Published in final edited form as:
Soc Sci Med. 2013 September ; 93: 139–146. doi:10.1016/j.socscimed.2013.06.016.

Socioeconomic status, John Henrysim and blood pressure among African-Americans in the Jackson Heart Study

Malavika A. Subramanyam[a], **Sherman A. James**[b], **Ana V. Diez-Roux**[c,d], **DeMarc A. Hickson**[e], **Daniel Sarpong**[e], **Mario Sims**[f], **Herman A. Taylor**[e,g,h], and **Sharon B. Wyatt**[e,i,j]

[a]Social Epidemiology, Indian Institute of Technology Gandhinagar, Ahmedabad, Gujarat, India

[b]Sanford School of Public Policy, Duke University, Durham North Carolina, USA

[c]Center for Integrative Approaches to Health Disparities, School of Public Health, University of Michigan, Ann Arbor Michigan, USA

[d]Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor Michigan, USA

[e]Jackson Heart Study, Jackson State University, Jackson Mississippi, USA

[f]University of Mississippi Medical Center, Jackson Mississippi, USA

[g]Division of Cardiovascular Diseases and Internal Medicine, University of Mississippi Medical Center, Jackson Mississippi, USA

[h]Division of Natural Science, Tougaloo College, Jackson Mississippi, USA

[i]School of Nursing, University of Mississippi Medical Center, Jackson Mississippi, USA

[j]School of Medicine, University of Mississippi Medical Center, Jackson Mississippi, USA

Abstract

John Henryism connotes a strong behavioral predisposition to engage in effortful, active coping with difficult social and economic stressors. This behavioral predisposition is measured by the 12 item John Henryism Scale for Active Coping (JHAC). The John Henry hypothesis predicts that the well-known inverse socioeconomic status (SES)-blood pressure association will be stronger among persons who score high rather than low on the JHAC. We tested this hypothesis in a large African American cohort using baseline data from the Jackson Heart Study. Unlike previous studies, we used multiple indicators of SES: income, education, occupation, childhood SES and cumulative SES. Because the hypothesis is most relevant for adults still in the labor force, we excluded retired participants, yielding a sample size of 3,978. Gender-specific Poisson regression models for hypertension adjusting for age, John Henryism, SES, and a John Henryism-SES

Corresponding Author: Malavika A. Subramanyam, IIT Gandhinagar, VGEC Campus, Ahmedabad GJ 382424, malavika@iitgn.ac.in, (91) 972 758 8917.

interaction term, were fit to examine associations. Separate models were fit for each SES indicator. We found some evidence that John Henryism modified the association between income and hypertension in men: low income was associated with higher prevalence of hypertension in men who scored high on John Henryism (prevalence ratio (PR) for low vs. high income tertile 1.12), but with lower hypertension prevalence among men who scored low on John Henryism (PR 0.85, one sided P value for multiplicative interaction <0.05). For women, the association of low income with higher hypertension prevalence was stronger at lower than higher levels of John Henryism (PR 1.27 and 1.06 at low and high levels of John Henryism respectively, P value<0.05). There was no evidence that John Henryism modified the associations of hypertension with other SES indicators in men or women. The modest support of the John Henryism Hypothesis in men only, adds to the literature on this subject, but underscores questions regarding the gender, spatial, socioeconomic and historical contexts in which the hypothesis is valid.

Keywords

United States; John Henryism; socioeconomic status; hypertension; African American

Introduction

Chronic psychosocial stress has long been hypothesized to be a risk factor for hypertension (Rosengren et al., 2004; Stamler, Stamler, & Pullman, 1967; Syme, 1979). To protect their physical and psychological wellbeing, individuals employ a variety of strategies to cope with difficult life stressors such as unemployment, work overload, financial hardship, family conflicts, discrimination, etc (Lazarus & Folkman, 1984). One common strategy involves "effortful, active" coping) which, according to James, Hartnett, and Kalsbeek (1983), is motivated by the belief that hard work and determination can modulate, if not eliminate altogether, threats to wellbeing posed by social and economic adversity. However, such "high-effort" coping when engaged in over many years could accelerate wear and tear (McEwen, 1998) on the cardiovascular system. James et al. (1983) termed such "high-effort" coping "John Henryism," a reference to John Henry, the legendary 19th century African American manual laborer who reputedly beat a mechanical steam drill in an epic steel-driving contest, but then dropped dead from complete exhaustion. Drawing on prior empirical work by Harburg et al. (1973) and Obrist et al. (1979), James and colleagues (1983) tested the hypothesis (Syme,1979) that the well-known elevated risk for hypertension among low socioeconomic status (SES) individuals, especially African Americans in these positions (Dyer, Stamler, Shekelle, & Schoenberger, 1976; Hypertension Detection and Follow-up Cooperative Group, 1977), could be due in part to repetitive, or prolonged "high-effort" coping with social and economic stressors. James et al. (1983) formalized this as the John Henryism Hypothesis which predicts that an observed inverse SES/blood pressure association will be stronger among individuals who score high on John Henryism than among those who score low. John Henryism is thus expected to act as an effect modifier of the inverse SES/blood pressure relationship.

