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Association Between Socioeconomic Status and Metabolic Syndrome in Women: Testing the Reserve Capacity Model

Karen A. Matthews,

Department of Psychiatry, University of Pittsburgh

Katri Räikkönen,

Department of Psychology, University of Helsinki, Helsinki, Finland

Linda Gallo, and

Department of Psychology, San Diego State University

Lewis H. Kuller

Department of Epidemiology, University of Pittsburgh

Abstract

Objective—Low socioeconomic status (SES) environments may impede the development of a bank of resources, labeled reserve capacity, and may also be stressful, thereby depleting available reserves. In consequence, lower SES persons may experience more negative emotions, leading to adverse health consequences. The authors tested the reserve capacity model in relation to the metabolic syndrome.

Design—There were 401 initially healthy women who followed longitudinally for 12 years. Self-reported characteristics, stressors, and cardiovascular risk factors were measured repeatedly. Structural equation modeling was used to evaluate hypothesized relationships.

Main Outcome Measure—Metabolic syndrome factor.

Results—Confirmatory factor analysis verified reserve capacity as the aggregate of optimism, self-esteem, and social support, and negative emotion as the aggregate of depressive symptoms, anger, and tension. Structural equation modeling showed two pathways to the metabolic syndrome factor, ($\chi^2(59) = 111.729, p < .0001$ $\chi^2/df = 1.894$; CFI = .956; RMSEA = .047): direct from low SES to the metabolic syndrome factor ($B = -0.19, t = -3.24, p = .001$); and indirect, from low SES to low reserve capacity to high negative emotions to the metabolic syndrome factor ($B = -0.024, t = -2.05, p = .04$).

Conclusion—Low SES may increase risk for metabolic syndrome, in part, through reserve capacity and negative emotions.

Keywords

stress; resources; metabolic syndrome; longitudinal; women

Low socioeconomic status (SES) is associated with an elevated risk of mortality and morbidity from diverse causes (Adler, Marmot, McEwan, & Stewart, 1999). In part, SES disparities in health are because of differences in the distribution of basic resources such as health care, nutrition, and sanitary living environments (Lynch, Smith, Kaplan, & House, 2000). This focus

may be particularly important to explaining poor health in groups characterized by poverty, but the impact of SES on health is not only at the poverty level and below. Rather, health disparities have a monotonic relationship with SES, so that even relatively affluent groups exhibit worse health than their higher SES counterparts.

Gallo and Matthews (2003) offered the reserve capacity model as a framework for understanding how emotional factors in particular might contribute to SES disparities in health. The model suggests that persons in low SES environments experience more frequent and intense harmful or potentially threatening situations and less frequent rewarding or potentially beneficial situations, relative to their higher SES counterparts. Frequent exposure to chronic and acute stressors, in turn, is thought to have a direct negative impact on emotional experiences. However, studies that account for initial differences in stress exposure suggest that at every level of stress, individuals with lower SES report more emotional distress than those with higher SES (Kessler & Cleary, 1980; McLeod & Kessler, 1990).

Why might individuals in low SES environments be more reactive to stress? Our framework suggests that low SES individuals maintain a smaller bank of resources—tangible, interpersonal, and intrapersonal—to deal with stressful events compared to their higher SES counterparts. Examples of types of resources are the ability to borrow money in emergencies for tangible; having a supportive friendship network for interpersonal; and having good problem solving skills for intrapersonal. Borrowing a concept from the aging literature, we label this reserve capacity. Low SES persons' reserve capacity to deal with stressful environments may be inadequate for two reasons: (a) Low-SES individuals are exposed to more situations that require using their reserves; and (b) their environments prevent the development and replenishment of resources to be kept in reserve.

