




ORIGINAL RESEARCH

Religiosity/Spirituality and Cardiovascular Health: The American Heart Association Life's Simple 7 in African Americans of the Jackson Heart Study

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BACKGROUND: Religiosity/spirituality is a major coping mechanism for African Americans, but no prior studies have analyzed its association with the American Heart Association Life's Simple 7 (LS7) indicators in this group.

METHODS AND RESULTS: This cross-sectional study using Jackson Heart Study (JHS) data examined relationships between religiosity (religious attendance, private prayer, religious coping) and spirituality (theistic, nontheistic, total) with LS7 individual components (eg, physical activity, diet, smoking, blood pressure) and composite score among African Americans. Multivariable logistic regression assessed the odds of achieving intermediate/ideal (versus poor) LS7 levels adjusted for sociodemographic, behavioral, and biomedical factors. Among the 2967 participants (mean [SD] age=54.0 [12.3] years; 65.7% women), higher religious attendance was associated with increased likelihood (reported as odds ratio [95% CI]) of achieving intermediate/ideal levels of physical activity (1.16 [1.06–1.26]), diet (1.10 [1.01–1.20]), smoking (1.50 [1.34–1.68]), blood pressure (1.12 [1.01–1.24]), and LS7 composite score (1.15 [1.06–1.26]). Private prayer was associated with increased odds of achieving intermediate/ideal levels for diet (1.12 [1.03–1.22]) and smoking (1.24 [1.12–1.39]). Religious coping was associated with increased odds of achieving intermediate/ideal levels of physical activity (1.18 [1.08–1.28]), diet (1.10 [1.01–1.20]), smoking (1.32 [1.18–1.48]), and LS7 composite score (1.14 [1.04–1.24]). Total spirituality was associated with increased odds of achieving intermediate/ideal levels of physical activity (1.11 [1.02–1.21]) and smoking (1.36 [1.21–1.53]).

CONCLUSIONS: Higher levels of religiosity/spirituality were associated with intermediate/ideal cardiovascular health across multiple LS7 indicators. Reinforcement of religiosity/spirituality in lifestyle interventions may decrease overall cardiovascular disease risk among African Americans.

Key Words: African Americans ■ health behavior ■ lifestyle ■ religiosity ■ risk factors ■ spirituality

Cardiovascular disease (CVD) affects nearly half of all African American (AA) adults, who are 30% more likely to die of CVD (ie, coronary heart disease, heart failure, stroke, and peripheral artery disease) than the overall US population.¹ Prevention and management of major CVD risk factors are key for addressing these persistent CVD disparities for promotion of cardiovascular health (CVH). Compared with non-Hispanic White people, AAs have 82% lower odds of achieving

≥5 ideal levels of the CVH components that make up the American Heart Association (AHA) Life's Simple 7 (LS7).² Developed as a primordial prevention strategy against CVD, the LS7 is an evidence-based metric of 7 health-promoting behaviors and biological risk factors: physical activity (PA), diet, smoking, body mass index (BMI), blood pressure (BP), cholesterol, and glucose.³ AAs have significantly worse health status than White people in every LS7 component except for total cholesterol.¹ Among

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CLINICAL PERSPECTIVE

What Is New?

- In this large cohort of community-dwelling African American adults from the Jackson Heart Study (JHS), higher levels of religiosity (eg, religious attendance, private prayer, religious coping) and spirituality (eg, theistic, nontheistic) were associated with intermediate/ideal cardiovascular health across multiple indicators of the American Heart Association Life's Simple 7.
- Our study provides the first high quality evidence substantiating that religiosity and spirituality can potentially have beneficial effects on select indicators of the Life's Simple 7 in African American men and women.

What Are the Clinical Implications?

- Recognition by health professionals and researchers of the centrality and influence of religiosity and spirituality in the lives of African American adults may serve as a means to address cardiovascular health disparities through sociocultural understanding and the strategic development of culturally relevant lifestyle interventions.

Nonstandard Abbreviations and Acronyms

| | |
|-------------|----------------------------------|
| AA | African American |
| AHA | American Heart Association |
| CVH | cardiovascular health |
| DSES | Daily Spiritual Experience Scale |
| JHS | Jackson Heart Study |
| LS7 | Life's Simple 7 |
| PA | physical activity |
| SES | socioeconomic status |

AAs in the JHS, there was a strong graded association between number of LS7 components in the ideal range and lower risk of incident CVD.⁴ In addition, a stepwise decrement in lifetime risk of coronary heart disease,⁵ heart failure,⁶ stroke,⁷ and peripheral artery disease⁸ with higher LS7 scores or better CVH has been demonstrated among AAs in several observational, population-based cohorts. Despite the substantial epidemiologic evidence for the benefits of ideal CVH among AAs, there are few data on the role of key psychosocial influences in the lives of AAs, such as their religious and spiritual beliefs,

in fostering achievement of ideal LS7 indicators. A recent meta-analysis provided evidence supporting the benefits of positive psychosocial factors such as religiosity/spirituality for CVH outcomes; however, the majority of included studies lacked focus on racial/ethnic minority groups, particularly AAs.⁹ Elucidation of a link between religiosity/spirituality and CVH could also inform the design of effective, culturally tailored, and faith-oriented interventions to improve CVH disparities by race/ethnicity, as recently endorsed in the AHA 2030 Impact Goal Presidential Advisory.¹⁰

Research suggests that religiosity/spirituality may have an important role in CVD among AAs. The 2014 Pew Research Center's US Religious Landscape Survey found that 75% of AAs report the primary importance of religion in their lives, and 83% believe in God.¹¹ Furthermore, the weekly religious service attendance and spiritual practices of AAs exceed those of all other racial groups, especially among women.^{12,13} A plethora of studies highlight the connection between religion and health,¹⁴ several of which have shown a protective relationship between religious participation and chronic disease-related death, including that caused by CVD.¹⁵ Greater religiosity/spirituality has been linked to better health behaviors such as lower caloric intake, alcohol use, and smoking among AAs, but findings are inconclusive regarding the effects of religiosity/spirituality on cardiometabolic profiles and CVD events.^{13,16} Nonetheless, no community-based cohort study has examined the effect of religiosity/spirituality on CVH behaviors and biological factors as defined by the AHA LS7. This supports the scientific premise and purpose of the current study to fill this gap by assessing the cross-sectional relationship between religiosity/spirituality and CVH in a cohort of AAs. We hypothesized that greater levels of religiosity/spirituality are positively associated with achieving intermediate or ideal levels of LS7 components and LS7 composite score among AAs. We also posited that socioeconomic status (SES), chronic stress, and social network would modify the association of religiosity/spirituality with CVH.

METHODS

Sample Population and Procedures

The data that support the findings of this study are available from the corresponding author upon reasonable request. The JHS is a community-based, prospective cohort study examining CVD risk in 5306 AA adults (by self-identification: 1935 men; 3371 women), aged 21 to 84 years residing in the tricounty area (Hinds, Madison, and Rankin counties) of Jackson, Mississippi. Details of the study design, recruitment approach, and measures have been previously published.^{17–19} Participants

completed in-depth interviews (face-to-face and telephone) and surveys administered by trained study staff to assess an array of sociocultural factors (including stress, social network, etc) via instruments validated from previous studies including AAs.¹⁸ The religiosity/spirituality questionnaires were completed by participants as part of a larger, self-administered survey.²⁰ Although religiosity/spirituality measures were a part of this comprehensive assessment of sociocultural influences on CVD risk, there is a low likelihood of participant response bias for religiosity/spirituality, as the JHS overall objective and purpose was not solely focused on ascertainment of religiosity/spirituality. Participants underwent baseline assessments between 2000 and 2004 that included data collection of sociodemographics, medical history, physical examination, laboratory studies, medications, and health behaviors. The current study included all JHS participants with complete data on each LS7 component (or CVH metric) and religiosity/spirituality data at baseline (2000–2004). Exclusion criteria were reported CVD (eg, coronary heart disease, heart failure, stroke, and peripheral artery disease) and missing data at baseline for all main variables of interest (religiosity/spirituality and ≥ 1 CVH metric). The study was approved by the institutional review boards of University of Mississippi Medical Center, Jackson State University, and Tougaloo College. All participants provided written informed consent. The current study was deemed exempt by the Mayo Clinic Institutional Review Board.

Primary Independent Variables

Religiosity

The domains of religiosity assessed were religious attendance, private prayer, and religious coping. *Religious attendance*, defined as frequency of organized religious activities such as church attendance, service viewing on television, and participation in bible study group meetings, consisted of 1 item with 6 response options (“not at all”=1 to “nearly everyday”=6). *Private prayer* was assessed as frequency of prayer or meditation outside of formal religious activity to which participants responded using an 8-point Likert scale ranging from 1 (“never”) to 8 (“more than once a day”). *Religious coping*, the use of religious beliefs or practices in adapting to difficult life situations and stressful events, was assessed by 1 item, “To what extent is your religion or spiritual tradition involved in understanding or dealing with stressful situations in any way?” to which participants responded using a 4-point Likert-type scale ranging from 1 (“not involved at all”) to 4 (“very involved”). Items were selected and adapted from the Fetzer Multidimensional Measurement of Religiousness/Spirituality (religious attendance, private prayer) and Religious Coping Scale (religious coping) instruments.^{20–22} All 3 measures of religiosity have

been previously validated in the JHS.^{20,23} Limited psychometric properties are available for these discrete items (Cronbach $\alpha > 0.80$ for religious coping), but they have been extensively examined in previous studies with similar populations.^{20,23}