Prior tests of the John Henryism Hypothesis have yielded mixed results. Using education alone, or education in combination with occupation, to define SES, the North Carolina-based

studies by James et al. (1983; James, Strogatz, Wing, & Ramsey, 1987; James, Keenan, Strogatz, Browning, & Garret,1992), with sample sizes of 132, 432 and 1690 respectively, found support for the hypothesis, in both African American men and women. The 1987 study by James et al. failed to find support for the hypothesis among Whites (N=381). To date, the only published study testing the John Henryism Hypothesis in a European sample was conducted by Duijkers, Drijver, Kromhout and James (1988). Using data from a community-based sample of 200 Dutch men and women, and education as the measure of SES, Duijkers et al. (1988) found support for the hypothesis in men, but not women. Again, with education as the SES measure, Dressler, Bindon and Neggers (1998) found no support for the hypothesis in an Alabama-based study of African American men and women. Of note, however, these authors found that John Henryism was positively, and significantly, associated with blood pressure among men, but inversely associated with blood pressure among women. Using Coronary Artery Risk Development in Young Adults (CARDIA) baseline data, McKetney and Ragland (1996) in a study of 2637 Black men and women and 2349 White men and women, ages 18- 30, observed no association of SES with blood pressure in any race-gender group and no evidence of a modification of the association by John Henryism. Viewing the above studies as a whole, it is not clear the degree to which the choice of SES measure or differences in unmeasured community-level variables across settings is responsible for the mixed results.

With few exceptions (McKetney & Ragland, 1996), prior tests of the John Henryism Hypothesis have employed relatively small samples (N < 2000) and have used mostly education to assess SES. While no particular indicator is considered the ideal measure, using multiple ways of capturing SES strengthens the operationalization of this construct and provides a more comprehensive test of the hypothesis. Moreover, as previously noted by James et al. (1992), the strength of the observed SES-hypertension association, and its effect modification by John Henryism, could depend on which SES measure best captures differential exposure to chronic social and economic stressors. Whatever the reasons for the mixed results, studies employing larger samples, and studies using a broader range of SES indicators, are needed for a robust test of the hypothesis.

In the current study, we test the John Henryism hypothesis using data from the Jackson Heart Study, a large population-based study of African Americans living in the Jackson Mississippi (MS) metropolitan area, and we employ multiple indicators of SES. To our knowledge, this is the first study to use more than two SES indicators to test the hypothesis. Also, given that at least two prior studies (Duijkers et al., 1988; Dressler et al., 1998) suggested that findings can differ for men and women, we conducted gender-specific tests of the hypothesis. And, finally, because psychosocial stress is theorized to be a key explanatory pathway in the JH Hypothesis (James et al., 1992), we tested whether the hypothesized effect modification persisted after controlling for psychosocial stress.

Methods

Study population

Data for this study were collected as part of the Jackson Heart Study (JHS), the largest single-site, population-based cohort study of cardiovascular disease (CVD) in African

Americans. The study population consists of community-dwelling African Americans, aged 21-95, residing in the Jackson, MS, metropolitan statistical area (MSA) (Taylor et al., 2005). Participants were recruited from urban and rural areas in the tri-county region of Hinds County (which includes the city of Jackson- the capital of Mississippi), Madison County, and Rankin County. Four methods were used in recruitment: 31% were recruited from the Jackson, MS site of the Atherosclerosis Risk in Communities study, 17% through random sampling of a commercially available database (Accudata) of households in the three counties, 30% as volunteers, and 22% as family members. The final JHS cohort included 5,301 participants (mean age = 55.6, s.d. = 12.7, 63.3% women), equivalent to 7% of all African Americans aged 21-95 residing in the Jackson MSA (Payne et al., 2005). Details of the study design and recruitment protocol have been described elsewhere (Taylor et al., 2005; Fuqua et al., 2005; Payne et al., 2005; Dubbert et al., 2005). Data from the baseline examination (2000-2004) of the JHS were used in this study.

Dependent variable—The presence or absence of hypertension (HTN), measured as a binary variable, was the health outcome. The average of two measurements, taken one minute apart, of seated blood pressure measured in the right arm was used to determine systolic and diastolic blood pressure for each participant. A random-zero mercury manometer was used to take the two readings after the participant had rested for five minutes. Blood pressure was measured at the University of Mississippi Medical Center by qualified clinical laboratory personnel trained for this purpose (Jackson Heart Study Protocol, 2001). A participant was considered to have hypertension if one of three conditions was met: a mean systolic pressure ≥140 mmHg or a mean diastolic pressure≥90 mmHg or a self-reported current use of antihypertensive medication.

Independent variables

SES was measured using an individual's annual family income, highest level of educational attainment, main occupation, childhood SES based on parental socioeconomic resources (see below), and a measure of cumulative SES, which combined data on income, education and childhood SES. Information on income, education and occupation was obtained via structured interviews conducted in the participants' homes by trained, African American interviewers. Childhood SES information was collected during the first-year of annual follow-up surveillance.

We used self-reported data on annual family income (less than $5,000; $5,000 - 7,999; $8,000 -11,999; $12,000 - 15,999; $16,000 - 19,999; $20,000 - 24,999; $25,000 - 34,999; $35,000 - 49,999; $50,000 -74,999; $75,000 - 99,999; $100,000 or more) to create the income variable. A continuous variable was created by imputing the median value of the category as the income for that individual. In case of missing income data (1% of non-retirees), the value of the mode for income of people with the same education level was imputed. This continuous variable was used to create the cumulative SES variable. Additionally, it was divided into tertiles for use in regression models.

Using self-reported data on the number of years of schooling completed, education was categorized as less than high school, high school graduate or general equivalency degree

(GED), some college (1-3 years), vocational school, or associate degree; and college graduate or higher (4+ years). This categorical variable was used in the regression models. Additionally, we created a continuous education variable by using the number of years of schooling. The following values were imputed: 12 years for those with a high school diploma or a GED, 13 years for those who had some/complete vocational schooling or some college education, 14 for those with associate degrees, 16 for a bachelor's degree, and 20 years for those with “more than college education.” Thirteen records were missing data on education. This continuous measure of education was used to create the cumulative SES measure.