Literature relevant to the reserve capacity model reveals supportive evidence for connections among components of the model, for example, SES and stress exposure, stress exposure and negative emotions (Gallo & Matthews, 2003). However, few studies are available to directly evaluate the proposed mediational pathways, and studies that did include most pieces of the framework provided very limited evidence for the dynamic links suggested in the model (cf. Thurston, Kubzansky, Kawachi, & Berkman, 2006). The first study explicitly designed to test the reserve capacity model used ecological momentary assessment methods. Women monitored positive and negative psychosocial experiences and emotions across two days (Gallo, Bogart, Vranceanu, & Matthews, 2005). Results showed that lower SES women experienced lower perceptions of control and positive affect and more frequent social strain in their daily lives when compared with their higher SES counterparts, and that control and strain contributed to the association between SES and positive affect. Women with lower SES also had less reserve capacity, that is, summative measures of intrapsychic and social resources, relative to those with higher SES. Reserve capacity, in turn, was related to higher levels of social strain, lower perceived control, lower positive affect, and higher negative affect in everyday life. This suggests that individuals with lower SES may suffer a disadvantage because of direct effects of low SES on daily experiences and emotions in combination with effects related to low resources. Surprisingly, and inconsistent with the model, SES was unrelated to ongoing negative affect.

In the present paper, we evaluate the reserve capacity model in women using a different approach. We use trait measures of negative affect and reserve capacity predicting an important health outcome, the metabolic syndrome. Metabolic syndrome refers to a cluster of aberrations of metabolic origin including impaired glucose and lipid metabolism, central adiposity, and hypertension. The National Cholesterol Education Program's Adult Treatment Panel III (ATP-III), the World Health Organization (WHO), and International Diabetes Foundation (IDF) have offered clinical cutoffs for defining the metabolic syndrome that vary somewhat; for example,

elevated blood pressure (BP) is considered to be 130/85 or BP treatment for ATP-III and IDF versus 140/90 for WHO. Nonetheless, individuals with the metabolic syndrome are at increased risk for morbidity and mortality from cardiovascular disease (CVD) (Gami et al., 2007; Lakka et al., 2002), Type 2 diabetes (Laaksonen, Lakka, Niskanen, Kaplan, Salonen, & Lakka, 2002), and all-cause mortality (Grundy, Brewer, Cleeman, Smith Jr., & Lenfant, 2004; Grundy et al., 2005).

Research devoted to testing whether psychosocial factors predict the metabolic syndrome is limited (Goldbacher & Matthews, 2007). In older adult men and women not on hormone replacement therapy, psychosocial distress predicted a composite score representing the components of the metabolic syndrome, over the course of 15 to 18 months (Vitaliano, Scanlan, Zhang, Savage, Hirsch, & Siegler, 2002). In middle-aged men and women, greater work stressors predicted the metabolic syndrome based on the ATP III definition (Chandola, Brunner, & Marmot, 2006). Cynicism also predicted a latent construct of metabolic syndrome across 3 years, in older men and women enrolled in the Swedish Adoption/Twin Study of Aging (Nelson, Palmer, & Pedersen, 2004). These studies lacked a baseline measurement of the metabolic syndrome, which precluded inferences about prospective relationships.

We have previously demonstrated that among middle-aged participants of the Healthy Women Study, depressive symptoms and intense and frequent feelings of anger predicted increasing risk for the ATP III-defined metabolic syndrome over an average of 7.4 years (Räikkönen, Matthews, & Kuller, 2002) and increasing risk for ATP-III, IDF- and WHO-defined metabolic syndrome over 12 years (Räikkönen, Matthews, & Kuller, 2007). Further, reports of marital dissatisfaction, divorce, and widowhood predicted increasing risk of the ATP III-defined metabolic syndrome over approximately 12 years (Troxel, Matthews, Gallo, & Kuller, 2005).

