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Associations of Psychological Well-Being with Carotid Intima Media Thickness in African American and White Middle-Aged Women

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Abstract

Objective—The present cross-sectional study aimed to: (1) examine associations between measures of psychological well-being, specifically life satisfaction and life engagement, and intima media thickness, a subclinical marker of atherosclerosis; (2) investigate if the interaction of psychological well-being and life events correlated with intima media thickness; and (3) explore these relationships across race.

Methods—A sample of 485 women (38% African American and 62% white; mean (SD) age = 50.2 (2.9)) underwent ultrasonography to assess carotid artery intima media thickness (IMT). The women completed self-report measures of life satisfaction, life engagement, and life events.

Results—Average (SD) IMT was 0.666 (0.10) mm. Life satisfaction showed a significant, independent, inverse relationship with IMT, after controlling for demographic, behavioral, psychological, and cardiovascular covariates ($\beta = -.105$, $p = .039$), such that each 1-point higher life satisfaction score was correlated with a significant 0.008 mm lower level of mean IMT. No significant association was seen between life events and IMT ($r = 0.05$, $p = .32$), and life

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satisfaction did not interact with life events on IMT (β = −.036, p = .46). No significant interaction between life satisfaction and race on IMT was observed (β = .068, p = .37). In contrast to life satisfaction, life engagement was not a significant correlate of IMT (r = −.07, p = .12).

Conclusions—Life satisfaction, a measure of psychological well-being, is an important independent correlate of subclinical atherosclerosis in middle-aged women.

Keywords

psychological well-being; life satisfaction; intima media thickness; atherosclerosis; women; race

INTRODUCTION

Intima media thickness (IMT) of the carotid arteries is a known marker of subclinical atherosclerotic disease, after multiple studies confirmed its association with higher risk for coronary heart disease (1), myocardial infarction (2–7), stroke (2,6), and cardiovascular mortality (5,8). Population-based, prospective studies, including the Atherosclerosis Risk in Communities (ARIC) Study and the Cardiovascular Health Study (CHS), have shown that carotid IMT is an independent predictor of coronary artery disease and cardiovascular events (3,4,6,9). Greater carotid IMT values have also been linked to cardiovascular risk factors, including smoking (1,10–12), male gender (1,13), aging (1,13–15), African American ethnicity (16,17), higher blood pressure (1,10,12,13), elevated low density lipoprotein cholesterol (1,10,12,14), elevated trigylcerides (10), and increased body mass index (BMI) (1,13).

Studies have found significant relationships between psychosocial factors and IMT. Specifically, higher IMT scores have been significantly correlated with greater psychological distress including greater hopelessness (18–20), hostility and cynical distrust (19,21–23), anger suppression (21,22), trait anger (24–26), depressive symptoms (27–29), feelings of discontent (30), sustained anxiety (31), general occupational stress (32), job strain (33,34), high job demand (35), and irritability in adults with low childhood SES (36). Overall, measures of psychosocial distress have been demonstrated to be significantly elevated with increased IMT and in certain studies, have been predictive of progression of IMT over multiple years (18,19,21,25,28,30,31).

While negative psychosocial factors have been shown to be higher in those with greater IMT, constructs capturing psychological well-being have been inversely associated with IMT in a small number of studies. In the Pittsburgh Healthy Women Study of midlife women, those who were more optimistic showed less progression of IMT over 3 years, after controlling for biological, behavioral, and medication covariates (37). Similarly, postmenopausal women in the Pittsburgh Healthy Women Study who reported greater marital satisfaction showed slower 3-year IMT progression than women with low levels of marital satisfaction (38), and a similar inverse correlation between positive marital interactions and IMT was recently shown in a study of healthy middle-aged cohabitating or married partners (39). Relationships between protective psychosocial factors and IMT as a marker of atherosclerosis may be promising but need further exploration.