Occupation was classified into the following four categories: management, service, sales and manual.

Childhood SES is a derived variable created from self-report data on parental education, number of rooms in the home, and access during childhood (until age 10) to 8 types of household assets such as indoor plumbing, a refrigerator, and a television set. The 8 items on access to material resources had high internal consistency with a Cronbach's alpha of 0.88. Parental education was measured as the greater of the two parents' educational attainment and categorized into less than high school (0), high school or some college/associate degree (0.5), and college and above (1). Questions about availability of each household asset were scored 1 for “yes” and 0 for “no.” A summary score with a range of 0 to 8 was created to measure material resources in childhood, which was further categorized as low (0-2), moderate (3-6) and high (>6). A summary childhood SES variable was created by combining the parental education and material resources variables. The *z* score of this variable was used to create the cumulative SES variable while the summary score divided into tertiles were included in the regression models.

The cumulative SES measure was created by summing the *z* scores for continuous measures of income, education, and childhood SES. This sum was further divided into tertiles to facilitate interpretation.

Effect modifier

John Henryism was operationalized as the sum of scores on the 12 item John Henryism Active Coping Scale (James, 1996). In the JHS, each item had four response options: completely true, somewhat true, somewhat false, and completely false. The responses were scored as 4, 3, 2 and 1, respectively, and a summary score was calculated by summing across the 12 items. A higher John Henryism score indicated a greater propensity to engage in high-effort coping with social and economic adversity. The internal consistency of the John Henryism scale was assessed by Cronbach's alpha. Following prior work by James et al., (1983, 1987, 1992), John Henryism was treated as a binary variable, dividing the summary score at the median. The robustness of the findings was also tested by fitting models using the John Henryism score as a continuous variable.

Covariates

The other covariates used in the analysis were age centered around the mean, gender and the score on the Global Perceived Stress scale (GPSS). The GPSS measures the perception of the severity of stress experienced in the eight domains of employment, relationships, related to one's neighborhood, caring for others, legal problems, medical problems, racism and discrimination, and meeting basic needs, over a prior period of twelve months. The severity of stress for each domain was rated by the participants on a 4-point scale ranging from “not stressful” to “very stressful,” and the summary score was used as a continuous variable. The GPSS was created by modifying the Survey of Recent Life Experiences, Perceived Stress Scale, and Life Events Scale and had a Cronbach's alpha of 0.72 in the JHS (Payne et al., 2005).

Exclusions

Given that the John Henryism Hypothesis is expected to be most relevant for adults who are eligible to participate in the labor force, only study participants who did not self-identify as “retired from my usual job and not working” (N = 3,978) were included in the analysis. We excluded any participant with missing data on John Henryism (N=535), HTN (N=30) and any of the covariables. This resulted in an analytic sample size ranging from 3405 (education) and 3374 (occupation), to 3387 (income tertiles).

Analysis

Descriptive statistics (means, standard deviations (SD) or proportions) for HTN, John Henryism, the SES variables and covariables were calculated in order to characterize the analytic sample. Age-adjusted, gender-specific correlations between SES, stress (i.e., GPSS) and John Henryism were computed. Spearman correlations were used for ordinal variables like occupation.

Given the high prevalence of HTN in the JHS, the odds ratios from logistic models could be misleading if interpreted as a measure of relative risk (Zou, 2004). Therefore, we used modified Poisson regression models with a log link and a robust error variance that provide direct estimates of the prevalence ratio.

We first fit a model with the following independent variables: age, gender, and the SES indicator. We then added terms denoting the John Henryism main effect as well as the interaction between the SES indicator and John Henryism. SES was included in models with the highest SES as the reference category and John Henryism with the lowest John Henryism as the reference category so that a positive interaction term between SES and John Henryism was indicative of support for the JH hypothesis. Separate models were fit for each SES indicator. In addition to testing the three-way interaction of SES, John Henryism and gender, we also conducted gender-stratified analyses by fitting all models separately for men and women. Finally, we fit models that additionally adjusted for the GPSS score in gender-stratified models testing the age-independent interaction of SES and John Henryism.

Because we were testing a hypothesis with an a priori specified direction, we used one-sided p values in all analyses (except the correlations) with an alpha of 0.05 to denote statistical

significance. However, the overall patterns of results did not change when two-sided p values and an alpha of 0.05 were used.

Results

Description of the sample

Table 1 shows the distribution of covariables among non-retirees, stratified by low and high John Henryism. Non-retirees with low (<median) John Henryism scores were slightly younger, had a lower prevalence of hypertension, included proportionately more higher SES individuals, and had higher average stress scores than their counterparts who scored high (=>median) on John Henryism. The John Henryism scale had an acceptable Cronbach's alpha of 0.79.

Age adjusted, gender-specific correlations among SES, stress, and John Henryism in non-retirees are shown in Table 2. Income was the only SES indicator to show a statistically significant inverse correlation with stress (r = -0.10 in both men and women), while occupation showed a modest positive association (r = 0.07) with stress, statistically significant only in men. Stress was inversely correlated with John Henryism in both genders, however the strength of the correlation was modest to weak in both men (r=-.13, p<0.0001) and women (r = -.06, p<0.01).

Association of SES with HTN

No SES measures were associated with HTN in men (Table 3) while all SES measures were inversely associated with HTN in women (Table 4). The greatest SES disparity was seen between women in manual jobs versus those in managerial positions (PR= 1.27, 95% CI: 1.14, 1.41). This pattern of statistically significant greater risk of HTN with lower SES among women was also observed with income, education and cumulative SES, though no evidence of a gradient was observed. The association with childhood SES was weak and not statistically significant.