Spirituality

Spirituality was measured with the short version of the Daily Spiritual Experience Scale (DSES).²⁴ The DSES was designed to assess ordinary daily experiences according to theistic and nontheistic experiences of spirituality in 6 domains. The 6 DSES items are each rated using a 6-point Likert scale as 1, “never,” to 6, “many times a day” (total score range, 6–36, with higher scores indicating higher spirituality). The theistic spirituality DSES subscale score (range, 3–18) was calculated by summing 3 of the items (feel God’s presence, desire closer union with God, feel God’s love) (Cronbach $\alpha = 0.73$). Likewise, the nontheistic spirituality DSES subscale score (range, 3–18) was calculated by summing 3 items (feel strength in my religion, feel deep inner peace and harmony, feel spiritually touched by creation; Cronbach $\alpha = 0.76$). Total spirituality DSES score was tabulated as the summation of the theistic and nontheistic subscale scores (Cronbach $\alpha = 0.85$). Higher scores on the total, theistic, and nontheistic DSES represent more reported daily spiritual experiences. Prior studies have demonstrated its favorable psychometric properties in the JHS.^{20,23}

Outcomes of Interest

The primary outcome of interest was CVH as measured by the AHA LS7 individual components and LS7 composite score. JHS participants completed assessments of the LS7 components at the baseline visit consisting of 7 health behaviors and biological factors: PA, diet, cigarette smoking, BMI, resting BP, total serum cholesterol level, and fasting plasma glucose level. Details on the standardized protocols and methods for measurement of the LS7 components at the assessments have been previously described.²⁵ The LS7 component metrics according to AHA criteria are shown in Table 1.^{25,26} The LS7 composite score was ascertained with the assignment of 0 points for *poor*, 1 point for *intermediate*, and 2 points for *ideal* for each LS7 component, with a cumulative sum of all components (range, 0–14, poor to ideal). LS7 composite score as a continuous measure was further classified into 3 groups, as previously conducted in the JHS: *poor CVH* (0–6), *intermediate CVH*,^{7,8} and *ideal CVH*.^{9–14,25}

Covariates

Covariates included baseline age (continuous), sex (men/women), educational attainment (less than high

Table 1. Definition of Poor, Intermediate, and Ideal Life's Simple 7 Component Metrics

| Component metrics | Poor (0 points) | Intermediate (1 point) | Ideal (2 points) |
|-------------------------------|---------------------|---|--|
| Cigarette smoking | Current | Former <1 y | Never or former >1 y |
| Healthy diet* | 0–1 | 2–3 | 4–5 |
| Physical activity† | None | 1–149 min/wk moderate intensity or 1–74 min/wk vigorous intensity or 1–149 min/wk moderate+vigorous intensity | ≥150 min/wk moderate intensity or ≥75 min/wk vigorous intensity or ≥150 min/wk moderate+vigorous intensity |
| Body mass index | ≥30.0 | 25.0–29.9 | <25.0 |
| Blood pressure, mm Hg | SBP ≥140 or DBP ≥90 | SBP 120–139 or DBP 80–89 or Treated to goal | <120/<80 untreated |
| Total cholesterol, mg/dL | ≥240 | 200–239 or Treated to goal | <200 untreated |
| Fasting plasma glucose, mg/dL | ≥126 | 100–125 or Treated to goal | <100 untreated |

Data from Lloyd-Jones et al³. DBP indicates diastolic blood pressure; and SBP, systolic blood pressure.

*Healthy diet score (0–5 components) included the following: fruits and vegetables, ≥4.5 cups/d; fish, ≥2 3.5-oz servings/wk; fiber-rich whole grains ≥1.1 g fiber/10 g carbohydrate, ≥3 1-oz-equivalent servings/d; sodium, ≤1500 mg/d; sugar-sweetened beverages, ≤450 kcal/wk. Dietary recommendations are scaled according to a 2000-kcal/d diet.

†Minutes of vigorous activity are equal to 2 times the minutes of moderate activity when moderate and vigorous activities are combined.

school to vocational/trade school or college graduate), income status (poor to affluent), and insurance status (insured/uninsured). For income status, 4 income categories (poor, lower-middle, upper-middle, and affluent) were assigned on the basis of family size, US Census poverty levels, and year of baseline clinic visit (2000–2004).²⁷ Corresponding income ranges for the categories were *poor*, less than poverty level; *lower-middle*, 1 to 1.5 times the poverty level; *upper-middle*, >1.5 but <3.5 times the poverty level; and *affluent*, ≥3.5 times the poverty level. On the basis of our prior work,²⁵ chronic stress was assessed at baseline using the Global Perceived Stress Scale, an adapted standardized stress scale for use in the JHS.¹⁸ The 8-item questionnaire measures global perceptions of ongoing stress over the prior 12-month period in several life domains (eg, racism/discrimination, employment, and legal challenges).²⁵ Scores range from 0 to 24, with higher scores indicating greater levels of stress. Another key covariate, social network, was assessed with an adapted version of the Berkman Social Network Index.²⁸ The 5-item instrument assesses current marital status, group membership, close friends, close relatives, and frequency of social contact. A total social network score was calculated ranging from 0 to 5, with higher scores indicating larger social network.

Statistical Analysis

Participant baseline characteristics were described overall and stratified by sex and religiosity/spirituality measures. Religious attendance, private prayer, and religious coping were categorized similar to prior work,^{20,23} while theistic and nontheistic subscales were grouped using quartiles. The rationale for presenting

the data in this manner is directly related to previously documented differences in religious participation and spiritual practices between AA men and women.^{11–13} Characteristics were compared between groups by sex using ANOVA and χ^2 tests, as appropriate, for continuous and categorical variables, respectively. By using absolute standardized differences, characteristics of participants included in the analysis were compared with those excluded; a difference <0.2 was considered to be a small effect, as outlined by Cohen.²⁹ The prevalence of CVH metrics (poor, intermediate, and ideal) was assessed for individual LS7 components for all participants and by sex based on the aforementioned rationale of existing sex-related differences in religiosity/spirituality. Similar to our prior study,²⁵ to investigate the associations of each religiosity/spirituality measure with LS7 components and LS7 composite score, multivariable logistic regression was used to compute odds ratios (ORs) with accompanying 95% CIs to compare intermediate/ideal CVH with poor CVH (reference). This comparison was chosen to maximize power for comparisons. For each LS7 component, models were adjusted in a sequential manner including each religiosity/spirituality measure (main predictors) in separate models to minimize multicollinearity. Model 1 included adjustment for age, sex, and SES (education, income, and insurance status); model 2 added chronic stress; and model 3 added social network. Additional post hoc analyses assessed for effect modification of each religiosity/spirituality measure with age, sex, SES, chronic stress, and social network on each LS7 component (and LS7 composite score category) by inclusion of a series of interaction effects within the logistic regression framework. Tests for multiplicative interactions between religiosity/

spirituality measures (ie, religious attendance*private prayer) and collectively across all religiosity/spirituality variables were conducted using the adjusted models. In all logistic regression analyses including interaction analyses, age, religiosity/spirituality measures, chronic stress, and social network scores were modeled as continuous variables. Distribution of LS7 composite scores were examined across categories of religiosity/spirituality measures to ensure that the association of these measures were approximately linear. Analyses were performed using SAS, version 9.4 (SAS Institute Inc, Cary, NC). Statistical significance was defined by 2-sided *P* values with an $\alpha=0.05$.

RESULTS

Among the 5306 initial participants in the JHS, 2339 were excluded because of CVD ($n=572$) or missing data on religiosity/spirituality ($n=1142$) or CVH metrics ($n=1247$) (people could be excluded for more than 1 reason),

resulting in a final analytic sample of 2967 participants. Compared with participants not included in this analysis ($n=2339$), included participants were younger, of lower education level and income status, and had better CVH (higher LS7 score) (Table S1). Table 2 summarizes the sample characteristics stratified by participant sex. Of the 2967 participants in the sample, 1949 (65.7%) were women, and the mean (SD) age was 54.0 (12.3) years. Mean (SD) reported values were high for religiosity (religious attendance, 5.0 [0.9], scale, 1–6; private prayer, 7.2 [1.3], scale, 1–8; religious coping, 3.6 [0.6], scale, 1–4), and spirituality (DSES score, 29.2 [4.7]; scale, 6–36). Compared with women, men reported higher income status ($P<0.001$). Women reported higher religiosity (religious attendance, private prayer, religious coping) and spirituality than men (all $P<0.001$). Higher chronic stress was reported among women than men ($P<0.001$), whereas men had a larger social network ($P<0.001$). The mean (SD) LS7 composite score was 7.3 (2.1), with no differences observed by sex.

Table 2. Baseline Characteristics of Jackson Heart Study Participants by Sex*

| Characteristic | Total (N=2967) | Women (n=1949) | Men (n=1018) | <i>P</i> value |
|---|-------------------------|-------------------------|-------------------------|----------------|
| Age, y | 54.0 (12.3) | 54.3 (12.3) | 53.5 (12.2) | 0.09 |
| Education | (n=2963) | (n=1947) | (n=1016) | 0.16 |
| Less than high school | 436 (14.7) | 273 (14.0) | 163 (16.0) | |
| High school graduate/GED | 527 (17.8) | 361 (18.5) | 166 (16.3) | |
| Vocational/trade school or college graduate | 2000 (67.5) | 1313 (67.4) | 687 (67.6) | |
| Income status | (n=2550) | (n=1672) | (n=878) | <0.001 |
| Poor | 296 (11.6) | 233 (13.9) | 63 (7.2) | |
| Lower-middle | 574 (22.5) | 413 (24.7) | 161 (18.3) | |
| Upper-middle | 818 (32.1) | 551 (33.0) | 267 (30.4) | |
| Affluent | 862 (33.8) | 475 (28.4) | 387 (44.1) | |
| Health insured | 2583/2960 (87.3) | 1692/1944 (87.0) | 891/1016 (87.7) | 0.61 |
| Married | 1689/2961 (57.0) | 934/1945 (48.0) | 755/1016 (74.3) | <0.001 |
| Cardiovascular risk factors | | | | |
| Hypertension | 1554 (52.4) | 1069 (54.8) | 485 (47.6) | <0.001 |
| Diabetes | 512 (17.3) | 347 (17.8) | 165 (16.2) | 0.27 |
| Hyperlipidemia | 342/2964 (11.5) | 231/1947 (11.9) | 111/1017 (10.9) | 0.44 |
| Current smoker | 310 (10.4) | 163 (8.4) | 147 (14.4) | <0.001 |
| LS7 composite score | 7.3 (2.1) | 7.2 (2.0) | 7.3 (2.1) | 0.28 |
| Religiosity measures | | | | |
| Religious attendance | 5.0 (0.9) | 5.1 (0.8) | 4.8 (1.1) | <0.001 |
| Private prayer | 7.2 (1.3) | 7.4 (1.1) | 6.9 (1.5) | <0.001 |
| Religious coping | 3.6 (0.6) (n=2914) | 3.6 (0.6) (n=1913) | 3.5 (0.7) (n=1001) | <0.001 |
| Spirituality measures | | | | |
| Theistic subscale score | 14.9 (2.5) | 15.2 (2.2) | 14.3 (2.8) | <0.001 |
| Nontheistic subscale score | 14.3 (2.6) | 14.5 (2.5) | 13.8 (2.8) | <0.001 |
| DSES total score | 29.2 (4.7) | 29.7 (4.3) | 28.2 (5.3) | <0.001 |
| Chronic stress score | 4.0 (2.0, 8.0) (n=2947) | 5.0 (2.0, 8.0) (n=1932) | 3.0 (1.0, 7.0) (n=1015) | <0.001 |
| Social network score | 4.2 (0.8) (n=2936) | 4.2 (0.8) (n=1931) | 4.3 (0.9) (n=1005) | <0.001 |