Differences in the association of psychosocial factors and IMT across race are less established, though some studies have shown differential associations. Anger has been shown to be associated with greater IMT in one multiethnic study of men and women, with the association being more robust in whites (24). In contrast, trait anger has been associated with greater IMT in African American men in a second study (26). In a sample of African American and white women enrolled in the Study of Women's Health across the Nation (SWAN) Pittsburgh site, higher levels of IMT have been directly associated with chronic stress and unfair treatment among African American women only (40). Studies of psychological well-being and IMT have mostly been conducted on white men and women, though one study of 60 African Americans assessed the impact of a transcendental meditation stress reduction intervention on progression of IMT (41). Participants randomly assigned to the intervention showed a significant decrease in IMT over a 6- to 9-month follow-up period when compared to those assigned to a cardiovascular risk factor health education control group, even after controlling for pre-intervention IMT values and age. This preliminary intervention study highlighted the importance of considering the role of both positive as well as negative psychosocial constructs on progression of IMT in African Americans. Overall, the association between IMT and the interaction of race and psychosocial stressors and well-being factors is preliminary and needs further investigation.

For the purposes of this cross-sectional study, we examined the relationship between psychological well-being and atherosclerosis in middle-aged women enrolled in SWAN Heart. Life satisfaction and life engagement capture components of psychological well-being, with life satisfaction measuring the match between expectations and life experience and life engagement measuring the extent one feels engaged in valued activities (42,43). Given both constructs represent cognitive evaluations of psychological well-being, we hypothesized that higher life satisfaction and life engagement would be associated with lower IMT, a subclinical marker of atherosclerosis. We also hypothesized that the association between our constructs of psychological well-being and IMT was dependent on number of life events. Others have proposed that greater psychological well-being may be a buffer in the face of stressful life events (44,45). It is also possible that with a greater frequency of life events, the relationship between psychological well-being and IMT may change, and this may be most salient for the association of IMT and life satisfaction, which assesses the congruence between current life experience and expectations. Finally, we explored the association of IMT with the interaction of psychological well-being and race because of prior findings in SWAN Heart coupled with the beneficial findings for one psychosocial stress reduction intervention in African Americans (41).

METHODS

Participants

Participants for the current study were recruited from the Chicago, Illinois, and Pittsburgh, Pennsylvania, sites of the Study of Women's Health Across the Nation (SWAN), a multiethnic, prospective multi-site study of the menopause transition in women between the ages of 42–52 years. A detailed description of the SWAN study design is published elsewhere (46).

At the Chicago (Rush University) and Pittsburgh (University of Pittsburgh) sites, the SWAN Heart Ancillary Study, which began about 4 years after SWAN baseline, was conducted to assess subclinical atherosclerosis during the menopause. The current cross-sectional study only used data collected from women who enrolled in the SWAN Heart Ancillary Study, corresponding with one of their SWAN annual visits 4, 5, 6, or 7. Eligibility at enrollment for the SWAN Heart Ancillary Study included white or African American ethnicity only, no current use of hormone therapy, and no evidence of clinical atherosclerosis including myocardial infarction, angina, intermittent claudication, cerebral ischemia, and/or revascularization. Informed consent was reviewed and signed by all study participants prior to enrollment, and the institutional review boards at both the Chicago and Pittsburgh sites approved the study protocol. Analyses for the current study were performed on all participants in the SWAN Heart Ancillary Study for whom an IMT value and measures of life engagement and life satisfaction were collected.

Procedure

Participants at the Pittsburgh site of SWAN were recruited into the study using random-digit dialing and lists of eligible women from voter registration. At the Chicago site, participants were randomly selected from a complete census of a defined community area. Participants completed psychosocial and sociodemographic measures, carotid ultrasound, and assessment of anthropometric and blood pressure measurements.