In the current report, we evaluated the association of one indicator of SES, educational attainment, and the development of the metabolic syndrome over an average of 12 years in the Healthy Women Study. We used confirmatory factor analysis to evaluate whether the concepts of reserve capacity (optimism, social support, and self-esteem), negative emotions (anxiety, depressive symptoms, and anger), and metabolic syndrome (blood pressure, lipids, and waist circumference) fit the data. Then we used structural equation modeling to evaluate the merits of the reserve capacity model for understanding the connections between SES and the development of the metabolic syndrome. Specifically, we tested the hypotheses that low SES would be connected to risk for the metabolic syndrome latent factor, in part, through connections with stressful experiences, and latent factors of reserve capacity and negative emotion.

Method

Participants and Procedures

Participants were enrolled in the Pittsburgh Healthy Women Study, a prospective study of the changes in behavioral and biological characteristics of women during the perimenopausal transition (Matthews, Kelsey, Meilahn, Kuller, & Wing, 1989). In 1983 through 1984, 541 participants were recruited from a random sample of licensed drivers in Allegheny County, Pennsylvania. Women eligible for the study met the following criteria: ages 42 to 50 years at study entry, menstruating within the past 3 months and not taking hormone replacement, diastolic blood pressure (DBP) <100 mmHg, not surgically menopausal, not diagnosed with diabetes or with hypertension, and not taking thyroid, lipid-lowering, or psychotropic medications. Of the sample, 490 self-identified as non-Hispanic White, 45 as African American, 2 as Hispanic American, and 1 as Indian American. The Institutional Review Board at the University of Pittsburgh approved this project; all subjects provided written informed consent.

Women underwent an extensive clinic exam at study entry and 3 years later. They returned cards monthly to indicate whether they had menstruated. Once classified as menopausal (i.e., 12 successive months without menstruating or taking hormone therapy and not menstruating for a total of 12 months), women returned for postmenopausal examinations and for successive follow up exams approximately every 2 to 3 years thereafter. For the current study, psychosocial attributes measured at baseline and at the first follow-up exam an average of 2.8 ($SD = 0.6$, Range 0.7–6.3) years later were averaged to improve reliability. This approach rests on the assumption that prolonged exposure to psychosocial attributes would be required to create their hypothesized effects on the development of the metabolic syndrome. Measurement of waist circumference, a component of the metabolic syndrome, was added late to the baseline protocol so it was necessary to use the 3-yr follow-up exam as the starting point to establish whether a woman met the ATP III requirements for the metabolic syndrome. Four hundred thirty-two women provided data on psychosocial attributes at the baseline and the 3-yr follow-up exam, and had data available simultaneously on metabolic, anthropometric, and hemodynamic measures at the 3-yr exam and at least one further follow-up exam ($M = 5.3$, $SD = 1.5$; range 2–9 exams). These women were similar to the 109 women without available data as above in educational attainment, components of the metabolic syndrome, and psychosocial characteristics, except for being lower in Beck Depression, $p = .03$, Framingham Tension, $p = .03$, stressfulness of ongoing problem scores, $p = .03$, and BP, $ps < .03$. The more exams the women participated in the lower the systolic BP (SBP), $p = .007$. Of the 432 women, 31 met the ATP III criteria at the 3-yr follow-up exam and were excluded from subsequent analyses. On average, the final follow up assessment was conducted 15.2 ($SD = 3.5$, Range = 3.4–20.3) years after baseline and 12.3 ($SD = 3.5$, Range 1.6–17.2) years after the 3-yr follow up assessment for the 401 women in the analytic sample.

Measures

SES—Collected at study entry, years of education (categorized as high school, some college, college graduate, and degree beyond college) were used as the indicator of SES. Other measures of SES, that is, income and occupational status, were not used because income data were not gathered routinely and many women were out of the labor force.