DSES indicates Daily Spiritual Experience Scale; GED, General Educational Development; and LS7, Life's Simple 7.

*Data are presented as mean (SD), n (%), or median (Q1, Q3).

Participants had statistically significant differences in demographics when stratified by religiosity/spirituality measures (Tables S2A through S2E). A few notable differences observed were that participants reporting more religiosity (religious attendance, private prayer, and religious coping) tended to be older, women, more educated, and more socially connected (all $P \leq 0.05$). Similar trends were seen among the spirituality scores (theistic, nontheistic) and several demographic factors (age, sex, education, social network) with the addition of stress (all $P < 0.05$). Hypertension and current smoking were consistently more prevalent with higher levels of religiosity/spirituality measures ($P < 0.05$ except for religious coping). LS7 scores increased with higher religiosity/spirituality, although only religious coping was statistically significant ($P = 0.002$). As expected, all religiosity/spirituality measures correlated well with stratification by each religiosity/spirituality measure (all $P < 0.001$).

Prevalence of LS7 Components

The prevalence rates of all LS7 metrics by LS7 component are reported separately by sex in Figure 1. Women had higher prevalence of poor LS7 metrics for PA (46.8% versus 43.3%) and BMI (59.5% versus 41.5%) than men (both $P < 0.01$). Compared with men, women had a higher prevalence of ideal LS7 metrics for smoking (90.5% versus 84.4%), BP (22.9% versus 20.4%), and glucose value (48.9% versus 45.1%) (all $P < 0.05$).

Religiosity/Spirituality Measures and LS7

The ORs (comparing intermediate/ideal CVH with poor CVH [reference]) for each LS7 component and LS7 composite score by religiosity/spirituality measures (per each 1-SD unit increase in each measure) for the minimally adjusted model (model 1) are shown in Figure 2.

Religiosity

After multivariable adjustment (model 1), higher religious attendance was associated with increased odds (OR [95% CI]) of achieving intermediate/ideal levels for PA (1.16 [1.06–1.26]), diet (1.10 [1.01–1.20]), smoking (1.50 [1.34–1.68]), BP (1.12 [1.01–1.24]), and LS7 composite score (1.15 [1.06–1.26]) (Table S3). Private prayer was associated with increased odds of achieving intermediate/ideal levels for diet (1.12 [1.03–1.22]) and smoking (1.24 [1.12–1.39]). Religious coping was associated with increased odds of achieving intermediate/ideal levels for PA (1.18 [1.08–1.28]), diet (1.10 [1.01–1.20]), smoking (1.32 [1.18–1.48]), and LS7 composite score (1.14 [1.04–1.24]). The statistically significant associations of each religiosity measure with each LS7 component or LS7

composite score remained significant after adjustment for chronic stress (model 2) and social network (model 3) (Tables S4 and S5). There were no statistically significant associations between any of the religiosity measures and BMI, cholesterol, or glucose.

Spirituality

Theistic spirituality was associated with increased odds (OR [95% CI]) of achieving intermediate/ideal levels for smoking (1.27 [1.13–1.43]) (model 1, Table S6). Nontheistic spirituality was associated with increased odds of achieving intermediate/ideal levels for PA (1.15 [1.06–1.25]) and smoking (1.38 [1.23–1.55]). Total spirituality (DSES score) was associated with increased odds of achieving intermediate/ideal levels for PA (1.11 [1.02–1.21]) and smoking (1.36 [1.21–1.53]). These associations remained statistically significant after adjustment for chronic stress (model 2) and social network (model 3) (Tables S7 and S8). Although the association between nontheistic spirituality and BP was nonsignificant in model 1 (1.10 [0.99–1.22]), it became significant in model 2 (1.13 [1.01–1.25]) and model 3 (1.12 [1.01–1.25]).

Effect Modification

Post hoc analyses demonstrated effect modification of the associations of specific religiosity/spirituality measures with sex and age (model 1; data not shown). The effect of religiosity/spirituality measures and LS7 components/composite score were modified by sex (religious attendance and LS7 composite score, $P = 0.01$; private prayer and LS7 composite score, $P = 0.006$; theistic spirituality and BMI, $P = 0.03$). In sex-stratified models of religious attendance and LS7 composite score, the OR (95% CI) for achieving intermediate/ideal LS7 composite score was increased among men (1.28 [1.13–1.44]; $P < 0.001$) but not among women (1.05 [0.93–1.19]; $P = 0.43$). Similarly, for private prayer, the odds of achieving intermediate/ideal LS7 composite score were greater among men (1.18 [1.05–1.32]; $P = 0.005$) but not among women (0.93 [0.82–1.07]; $P = 0.30$). A significant interaction was also observed between theistic spirituality and BMI. When sex-specific subgroups were examined, however, neither sex showed a significant association between theistic spirituality and BMI.

The effect of spirituality measures and LS7 components were also modified by age (theistic and PA, $P = 0.02$; theistic and BP, $P = 0.04$; nontheistic and diet, $P = 0.04$; total spirituality and BP, $P = 0.04$). For nontheistic spirituality, the odds (OR [95% CI]) of achieving intermediate/ideal diet were greater among those aged < 55 years (1.17 [1.04–1.31]; $P = 0.009$) but not among those aged ≥ 55 years (0.94 [0.83–1.06]; $P = 0.30$). For total spirituality, the odds of achieving intermediate/

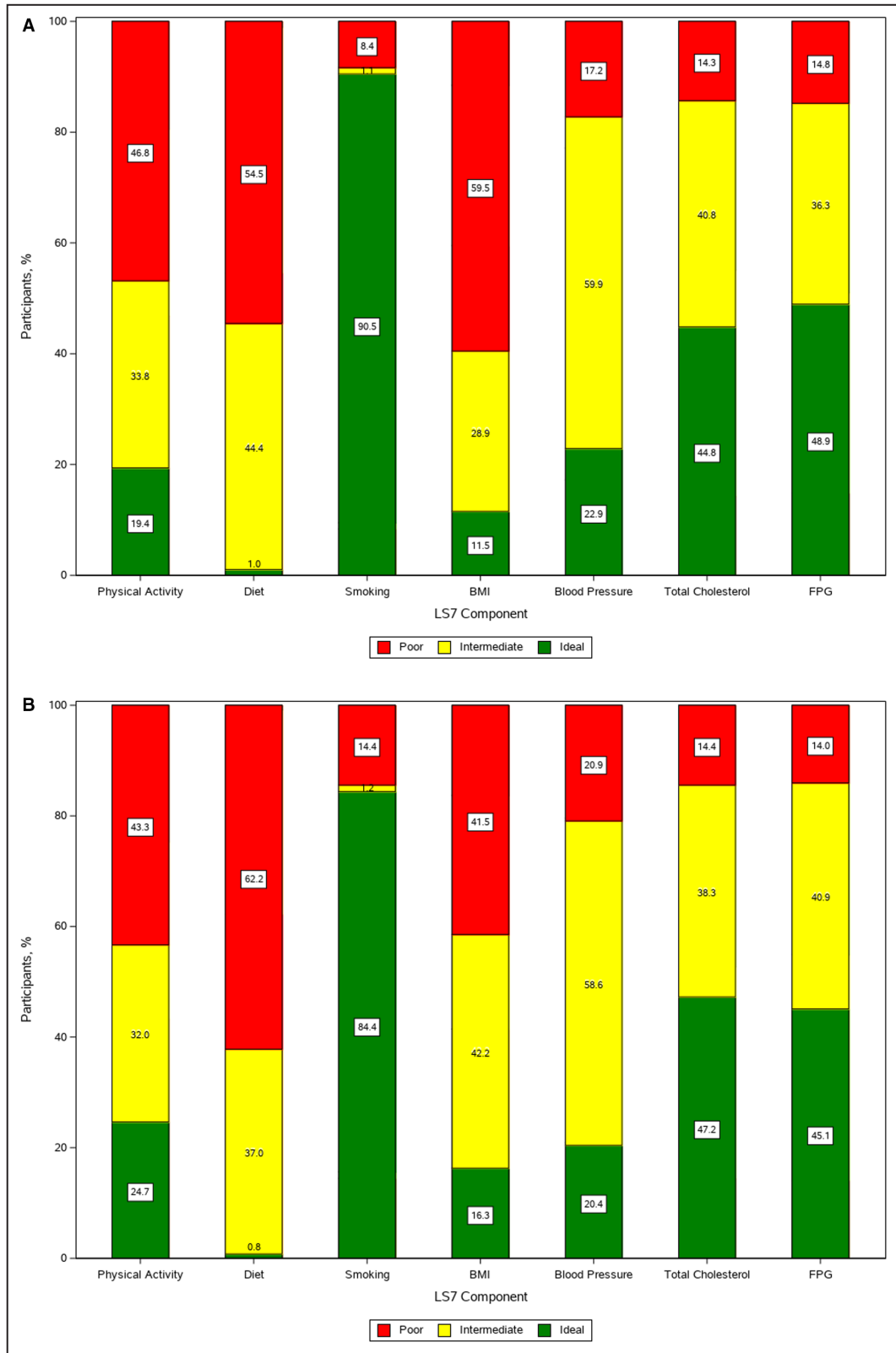


Figure 1. Prevalence of cardiovascular health metrics among Jackson Heart Study participants. Percentage of poor, intermediate, and ideal cardiovascular health behaviors for each component of Life’s Simple 7 (LS7) are shown. **A**, Women. **B**, Men. BMI indicates body mass index; and FPG, fasting plasma glucose.