Measures

Ultrasound Measurement—During the ancillary study visit, ultrasound of the carotid artery intima media thickness (IMT) was assessed by a Toshiba SSA-270A scanner in Pittsburgh and a Hewlitt Packard 5500 scanner in Chicago. These machines have comparable image quality, and the procedure followed for ultrasound IMT assessment was standardized across both sites. B-mode images of common carotid artery were digitized for measurement of IMT. Specifically, images were taken of the near and far walls of the distal common carotid artery one centimeter proximal to the carotid bulb, the far wall of the carotid bulb, and the internal carotid artery. To measure the average intimal medial thickening, these images were displayed on a workstation monitor, and two lines were electronically drawn along the lumen-intima surface and the media-adventitia interface on a one-centimeter segment of the carotid artery. The computer generated one measurement for each pixel over this area, for a total of about 140 measures. An average of measures from each location was used to calculate an overall measure of IMT (millimeters). Readings of the ultrasound scans were done at the University of Pittsburgh, under the supervision of Dr. Sutton-Tyrrell, and those performing the readings were annually recertified to minimize reader drift. Repeated readings of 20 ultrasound scans were performed to assess reproducibility, and results included an intraclass correlation of 0.98 for IMT values (23).

Psychosocial Measurement

Satisfaction with Life Scale: The Satisfaction with Life Scale (SWLS) is a 5-item scale measuring an individual's overall satisfaction with life, designed to be used in a non-psychiatric adult population (42). Responses on the SWLS range on a 7-point scale

(1=strongly disagree, 7=strongly agree), with all 5 items framed in a positive direction. All items in the SWLS were averaged, with higher scores representing greater overall life satisfaction. Internal consistency of the SWLS was high (Cronbach's α = .92). Test-retest reliability for the SWLS was .50–.84 in prior studies (42).

Life Engagement Test: The Life Engagement Test (LET) is a 6-item scale measuring one's present involvement in life through value and importance assigned to one's activities (43). The LET is an index of current life purpose. Responses range on a 5-point scale (1=strongly disagree, 5=strongly agree), with 3 items framed in a positive direction and 3 items framed in a negative direction. The 3 items framed in a negative direction were reverse coded, then all items were averaged, with higher scores representing greater life engagement. Cronbach's α for the LET was .87, indicating good internal consistency. In prior studies, test-retest reliability ranged from .61 to .76 (43).

Life Events Scale: The Life Events Scale, a self-report measure of stressful life events, was derived from the Psychiatric Epidemiology Research Interview (47) and modified to include 18 events that were particularly relevant for middle-aged women. Participants were asked to indicate whether the event occurred. A higher score on the Life Events Scale represented a higher number of life events.

Covariates—Covariates for the analyses included relevant demographic, behavioral, psychological, and cardiovascular risk factors of IMT. Sociodemographic factors were assessed through self-reported questionnaires: race (African American, white), education (high school education or less, some college, college degree, or graduate schooling), smoking status (current smoker, not a current smoker), and age. Menopausal status was assessed via self-reported bleeding and categorized as: 1. premenopausal (menstrual period in the past 3 months with no irregularities in the past year), 2. perimenopausal (either menstrual period in the past 3 months with some irregularity over the previous year or no menstrual period in the past 3 months but menstrual bleeding within the past year), and 3. postmenopausal (no menstrual period within the past year). Body mass index was calculated as weight in kilograms divided by the square of height in meters (kg/m2). Systolic (SBP) and diastolic (DBP) blood pressure (mmHg) measurements were calculated as an average of two seated manual readings on the right arm following a 5-minute rest period. Finally, self-reported depressive symptoms were assessed using the well-validated Center for Epidemiologic Studies Depression Scale, a summed 20-item measure (range: 0 to 60) with higher scores signifying greater depressive symptoms (48).

Data Analyses

Data analyses were performed on all SWAN Heart Ancillary Study participants who had an IMT value and who completed the life engagement and life satisfaction measures. The study sample was characterized by age, race, education, menopausal status, smoking status, and marital status. Bivariate associations (Spearman correlations) between IMT and the psychological well-being measures were examined. Regression analyses (PROC GLM) were performed to test the association between IMT and psychological well-being. Regression analyses (PROC GLM) were also used the test the association between IMT and the

interaction of psychological well-being and life events (e.g., life satisfaction × life events) as well as IMT and the interaction of psychological well-being and race (e.g., life satisfaction × race). In these models, the main effects for each appropriate construct were also included (i.e., psychological well-being (centered), life events (centered), and race (dummy-coded)). Demographic, behavioral, psychological, and cardiovascular risk factors were included as covariates in these models. All analyses were performed using SAS, version 9.4 (SAS Institute, Cary, NC).