Psychosocial attributes—The participants completed several measures of negative emotions: the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), the Framingham Tension Scale (Haynes, Levine, Scotch, Feinlieb, & Kannel, 1978), and the Spielberger Trait Anger Questionnaire (Spielberger, Johnson, Russell, 1985). They also completed measures thought to reflect reserve capacity: the Life Orientation Test for dispositional optimism (Scheier & Carver, 1985), the Interpersonal Support Evaluation List (ISEL; a measure of functional components of social support; Cohen, Marmelstein, Kamarck, & Hoberman, 1985), and a measure of self-esteem (Fenigstein, Carver, & Scheier, 1975).

Stressful events were measured in several ways. In lieu of an interview, women endorsed on a questionnaire whether any of 54 life events, positive, negative, or ambiguous in valence, had occurred during the past 6 months. To capture events that were truly stressful to the women, they then identified up to three of the most important events they had experienced and rated them as very (2), moderately (1) or not at all stressful (0). These ratings of stress were used to classify women into one of two groups: those who reported any event at the baseline or 3-yr exam that was rated as very stressful and important ($N = 188$, with 96 reporting one event, 54 reporting two events, and 38 reporting at least three events across the exams); and those who reported no event as very stressful at either exam. This latter group included women who reported events that were rated as less than very stressful. We also considered the average stress rating of the three most important life events; the 71 women who reported no important events were assigned 0. A second questionnaire asked about whether women reported any of five

ongoing problems that lasted longer than 6 months or another ongoing problem (self-identified). If they endorsed an ongoing problem, they rated the stressfulness of the problem on the above 3-point scale and responses were averaged across the two time periods. The 39 women who did not endorse any ongoing problems were scored as 0. We did not measure “hassles” as part of our stress assessment.

Metabolic syndrome—Blood was drawn in the morning after a 12-hr fast. Glucose was analyzed by enzymatic assay (Yellow Springs Glucose Analyzer, Yellow Springs, OH). Triglycerides and total high density lipoprotein cholesterol (HDL-C) were measured in the lipid laboratory of the Graduate School of Public Health, which has been certified by the Centers of Disease Control and Prevention, Atlanta, GA. Waist was measured with a standard, flexible measuring tape, in centimeters, at the smallest circumference above the hips over undergarments. Blood pressure was measured three times on two occasions, two hours apart, with a random zero muddler sphygmomanometer. The final overall measures of SBP and diastolic BP (DBP) were the average of the last two readings from these two assessments. For purposes of assessing the association of educational attainment and the metabolic syndrome, we used the ATP III (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, 2001) criteria because it is widely used in the United States. This definition requires three or more of the following risk factors: fasting glucose ≥ 110 mg/dl; triglycerides ≥ 150 mg/dl; HDL-C < 50 mg/dl; waist circumference > 88 cm, and SBP ≥ 130 and/or DBP ≥ 85 mmHg or BP medication (Grundey et al., 2004). Note that the metabolic syndrome factor used in the *SEM* analysis described below is based on the confirmatory factor analysis of the continuous measures of the components of the metabolic syndrome and does not include medication status.

Statistical Analyses

The first step was to examine the association between educational attainment and incident metabolic syndrome by chi square. Confirmatory factor analysis (CFA) tested whether dispositional optimism, social support, and self-esteem formed a latent reserve capacity factor, if trait anger, depression and tension comprised a latent negative emotions factor, and if continuous measures of fasting glucose, HDL-cholesterol, triglycerides, waist circumference, and SBP and DBP formed a latent metabolic syndrome factor. Structural equation modeling (SEM) tested associations among SES, reserve capacity, negative emotions, and metabolic syndrome latent factors, and whether the associations varied by levels of stressful life experiences. All analyses were performed in MPLUS 3.0 (Muthen & Muthen, 1998). We applied standard model fitting procedures, used the maximum likelihood estimation method, and evaluated the goodness of fit of the models by chi-square statistic ($\chi^2/df > 2$; Bollen, 1989; Loehlin, 1987), comparative fit index (CFI $> .90$), and root mean square error of approximation (RMSEA). RMSEA below .05 indicates a close fit and RMSEA from .05 to .08 indicates an adequate fit (Browne & Cudeck, 1993). Scaling corrections were computed for nonnormally distributed variables where appropriate.