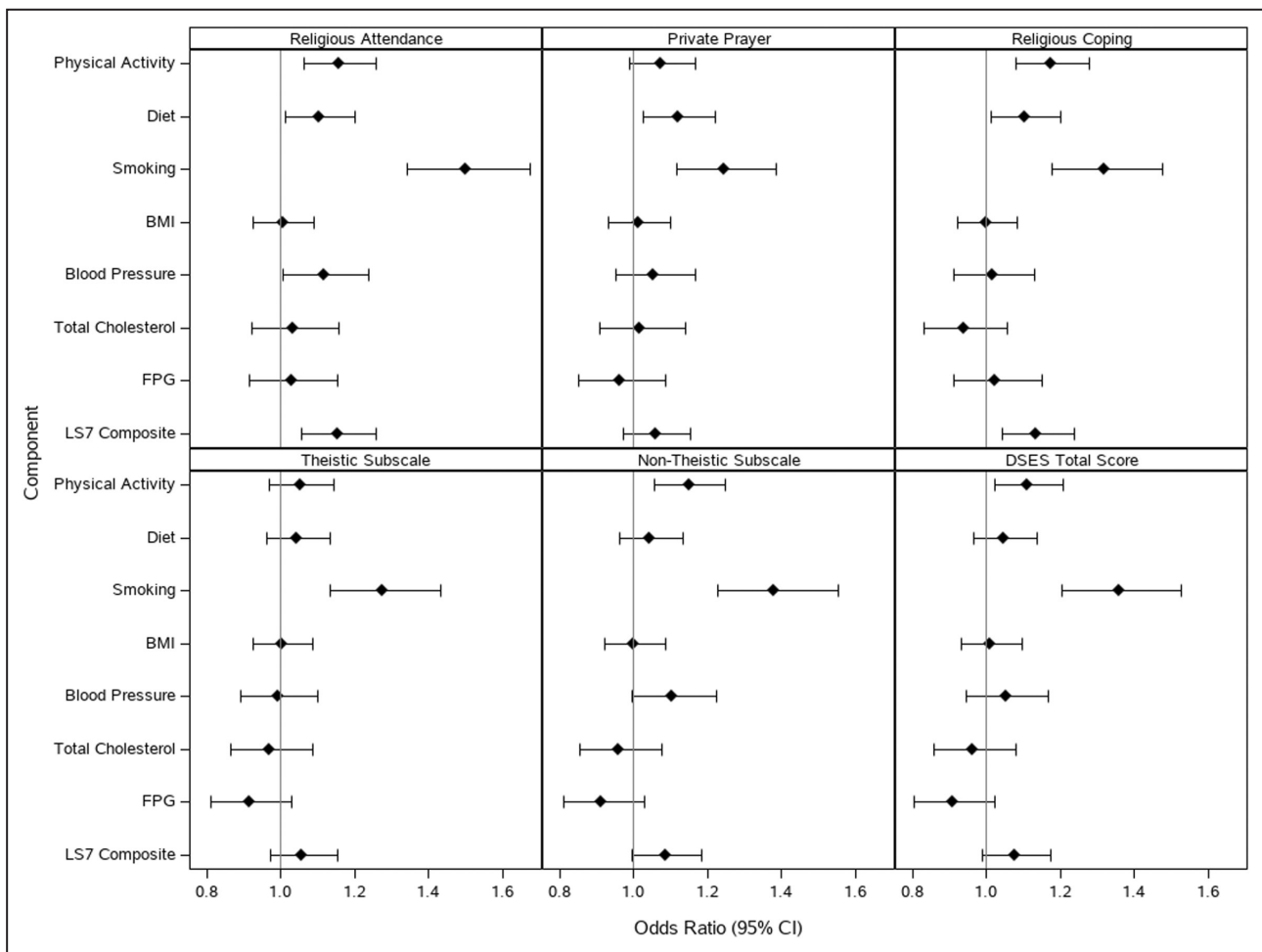


Figure 2. Odds ratios for the association between Life's Simple 7 (LS7) components and religiosity and spirituality measures. Data are shown for model 1: adjusted for age, sex, education, income, and insurance status. Odds ratios of achieving intermediate/ideal levels versus poor levels (reference) of LS7 are displayed. Odds ratios are per 1-SD unit increase in religiosity and spirituality measures. BMI indicates body mass index; DSES, Daily Spiritual Experience Scale; and FPG, fasting plasma glucose.

ideal diet were greater among younger people (<55years) (1.16 [1.03–1.31]; $P=0.01$) but not among older people (≥ 55 years) (0.95 [0.84–1.07]; $P=0.40$).

The interaction terms between each religiosity/spirituality measure and SES, chronic stress, and social network for each LS7 component and LS7 composite score were not statistically significant (data not shown).

DISCUSSION

In this community cohort of AAs, higher levels of religiosity/spirituality were associated with greater likelihood of achieving intermediate/ideal (versus poor) CVH across multiple LS7 indicators. Our findings underscore that religiosity/spirituality is an integral part of the AA experience given the reported high levels of religiosity/spirituality in multiple domains that were associated with CVH behaviors (PA, diet, and smoking), biological factors (BP), and LS7 composite score in our sample. Thus, religiosity/spirituality should be

acknowledged as prominent sociocultural influences on CVH in the lives of this population, rather than as heuristic constructs in need of improvement.

The association between religiosity/spirituality and CVH we report confirms and extends prior research linking religiosity/spirituality and cardiovascular risk factors among AAs. Debnam and colleagues³⁰ identified the role of religious social support in health behaviors such as fruit and vegetable consumption and moderate PA in AAs (N=2370). In the Multi-Ethnic Study of Atherosclerosis cohort (N=5474, 30% AA), there was no consistent association between greater religiosity/spirituality and overall better cardiovascular risk factors.¹³ Although those findings were similar to our study, AA women in that cohort were more likely to report higher levels of religiosity/spirituality, and there was a negative association between religiosity/spirituality and smoking.¹³ In our study, higher religiosity/spirituality was associated with a higher likelihood of achieving intermediate or ideal smoking status (either

quitting or never smoking) across all domains of religiosity/spirituality. This observation may indicate that religiosity/spirituality, as practices or habits of thought, has stronger links or parallels to modifiable CVH behaviors (eg, tobacco use) than to CVH biological factors (eg, cholesterol, glucose). This finding may also reflect underreporting by participants of sinful or morally objectionable health behaviors under religiosity/spirituality doctrine.^{23,31} In concordance with a previous study of JHS participants, religiosity/spirituality was not cross-sectionally related to weight or obesity indicators (ie, BMI) within our analyses.²³ A ceiling effect of high religiosity/spirituality on weight/BMI may exist across the sample as seen in other similar populations of AAs.³² The lack of association between higher religiosity/spirituality and intermediate/ideal BMI may represent an underlying lack of motivation or confidence in ability to lose weight by some individuals or a sequela of traditional culture and environment of some AA churches (ie, high-calorie or high-portion-sized meals at church-based events leading to higher BMI). Given the link between obesity (higher BMI) and related risk factors (dyslipidemia, diabetes),³³ our comparable results for cholesterol and glucose are not of surprise.

Studies have shown inconsistent relationships between religiosity/spirituality and metabolic risk factors such as lipid and glucose levels for AAs specifically.^{13,34} We speculate that the lack of association between religiosity/spirituality and serum markers such as cholesterol and glucose could indicate that more nuanced examinations of further religiosity constructs are necessary beyond those examined in this study. Religious health fatalism or the “belief that health outcomes are inevitable and/or determined by God” may have a deleterious impact on CVH.³⁵ A subscale of this religiosity measurement, helpless inevitability, has been associated with self-reported elevated cholesterol in churchgoing AAs.³⁶ Although challenging to determine directionality, individuals with higher helpless inevitability may have difficulty with health-promoting behaviors to promote cholesterol management. Therefore, it is unclear whether fatalistic beliefs cause certain health outcomes or if fatalistic beliefs occur as a result of poor health, for example. Similar to our study, measures of religious involvement (eg, prayer) lacked significant associations with elevated cholesterol. Glover et al³⁷ demonstrated that religious practices were not associated with prevalent type 2 diabetes among AAs enrolled in the JHS, also suggesting that further inquiry of specific religiosity/spirituality domains is warranted. We caution about overinterpretation of findings related to religiosity/spirituality and indicators of cardiometabolic risk as these are also influenced by the presence of other comorbidities (eg, autoimmune and rheumatologic disorders, etc) and potentially medical treatment (or lack thereof) of hyperlipidemia and type

2 diabetes.^{38,39} However, there is a large proportion of individuals diagnosed with a chronic illness who may also be working diligently toward improving their overall CVH (incorporating fruits/vegetables into their diet and maintaining regular PA), which is supported by our findings.