RESULTS

Characteristics of the Sample

Descriptive statistics for the total sample as well as by race are presented in Table 1. The overall sample included 485 women, of which 186 (38%) were African American and 299 (62%) were white. The women were on average 50 years old (range: 45 to 58 years), fairly well-educated, mostly non-smokers, and overweight with an average BMI of 29 kg/m^2. The majority were married, and over half were perimenopausal.

As seen in Table 2, on average, the women reported high levels of life engagement (mean = 4.16, sd = 0.5), though some did report low level of life engagement (range of means = 1.6 to 5.0). They also reported relatively high levels of life satisfaction (mean = 5.10, sd = 1.2), though the range of scores was wide (range of means = 1.2 to 7.0). The scores on the life engagement and life satisfaction measures were normally distributed.

It was noted that certain variables were significantly different across race, as shown by unadjusted data presented in Table 2. Specifically, life satisfaction was significantly higher for white than for African American women ($p < .001$), but there was no significant difference in life engagement across race ($p = .85$). However, African American women reported significantly more life events than white women ($p < .001$). Also, there was a significant difference in IMT across race ($p < .001$), with African American women having higher average IMT values than white women. Finally, BMI, SBP, and DBP were all significantly greater in African American women than in white women (all p's < .001).

Associations between Psychological Well-Being and IMT

Spearman correlations revealed IMT was significantly correlated with life satisfaction ($r = -.14$, $p = .002$) across the total sample and for African American women ($r = -.17$, $p = .02$) only but not for white women ($r = -.06$, $p = .30$). The association between life engagement and IMT was weak and non-significant for the overall sample as well as for African American and white women ($r = -.07$, $r = -.05$, and $r = -.08$, respectively; all p's > .10). Number of life events significantly correlated with life satisfaction ($r = -.19$, $p < .001$) but was not significantly correlated with mean IMT ($r = .05$, $p = .32$). Life satisfaction and life engagement had significant, but only modest correlations with depressive symptoms ($r = -.37$, $p < .001$; $r = -.35$, $p < .001$, respectively), while correlations between life satisfaction and life engagement and other covariates were small (r's = −.005 to −.10).

Regression analyses were used to determine if psychological well-being was an independent correlate of IMT, after controlling for relevant demographic variables, behavioral and

psychological covariates, and established cardiovascular risk factors. In the initial model, age, race, education, and menopausal status were included as covariates. In a subsequent model, behavioral and cardiovascular covariates, including smoking status, BMI, SBP, and DBP, were added to the analysis along with the demographic covariates. In a final model, a psychological measure was added to the list of previously included covariates. Results for all regression models are presented in Table 3.

The initial regression analysis (Table 3, Model 1) on IMT with life satisfaction and demographic covariates was significant. Life satisfaction was a significant, independent correlated of IMT ($p = .041$). Other significant covariates were age, having less than or equal to a high school education (referent: graduate school education), and African American race (referent: white). In this model, life satisfaction independently correlated with IMT after controling for all demographic covariates, such that each 1-point higher life satisfaction score was associated with a significant 0.008 mm lower level in mean IMT.

A subsequent regression analysis (Table 3, Model 2) was performed to examine the association between life satisfaction and IMT while adjusting for behavioral and cardiovascular risk factors as well as demographic covariates. In this adjusted model, which was also significant, life satisfaction remained a significant, independent correlate of IMT ($p = .009$). Specifically, each 1-point higher life satisfaction score was associated with a significant 0.010 mm lower level in mean IMT. Age and education remained significant covariates, though after adjustments were made for BMI, SBP, DBP, and current smoking, race was no longer significantly correlated with IMT. A third model (Table 3, Model 3) examined the association of life satisfaction and IMT adjusting for depressive symptoms along with previously included demographic, behavioral, and cardiovascular risk factors. In this fully-adjusted, significant model, life satisfaction remained a significant, independent correlate of IMT ($p = .039$), such that each 1-point higher life satisfaction score was associated with a significant 0.008 mm lower level in mean IMT. As in the second model, age, education, smoking, BMI, SBP, and DBP remained significant covariates, while the additional covariate, depressive symptoms, was not a significant correlate of IMT.

