequate internal consistency for the LOT-R was evident in the current study with an overall Cronbach alpha of 0.73.

Cardiovascular health. Details of the MESA study protocol and assessment methods have been published elsewhere.¹¹ Briefly, former and current smoking status was determined from self-report. A food frequency questionnaire adapted from the Insulin Resistance Atherosclerosis Study survey was used to evaluate dietary intake.²⁷ Adapted from the Cross-Cultural Activity Participation Study, physical activity was assessed subjectively using a detailed self-report survey instrument.²⁸ BMI, measured as kg/m², was calculated from staff-ascertained measures of weight and height. After a 12-hour fast, blood was drawn (-40 ml) to obtain lipid profiles and fasting glucose values. Congruent across study sites, 3 systolic and diastolic blood pressure readings were taken with participants in a seated position; mean values were obtained by averaging the last 2 readings.^{29,30} Self-reported medication use also was considered when identifying those with pre-existing diabetes mellitus, hypercholesterolemia, and hypertension. Information on dietary intake was obtained during the baseline assessment; the remaining CVH metrics were evaluated using data from the first follow-up visit.

Cardiovascular health was assessed with the following 7 metrics: smoking status, diet, physical activity, BMI, fasting plasma glucose, serum cholesterol, and blood pressure. Each metric was scored and categorized as poor, intermediate, and ideal, as specified by AHA recommendations, with consideration of medication use (ie, antihypertensive, lipid-lowering, and hypoglycemic) where appropriate.² Points were allocated for each of the 7 metrics with scores of 0 (poor), 1 (intermediate), or 2 (ideal) for each health behavior (diet, smoking, physical activity, BMI) and health factor (blood pressure, blood sugar, total cholesterol). A total CVH score was computed by summing across metrics to derive a score that could range from 0 to 14, with higher scores indicative of better cardiovascular health. This composite CVH score was categorized further into poor (0-7 points), intermediate (8-11 points), and ideal (12-14 points), which is consistent with previously published classification

Table 1
Characteristics of the Study Sample According to Quartile of Optimism: MESA (N = 5134)

Quartile of LOT-R Score (Optimism)	Optimism Quartile				p ^b
	Least Optimistic I	Mid-Low Optimistic II	Mid-High Optimistic III	Most Optimistic IV	
	N = 1611	N = 1522	N = 1118	N = 883	
Age, M (SD)	63.5 (10.5)	63.0 (10.1)	63.6 (9.8)	64.2 (10.1)	.04
Sex					
Women, N (%)	872 (54.1)	781 (51.3)	596 (53.3)	476 (53.9)	.41
Race/Ethnicity, N (%)					
Caucasian	670 (41.6)	654 (43.0)	518 (46.3)*	297 (33.6)*	<.0001
Chinese-American	199 (12.4)	191 (12.6)	111 (9.9)	95 (10.8)*	
African-American	368 (22.8)	368 (24.2)	304 (27.2)*	244 (27.6)	
Hispanic	374 (23.2)	309 (20.3)	185 (16.6)	247 (28.0)	
Marital Status					
Married/Living as married /Living with a partner	968 (60.2)	954 (62.7)	711 (63.7)	564 (63.9)	.18
Other ^a	640 (39.8)	568 (37.3)	406 (36.4)	319 (36.1)	
Annual Income, N (%)					
Less than 40K	852 (52.9)	716 (47.0)	452 (40.4)	423 (47.9)	<.0001
≥ 40K	759 (47.1)	806 (53.0)*	666 (59.6)*	460 (52.1)*	
Education, N (%)					
Less than high school	314 (19.5)	209 (13.7)	139 (12.4)	170 (19.3)	<.0001
High school	378 (23.5)	261 (17.2)	145 (13.0)	133 (15.1)	
Some college	437 (27.2)	448 (29.4)*	326 (29.2)*	245 (27.8)	
Bachelor degree	240 (14.9)	297 (19.5)*	240 (21.5)*	159 (18.0)	
Graduate or professional degree	239 (14.9)	307 (20.2)*	267 (23.9)*	176 (19.9)*	
Health Insurance Status, N (%)					
Has health insurance	1521 (94.4)	1417 (93.1)	1050 (93.9)	801 (90.7)*	.003
Does not have health insurance	90 (5.6)	105 (6.9)	68 (6.1)	82 (9.3)	
SF-12 Health Survey, M (SD)					
Mental Health Index	48.3 (10.0)	52.7 (7.8)	54.1 (7.3)	55.8 (6.6)	<.0001

Note.

a Includes those reporting being widowed, divorced, separated, or never married.

b The p-value examining overall group differences using χ^2 or F tests as appropriate.