To our knowledge, this is the first study to investigate the association of a comprehensive set of CVH behaviors and biological factors with religiosity/spirituality among AAs. An intriguing finding in the current study is the relationship between higher levels of religiosity/spirituality and discrete LS7 components traditionally found at suboptimal levels in AAs—PA, diet, and BP.⁴⁰ These results demonstrate that there remains a great deal to learn about the contribution of religiosity/spirituality on CVH in this population. Nonetheless, our study fills a gap in the literature by providing additional evidence that religiosity/spirituality exerts independent, beneficial effects on CVH.

There were noteworthy findings of effect modification of religiosity/spirituality measures by sex and age. The postulated pathway of the demonstrated magnified positive effect of dimensions of religiosity on overall CVH within men could suggest that men disproportionately express their religiosity through action compared with women.⁴¹ Thus, men possibly translated these forms of “religiousness” to overall CVH health-promoting behaviors and factors. The significant effect modification of spirituality measures with diet by age group in this study is a novel finding, as no literature to date has examined this relationship in detail among AAs. This could represent differing manners that younger (versus older) generations reconcile their faith through spirituality (connection to the divine) as identity formation, sense of purpose, and a way of life, which in turn influences their health behaviors.^{42–47}

Our hypothesis was supported by our findings, and there are various explanatory mechanisms by which stronger religiosity/spirituality practices may account for better CVH. One is that religious service attendance may increase people’s exposure to messaging such as sermons and bible studies that integrate health and wellness topics, which in turn influences their health behaviors.⁴⁸ Another proposed mechanism is that intrinsic social support, optimistic orientation, and social services provided by religious institutions may encourage positive health behaviors.^{30,49–51} In addition, higher religiosity/spirituality may encourage health care use for preventive health services both within and outside the church setting, which could lead to better cardiovascular risk factor management.^{52,53} Furthermore, religiosity/spirituality may promote positive self-care practices by enhancing one’s ability to refrain from unhealthy behaviors in accordance with religious doctrine.^{49,54}

Our results convey important implications for CVH promotion among AAs. The high prevalence of religiosity/spirituality among AAs in our study is consistent with prior investigations.⁵⁵ This presents an opportunity to incorporate religiosity/spirituality components into culturally tailored behavioral interventions that are both age and sex appropriate to bolster their effectiveness. Future faith-based lifestyle interventions may consider the adaptation or integration of specific religiosity/spirituality measures (eg, religious attendance, religious coping, and nontheistic spirituality) that appear to exert the most significant effects on several LS7 components (Figure 3). Church pastors can play a major role as allies for intervention implementation within AA churches to promote religious and spiritually infused messages of prevention. Our findings also support the substantial role of AA churches in CVH promotion initiatives toward a goal of CVD prevention in an extremely high-risk group.^{56,57} AA churches have been the cornerstone of health-promotion programming through community-based interventions.^{56,58–62} Our previous research demonstrating improvements in CVH by targeting multiple cardiovascular risk factors through the AHA LS7 framework and AA church-based social networks supports integration of more culturally relevant religiosity/spirituality elements to promote ideal CVH in this population.^{59,63} Also, religiosity/spirituality may impart benefits of social and emotional stability, stress buffering, and optimism during times of crises such as the current global coronavirus disease 2019 pandemic and resurgence of racial turmoil and social unrest, which could foster and facilitate maintenance of CVH.^{50,64,65} Given clear clinical gaps in access to quality health care and health information among socioeconomically disadvantaged populations, particularly AAs, culturally tailored health promotion interventions in partnership with faith-based organizations may serve to assist in fulfilling these unmet needs.⁶⁶

Furthermore, our findings lend support to the recognition of the influence of religiosity/spirituality on CVH by health professionals as a means to attenuate CVH disparities through sociocultural understanding and enhancement of the patient-physician relationship. Health care providers have expressed ethical concerns about coercion or projecting beliefs onto patients and associated time constraints with religiosity/spirituality inquiry.^{67,68} However, there is evidence supporting patients' preference that respectful conversations surrounding religiosity/spirituality spur from comprehensive psychosocial history taking, particularly in routine medical care or screening, rather than solely during end-of-life care discussions.⁶⁷ Understandably, clinicians have limited time in clinical encounters, however studies have demonstrated that assessing religiosity/spirituality as a part of the psychosocial history

does not necessarily lead to longer visits.^{69–71} In fact, the Joint Commission on Accreditation of Healthcare Organizations endorses brief, culturally sensitive spiritual assessments under its behavioral health care standards, which is of particular importance in AAs.^{72,73} Referrals to trained chaplains serve as excellent resources when religiosity/spirituality topics go beyond the competence or comfort level of the clinician.^{67,68} Incorporation of this patient-centered approach maintains patient autonomy to engage in discussions surrounding their religiosity/spirituality beliefs and demonstrates acknowledgement by the health care team of the patient's faith-based practices while upholding the highest standard of ethical medical care.⁶⁸ In addition, our study findings may inform the future development of more culturally relevant tools to better categorize religiosity/spirituality status on public and population health levels to improve CVH outcomes in diverse populations.

Strengths and Limitations

This study has several strengths. The JHS is the largest study of CVD risk factors among AAs. CVH was adjudicated by rigorous methods including standardized data collection protocols by trained personnel and validated questionnaires. Furthermore, our robust assessment of multiple religiosity/spirituality domains allowed us to examine the extent to which unique religiosity/spirituality domains influence CVH. The study also has some limitations. Our cross-sectional design allowed for evaluation of CVH metrics only at baseline; thus, longitudinal changes in LS7 metrics and causal inferences could not be determined. Participants included in this analysis tended to have better CVH than those excluded, which could potentially lead to an underestimation of associations between religiosity/spirituality and CVH metrics.^{74,75} In addition, people with existing CVD were not included, which could provide insights into the influence of religiosity/spirituality on clinical outcomes in this population. Such analysis was beyond the scope of the current investigation because the AHA LS7 framework was principally developed for the prevention of CVD. Finally, because the study was limited to 1 metropolitan area, our findings lack generalizability to AAs in other regions of the United States. Nonetheless, our study enhances our understanding of religiosity/spirituality as a psychosocial asset that influences CVH in a population that experiences substantial disparities in social determinants and health outcomes.

CONCLUSIONS

In this large sample of community-dwelling AAs, those with higher religiosity/spirituality were found to have



Figure 3. Religiosity and spirituality measures and the American Heart Association Life's Simple 7 (LS7) components.

intermediate/ideal CVH across multiple indicators of the AHA LS7, which persisted after multivariable adjustment for sociodemographic factors, chronic stress,

and social network. Recognition and reinforcement of religiosity/spirituality in health care, along with culturally relevant lifestyle interventions (for people or groups

finding such approaches acceptable), may decrease the overall cardiometabolic risk of CVD among AAs, thus mitigating CVH disparities.

ARTICLE INFORMATION

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Disclosures

None.

Supplemental Material

Tables S1–S8

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SUPPLEMENTAL MATERIAL

Table S1. Baseline Characteristics of Jackson Heart Study Participants Stratified by Inclusion vs. Exclusion Status*

| Characteristic | Included (N=2,967) | Excluded (N=2,339) | Absolute Standardized Difference[†] |
|---|---------------------------|---------------------------|---|
| Age, y | 54.0 (12.3) | 57.0 (13.4) | 0.24 |
| Sex | | | 0.11 |
| Female | 1949 (66%) | 1418 (61%) | |
| Male | 1018 (34%) | 921 (39%) | |
| Education | | | |
| Less than high school | 436 (15%) | 670 (29%) | 0.35 |
| High school graduate/GED | 527 (18%) | 439 (19%) | 0.03 |
| Vocational/trade school or college graduate | 2000 (67%) | 1219 (52%) | 0.31 |
| Income Status | | | |
| Poor | 296 (12%) | 406 (21%) | 0.26 |
| Lower-middle | 574 (23%) | 525 (27%) | 0.11 |
| Upper-middle | 818 (32%) | 509 (26%) | 0.13 |
| Affluent | 862 (34%) | 496 (26%) | 0.18 |
| Health Insured | 2583 (87%) | 1989 (86%) | 0.05 |
| Married | 1689 (57%) | 1202 (52%) | 0.11 |

Cardiovascular Risk Factors

| | | | |
|----------------------------|----------------|----------------|------|
| Hypertension | 1554 (52%) | 1442 (62%) | 0.19 |
| Diabetes | 512 (17%) | 656 (29%) | 0.28 |
| Hyperlipidemia | 342 (12%) | 379 (17%) | 0.15 |
| Current Smoker | 310 (10%) | 383 (17%) | 0.18 |
| LS7 Composite Score | 7.3 (2.1) | 6.6 (2.0) | 0.30 |
| Religiosity Measures | | | |
| Religious Attendance | 5.0 (0.9) | 4.9 (1.0) | 0.08 |
| Private Prayer | 7.2 (1.3) | 7.1 (1.3) | 0.04 |
| Religious Coping | 3.6 (0.6) | 3.5 (0.7) | 0.05 |
| Spirituality Measures | | | |
| Theistic Subscale Score | 14.9 (2.5) | 14.8 (2.4) | 0.04 |
| Nontheistic Subscale Score | 14.3 (2.6) | 14.2 (2.6) | 0.03 |
| DSES Total Score | 29.2 (4.7) | 29.1 (4.7) | 0.02 |
| Chronic Stress Score | 4.0 (2.0, 8.0) | 4.0 (1.0, 8.0) | 0.02 |
| Social Network Score | 4.2 (0.8) | 4.1 (0.9) | 0.15 |

* Data are presented as mean (SD), No. of persons (%) or median (Q1, Q3).

† Difference <0.2 was considered a small effect.³⁰

DSES indicates Daily Spiritual Experience Scale; LS7, Life's Simple 7.