In a separate multivariable model, life events did not significantly moderate the association between life satisfaction and IMT, after controlling for demographic, behavioral, and cardiovascular covariates ($p = .46$). Our second marker of psychological well-being, life engagement was not a significant correlate of IMT ($p = .12$), and in a multivariable model, the association between IMT and the interaction of life events and life engagement, after controlling for demographic, behavioral, and cardiovascular covariates, was not significant ($p = .87$).

Regression analyses were performed to test whether the relationship between life satisfaction and IMT varied by race. After controlling for demographic, behavioral, and cardiovascular covariates, no significant interaction was observed between life satisfaction and race on IMT ($p = .37$).

DISCUSSION

This study aimed to examine the association between carotid IMT and measures of psychological well-being, both directly and through their interaction with life stressors, and explore differences in these associations across race. Support was found for the hypothesis that psychological well-being, measured by life satisfaction, was inversely correlated with IMT. Results demonstrated that level of life satisfaction was a significant inverse correlate of mean IMT values, when adjusting for relevant demographic and behavioral covariates and established risk factors of subclinical atherosclerotic disease. Interestingly, life satisfaction continued to be significantly correlated with IMT, even after inclusion of depressive symptoms, which failed to significantly correlate with IMT. Though the effect size for life satisfaction was small, it remained significantly correlated with IMT along with known cardiovascular risk factors. This finding supports the few prior studies that have reported a relationship between psychosocial well-being and lower IMT (37–39). It is also consistent with findings from the Healthy Women Study, in which an association was found between low life satisfaction and being in the subgroup of women with the highest scores on aortic calcification, another important marker of atherosclerosis (49). Finally, it shows that life satisfaction, as a marker of psychological well-being, is significantly associated with IMT independent of depressive symptoms, a marker of psychological distress. This finding is similar to that seen in the Whitehall Study of 7942 adults, for which positive psychological well-being was associated with decreased risk of CHD and the association was only slightly weakened after adjusting for emotional distress (50).

A similar relationship was not found between life engagement and IMT. Conceptual differences between life satisfaction and life engagement exist, which may help clarify this finding. Life engagement aims at measuring a current sense of purpose in one’s life (43). As a measure of psychological well-being, this construct captures the degree of worth associated with an individual’s current life activities. Meanwhile, life satisfaction captures the quality of one’s overall life experience; therefore, according to Pavot and Diener (42), life satisfaction represents a cognitive evaluation of whether one’s life meets self-set expectations. Individuals whose appraisal of their overall life is more consistent with their own expectations may be more affectively stable and psychologically adaptable and thus, experience greater overall life satisfaction (51). The sense of life balance and general adaptability characteristic of individuals with greater life satisfaction, but not necessarily characteristic of those with greater life engagement, may translate to better health outcomes.

This association between life satisfaction and improved health may occur by means of improved vagal tone, decreased arousal of the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis, dampened cardiovascular reactivity, decreased metabolic syndrome, improved lifestyle behaviors, and less dysregulation of immune function (45,52–56). Life satisfaction may also result in stability of mood, given its potential impact on affective states (57,58), and some studies have shown preliminary links between mood and IMT (19,27–31). In the present study, we found that life satisfaction and life engagement had significant, but modest associations with depressive symptoms; therefore, in our sample, psychological well-being is related yet distinct from negative affective.

Additional studies examining the interaction of affective states and life satisfaction in their relationship to IMT would be of interest.

This study also aimed to investigate if the frequency of life events moderated the relationship between psychological well-being and IMT. Given life satisfaction is conceptualized as the match between life experiences and expectations, this study hypothesized that higher frequency of life events may temper the relationship between life satisfaction and IMT. The investigation of this relationship was limited, because life events was not a significant correlated of IMT in this study. Our sample of women reported relatively low numbers of life events. In future studies, consideration of the intensity along with number of life stressors may be beneficial to determine if psychosocial stressors such as stressful life events interact with psychological well-being on IMT.