* Multinomial regression model(s) treating least optimistic as the referent group along with the socio-demographic categories of Hispanic, male, not-insured, less than high school, and income < 40K; used to examine between-group differences with a $p < .05$.

methods for total CVH.³¹

Covariates. Covariates included age, sex, race/ethnicity (ie, Caucasian; Chinese-American; African-American; or Hispanic), marital status, education, income, health insurance status (ie, insured or not insured), and psychological ill-being. Cat-

egorical values were created for marital status (ie, married/living as married/living with a partner; or other [widowed, divorced, separated, or never married]), education (ie, less than high school; high school; some college; bachelor degree; or graduate/professional degree), and income (ie, less than

Table 2
Distribution of Total Cardiovascular Health (CVH) and Subcomponents by
Quartile of Optimism: MESA (N = 5134)

Quartile of LOT-R Score (Optimism)	Optimism Quartile				p ^b
	Least Optimistic I N = 1611	Mid-Low Optimistic II N = 1522	Mid-High Optimistic III N = 1118	Most Optimistic IV N = 883	
Total CVH Score^a, M (SD)	7.57 (2.49)	7.96 (2.43)	8.06 (2.41)	8.13 (2.31)	<.0001
CVH, N (%)					
Poor	774 (48.1)	637 (41.9)	458 (41.0)	334 (37.8)	<.0001
Intermediate	752 (46.7)	791 (52.0)*	569 (50.9)*	485 (54.9)*	
Ideal	84 (5.2)	94 (6.2)	90 (8.1)*	64 (7.3)*	
Diet					
Poor	731 (45.4)	623 (40.9)	418 (37.4)	309 (35.0)	<.0001
Intermediate	802 (49.8)	807 (53.0)*	622 (55.6)*	511 (57.9)*	
Ideal	78 (4.8)	92 (6.0)*	78 (7.0)*	63 (7.1)*	
Smoking					
Poor	217 (13.5)	168 (11.0)	106 (9.5)	73 (8.3)	.0005
Intermediate	653 (40.5)	671 (44.1)*	490 (43.8)*	366 (41.5)*	
Ideal	741 (46.0)	683 (44.5)	522 (46.7)*	444 (50.3)*	
Physical Activity					
Poor	476 (29.6)	342 (22.5)	238 (21.3)	212 (24.0)	<.0001
Intermediate	300 (18.6)	265 (17.4)	182 (16.3)	154 (17.4)	
Ideal	835 (51.8)	915 (60.1)*	698 (62.4)*	517 (58.6)*	
Body Mass Index					
Poor	560 (34.8)	484 (31.8)	331 (29.6)	258 (29.2)	.02
Intermediate	608 (37.7)	581 (38.2)	471 (42.1)	362 (41.0)	
Ideal	443 (27.5)	457 (30.0)	316 (28.3)	263 (29.8)	
Blood Pressure					
Poor	773 (48.0)	708 (46.5)	560 (50.1)	419 (47.5)	.62
Intermediate	297 (18.4)	279 (18.3)	205 (18.3)	168 (19.0)	
Ideal	541 (33.6)	535 (35.2)	353 (31.6)	296 (33.5)	
Blood Sugar					
Poor	250 (15.5)	202 (13.3)	135 (12.1)	110 (12.5)	.04
Intermediate	275 (17.1)	286 (18.8)*	177 (15.8)	160 (18.1)	
Ideal	1086 (67.4)	1034 (67.9)	806 (72.1)*	613 (69.4)*	
Total Cholesterol					
Poor	494 (30.7)	439 (28.8)	305 (27.3)	218 (24.7)	.01
Intermediate	425 (26.4)	373 (24.5)	305 (27.3)	262 (29.7)*	
Ideal	692 (43.0)	710 (46.7)	508 (45.4)	403 (45.6)*	