Table S2a. Baseline Characteristics of Jackson Heart Study Participants by Religious Attendance*

| Characteristic | Few times/year or | | | | <i>P</i> value |
|---|-------------------|----------------------------|--------------------------------|----------------------------|-------------------|
| | less (N=186) | Few times/month (N=389) | At least once/week (N=1525) | Nearly everyday (N=867) | |
| Age, y | 48.8 (11.3) | 50.5 (11.5) | 54.7 (12.1) | 55.5 (12.5) | <.001 |
| Sex | | | | | <.001 |
| Female | 73 (39%) | 209 (54%) | 1042 (68%) | 625 (72%) | |
| Male | 113 (61%) | 180 (46%) | 483 (32%) | 242 (28%) | |
| Education | | | | | <.001 |
| Less than high school | 26 (14%) | 44 (11%) | 198 (13%) | 168 (19%) | |
| High school graduate/GED | 37 (20%) | 68 (18%) | 247 (16%) | 175 (20%) | |
| Vocational/trade school or college graduate | 123 (66%) | 276 (71%) | 1080 (71%) | 521 (60%) | |
| Income Status | | | | | 0.002 |
| Poor | 24 (15%) | 43 (13%) | 135 (10%) | 94 (13%) | |
| Lower-middle | 34 (22%) | 71 (21%) | 285 (21%) | 184 (25%) | |
| Upper-middle | 43 (27%) | 99 (29%) | 426 (32%) | 250 (35%) | |
| Affluent | 57 (36%) | 125 (37%) | 484 (36%) | 196 (27%) | |
| Health Insured | 143 (78%) | 335 (86%) | 1361 (89%) | 744 (86%) | <.001 |
| Married | 93 (50%) | 207 (53%) | 875 (57%) | 514 (59%) | 0.045 |

| | | | | | |
|-----------------------------|----------------|----------------|----------------|----------------|-------|
| Cardiovascular risk factors | | | | | |
| Hypertension | 79 (42%) | 191 (49%) | 812 (53%) | 472 (54%) | 0.012 |
| Diabetes | 34 (18%) | 59 (15%) | 250 (16%) | 169 (19%) | 0.16 |
| Hyperlipidemia | 20 (11%) | 42 (11%) | 174 (11%) | 106 (12%) | 0.86 |
| Current smoker | 48 (26%) | 71 (18%) | 137 (9%) | 54 (6%) | <.001 |
| LS7 composite score | 6.9 (2.2) | 7.2 (2.2) | 7.3 (2.0) | 7.3 (2.1) | 0.17 |
| Religiosity measures | | | | | |
| Private prayer | 5.6 (2.2) | 6.6 (1.5) | 7.3 (1.0) | 7.7 (0.7) | <.001 |
| Religious coping | 3.0 (0.9) | 3.3 (0.7) | 3.6 (0.6) | 3.8 (0.5) | <.001 |
| Spirituality measures | | | | | |
| Theistic subscale score | 12.8 (3.3) | 13.8 (2.9) | 15.0 (2.2) | 15.6 (2.0) | <.001 |
| Nontheistic subscale score | 11.9 (3.3) | 13.1 (2.8) | 14.4 (2.4) | 15.0 (2.3) | <.001 |
| DSES total score | 24.7 (6.1) | 26.9 (5.3) | 29.5 (4.2) | 30.7 (4.0) | <.001 |
| Chronic stress score | 5.0 (3.0, 8.0) | 5.0 (2.0, 9.0) | 4.0 (2.0, 7.0) | 4.0 (1.5, 8.0) | 0.009 |
| Social network score | 3.6 (1.1) | 4.1 (0.8) | 4.3 (0.8) | 4.3 (0.8) | <.001 |

* Data are presented as mean (SD), No. of persons (%) or median (Q1, Q3).

Table S2b. Baseline Characteristics of Jackson Heart Study Participants by Private Prayer*

| Characteristic | Once/week or less | Few times/week | Once/day | More than once/day | <i>P</i> value |
|---|-------------------|----------------|-------------|-----------------------|-------------------|
| | (N=219) | (N=328) | (N=754) | (N=1666) | |
| Age, y | 51.7 (11.9) | 51.4 (11.8) | 53.7 (12.2) | 55.0 (12.3) | <.001 |
| Sex | | | | | <.001 |
| Female | 98 (45%) | 173 (53%) | 453 (60%) | 1225 (74%) | |
| Male | 121 (55%) | 155 (47%) | 301 (40%) | 441 (26%) | |
| Education | | | | | 0.007 |
| Less than high school | 38 (17%) | 32 (10%) | 108 (14%) | 258 (16%) | |
| High school graduate/GED | 35 (16%) | 44 (13%) | 133 (18%) | 315 (19%) | |
| Vocational/trade school or college graduate | 145 (67%) | 252 (77%) | 513 (68%) | 1090 (66%) | |
| Income Status | | | | | <.001 |
| Poor | 32 (17%) | 27 (9%) | 74 (11%) | 163 (12%) | |
| Lower-middle | 37 (20%) | 54 (19%) | 142 (21%) | 341 (24%) | |
| Upper-middle | 52 (28%) | 84 (29%) | 200 (30%) | 482 (34%) | |
| Affluent | 67 (36%) | 122 (43%) | 251 (38%) | 422 (30%) | |
| Health Insured | 182 (83%) | 277 (85%) | 671 (89%) | 1453 (87%) | 0.09 |
| Married | 126 (58%) | 198 (61%) | 433 (58%) | 932 (56%) | 0.47 |

| | | | | | |
|-----------------------------|----------------|----------------|----------------|----------------|-------|
| Cardiovascular risk factors | | | | | |
| Hypertension | 104 (47%) | 147 (45%) | 388 (51%) | 915 (55%) | 0.003 |
| Diabetes | 38 (17%) | 45 (14%) | 119 (16%) | 310 (19%) | 0.10 |
| Hyperlipidemia | 23 (11%) | 28 (9%) | 86 (11%) | 205 (12%) | 0.25 |
| Current smoker | 43 (20%) | 50 (15%) | 80 (11%) | 137 (8%) | <.001 |
| LS7 composite score | 6.9 (2.0) | 7.2 (2.1) | 7.3 (2.1) | 7.3 (2.0) | 0.17 |
| Religiosity measures | | | | | |
| Religious attendance | 4.0 (1.3) | 4.6 (0.9) | 4.9 (0.8) | 5.3 (0.8) | <.001 |
| Religious coping | 3.0 (0.8) | 3.3 (0.7) | 3.5 (0.6) | 3.7 (0.6) | <.001 |
| Spirituality measures | | | | | |
| Theistic subscale score | 12.3 (3.5) | 13.6 (2.7) | 14.5 (2.2) | 15.7 (1.9) | <.001 |
| Nontheistic subscale score | 11.8 (3.4) | 13.1 (2.6) | 13.9 (2.4) | 15.0 (2.2) | <.001 |
| DSES total score | 24.2 (6.2) | 26.8 (4.9) | 28.4 (4.3) | 30.7 (3.8) | <.001 |
| Chronic stress score | 4.0 (2.0, 8.0) | 5.0 (2.0, 9.0) | 4.0 (2.0, 8.0) | 4.0 (2.0, 8.0) | 0.10 |
| Social network score | 4.0 (1.0) | 4.2 (0.8) | 4.2 (0.8) | 4.3 (0.8) | <.001 |

* Data are presented as mean (SD), No. of persons (%) or median (Q1, Q3).

Table S2c. Baseline Characteristics of Jackson Heart Study Participants by Religious Coping*

| Characteristic | Somewhat | | | | <i>P</i> value |
|---|-------------------------------|------------------------------|---------------------|---------------------------|-------------------|
| | Not involved at all (N=42) | Not very involved (N=122) | involved (N=858) | Very involved (N=1892) | |
| Age, y | 51.9 (10.4) | 51.2 (12.6) | 52.6 (12.3) | 54.7 (12.2) | <.001 |
| Sex | | | | | <.001 |
| Female | 20 (48%) | 60 (49%) | 533 (62%) | 1300 (69%) | |
| Male | 22 (52%) | 62 (51%) | 325 (38%) | 592 (31%) | |
| Education | | | | | 0.05 |
| Less than high school | 11 (26%) | 20 (16%) | 132 (15%) | 259 (14%) | |
| High school graduate/GED | 5 (12%) | 30 (25%) | 155 (18%) | 324 (17%) | |
| Vocational/trade school or college graduate | 26 (62%) | 72 (59%) | 569 (66%) | 1307 (69%) | |
| Income Status | | | | | 0.002 |
| Poor | 3 (9%) | 13 (12%) | 110 (15%) | 167 (10%) | |
| Lower-middle | 15 (47%) | 25 (23%) | 177 (24%) | 346 (21%) | |
| Upper-middle | 6 (19%) | 30 (28%) | 222 (30%) | 545 (34%) | |
| Affluent | 8 (25%) | 41 (38%) | 235 (32%) | 567 (35%) | |
| Health Insured | 30 (71%) | 100 (83%) | 729 (85%) | 1678 (89%) | <.001 |
| Married | 24 (57%) | 64 (52%) | 481 (56%) | 1089 (58%) | 0.66 |

| | | | | | |
|-----------------------------|----------------|----------------|----------------|----------------|-------|
| Cardiovascular risk factors | | | | | |
| Hypertension | 25 (60%) | 65 (53%) | 433 (50%) | 993 (52%) | 0.57 |
| Diabetes | 8 (19%) | 21 (17%) | 145 (17%) | 324 (17%) | 0.99 |
| Hyperlipidemia | 2 (5%) | 16 (13%) | 105 (12%) | 213 (11%) | 0.43 |
| Current smoker | 10 (24%) | 25 (20%) | 111 (13%) | 157 (8%) | <.001 |
| LS7 composite score | 6.8 (1.7) | 6.9 (2.1) | 7.1 (2.0) | 7.4 (2.1) | 0.002 |
| Religiosity measures | | | | | |
| Religious attendance | 4.3 (1.7) | 4.2 (1.2) | 4.7 (1.0) | 5.2 (0.8) | <.001 |
| Private prayer | 6.0 (2.5) | 6.0 (2.0) | 6.8 (1.5) | 7.5 (0.9) | <.001 |
| Spirituality measures | | | | | |
| Theistic subscale score | 13.0 (4.1) | 12.4 (3.3) | 13.9 (2.6) | 15.6 (1.9) | <.001 |
| Nontheistic subscale score | 11.5 (4.0) | 11.3 (3.2) | 12.9 (2.6) | 15.1 (2.1) | <.001 |
| DSES total score | 24.4 (7.8) | 23.7 (6.0) | 26.8 (4.7) | 30.7 (3.7) | <.001 |
| Chronic stress score | 3.5 (1.0, 7.0) | 5.0 (1.0, 8.0) | 4.0 (2.0, 8.0) | 4.0 (2.0, 8.0) | 0.11 |
| Social network score | 4.0 (0.8) | 3.9 (1.1) | 4.2 (0.9) | 4.3 (0.8) | <.001 |

* Data are presented as mean (SD), No. of persons (%) or median (Q1, Q3).