Results

Sample Characteristics

Biological characteristics of the sample at baseline according to level of education have been presented previously (Matthews et al., 1989). Table 1 presents the average levels of metabolic, anthropometric, and blood pressure characteristics throughout the 12-yr follow-up (starting with the 3-yr follow-up exam) and psychosocial characteristics across baseline and 3-yr follow-up exams according to level of education. Women with less education had higher levels of depressive symptoms and lower levels of social support and self-esteem averaged across the first 3 years, $ps < .05$ for tests for linear trend. Optimism and self-esteem, however, were

particularly low in women with a high school education or less. Unexpectedly, educational attainment was not related to reporting at least one very stressful and important life event that occurred in the last 6 months, the average of stressfulness of the three most important life events that occurred in the last 6 months, or average stressfulness of ongoing problems lasting longer than 6 months at the baseline and 3-yr follow-up exams, all $ps > .43$.

Components of the metabolic syndrome averaged across the 12 years were related to educational attainment, $ps < .05$ for linear trend, with the exception of averaged DBP. Ninety or 22.4% women had developed the metabolic syndrome after the 3-yr examination. Figure 1 shows a graded, inverse relationship between education and the proportion of women who developed the ATP-III metabolic syndrome after the 3-yr exam, $p = .007$ for linear trend.

Structural Equation Modeling of Reserve Capacity Model

Table 2 shows the confirmatory factor analysis loadings for latent reserve capacity and negative emotions averaged across 3 years and the metabolic syndrome factors averaged across 12 years. The latent factors were allowed to correlate freely. To obtain adequate fit, error terms for depression and trait anger, SBP and DBP, and SBP and fasting glucose were allowed to correlate. After these specifications, the factor loadings were significant, except for DBP, in the expected direction, and the model fit the data well ($\chi^2(48) = 94.257, p = .0001; \chi^2/df = 1.964; CFI = .960; RMSEA = .049$). The reserve capacity and negative emotions ($\beta = -.72, t = -7.04, p < .001$), and negative emotions and metabolic syndrome latent factors ($\beta = .22, t = 3.08, p = .001$) correlated significantly. The reserve capacity and metabolic syndrome latent factors were not significantly correlated ($\beta = -.07, t = -0.99, p = .32$).

Because preliminary analyses showed that there were no direct associations between educational attainment and stressful life circumstances, we tested model fit in two ways using one of the stress measures: reporting an important, very stressful life event within the last 6 months either at the baseline or 3-yr exams or both. We chose this measure because in other analyses of women in this sample, it predicted incident metabolic syndrome (Raikkonen et al., 2007). The first model did not include stressful life events and tested whether low SES environments were associated with low reserve capacity, and as a consequence, if lower SES persons had more negative emotions and attendant metabolic syndrome. The following three indirect and two direct paths were specified: (a) an indirect path from SES to reserve capacity to negative emotions to metabolic syndrome, (b) an indirect path from reserve capacity to negative emotions to metabolic syndrome, (c) an indirect path from SES to reserve capacity to negative emotions, (d) a direct path from SES to metabolic syndrome, and (e) a direct path from SES to negative emotions. The second model tested whether the occurrence of at least one very stressful and important life event would alter the above pathways, that is, whether stressful life events served as a moderator in the model. Specifically, a multi-sample procedure was applied in testing whether the fit of models was statistically significantly different when we specified identical and different factor loadings and paths for those experiencing at least one event rated as very stressful and important during the past 6 months versus no event occurred or event occurred but was not rated as very stressful during the past 6 months.