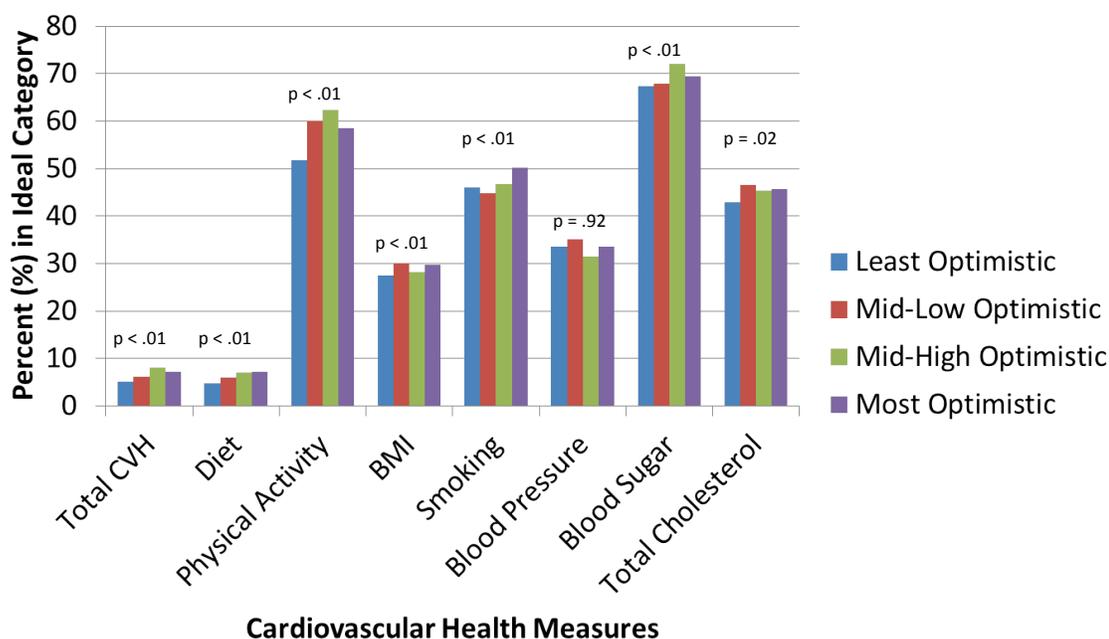
Note.

a Continuous CVH scores range from 0-14 with higher scores representing better CVH.

b The p-value examining overall group differences using χ^2 or F tests as appropriate.

* Multinomial regression model(s) treating categories of poor CVH and least optimistic as the referent group to examine between-group differences; p < .05.

Figure 2
Proportion in Ideal Classification Group across Metrics by Optimism Quartile^a



Note.

a = P-values for comparison across groups based on Chi-square tests.

\$40,000; or \geq \$40,000). All socio-demographic information was collected using self-report questionnaires completed in person at the first follow-up assessment (2002-2004). Psychological ill-being was assessed using the Mental Health Composite Scale of the 12-item Short Form Health Survey (SF-12).³² Scores for mental health range from 0 to 100, with lower scores indicative of poorer mental health. Physical health was assessed using self-report measures, ie, Physical Health Composite Scale of the SF-12³² and inquiry of diagnosed medical conditions of arthritis, liver and kidney disease.

Statistical Analyses

The continuous composite score for optimism was used to create quartiles across the full range of the observed distribution. Descriptive characteristics are presented by quartile of optimism. Group differences in participant characteristics across optimism quartiles were examined using an F-test or χ^2 -test as appropriate. Age-, sex-, and race-adjusted mean optimism scores were computed for the com-

posite CVH measure and individual metrics across classification groups (ie, ideal, intermediate, poor); F-tests were used for comparison across groups.

The association between optimism and the composite CVH score was examined using multinomial logistic regression. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated for the prevalence of intermediate and ideal CVH (versus poor CVH), across quartiles of optimism. The lowest quartile of optimism (ie, the least optimistic) served as the reference category. Three separate models were constructed. Model 1 was unadjusted. Model 2 was adjusted for age, sex, race/ethnicity, marital status, education, income, and insurance status. Model 3 was adjusted additionally for psychological ill-being. In sensitivity analyses, multivariate Model 2 was re-examined with additional inclusion of covariates capturing self-reported measures of physical health, ie, physical health composite scale of SF-12 and medical comorbidities of arthritis, liver and kidney disease. Additional sensitivity analyses employing multinomial logistic

Table 3
Multivariable Association between Optimism and Cardiovascular Health (N = 5128)