Table S2d. Baseline Characteristics of Jackson Heart Study Participants by Theistic Subscale Score*

| Characteristic | Theistic Score | | | Theistic Score 17- | <i>P</i> value |
|---|--------------------------------|-------------------|------------------------------|--------------------|-------------------|
| | Theistic Score 3-13 (N=665) | 14-15 (N=1039) | Theistic Score 16 (N=448) | 18 (N=815) | |
| Age, y | 52.1 (12.0) | 54.2 (12.0) | 55.5 (12.4) | 54.4 (12.6) | <.001 |
| Sex | | | | | <.001 |
| Female | 357 (54%) | 675 (65%) | 323 (72%) | 594 (73%) | |
| Male | 308 (46%) | 364 (35%) | 125 (28%) | 221 (27%) | |
| Education | | | | | 0.006 |
| Less than high school | 80 (12%) | 164 (16%) | 63 (14%) | 129 (16%) | |
| High school graduate/GED | 118 (18%) | 193 (19%) | 99 (22%) | 117 (14%) | |
| Vocational/trade school or college graduate | 466 (70%) | 681 (66%) | 285 (64%) | 568 (70%) | |
| Income Status | | | | | 0.020 |
| Poor | 63 (11%) | 109 (12%) | 48 (13%) | 76 (11%) | |
| Lower-middle | 120 (21%) | 210 (24%) | 106 (28%) | 138 (20%) | |
| Upper-middle | 178 (31%) | 277 (31%) | 121 (32%) | 242 (34%) | |
| Affluent | 221 (38%) | 289 (33%) | 106 (28%) | 246 (35%) | |
| Health Insured | 574 (87%) | 901 (87%) | 388 (87%) | 720 (88%) | 0.70 |
| Married | 385 (58%) | 606 (59%) | 242 (54%) | 456 (56%) | 0.37 |

| | | | | | |
|-----------------------------|----------------|----------------|----------------|----------------|-------|
| Cardiovascular risk factors | | | | | |
| Hypertension | 314 (47%) | 555 (53%) | 248 (55%) | 437 (54%) | 0.022 |
| Diabetes | 98 (15%) | 188 (18%) | 84 (19%) | 142 (17%) | 0.24 |
| Hyperlipidemia | 62 (9%) | 137 (13%) | 56 (13%) | 87 (11%) | 0.07 |
| Current smoker | 98 (15%) | 110 (11%) | 39 (9%) | 63 (8%) | <.001 |
| LS7 composite score | 7.2 (2.0) | 7.2 (2.1) | 7.2 (2.1) | 7.4 (2.0) | 0.43 |
| Religiosity measures | | | | | |
| Religious attendance | 4.5 (1.1) | 5.1 (0.8) | 5.1 (0.7) | 5.2 (0.8) | <.001 |
| Private prayer | 6.4 (1.8) | 7.2 (1.1) | 7.6 (0.8) | 7.6 (0.8) | <.001 |
| Religious coping | 3.2 (0.7) | 3.6 (0.6) | 3.7 (0.6) | 3.8 (0.5) | <.001 |
| Spirituality measures | | | | | |
| Nontheistic subscale score | 11.5 (2.6) | 14.1 (1.7) | 14.9 (1.6) | 16.4 (1.7) | <.001 |
| DSES total score | 22.7 (3.9) | 28.8 (1.9) | 30.9 (1.6) | 34.0 (2.0) | <.001 |
| Chronic stress score | 5.0 (2.0, 8.0) | 4.0 (2.0, 8.0) | 4.0 (1.0, 8.0) | 4.0 (1.0, 7.0) | 0.033 |
| Social network score | 4.2 (0.9) | 4.3 (0.8) | 4.3 (0.8) | 4.2 (0.8) | 0.020 |

* Data are presented as mean (SD), No. of persons (%) or median (Q1, Q3).

S2e. Baseline Characteristics of Jackson Heart Study Participants by Nontheistic Subscale Score*

| Characteristic | Nontheistic Score | Nontheistic Score | Nontheistic Score | Nontheistic Score | <i>P</i> value |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|
| | 3-12 (N=637) | 13-14 (N=697) | 15 (N=702) | 16-18 (N=931) | |
| Age, y | 51.2 (12.1) | 52.8 (12.0) | 55.7 (12.0) | 55.6 (12.3) | <.001 |
| Sex | | | | | <.001 |
| Female | 367 (58%) | 446 (64%) | 470 (67%) | 666 (72%) | |
| Male | 270 (42%) | 251 (36%) | 232 (33%) | 265 (28%) | |
| Education | | | | | 0.016 |
| Less than high school | 103 (16%) | 75 (11%) | 124 (18%) | 134 (14%) | |
| High school graduate/GED | 105 (17%) | 134 (19%) | 125 (18%) | 163 (18%) | |
| Vocational/trade school or college graduate | 428 (67%) | 488 (70%) | 452 (64%) | 632 (68%) | |
| Income Status | | | | | 0.20 |
| Poor | 76 (14%) | 70 (12%) | 78 (13%) | 72 (9%) | |
| Lower-middle | 127 (23%) | 140 (23%) | 132 (22%) | 175 (22%) | |
| Upper-middle | 166 (30%) | 193 (32%) | 196 (33%) | 263 (33%) | |
| Affluent | 189 (34%) | 196 (33%) | 186 (31%) | 291 (36%) | |
| Health Insured | 536 (84%) | 609 (88%) | 621 (89%) | 817 (88%) | 0.09 |
| Married | 364 (57%) | 382 (55%) | 415 (59%) | 528 (57%) | 0.48 |

| | | | | | |
|-----------------------------|----------------|----------------|----------------|----------------|-------|
| Cardiovascular risk factors | | | | | |
| Hypertension | 299 (47%) | 364 (52%) | 379 (54%) | 512 (55%) | 0.013 |
| Diabetes | 101 (16%) | 102 (15%) | 143 (20%) | 166 (18%) | 0.027 |
| Hyperlipidemia | 64 (10%) | 72 (10%) | 87 (12%) | 119 (13%) | 0.23 |
| Current smoker | 102 (16%) | 84 (12%) | 65 (9%) | 59 (6%) | <.001 |
| LS7 composite score | 7.1 (2.0) | 7.2 (2.1) | 7.2 (2.2) | 7.4 (2.0) | 0.07 |
| Religiosity measures | | | | | |
| Religious attendance | 4.6 (1.1) | 4.9 (0.9) | 5.1 (0.8) | 5.3 (0.7) | <.001 |
| Private prayer | 6.5 (1.7) | 7.1 (1.2) | 7.4 (1.0) | 7.6 (0.9) | <.001 |
| Religious coping | 3.1 (0.7) | 3.5 (0.6) | 3.7 (0.5) | 3.8 (0.5) | <.001 |
| Spirituality measures | | | | | |
| Theistic subscale score | 12.2 (2.7) | 14.5 (1.7) | 15.2 (1.4) | 16.8 (1.5) | <.001 |
| DSES total score | 22.6 (4.0) | 28.1 (1.8) | 30.2 (1.4) | 33.8 (2.0) | <.001 |
| Chronic stress score | 5.0 (3.0, 9.0) | 5.0 (2.0, 8.0) | 4.0 (1.0, 7.0) | 4.0 (1.0, 7.0) | <.001 |
| Social network score | 4.1 (1.0) | 4.2 (0.8) | 4.3 (0.8) | 4.3 (0.7) | <.001 |

* Data are presented as mean (SD), No. of persons (%) or median (Q1, Q3).

Table S3. Logistic Regression Model Summary for Intermediate/Ideal (vs. Poor) Life's Simple 7 Components and Religiosity Measures: Model 1*

| Component | Odds Ratio (95% CI) ^{†,‡} | | |
|-------------------|-------------------------------------|-------------------------------|---------------------------------|
| | Religious Attendance OR (95% CI) | Private Prayer OR (95% CI) | Religious Coping OR (95% CI) |
| Physical Activity | 1.156 (1.062, 1.259) | 1.073 (0.987, 1.167) | 1.175 (1.080, 1.278) |
| Diet | 1.101 (1.011, 1.200) | 1.119 (1.026, 1.220) | 1.103 (1.013, 1.200) |
| Smoking | 1.499 (1.342, 1.675) | 1.244 (1.117, 1.386) | 1.318 (1.176, 1.477) |
| BMI | 1.004 (0.925, 1.091) | 1.012 (0.932, 1.099) | 1.009 (0.930, 1.096) |
| Blood Pressure | 1.115 (1.005, 1.237) | 1.053 (0.950, 1.168) | 1.014 (0.912, 1.128) |
| Total Cholesterol | 1.033 (0.921, 1.158) | 1.016 (0.906, 1.139) | 0.937 (0.832, 1.056) |
| FPG | 1.028 (0.915, 1.155) | 0.961 (0.851, 1.085) | 1.023 (0.911, 1.149) |
| LS7 Composite | 1.153 (1.057, 1.257) | 1.058 (0.971, 1.153) | 1.135 (1.041, 1.237) |

BMI, body mass index; FPG, fasting plasma glucose; LS7, Life's Simple 7.

* Model 1: adjusted for age, sex, education, income, and insurance status.