Figure 2 shows the results of the first SEM model including SES, reserve capacity, negative emotions, and the metabolic syndrome factor. The model fit the data well ($\chi^2(59) = 111.729, p < .001; \chi^2/df = 1.894; CFI = .956; RMSEA = .047$). SES had a significant indirect pathway to metabolic syndrome through reserve capacity and negative emotions ($B = -.024, t = -2.048, p = .04$), and a significant direct pathway to metabolic syndrome ($B = -.193, t = 3.24, p = .001$; Figure 2). In addition, indirect pathways from SES to negative emotions through reserve capacity ($B = -.136, t = -3.08, p = .003$), and from reserve capacity to metabolic syndrome through negative emotions ($B = -.125, t = -2.56, p = .01$) were significant. A direct pathway

from SES to negative emotions was not significant, and was, therefore, removed from the final model.

Because educational level was unrelated to exposure to stress, we tested whether the fit of a model presuming identical factor loadings and paths for those with a high and a low level of stressful events ($\chi^2(134) = 197.857, p < .001; \chi^2/df = 1.477; CFI = .944; RMSEA = .049$) would significantly differ from a model presuming that the factor loadings and paths for those with a high relative to a low level of stressful events ($\chi^2(118) = 190.466, p < .001; \chi^2/df = 1.614; CFI = .936; RMSEA = .064$) would differ. The chi-square difference test showed that the model presuming identical loadings and paths did not significantly differ from the model presuming different loadings and paths, $\chi^2(16) = 7.391, p = .96$. Thus, the level of stress did not significantly alter the factor loadings or paths among SES, reserve capacity, negative emotions, and the metabolic syndrome.

Discussion

The primary objective of the current study was to evaluate the utility of the reserve capacity model for understanding why SES is related to health inequalities. The context for testing the model was the development of the metabolic syndrome, an important predictor of risk for coronary heart disease and diabetes. As a first step, we examined the association of educational attainment and the development of the metabolic syndrome across a 12-yr period among middle-aged women who were initially healthy and pre-menopausal at study entry. We confirmed that women with less education were more likely to develop the metabolic syndrome, relative to their better educated counterparts. This was true whether women who were categorized as having the metabolic syndrome at the first evaluation (third year examination) were included or excluded from the analyses.

These findings add to a growing literature on SES as a determinant of the metabolic syndrome. Several cross-sectional studies show associations between indicators of SES and the metabolic syndrome: for household income in women in NHANES III (Park, Zhu, Palaniappan, Heshka, Carnethon, & Heymsfield, 2003), for occupational grade in Whitehall II for both men and women (Brunner et al., 1997), and for retrospective reports of childhood SES in Coronary Artery Risk Development in Young Adults (CARDIA), especially in women (Lehman, Taylor, Kiefe, & Seeman, 2005). In contrast, there was no association between metabolic syndrome risk and income in a sample of African Americans at high risk for diabetes (Gaillard, Schuster, Bossetti, Green, & Osei, 1997), or between the ATP III defined metabolic syndrome and occupational prestige in the Young Finns Study (Kivimaki et al., 2006). Education and occupational status (women only) predicted a modified ATP III definition of the metabolic syndrome in the 1946 Birth Cohort Study (Langenberg, Kuh, Wadsworth, Brunner, & Hardy, 2006). Thus, the present findings are among the few longitudinal analyses confirming an association of SES and metabolic syndrome, especially in women.

After confirming the measurement models for reserve capacity, negative emotions, and metabolic syndrome, we used structural equation modeling to evaluate the proposed associations among the latent factors. Our analyses partially supported the reserve capacity model. Socioeconomic status was related directly and indirectly to the development of the metabolic syndrome. The indirect pathway was through low levels of the reserve capacity latent factor, which, in turn, was associated with high levels of the negative emotion latent factor, and then to high risk for the metabolic syndrome cluster.