6-item LOT-R	Cardiovascular Health	
	Intermediate vs. Poor	Ideal vs. Poor
	OR (95% CI)	OR (95% CI)
M1: Unadjusted		
Quartile I—Lowest	1.0 (ref)	1.0 (ref)
Quartile II	1.28 (1.11, 1.48)	1.36 (0.99, 1.86)
Quartile III	1.28 (1.10, 1.50)	1.81 (1.32, 2.49)
Quartile IV—Highest	1.50 (1.26, 1.78)	1.76 (1.24, 2.50)
M2: Minimally Adjusted^a		
Quartile I—Lowest	1.0 (ref)	1.0 (ref)
Quartile II	1.21 (1.04, 1.40)	1.24 (0.89, 1.73)
Quartile III	1.19 (1.01, 1.41)	1.76 (1.26, 2.48)
Quartile IV—Highest	1.55 (1.29, 1.85)	2.11 (1.45, 3.06)
M3: Multivariable Adjusted^b		
Quartile I—Lowest	1.0 (ref)	1.0 (ref)
Quartile II	1.19 (1.02, 1.39)	1.18 (0.84, 1.65)
Quartile III	1.17 (0.99, 1.39)	1.64 (1.15, 2.33)
Quartile IV—Highest	1.51 (1.25, 1.82)	1.92 (1.30, 2.85)

Note.

Quartiles range from lowest (I) to highest (IV) for the LOT-R measure, with Quartile IV corresponding to the highest levels of optimism for the full 6-item LOT-R measure.

a Adjusted for age, sex, race/ethnicity, marital status, education, income, and insurance status.

b Adjusted for age, sex, race/ethnicity, marital status, education, income, insurance status, and mental health (SF-12).

regression treated dispositional optimism as a continuous score ranging from 6 to 24 when modeling its association with composite CVH categories (poor CVH versus intermediate or ideal).

All data analyses were conducted using statistical software (SAS 9.1 for Windows; SAS, Inc, Cary, North Carolina).

RESULTS

Characteristics of the Study Sample

Table 1 provides participant characteristics according to level of optimism. The p-values for overall trend across socio-demographic characteristics are presented by quartile of optimism. Participants categorized as most optimistic tended to be older and reported more favorable mental health. Race/ethnicity, income, education and health insurance status differed by optimism level. A greater pro-

portion of African-American and Hispanic/Latino participants were in the highest optimism quartile as compared with the lowest quartile, whereas this finding was reversed for white and Chinese participants. Compared to the least optimistic participants, greater levels of income and education were reported by those in the highest optimism quartile. Finally, as compared to the least optimistic, a slightly greater proportion of uninsured persons were classified as most optimistic.

Association of Optimism with Cardiovascular Health Measures

Table 2 shows the distribution of the CVH measures by optimism quartile. A significantly higher mean composite CVH score was observed with increasing levels of optimism, ranging from 7.57 among the least optimistic to 8.13 among the most optimistic. Optimists displayed more favor-

Table 4
Odds Ratios and 95% Confidence Intervals (CIs) for the Cross-sectional Association of
One Standard Deviation Increase in Optimism Score with Cardiovascular Health
(N = 5128)

6-item LOT-R	Cardiovascular Health	
	Intermediate vs. Poor	Ideal vs. Poor
	OR (95% CI)	OR (95% CI)
M1: Unadjusted	1.17 (1.10, 1.24)	1.28 (1.13, 1.44)
M2: Minimally Adjusted^a	1.14 (1.08, 1.21)	1.21 (1.06, 1.37)
M3: Multivariable Adjusted^b	1.13 (1.06, 1.21)	1.15 (1.003, 1.32)

Note.

a Adjusted for age, sex, race/ethnicity, marital status, education, income, and insurance status.

b Adjusted for age, sex, race/ethnicity, marital status, education, income, insurance status, and mental health (SF-12).

able CVH profiles with greater likelihood for classification into intermediate and/or ideal categories across multiple health behaviors and factors.

This finding is supported in Figure 2 which presents the proportion of participants classified as ideal across the CVH metrics based upon optimism quartile. Although a completely graded response is not evident, across most health metrics, a greater proportion of individuals have an ideal health classification with increasing optimism scores.