Interaction of SES and John Henryism

The global tests of interaction of SES and median-split John Henryism were not statistically significant in either gender for any of the SES measures. However, the interaction of low income tertile and high John Henryism was statistically significant in both men and women.

Among men with high John Henryism scores, being in the lowest income tertile, versus the highest, was associated with a greater prevalence of HTN (PR=1.12, 95% CI: 0.95, 1.33). In contrast, among men with low John Henryism scores, being in the lowest income tertile was associated with a lower prevalence of hypertension (PR=0.85, 95% CI: 0.69, 1.05) compared to those in the highest tertile (Table 2) (estimate of interaction term = 0.27, s.e. = 0.14, p< 0.05). The interactions for childhood and cumulative SES showed a similar pattern, but were not statistically significant.

In women with high John Henryism scores, those in the lowest income tertile had a slightly higher prevalence of HTN (PR=1.06, 95% CI: 0.93, 1.20) than those in the highest tertile, whereas among women with low John Henryism scores, being in the lowest, as opposed to

highest, income tertile was associated with a significantly higher prevalence of HTN (PR=1.27, 95% CI: 1.11, 1.44) (Table 3) (estimate of interaction term = -0.18, s.e. = 0.09, $p< 0.05$). Tests for education and cumulative SES revealed similar results, but estimates of the corresponding interaction terms were not statistically significant.

The patterns remained the same in both men and women after adjustment for global stress scores. Results were similar when the continuous John Henryism variable was used, however, the pattern of significant results for the lowest income tertile was not observed. We found no statistically significant global tests of three-way interactions involving SES, John Henryism and gender.

Discussion

We used data from a large population-based cohort of African Americans to test the John Henryism Hypothesis. We found support for the hypothesis in men using income as the measure of SES, but no support for the hypothesis when using education, occupation, childhood SES, or a cumulative SES measure. Data for women were not consistent with the hypothesis regardless of the SES indicator used.

Our finding that the income disparity in hypertension prevalence was greater among men with high versus those with low John Henryism scores parallels findings reported by James and colleagues in studies conducted in the 1980s and early 1990s in Eastern North Carolina. In 1983, for example, these researchers tested the John Henryism Hypothesis in a small, community-probability sample of 132 African American men, ages 17-60 (James et al., 1983). In keeping with the hypothesis, they found that a low level of education (< HS), their chosen measure of SES, was associated with higher adjusted diastolic blood pressure only for men who also scored high on John Henryism. For men who scored low on John Henryism, mean blood pressure did not vary by level of education. Using a composite SES measure based on education and occupation, they found similar patterns of results in two, larger studies (James et al., 1987; James et al., 1992), both of which were also conducted in Eastern North Carolina. In the first (James et al., 1987), a study of 432 African Americans (ages 21-50); the adjusted prevalence of HTN in persons (data pooled for men and women) characterized by low SES (<9 years of education or unskilled blue-collar job) and high John Henryism was 31.4%, in contrast to 11.5% for persons scoring higher on SES (> 9 years of education and skilled/white collar job) and high John Henryism. SES was not significantly associated with HTN prevalence for men and women scoring low on John Henryism (low SES= 25.0%, high SES= 23.4%). In a second study of 1,690 African Americans aged 25-50 years, and pooling data on men and women, James et al (1992) observed a smooth, negative SES gradient in HTN among persons scoring high on John Henryism: HTN prevalence for low SES =29.4%, for medium SES =26.2%, and high SES =20.5% . However, a “J-shaped” relationship was observed among persons scoring low on John Henryism, in that higher SES was unexpectedly associated with a greater prevalence of HTN than low and medium SES: low SES= 22.6%, medium SES = 22.8%, and high SES = 25.9%. Additional analyses revealed that this “J-shaped” SES-HTN relationship among low John Henryism individuals was completely explained by the unexpected high perceived stress scores among men in white collar, managerial-level jobs (James et al., 1992).

In the current study, findings for women were not consistent with the John Henryism hypothesis: the HTN prevalence differential between low and high income women was greater among those scoring low on John Henryism as compared to those scoring high. The only other published study documenting elevated risk for HTN among African American women scoring low on John Henryism was that by Dressler et al. (1998). Low John Henryism among African American women in this Tuscaloosa, Alabama study probably connoted their fatigue due to past, repetitive high-effort coping with difficult life stressors. Low John Henryism scores among African American women in the Jackson Heart Study could reflect a similar phenomenon, and the combination of low SES and low John Henryism scores among these women could be a classic example of what Geronimus (2001, 2006) calls "weathering" and what McEwen (1998) calls allostatic load.

The consistency of elevated prevalence of HTN for low John Henryism women in the JHS across all SES measures adds plausibility to the idea that these women are suffering "burn-out". As a preliminary check on this possibility, we conducted a series of sex-specific exploratory analyses of the relationships between our SES measures and our global stress measure, on the one hand, and the relationship between global stress and John Henryism scores, on the other. For women, income was inversely correlated with global stress ($r = -0.10$, $p<0.0001$; whereas education ($r =0.02$, $p =0.46$) and occupation ($r= 0.04$, $p =0.11$) were not. Among women, global stress was also inversely correlated with John Henryism, though weakly ($r= -0.06$, p value =0.01). Another potential explanation of our findings for women is that they reflect the impact of unique, societal level, race and gender stressors on African American women which pressure them to be "strong" in the face of adversity, despite potentially heavy costs to their health (Beauboeuf-Lafontan, 2009; Woods-Giscombe, 2010). Our intriguing findings for women require replication and further investigations in other samples.