† Odds ratios of achieving intermediate/ideal levels vs. poor levels (reference) of LS7. Odds ratios are per 1-SD unit increase in religiosity measure.

‡ Bold indicates statistical significance ($P < .05$).

Table S4. Logistic Regression Model Summary for Intermediate/Ideal (vs. Poor) Life's Simple 7 Components and Religiosity Measures: Model 2*

| Component | Odds Ratio (95% CI) ^{†,‡} | | |
|-------------------|-------------------------------------|-------------------------------|---------------------------------|
| | Religious Attendance OR (95% CI) | Private Prayer OR (95% CI) | Religious Coping OR (95% CI) |
| Physical Activity | 1.160 (1.066, 1.263) | 1.074 (0.988, 1.167) | 1.172 (1.077, 1.275) |
| Diet | 1.108 (1.017, 1.208) | 1.116 (1.023, 1.216) | 1.097 (1.008, 1.195) |
| Smoking | 1.502 (1.344, 1.679) | 1.244 (1.117, 1.386) | 1.314 (1.172, 1.473) |
| BMI | 1.007 (0.927, 1.094) | 1.012 (0.932, 1.099) | 1.006 (0.927, 1.093) |
| Blood Pressure | 1.119 (1.008, 1.241) | 1.056 (0.952, 1.170) | 1.019 (0.916, 1.134) |
| Total Cholesterol | 1.027 (0.915, 1.153) | 1.016 (0.906, 1.140) | 0.943 (0.837, 1.063) |
| FPG | 1.031 (0.917, 1.158) | 0.964 (0.854, 1.089) | 1.023 (0.910, 1.150) |
| LS7 Composite | 1.157 (1.061, 1.262) | 1.058 (0.971, 1.154) | 1.133 (1.039, 1.235) |

BMI, body mass index; FPG, fasting plasma glucose; LS7, Life's Simple 7.

* Model 2: adjusted for age, sex, education, income, insurance status, and chronic stress.

† Odds ratios of achieving intermediate/ideal levels vs. poor levels (reference) of LS7. Odds ratios are per 1-SD unit increase in religiosity measure.

‡ Bold indicates statistical significance ($P < .05$).

Table S5. Logistic Regression Model Summary for Intermediate/Ideal (vs. Poor) Life's Simple 7 Components and Religiosity Measures: Model 3*

| Component | Odds Ratio (95% CI) ^{†,‡} | | |
|-------------------|-------------------------------------|-------------------------------|---------------------------------|
| | Religious Attendance OR (95% CI) | Private Prayer OR (95% CI) | Religious Coping OR (95% CI) |
| Physical Activity | 1.161 (1.064, 1.266) | 1.067 (0.981, 1.161) | 1.173 (1.078, 1.277) |
| Diet | 1.125 (1.031, 1.229) | 1.121 (1.027, 1.223) | 1.101 (1.010, 1.200) |
| Smoking | 1.452 (1.295, 1.627) | 1.213 (1.087, 1.355) | 1.289 (1.148, 1.448) |
| BMI | 1.005 (0.923, 1.094) | 1.007 (0.926, 1.094) | 1.007 (0.927, 1.094) |
| Blood Pressure | 1.118 (1.006, 1.244) | 1.060 (0.956, 1.176) | 1.016 (0.912, 1.132) |
| Total Cholesterol | 1.021 (0.908, 1.149) | 1.011 (0.901, 1.136) | 0.940 (0.833, 1.060) |
| FPG | 1.017 (0.903, 1.146) | 0.959 (0.848, 1.085) | 1.017 (0.903, 1.144) |
| LS7 Composite | 1.134 (1.038, 1.239) | 1.044 (0.956, 1.139) | 1.119 (1.026, 1.221) |

BMI, body mass index; FPG, fasting plasma glucose; LS7, Life's Simple 7.

* Model 3: adjusted for age, sex, education, income, insurance status, chronic stress, and social network.

† Odds ratios of achieving intermediate/ideal levels vs. poor levels (reference) of LS7. Odds ratios are per 1-SD unit increase in religiosity measure.

‡ Bold indicates statistical significance ($P < .05$).

Table S6. Logistic Regression Model Summary for Intermediate/Ideal (vs. Poor) Life's Simple 7 Components and Spirituality Measures: Model 1*

| Component | Odds Ratio (95% CI) ^{†,‡} | | |
|-------------------|------------------------------------|----------------------------------|------------------------------|
| | Theistic Subscale OR (95% CI) | Nontheistic Subscale OR (95% CI) | DSES Total Score OR (95% CI) |
| Physical Activity | 1.053 (0.970, 1.144) | 1.149 (1.057, 1.249) | 1.110 (1.021, 1.206) |
| Diet | 1.043 (0.961, 1.133) | 1.044 (0.961, 1.134) | 1.047 (0.964, 1.138) |
| Smoking | 1.274 (1.132, 1.434) | 1.380 (1.226, 1.554) | 1.357 (1.205, 1.528) |
| BMI | 0.999 (0.921, 1.083) | 1.001 (0.923, 1.086) | 1.000 (0.922, 1.085) |
| Blood Pressure | 0.991 (0.892, 1.101) | 1.103 (0.994, 1.225) | 1.051 (0.946, 1.167) |
| Total Cholesterol | 0.970 (0.864, 1.088) | 0.960 (0.855, 1.077) | 0.962 (0.857, 1.079) |
| FPG | 0.914 (0.811, 1.029) | 0.913 (0.811, 1.027) | 0.906 (0.805, 1.021) |
| LS7 Composite | 1.057 (0.971, 1.152) | 1.084 (0.995, 1.182) | 1.077 (0.988, 1.174) |

BMI, body mass index; DSES, Daily Spiritual Experience Scale; FPG, fasting plasma glucose; LS7, Life's Simple 7.

* Model 1: adjusted for age, sex, education, income, and insurance status.

[†] Odds ratios of achieving intermediate/ideal levels vs. poor levels (reference) of LS7. Odds ratios are per 1-SD unit increase in spirituality measure.

[‡] Bold indicates statistical significance ($P < .05$).

Table S7. Logistic Regression Model Summary for Intermediate/Ideal (vs. Poor) Life's Simple 7 Components and Spirituality Measures: Model 2*

| Component | Odds Ratio (95% CI) ^{†,‡} | | |
|-------------------|------------------------------------|----------------------------------|------------------------------|
| | Theistic Subscale OR (95% CI) | Nontheistic Subscale OR (95% CI) | DSES Total Score OR (95% CI) |
| Physical Activity | 1.051 (0.968, 1.142) | 1.152 (1.059, 1.254) | 1.110 (1.021, 1.207) |
| Diet | 1.037 (0.955, 1.127) | 1.036 (0.952, 1.127) | 1.040 (0.956, 1.130) |
| Smoking | 1.259 (1.119, 1.417) | 1.350 (1.198, 1.522) | 1.332 (1.182, 1.500) |
| BMI | 0.994 (0.916, 1.078) | 0.997 (0.918, 1.082) | 0.995 (0.917, 1.080) |
| Blood Pressure | 0.996 (0.896, 1.107) | 1.125 (1.012, 1.250) | 1.064 (0.958, 1.183) |
| Total Cholesterol | 0.982 (0.875, 1.102) | 0.970 (0.863, 1.091) | 0.974 (0.867, 1.094) |
| FPG | 0.912 (0.809, 1.028) | 0.907 (0.805, 1.023) | 0.903 (0.801, 1.018) |
| LS7 Composite | 1.056 (0.969, 1.151) | 1.085 (0.995, 1.184) | 1.077 (0.988, 1.174) |

BMI, body mass index; DSES, Daily Spiritual Experience Scale; FPG, fasting plasma glucose; LS7, Life's Simple 7.

* Model 2: adjusted for age, sex, education, income, insurance status, and chronic stress.

† Odds ratios of achieving intermediate/ideal levels vs. poor levels (reference) of LS7. Odds ratios are per 1-SD unit increase in spirituality measure.

‡ Bold indicates statistical significance ($P < .05$).

Table S8. Logistic Regression Model Summary for Intermediate/Ideal (vs. Poor) Life's Simple 7 Components and Spirituality Measures: Model 3*

| Component | Odds Ratio (95% CI) ^{†,‡} | | |
|-------------------|------------------------------------|----------------------------------|------------------------------|
| | Theistic Subscale OR (95% CI) | Nontheistic Subscale OR (95% CI) | DSES Total Score OR (95% CI) |
| Physical Activity | 1.042 (0.959, 1.133) | 1.147 (1.053, 1.249) | 1.102 (1.013, 1.199) |
| Diet | 1.038 (0.955, 1.128) | 1.039 (0.954, 1.130) | 1.041 (0.957, 1.133) |
| Smoking | 1.224 (1.086, 1.379) | 1.312 (1.162, 1.480) | 1.292 (1.145, 1.457) |
| BMI | 0.995 (0.917, 1.079) | 0.997 (0.917, 1.083) | 0.995 (0.917, 1.081) |
| Blood Pressure | 0.983 (0.884, 1.093) | 1.120 (1.007, 1.246) | 1.055 (0.949, 1.173) |
| Total Cholesterol | 0.979 (0.872, 1.099) | 0.966 (0.859, 1.086) | 0.970 (0.863, 1.090) |
| FPG | 0.910 (0.807, 1.026) | 0.903 (0.801, 1.020) | 0.900 (0.797, 1.015) |
| LS7 Composite | 1.043 (0.956, 1.137) | 1.071 (0.981, 1.169) | 1.062 (0.973, 1.159) |

BMI, body mass index; DSES, Daily Spiritual Experience Scale; FPG, fasting plasma glucose; LS7, Life's Simple 7.

* Model 3: adjusted for age, sex, education, income, insurance status, chronic stress, and social network.

† Odds ratios of achieving intermediate/ideal levels vs. poor levels (reference) of LS7. Odds ratios are per 1-SD unit increase in spirituality measure.

‡ Bold indicates statistical significance ($P < .05$).