Table 3 presents the odds ratios and associated confidence intervals for having intermediate or ideal CVH according to quartile of optimism, with poor CVH serving as the referent category. In unadjusted models and when compared to the least optimistic group, persons in the highest quartile of optimism showed a 50% higher odds of being in the intermediate versus poor CVH category (95% CI = 1.26, 1.78) and 76% higher odds of being in the ideal versus poor CVH category (95% CI = 1.24, 2.50). These associations were strengthened after adjustment for socio-demographic factors (Model 2); those in the highest quartile had 55% higher odds of having intermediate CVH (95% CI = 1.29, 1.85) and twice the odds of having ideal CVH (95% CI = 1.45, 3.06). Similar results were observed in the multivariable adjusted model accounting for ill-being. In sensitivity analyses, adjustment for self-reported physical health and medical comorbidities mildly attenuated the results, with documented

maintenance of a robust association between optimism and CVH (not shown).

Table 4 presents the association between continuous scores of dispositional optimism and CVH categories. As before, a 3-category modeling scheme was used to examine CVH; poor [0-7 points] (ref), intermediate (8-11 points), and ideal (12-14 points). In the multivariable adjusted model, one SD increase in dispositional optimism was associated with 13% [95% CI = 1.06, 1.21] higher odds of being in intermediate health and 15% [95% CI = 1.003, 1.32] higher odds for classification into ideal health, when treating poor CVH as the referent category for the modeling procedure. As before, inclusion of psychological ill-being as a covariate only slightly attenuated the observed associations. Differences were not observed for dispositional optimism scores (19.8 vs. 19.9, $p = .39$), but on average, less favorable CVH profiles were evident for participants with missing values across the main variables of interest.

DISCUSSION

There was a statistically significant positive cross-sectional association between dispositional optimism and CVH, with the most optimistic persons exhibiting twice the odds of having ideal CVH profiles in unadjusted analyses. This association remained significant even after adjustment for socio-demographic characteristics (ie, age, sex, race/

ethnicity, marital status, education, income, and insurance status) and psychological ill-being. Secondary analyses identified the associations of optimism with individual CVH metrics of diet, physical activity, BMI, smoking, blood sugar and total cholesterol as contributing to the overall association.

Although this is the first study to consider the association between optimism and CVH as defined by the American Heart Association,² our results are generally consistent with evidence derived from studies considering the relationship between dispositional optimism and single cardiac-related health behaviors and/or factors. Previous cross-sectional and longitudinal evidence links optimism to more favorable dietary^{9,10} and physical activity^{8,9,33} profiles, and reduced likelihood for smoking.^{6,11,34,35} Reports on the relationship between optimism and BMI are less consistent.⁸⁻¹⁰

These findings notwithstanding, it is worth noting that cross-sectional and longitudinal studies have yielded somewhat inconsistent findings on the association of dispositional optimism with metabolic and physiologic measures (eg, glycated hemoglobin, lipids and blood pressure).⁶ Unlike our findings with the MESA cohort, Brody et al³⁶ did not find an association between optimism and glycemic control in a sample of 200 African-American adults with type 2 diabetes. Discordant findings may be a consequence of dissimilar study measures (ie, fasting glucose in mg/dl vs. HbA1C) and divergent participant samples (ie, diabetic individuals of African-American descent vs. a heterogeneous cohort with and without diabetes). Additionally, the LOT-R scoring rubric used by Brody et al³⁶ focused on identifying persons with low levels of optimism and did not consider effects across the continuum of optimism levels. The relatively small sample (N = 200) of African-American adults with type 2 diabetes may account for the null findings, particularly if insufficient power was achieved to detect the association of interest, ie, low optimism and HbA1C. Contributing to the current state of knowledge in the area of positive psychological well-being and glycemic control, the current study, the first to utilize a large (N = 5134) heterogeneous adult cohort, documents a robust association between optimism and fasting glucose levels. This is also applicable in relation to findings on the association between optimism and lipid levels, as limited and discordant

findings are also reported to date.^{9,13}

Longitudinal studies document protective effects of optimism-related measures (ie, hope, curiosity, vitality) on incident hypertension across a one-year time span.^{12,13} However, several cross-sectional studies report an inverse association between dispositional optimism and blood pressure,¹⁴ whereas others document null findings.^{6,37} Racial/ethnic heterogeneity of the MESA sample, particularly inclusion of underserved minority populations (ie, African Americans and Hispanic/Latinos), may inform our null finding. Raikkonen and Matthews³⁸ found a robust association between optimism and ambulatory blood pressure in a sample of middle-aged working non-Hispanic Whites, whereas no such finding was evident in a more diverse adolescent sample that included African Americans.³⁷ Results for the MESA cohort are consistent with that reported for racial/ethnic minority adolescents, with similarities in racial/ethnic composition potentially explaining congruent findings. If racial/ethnic minorities more frequently experience chronic daily stressors such as racial discrimination, it is possible that this may obscure the effects of an individual's life orientation on single-day assessments of blood pressure, particularly if stressful events serve to temporarily increase blood pressure.