A limitation of the JHS sample as a venue for testing the John Henryism hypothesis is the absence of SES gradients in hypertension among men. This is similar to the null findings for the association of education with blood pressure in the study by McKetney & Ragland (1996) which also failed to support the John Henryism hypothesis. As emphasized elsewhere by James et al. (1992), the presence of a reasonably strong inverse SES-hypertension gradient, along with a reasonably strong inverse association between SES and psychological stress, may be preconditions for detecting the hypothesized modification of the SES-hypertension association. As the correlation coefficients in Table 2 illustrate, the only SES measure to be inversely associated with global stress scores was income, and this was weak ($r= -.10$). Moreover, for men, global stress score and occupation were positively correlated ($r=-.07$), though again weakly. Additional exploratory analyses found no evidence of an age-independent stress-HTN association among non-retiree men. For non-retiree women, the age-adjusted prevalence ratio for hypertension was 1.03 (95%CI: 1.01, 1.05) with every one point higher stress score. This latter finding for JHS women is reminiscent of findings for African American women in the Pitt County Study (Strogatz et al, 1997). Hence, with the possible exception of the relationship between income and HTN, and income and stress, the pattern of associations present when the John Henryism Hypothesis was upheld in prior

studies of African Americans by James and colleagues (1983, 1987, 1992) in Eastern North Carolina is largely absent in the Jackson Heart Study.

The use of multiple SES indicators was motivated by our desire to perform as comprehensive a test as possible of the John Henryism Hypothesis. We found interesting gender-specific results with income, but not with the other SES indicators. A deeper exploration of the SES-stress relationship in this population, using a variety of measures including biological markers of stress, could help to illuminate these findings. It is also possible that despite our use of multiple measures we did not examine an SES dimension that accurately captured prior, chronic exposure to high levels of psychosocial stressors, especially at critical stages of the life cycle. Also, neighborhood SES, which has the potential to capture the spatial and historical context of the lives of JHS participants, could prove to be especially informative of how prolonged effortful, active coping translates psychosocial and material deprivation into elevated risk for hypertension. In the current study, as in previous studies, of John Henryism and blood pressure, effect modification was investigated on a multiplicative scale. Future work would benefit from a consideration of alternative and more modern approaches to investigating synergism between and among factors (VanderWeele & Robins, 2007). While we found evidence of statistically significant multiplicative interactions between income and John Henryism in men, these results should be viewed in the context of the multiple tests we conducted.

The cross-sectional nature of this analysis does not allow us to determine whether John Henryism measured at one point in time is a valid reflection of the long term levels most likely to be relevant to the development of hypertension. Data on John Henryism were missing among about 15% of the original JHS sample and were more likely to be missing among participants of lower SES. However, there were no differences, on average, in the age, gender and global stress scale scores among those missing and not missing John Henryism data. Additionally, there was substantial overlap in the distribution of SES among those missing and not missing John Henryism data. Thus, the probability that this pattern of missingness entirely explains the lack of statistically significant associations is small. The relatively high prevalence of HTN in this sample (57% in the non-retirees), might have reduced our ability to estimate the influence of our particular set of social determinants on HTN. Studies examining CVD risk factors and outcomes that specifically capture the wear and tear caused by prolonged exposure to the stress of living in low SES circumstances, and its potential exacerbation by high John Henryism, are needed to shed more light on the interaction of SES, stress, coping strategies, and CVD risk among African Americans.

This study provides additional, albeit modest, support of the JH Hypothesis in men, adds to the growing literature on this subject, and underscores questions regarding the gender, spatial, socioeconomic and historical context in which the JH Hypothesis is likely to be valid. Further research using large African American samples as well as samples from other populations and geographical contexts are needed to clarify the conditions under which prolonged effortful active coping with social and economic adversity increases risk for cardiovascular disease, especially in low SES populations.

Acknowledgments

This research was supported in part by the Michigan Center for Integrative Approaches to Health Disparities (P60MD002249) funded by the National Center on Minority Health and Health Disparities. The Jackson Heart Study is supported by NIH contracts N01-HC-95170, N01-HC-95171, and N01-HC-95172 that were provided by the National Heart, Lung, and Blood Institute and the National Center for Minority Health and Health Disparities.

References

Beauboeuf-Lafontant, T. Behind the mask of the strong Black woman: Voice and the embodiment of a costly performance. Philadelphia: Temple University Press; 2009.

Dressler WW, Bindon JR, Neggers YH. John Henryism, gender, and arterial blood pressure in an African American community. Psychosomatic Medicine. 1998; 60(5):620–624. [PubMed: 9773768]

Dubbert PM, Carithers T, Ainsworth BE, Taylor HA Jr, Wilson G, Wyatt SB. Physical activity assessment methods in the Jackson Heart Study. Ethnicity & Disease. 2005; 15(4 S6):S6-56–61.

Dyer AR, Stamler J, Shekelle RB, Schoenberger J. The relationship of education to blood pressure: findings on 40,000 employed Chicagoans. Circulation. 1976; 54:987–992. [PubMed: 991416]

Duijkers TJ, Drijver M, Kromhout D, James SA. “John Henryism” and blood pressure in a Dutch population. Psychosomatic Medicine. 1988; 50(4):353–359. [PubMed: 3413269]

Fuqua SR, Wyatt SB, Andrew ME, Sarpong DF, Henderson FR, Cunningham MF, Taylor HA. Recruiting African American research participation in the Jackson Heart Study: Methods, response rates, and sample description. Ethnicity & Disease. 2005; 15(4 S6):S6-18–29. [PubMed: 16317982]

Geronimus AT. Understanding and eliminating racial inequalities in women's health in the United States: The role of the weathering conceptual framework. Journal of American Medical Women's Association. 2001; 56(4):133–136.