Interestingly, in another recent test of the reserve capacity model, educational attainment was related to individual components of the metabolic syndrome in a cross-sectional framework, and the relationship with abdominal obesity (i.e., waist circumference) in particular was

partially explained by composite psychosocial resources (Gallo, Espinosa de los Monteros, Ferent, Urbina, & Talavera, in press). This suggests that both direct effects of reserves as well as indirect effects, via negative emotions, may be important targets for future studies that examine the reserve capacity model in relation to the metabolic syndrome.

Several unexpected findings and limitations of the current study should be highlighted. First, our measures of stress, including the occurrence of at least one very stressful life and important event in the last 6 months, the average ratings of stressfulness of important life events in the last 6 months, and the average stressfulness of problems lasting longer than 6 months, were not associated with educational attainment in our sample, thus precluding inclusion of stressful life circumstances in the model. Prior studies do find an association of SES and total number of stressful life events measured by different survey methods and in more diverse samples than in the current report (Kessler & Cleary, 1980; McLeod & Kessler, 1990). Although our other analyses show that the occurrence of very stressful important life events was directly related to the development of the metabolic syndrome (Räikkönen et al., 2007), the present findings suggest that the reserve capacity model may be only partially applicable to understanding the development of risk for metabolic syndrome associated with SES because of the lack of association of stress and educational attainment. Furthermore, it may be that other types of stress, for example, frequent hassles throughout the day, may be more tied to SES gradients in samples with characteristics like the healthy women enrolled in the study. In that regard, it is noteworthy that in another test of the reserve capacity model showed associations of SES with momentary assessments of perceived control and social strain (Gallo et al., 2005).

Second, SES predicted a significant, but not a large risk for the development of the metabolic syndrome, that is, 7.7% of the variance, through its direct and indirect pathways outlined in the model. Although the pathways are important to understanding the metabolic syndrome in women, other factors are also critical, including genetic and lifestyle factors.

Third, the reserve capacity model takes a life course perspective on health inequalities. It suggests that over time the psychological processes associated with SES will become more frequent and impactful. The sample was composed of midlife women as they transitioned through the menopause and beyond and who were selected because they were healthy. The applicability of the reserve capacity model to other life stages, particularly earlier stages of adolescence and young adulthood, is important to evaluate in future research. It is noteworthy that cross-sectional associations between childhood SES and metabolic functioning were mediated through a harsh early family environment and poor psychosocial functioning in the CARDIA population of young to midlife adults, especially in women (Lehman et al., 2005).

In any event, the present findings do demonstrate that positive reserves and negative emotions may serve as potential psychological pathways through which SES may relate to the metabolic syndrome, and possibly, more distal, related health outcomes such as CVD and Type II diabetes. It will be important in future work to evaluate the role of positive emotions and a more comprehensive assessment of stress in diverse samples in understanding the disparities in risk for the metabolic syndrome associated with SES.

Conclusions

The present paper provides partial support for the reserve capacity model. It provides unique longitudinal data demonstrating the relationship between SES and the metabolic syndrome in women. The results cannot be generalized to men. Although the effects of reserve capacity and negative emotions are not large, they do underscore the psychosocial pathways that lead to poor metabolic functioning and to potential risk for subsequent Type II diabetes and coronary disease.

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Figure 1.

Percentage of women with incident metabolic syndrome during the 12-yr follow-up period according to educational attainment. Error bars refer to 95% confidence intervals. $\chi^2(df = 3) = 7.98, p = .05$, for a linear trend $p = .005$, in a logistic regression OR = .512, 95% CI .316 to .829, $p = .007$ for a linearly decreasing risk with the lowest educational attainment group as a reference category.

Note. Model fit: Chi-square (59) = 111.729, $p < .0001$; χ^2/df – ratio = 1.894; CFI = .956; RMSEA = .047

Figure 2.

Structural equation model of the associations among educational attainment, reserve capacity, negative emotions, and metabolic syndrome latent factors during the 12-yr follow-up period.