Future studies will want to consider the mechanism through which dispositional optimism may influence the metrics used to construct the CVH score, particularly as the difference in CVH between the least and most optimistic subgroups, ie, 0.56 points, may be of clinical significance as it approximates the 1-point difference associated with an 8% reduction in stroke risk.³⁹ At the population level, even this moderate difference in CVH score translates into a significant reduction in subsequent deaths. In terms of mechanism, one possibility is that optimists employ more adaptive coping skills when faced with adversity.⁴⁰ For example, optimists are more likely to engage in active problem-focused coping and positive reinterpretation of stress evoking events, while infrequently employing tactics of denial and avoidance.^{41,42} In turn, these positive coping responses have been predictive of a greater likelihood of engaging in prudent health behaviors—ie, tobacco avoidance and moderate alcohol use—and attainment of favorable physical health profiles.⁴⁰

Although additional work is necessary, our find-

ings offer support—through assessment of the new construct of CVH—for the hypothesized biobehavioral mechanism through which optimism favorably impacts CVD-related endpoints. Major CVD risk factors (eg, hypercholesterolemia, hypertension, diabetes, obesity)—considered when deriving the CVH score—have substantial evidence linking them to progression of subclinical atherosclerosis, clinical manifestation of CVD, and subsequent CVD-related mortality.⁴³ Thus, the mechanism whereby psychological well-being influences CVD-related outcomes may well be both behavioral and biological in nature, through favorable impact on engagement in healthy behavior (eg, high levels of physical activity) and enhanced regulation of metabolic and cardiovascular functioning (eg, improved glucose metabolism).⁴⁴

The present study has multiple strengths. It is the first to examine the association of dispositional optimism and CVH in a large (N = 5134) ethnically/racially diverse sample of adults. This allowed for examination of effect modification by race/ethnicity, yielding no apparent interaction of race/ethnicity with dispositional optimism when regressed upon CVH metrics. A well-validated instrument was used to assess dispositional optimism and standardized approaches were used to obtain objective measures of the health factors, ie, blood pressure, blood sugar, and total cholesterol. However, study limitations should be considered when interpreting findings. Measurement error and misclassification bias are plausible for dietary intake and physical activity as they were self-reported. As with all cross-sectional studies, we are unable to make definitive inferences about causality. Specifically, it is possible that individuals are more optimistic because they are healthier. Longitudinal studies are needed to establish causality and adequately address uncertainties regarding temporality of the association. Finally, future studies should examine differential item functioning when using the LOT-R with diverse ethnic/racial subgroups, particularly as we observed a greater proportion of African-American and Hispanic/Latino participants in the highest optimism quartile as compared with the lowest quartile.

IMPLICATIONS FOR HEALTH BEHAVIOR OR POLICY

We found a significant positive association be-

tween dispositional optimism and CVH. This evidence suggests that, primordial, primary, and secondary prevention strategies through modification of psychological well-being (eg, optimism) may be a potential avenue in helping to reach AHA's goal to increase cardiovascular health by 20% before 2020. As evidence suggests that 40% of individual variance in happiness—a hedonistic construct of psychological well-being—is determined by intentional activities under direct human volition,⁴⁵⁻⁴⁷ current evidence, in conjunction with implementation of randomized clinical trials will further aid in determining whether successful alteration of psychological well-being favorably impacts CVH behaviors and factors. Indeed, mutable psychological factors (eg, optimism) are evident for which public health interventions may be of benefit.

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Human Subjects Approval Statement

The Multi-Ethnic Study of Atherosclerosis (MESA) was approved by the institutional review boards at each of the study sites.

Conflict of Interest Declaration

The authors declare that they have no conflict of interest with respect to the data reported herein.

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