Geronimus AT, Hicken M, Keene D, Bound J. Weathering and age patterns of allostatic load scores among blacks and whites in the United States. American Journal of Public Health. 2006; 96(5):826–833. [PubMed: 16380565]

Harburg EH, Erfurt JC, Hauenstein LS, Chape C, Schull WI, Schork MA. Socioecological stressor areas and Black-White blood pressure. Journal of Chronic Disease. 1973; 26:595–611.

Hypertension Detection and Follow-up Cooperative Group. Race, education, and prevalence of hypertension. American Journal of Epidemiology. 1977; 106:351–61. [PubMed: 920724]

Jackson Heart Study. Jackson Heart Study Protocol, Manual 4, Blood Pressure, Visit 1. 2001. Retrieved from: http://jhs.jsums.edu/jhsinfo/Portals/0/pdf/manuals1/Blood_pressure_manual4_02-18-2001(1).pdf

James SA, Hartnett SA, Kalsbeek WD. John Henryism and blood pressure differences among black men. Journal of Behavioral Medicine. 1983; 6(3):259–278. [PubMed: 6663614]

James SA, Strogatz DS, Wing SB, Ramsey DL. Socioeconomic status, John Henryism, and hypertension in blacks and whites. American Journal of Epidemiology. 1987; 126(4):664–673. [PubMed: 3631056]

James SA, Keenan NL, Strogatz DS, Browning SR, Garret JM. Socioeconomic status, John Henryism, and blood pressure in black adults: The Pitt county study. American Journal of Epidemiology. 1992; 135(1):59–67. [PubMed: 1736661]

James SA. John Henryism and the health of Americans. Culture, Medicine and Psychiatry. 1994; 18:163–182.

James, SA. The John Henryism Scale for Active Coping. In: Jones, RL., editor. Handbook of Tests and Measurements for Black Populations. Vol. 2. Hampton VA: Cobb & Henry Publishers; 1996. p. 415-425.

Lazarus, RS.; Folkman, S. Stress, Appraisal and Coping. New York: Springer; 1984.

McEwen BS. Protective and damaging effects of stress mediators. New England Journal of Medicine. 1998:172–179.

McKetney EC, Ragland DR. John Henryism, education, and blood pressure in young adults: The CARDIA study. American Journal of Epidemiology. 1996; 143(8):787–791. [PubMed: 8610688]

Obrist, PA.; Langer, AW.; Grignolo, A.; Sutterer, JR.; Light, KC.; McCubbin, JA. Blood pressure control mechanisms and stress: Implications for the etiology of hypertension. In: Onesti, G.; Klimt, LR., editors. Hypertension: Determinants, Complications, and Intervention. New York: Grune and Stratton; 1979. p. 69-94.

Payne TJ, Wyatt SB, Mosley TH, Dubbert PM, Guiterrez-Mohammed ML, Calvin RL, et al. Williams DR. Sociocultural methods in the Jackson Heart Study: Conceptual and descriptive overview. Ethnicity & Disease. 2005; 15(4):S6-38–48. [PubMed: 16317984]

Rosengren A, Hawken S, Ounpuu S, Sliwa K, Zubaid M, Almahmeed W, et al. Yusuf S. Association of psychosocial risk factors with risk of acute myocardial infarction in 11119 cases and 13648 controls from 52 countries (the INTERHEART study): Case-control study. The Lancet. 2004; 364(9438):953–962.

Stamler, J.; Stamler, R.; Pullman, TN., editors. The Epidemiology of Hypertension. Grune and Stratton; New York: 1967.

Strogatz DS, Croft JB, James SA, Keenan NL, Browning SB, Garrett JM. Social support, stress and blood pressure in Blacks: The Pitt County study. Epidemiology. 1997; 8(5):482–487. [PubMed: 9270947]

Syme, SL. Psychosocial determinants of hypertension. In: Onesti, G.; Klimt, LR., editors. Hypertension: Determinants, Complications, and Intervention. New York: Grune and Stratton; 1979. p. 95-98.

Taylor HA Jr, Wilson JG, Jones DW, Sarpong DF, Srinivasan A, Garrison RJ, et al. Wyatt SB. Toward resolution of cardiovascular health disparities in African Americans: Design and methods of the Jackson Heart Study. Ethnicity & Disease. 2005; 15(4 S6):S6-4–17.

VanderWeele TJ, Robins JM. The identification of synergism in the sufficient-component cause framework. Epidemiology. 2007; 18(3):329–339. [PubMed: 17435441]

Woods-Giscombe CL. Superwoman schema: African American women's views on stress, strength, and health. Qualitative Health Research. 2010; 20(5):668–683. [PubMed: 20154298]

Zou G. A modified Poisson regression approach to prospective studies with binary data. American Journal of Epidemiology. 2004; 159(7):702–706. [PubMed: 15033648]

Research highlights

- John Henryism connotes a strong behavioral predisposition of effortful active coping.
- Inverse SES-BP association hypothesized as stronger with high than low John Henryism.
- We tested this hypothesis using the baseline data from the Jackson Heart Study.
- Unlike previous studies we used multiple indicators of socioeconomic status.
- Modest support found raises questions about context in which hypothesis is applicable.

Table 1

Mean (standard deviation) and percent distribution of demographic, psychosocial, and socioeconomic characteristics for non-retirees in the Jackson Heart Study baseline sample (2000-2004) stratified by high and low John Henryism.