When examining potential differences in the association between IMT and psychological well-being across race, it was revealed that mean IMT was significantly higher in African American women in this sample. African American women had significantly lower life satisfaction and more life events than white women. Despite these mean differences, no significant relationship was found between the interaction of race with life satisfaction and IMT in an adjusted model. The role of race as a moderator of the association between life satisfaction and IMT was no longer significant after cardiovascular risk factors were included in the model. African American race did significantly correlated with IMT in the model including demographic covariates; however, when known cardiovascular risk factors were added to the model, the association between race and IMT attenuated. Given these findings are preliminary and the few other studies that have examined psychological cushioning factors and IMT have enrolled primarily white subjects (37–39), further investigation of the protective nature of life satisfaction on IMT across race is encouraged.

There were a few important limitations to this study. First, the design of the study was cross-sectional. It is preferable to measure progression of IMT over time as a marker of the atherosclerotic disease process. Future studies would benefit from a longitudinal design so that the causal relationships between psychological factors, other relevant risk factors, and IMT can be explored. Second, some characteristics of this sample were not representative of the general population of middle-aged women, and therefore, generalizability of the results is somewhat limited. Third, the addition of more sensitive measures of stressors, which assess level of perceived distress associated with each stressor, would have been ideal. Though likely experiencing some psychosocial distress, our sample of women reported few life events. To truly examine the potential interaction of psychological well-being with psychosocial stressors on IMT, future studies should use measures of stressors that are broadly distributed across the sample and that capture the intensity of the experience (59). Finally, inclusion of a more refined smoking risk factor variable in the model, which assessed smoking history along with current smoking behavior, would be recommended (1).

Despite these limitations, there are important implications of this study. The results for life satisfaction lend support to the assertion that psychological well-being is independently associated with subclinical atherosclerosis and that the role of psychological well-being may be independent of and perhaps more powerful than the role of depressive symptoms. We

strongly encourage further study of the associations with and potential longitudinal effects on IMT of life satisfaction in combination with psychological risk factors, such as depressed mood and negative affect. Though the interaction between life satisfaction and life events was not associated with IMT in our sample, our measure of psychosocial stressors had limitations, and additional investigation of this potential interactive effect would be recommended.

The development of additional studies to corroborate and extend upon these findings has important scientific and potential clinical applications. The previously mentioned transcendental meditation stress reduction intervention study (41) of 60 African American men and women concluded that a 0.098mm decrease in IMT displayed by the intervention group was equivalent to an 11% reduction in risk of myocardial infarction, based on the work of Salonen and Salonen ((60), as cited in Ref. (41)), and a 7.7% to 15% reduction in the incidence of stroke, based on the work of O'Leary and colleagues ((6), as cited in Ref. (41)). Interventions promoting psychological well-being may assist in delaying atherosclerosis and cardiovascular events, as shown in the Castillo-Richmond et al. (41) study. There is a growing body of research supporting the relationship between psychological well-being and subclinical cardiovascular disease, and if findings from the current study are consistently replicated and investigated in prospective, longitudinal studies, it may warrant future development of preventive psychological interventions aimed at fostering life satisfaction and a general state of psychological wellness in individuals displaying cardiovascular risk profiles.

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Acronyms

IMT	intima media thickness
BMI	body mass index
SWAN	Study of Women's Health Across the Nation
SWLS	Satisfaction with Life Scale
LET	Life Engagement Test
SBP	systolic blood pressure
DBP	diastolic blood pressure

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Table I

Descriptive Statistics for Total Sample and by Race

Variable	Total (*n* = 485)	African American (*n* = 186)	White (*n* = 299)
Age [y, *M* (*SD*)]	50.2 (2.9)	50.3 (2.9)	50.1 (2.9)
Education [%]			
≤ High School Diploma	15.6	17.5	14.4
Some College	31.2	38.4	26.8
College Degree	21.8	19.8	23.0
Graduate School	31.4	24.3	35.8
Menopausal Status [%]			
Pre	29.8	32.1	28.4
Peri	60.0	58.7	60.9
Post	10.1	9.2	10.7
Smoking Status [%]			
Non-Smoker	85.1	84.3	85.5
Current Smoker	14.9	15.7	14.5
Marital Status [%]			
Single	9.1	9.8	8.7
Married	70.0	52.7	80.6
Separated	3.1	4.9	2.0
Divorced	15.3	29.3	6.7
Widowed	2.5	3.3	2.0

y = years; *M* = mean; *SD* = standard deviation.