Table 1

Means and SD of the Study Variables According to Educational Attainment

	Educational attainment				ANOVA	
	High school <i>N</i> = 109 <i>M</i> (<i>SD</i>)	Some college <i>N</i> = 89 <i>M</i> (<i>SD</i>)	College graduate <i>N</i> = 98 <i>M</i> (<i>SD</i>)	Degree beyond college <i>N</i> = 105 <i>M</i> (<i>SD</i>)	<i>F</i>	<i>P</i> <i>P</i> _{linear}
Triglycerides (mg/dl)	110.96 (50.97)	98.03 (41.96)	100.77 (51.25)	95.71 (36.03)	1.95	.12
HDL-cholesterol (mg/dl)	58.45 (12.61)	63.02 (12.87)	62.71 (13.85)	63.51 (13.69)	3.53	.02
Fasting glucose (mg/dl)	88.37 (13.31)	87.45 (8.44)	87.07 (9.10)	85.66 (6.84)	1.34	.26
Waist circumference (cm)	81.90 (9.44)	79.99 (10.66)	78.60 (11.11)	77.05 (9.19)	4.91	.002
Systolic blood pressure (mmHg)	117.02 (13.99)	115.02 (12.54)	114.79 (14.04)	111.65 (13.70)	3.01	.03
Diastolic blood pressure (mmHg)	73.05 (8.23)	71.11 (6.95)	71.25 (7.79)	71.13 (6.67)	1.58	.19
Age	49.13 (1.52)	49.12 (1.45)	49.13 (1.51)	48.59 (1.62)	3.14	.03
Depression	5.33 (5.20)	4.73 (4.06)	4.27 (3.43)	3.83 (4.29)	2.47	.06
Framingham tension	.29 (.28)	.26 (.25)	.26 (.26)	.26 (.27)	0.49	.69
Trait anger	18.08 (4.57)	17.74 (3.92)	17.90 (3.76)	17.02 (3.79)	1.37	.25
Dispositional optimism	15.20 (4.64)	16.82 (4.11)	16.64 (4.13)	16.26 (4.12)	2.98	.03
Social support	7.43 (2.15)	7.64 (2.11)	8.07 (2.05)	8.34 (1.85)	2.87	.04
Self-esteem	4.14 (1.52)	5.02 (1.22)	4.99 (1.31)	4.79 (1.50)	9.46	<.001
At least one very stressful life event in the last 6 months (<i>n</i> / %)	51 / 27.1	38 / 20.2	51 / 27.1	48 / 25.5	1.75	.63
Stressfulness ratings of 3 important life events in the last 6 months	.80 (.67)	.81 (.61)	.93 (.64)	.82 (.65)	.86	.46
Stressfulness ratings of ongoing problems longer than 6 months	.92 (.66)	.87 (.64)	1.02 (.60)	.91 (.66)	.91	.44

Note. Biological, anthropometric, and hemodynamic characteristics are mean values computed across all available observations ($M = 5.3$, $SD = 1.5$) across the 12-year follow-up. Age and psychological attributes are average of baseline and the first follow-up. The statistics are based on log-transformed values, means and standard deviations are transformed back for clarity of presentation.

Table 2
Confirmatory Factor Analysis of Reserve Capacity, Negative Emotion, and Risk Factors Comprising the Metabolic Syndrome Variables

Variables	Reserve capacity		Negative emotion		Metabolic syndrome	
	β	t-test	β	t-test	β	t-test
Optimism	.73	Fixed				
Self-esteem	.58	8.48				
Social support	.44	6.93				
Trait anger			.60	Fixed		
Depression			.81	9.02		
Tension			.67	7.72		
Triglycerides					.67	Fixed
HDL-cholesterol					-.70	-8.80
Fasting glucose					.39	6.17
Waist circumference					.61	8.53
Systolic blood pressure					.16	2.59
Diastolic blood pressure					.08	1.42

Note. $\chi^2(48) = 94.257, p < .001, \chi^2/df = 1.964, CFI = .960, RMSEA = .049$.