Characteristic		Non-retirees[a] N = 3978	Low John Henryism[b] N =1807	High John Henryism[b] N = 1636
Age		50.8 (11.5)	49.6 (10.8)	51.7 (11.6)***
Gender (%)	Male	38.1	36.7	37.8
	Female	61.9	63.3	62.2
John Henryism score		41.57 (4.5)	38.19 (3.4)	45.30 (1.6)***
John Henryism (binary)	Low	52.5		
	High	47.5		
Stress score		5.7 (4.5)	6.1 (4.5)	5.3 (4.4)***
Hypertension (%)	Yes	56.8	54.7	58.8*
	No	43.2	45.3	41.2
Income (tertiles)	Low	27.1	23.7	27.3
	Middle	35.9	36.8	34.8
	High	37.0	39.5	37.9
Education	≤HS	13.0	8.9	15.2***
	HS	20.0	17.8	21.0
	Some college	32.7	34.6	30.7
	≥College	34.3	38.7	33.1
Occupation	Manual	37.2	39.8	37.1**
	Sales	23.5	20.6	24.7
	Service	18.9	21.4	17.2
	Management	20.4	18.2	21.0
Childhood SES	Low	23.7	21.5	25.6**
	Middle	29.1	28.5	29.4
	High	47.2	50.0	45.0
Cumulative SES	Low	25.5	21.2	26.9**
	Middle	36.1	36.0	34.8
	High	38.4	42.8	38.3

HS = High school; N = sample size; SES = Socioeconomic status. *P* values of tests of difference (low vs. high John Henryism groups):

*=p<0.01,

**=p<0.05,

***=p<0.001.

[a]N missing data in non-retirees: John Henryism score (535), stress score (483), hypertension (42), income (33), education (13), occupation (11, plus 46 excluded as “no occupation”), childhood SES (322), cumulative SES (11)

[b] N missing data in low/high John Henryism categories= Stress score (213/195), hypertension (16/14), income (16/10), education (3/5), occupation (3+13 excluded as “no occupation”/5+18 excluded as “no occupation”), childhood SES (88/60), cumulative SES (6/2).

Table 2

Age adjusted, gender-specific correlations among SES, stress, and John Henryism for non-retirees in the Jackson Heart Study.

Men	Income	Education	Occupation[a]	Stress score	John Henryism
Income	1.00	0.55	0.35***	-0.10**	0.01
Education		1.00	0.53***	-0.03	-0.07*
Occupation			1.00	0.07*	-0.05
Stress score				1.00	-0.13***
John Henryism					1.00
Women					
Income	1.00	0.57	0.36***	-0.10***	0.01
Education		1.00	0.49***	0.02	-0.01
Occupation			1.00	0.04	0.01
Stress score				1.00	-0.06**
John Henryism					1.00

*=p<0.05,

**=p<0.01,

***=p<0.001.

[a]Spearman correlation coefficient.

Table 3

Prevalence ratios of hypertension associated with SES indicators stratified by level of John Henryism, and results of tests for multiplicative interaction between John Henryism and SES categories, among male non-retirees in the Jackson Heart Study.

		Prevalence ratios (95% CI)		Interaction coefficients and global P values for interaction	
Characteristics	**All**[a]	**Low John Henryism**[b]	**High John Henryism**[b]	**SES*John Henryism interaction**[c]	**SES*John Henryism interaction**[d]
Income		N=654	N=607		
Low tertile	0.99 (0.87, 1.13)	0.85 (0.69, 1.05)	1.12 (0.95, 1.33)	0.27 (0.14)*	0.27 (0.15)*
Middle tertile	1.09 (0.98, 1.21)	1.02 (0.88, 1.19)	1.16 (1.00, 1.35)	0.13 (0.11)	0.11 (0.12)
Top tertile	1	1	1	P value *0.06*[e]	P value *0.10*[e]
Education		N=657	N=607		
≤HS	0.97 (0.85, 1.12)	0.94 (0.74, 1.19)	0.99 (0.83, 1.19)	0.04 (0.15)	-0.04 (0.15)
HS	1.03 (0.90, 1.19)	1.00 (0.81, 1.24)	1.06 (0.88, 1.28)	0.05 (0.14)	0.05 (0.16)
Some college	1.04 (0.93, 1.18) 1	1.05 (0.89, 1.25) 1	1.03 (0.87, 1.23) 1	-0.02 (0.12)	0.01 (0.13)
≥College	1	1	1	P value *0.47*[e]	P value *0.46*[e]
Occupation		N=655	N=604		
Manual	1.06 (0.95, 1.20)	1.03 (0.86, 1.22)	1.09 (0.94, 1.28)	0.06 (0.12)	0.04 (0.13)
Sales	1.06 (0.90, 1.24)	1.15 (0.93, 1.42)	0.95 (0.74, 1.21)	-0.19 (0.17)	-0.14 (0.18)
Service	1.08 (0.94, 1.24)	1.08 (0.88, 1.33)	1.08 (0.89, 1.31)	-0.004 (0.14)	-0.07 (0.16)
Management	1	1	1	P value *0.23*[e]	P value *0.36*[e]
Childhood SES		N=632	N=589		
Low tertile	0.88 (0.76, 1.02)	0.83 (0.67, 1.03)	0.94 (0.77, 1.15)	0.09 (0.12)	0.10 (0.13)
Middle tertile	1.09 (0.96, 1.24)	1.00 (0.83, 1.21)	1.19 (1.00, 1.42)	0.16 (0.12)	0.16 (0.13)
High tertile	1	1	1	P value *0.21*[e]	P value *0.23*[e]
Cumulative SES		N=657	N=610		
Low tertile	0.96 (0.85, 1.09)	0.90 (0.74, 1.08)	1.04 (0.87, 1.24)	0.13 (0.12)	0.12 (0.13)
Middle tertile	1.03 (0.92, 1.15)	0.92 (0.78, 1.08)	1.15 (0.98, 1.35)	0.22 (0.12)*	0.20 (0.13)
High tertile	1	1	1	*0.08*[e]	*0.14*[e]

HS = High school; N = sample size; SES = Socioeconomic status.