Table II

IMT, Psychological Well-Being, and Covariates

Variable	Total	African American	White
Mean IMT [mm, *M* (*SD*)]	0.666 (0.10)	0.685*** (0.10)	0.654 (0.09)
Life Satisfaction [*M* (*SD*)]	5.10 (1.20)	4.79 (1.27)	5.28*** (1.11)
Life Engagement [*M* (*SD*)]	4.16 (0.54)	4.16 (0.58)	4.17 (0.51)
Life Event Number [*M* (*SD*)]	3.24 (2.39)	3.84*** (2.51)	2.91 (2.26)
BMI [kg/m^2, *M* (*SD*)]	29.3 (6.3)	30.8*** (6.7)	28.3 (5.8)
SBP [mmHg, *M* (*SD*)]	119.9 (17.0)	127.0*** (18.7)	115.5 (14.1)
DBP [mmHg, *M* (*SD*)]	76.2 (10.1)	80.4*** (9.9)	73.6 (9.3)
Depressive Symptoms [*M (SD)*]	7.28 (8.13)	7.51 (8.53)	7.14 (7.89)

M = mean; *SD = standard deviation*.

p values were obtained from *t* tests performed to compare African American and white women.

*** $p < .001$.

Table III

Regression Analyses Examining the Association between Life Satisfaction and IMT

	Model 1 (R^2 = .09)				Model 2 (R^2 = .16)				Model 3 (R^2 = .17)			
Variable	***B***	***SE(B)***	**β**	***p***	***B***	***SE(B)***	**β**	***p***	***B***	***SE(B)***	**β**	***p***
Life Satisfaction	−0.008	0.004	−0.095	0.041	−0.010	0.004	−0.124	0.009	−0.008	0.004	−0.105	0.039
Race												
African American	0.022	0.009	0.111	0.016	0.007	0.010	0.034	0.50	0.008	0.010	0.039	0.44
White	Referent				Referent				Referent			
Age	0.007	0.002	0.217	<.001	0.005	0.002	0.146	0.012	0.005	0.002	0.149	0.010
Menopausal Status												
Post	0.026	0.018	0.080	0.16	0.022	0.018	0.070	0.24	0.022	0.018	0.070	0.24
Peri	0.014	0.011	0.071	0.22	0.016	0.011	0.082	0.17	0.016	0.011	0.085	0.15
Pre	Referent				Referent				Referent			
Education												
≤ High School	0.036	0.013	0.136	0.008	0.039	0.014	0.153	0.004	0.039	0.014	0.152	0.004
Some College	0.020	0.011	0.099	0.068	0.012	0.012	0.061	0.28	0.013	0.012	0.065	0.25
College Degree	−0.002	0.012	−0.007	0.90	0.009	0.013	0.037	0.50	0.009	0.013	0.039	0.48
Graduate School	Referent				Referent				Referent			
BMI					0.003	0.001	0.217	<.001	0.003	0.001	0.212	<.001
Smoker												
Current Smoker					0.028	0.013	0.105	0.028	0.029	0.013	0.111	0.021
Non-smoker					Referent				Referent			
SBP					0.001	0.0004	0.218	0.004	0.001	0.0004	0.217	0.004
DBP					−0.001	0.001	−0.156	0.032	−0.001	0.001	−0.153	0.035
Depressive Symptoms									0.001	0.001	0.056	0.26

BMI = body mass index; SBP = systolic blood pressure; DBP = diastolic blood pressure; *B* = unstandardized regression coefficients; *SE(B)* = standard error of the regression coefficients; β = standardized regression coefficients.

Model 1 included life satisfaction and demographic covariates. Model 2 included life satisfaction, demographic, behavioral, and cardiovascular covariates. Model 3 included life satisfaction, depressive symptoms, demographic, behavioral, and cardiovascular covariates.