*=p<0.05,

** =p<0.01,

*** =p<0.001.

[a] Model for all male non-retirees, includes age and SES indicator.

[b] Model includes age, SES indicator, John Henryism and SES*John Henryism interaction.

[c] Beta estimate and standard error for the interaction terms from a model that includes age, SES indicator, John Henryism and SES*John Henryism interaction.

[d] Beta estimate and standard error for the interaction terms from a model that includes age, SES indicator, stress score, John Henryism and SES*John Henryism interaction.

[e] One-sided p value from the joint test of SES*John Henryism interaction terms.

Table 4

Prevalence ratios of hypertension associated with SES indicators stratified by level of John Henryism, and results of tests for multiplicative interaction between John Henryism and SES categories, among female non-retirees in the Jackson Heart Study.

		Prevalence ratios (95% CI)		Interaction coefficients and global P values for interaction	
Characteristics	**All**[a]	**Low John Henryism**[b]	**High John Henryism**[b]	**P value for SES*John Henryism interaction**[c]	**P value for SES*John Henryism interaction**[d]
Income		N=1121	N=1005		
Low tertile	1.16 (1.06, 1.27)	1.27 (1.11, 1.44)	1.06 (0.93, 1.20)	-0.18 (0.09)*	-0.16 (0.10)
Middle tertile	1.16 (1.06, 1.27)	1.23 (1.08, 1.40)	1.09 (0.96, 1.24)	-0.13 (0.9)	-0.11 (0.10)
Top tertile	1	1	1	P value *0.06*[e]	P value *0.12*[e]
Education		N=1131	N=1010		
≤HS	1.11 (1.01, 1.23)	1.16 (1.00, 1.35)	1.05 (0.92, 1.20)	-0.10 (0.10)	-0.04 (0.10)
HS	1.13 (1.03, 1.24)	1.26 (1.10, 1.43)	1.01 (0.89, 1.16)	-0.21 (0.09)*	-0.19 (0.10)*
Some college	1.14 (1.04, 1.25)	1.21 (1.06, 1.37)	1.05 (0.92, 1.21)	-0.14 (0.09)	-0.11 (0.10)
≥College	1	1	1	P value *0.07* [e]	P value *0.13* [e]
Occupation		N=1120	N=995		
Manual	1.27 (1.14, 1.41)	1.26 (1.08, 1.47)	1.28 (1.11, 1.48)	0.02 (0.11)	0.09 (0.11)
Sales	1.11 (1.00, 1.22)	1.11 (0.97, 1.27)	1.11 (0.95, 1.28)	-0.003 (0.10)	0.01 (0.11)
Service	1.15 (1.06, 1.25)	1.18 (1.05, 1.33)	1.18 (0.99, 1.26)	-0.06 (0.08)	-0.04 (0.09)
Management	1	1	1	P value *042* [e]	P value *0.33* [e]
Childhood SES		N=1074	N=974		
Low tertile	1.01 (0.90, 1.12)	1.00 (0.86, 1.16)	1.01 (0.87, 1.18)	-0.02 (0.08)	-0.01 (0.09)
Middle tertile	1.09 (1.00, 1.20)	1.07 (0.94, 1.22)	1.12 (0.98, 1.28)	0.03 (0.09)	0.02 (0.09)
High tertile	1	1	1	P value *0.43* [e]	P value *0.46* [e]
Cumulative SES		N=1128	N=1010		
Low tertile	1.16 (1.06, 1.27)	1.24 (1.09, 1.41)	1.08 (0.95, 1.22)	-0.14 (0.08)	-0.12 (0.09)
Middle tertile	1.09 (1.00, 1.20)	1.17 (1.03, 1.33)	1.01 (0.89, 1.16)	-0.15 (0.10)	-0.12 (0.10)
High tertile	1	1	1	P value *0.10*[e]	P value *0.17*[e]

HS = High school; N = sample size; SES = Socioeconomic status.

*=p<0.05,

** =p<0.01,

*** =p<0.001.

[a] Model for all male non-retirees, includes age and SES indicator.

[b] Model includes age, SES indicator, John Henryism and SES*John Henryism interaction.

[c] Beta estimate and standard error for the interaction terms from a model that includes age, SES indicator, John Henryism and SES*John Henryism interaction.

[d] Beta estimate and standard error for the interaction terms from a model that includes age, SES indicator, stress score, John Henryism and SES*John Henryism interaction.

[e] One-sided p value from the joint test of SES*John Henryism interaction terms.

Table 5

Predicted prevalence (%) of hypertension by income, stratified by low and high John Henryism for male and female non-retirees in the Jackson Heart Study.[a]

Men		**Low John Henrysim**	**High John Henryism**
Income tertiles	Low tertile	48.82	59.63
	Middle tertile	59.73	58.97
	Top tertile	57.69	50.60
Women			
Income tertiles	Low tertile	68.40	62.54
	Middle tertile	61.96	61.01
	Top tertile	49.13	52.93

[a]Predictions made for age group 45-54 from models stratified by gender and John Henryism andadjusting for age.