

Job Strain and Blood Pressure in African Americans: The Pitt County Study

ABSTRACT

Objectives. This report examined whether job strain (or its components, decision latitude and job demands) was associated with elevated blood pressure levels in a community-based sample of 726 African-American adults.

Methods. Blood-pressure, anthropometric, behavioral, demographic, and psychosocial data were collected for the current cross-sectional analyses during home interviews conducted for the second wave (1993) of the Pitt County Study (North Carolina), a prospective cohort study of hypertension among African Americans.

Results. Job strain was not associated with blood pressure among men or women in this study. However, men in the 80th percentile of decision latitude had more than a 50% decrease in the prevalence of hypertension compared with men in the 20th percentile (odds ratio = .46, 95% confidence interval = .22, .96).

Conclusions. These results indicate that decision latitude may be important for hypertension risk among African-American men. More research is needed on African Americans to determine why job strain and its two component variables differ in their associations with blood pressure for men and women. (*Am J Public Health*. 1997;87:1297-1302)

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Introduction

According to the third National Health and Nutrition Examination Survey (NHANES III),¹ the age-adjusted prevalence of hypertension was 34.0% for African-American men and 31.0% for African-American women. The corresponding figures for non-Hispanic Whites were 25.4% and 21.0%. The reasons for the excess prevalence among African Americans are not known; hypotheses have focused on a variety of risk factors, including psychosocial stress.² This includes stressful work conditions,³ which, with few exceptions,^{4,5} have received little attention in the hypertension research that has included African Americans. This limited attention is all the more noteworthy given that African Americans are overrepresented in low-wage, blue-collar jobs.⁶ Such jobs typically offer limited opportunity for control over the pace of work and independent decision making, conditions that help to define job strain.⁷

In the 1980s, Karasek and colleagues⁸ hypothesized that job strain, defined as exposure to high job demands (working fast and hard) and low decision latitude (little authority and low skill level) increased risk for cardiovascular disease. Studies specifically examining the association between job strain and hypertension have been conducted in both the United States⁹⁻¹⁶ and Sweden.¹⁷⁻²⁰ As shown in Table 1, the Swedish studies reported positive findings more consistently. In general, women and non-Caucasians are underrepresented in this literature.

Only two studies with some degree of focus on African Americans were found. The first¹⁴ involved a multiracial (mostly male) sample of San Francisco

bus drivers, while the second¹⁶ involved a small, biracial sample of primarily white-collar workers in North Carolina. It is not clear to what degree findings from these studies are generalizable to larger, community-based samples of African-American men and women employed in a broader range of occupations. The current study builds directly upon this prior work,^{14,16} examining the applicability of the job-strain hypothesis, and associated measures, to a community-based probability sample of African-American adults.

Methods

Study Population

The Pitt County Study is a prospective cohort study of 1195 African-American men and women residing in Pitt County, North Carolina. In 1988, a community probability sample of 1784 African-American men and women, ages 25 through 50, was interviewed to determine cross-sectional associations between selected psychosocial and behavioral risk factors and hypertension (blood pressure \geq 140/90 mmHg or taking hypertension medication). In 1993, all 1407 initially untreated normotensive subjects

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TABLE 1—Studies of Blood Pressure That Used Karasek's Job-Strain Model

First Author	Year	Sample	Design	Blood Pressure Measurement	Findings
Sweden					
Theorell ¹⁷	1993	56 women, aged 20–40	cross-sectional	ABPM	+JS at work +JS at rest (SBP only)
Theorell ¹⁸	1991	161 men, aged 35–55	cross-sectional	ABPM	+JS at work and rest (DBP only)
Theorell ¹⁹	1988	51 men and 22 women, aged 22–63	prospective cohort	ABPM	+JS with positive family history (SBP only)
Theorell ²⁰	1985	71 men, aged 28	case-control	Sphyg	+JS with higher BP at age 18 (SBP only)
United States					
Pieper ⁹	1989	meta-analysis of 5 studies, 12 555 men, aged 18–64	cross-sectional	Sphyg	JS JD +DL
Reed ¹⁰	1989	8006 men of Japanese ancestry, aged 70–89	prospective cohort	Sphyg	JS JD DL
Schnall ^{11,12}	1990	196 men, 81% White, aged 30–60	case-control	Sphyg and ABPM	+JS
Schnall ¹³	1992	264 men, 84% White, aged 30–60	cross-sectional	ABPM	+JS
Albright ¹⁴	1992	1396 bus drivers, 91% male, 60% Black, aged 20–69	cross-sectional	Sphyg	JS JD DL
Van Egeren ¹⁵	1992	17 men and 20 women, 35 White, aged 21–52	cross-sectional	ABPM	+JS at work (DBP/SBP) +JS at home (SBP only)
Light ¹⁶	1992	Men: Black (n = 27) and White (n = 38) Women: Black (n = 30) and White (n = 34), aged 18–47	cross-sectional	Sphyg and ABPM	+JS (men only)

Note. JS = job strain; DL = decision latitude; JD = job demands; ABPM = ambulatory blood pressure monitor; Sphyg = standard mercury sphygmomanometer; + = significant association with blood pressure in the expected direction; SBP = systolic blood pressure; DBP = diastolic blood pressure.

diastolic blood pressure < 95 mmHg in 1988) were followed up, and 1195 (85%) were successfully reinterviewed.

The data for the current cross-sectional study were obtained during the 1993 interviews. Analyses were restricted to the 1001 individuals with untreated baseline (1988) blood pressure below 140/90 mmHg in order to minimize potential differential misclassification on the exposure because of knowledge of hypertension risk. The study focuses on the 280 men and 463 women who were employed in 1993 and who met the blood pressure criterion. Seven men and 10 women were subsequently excluded because of missing values on analysis variables, resulting in a final analysis sample of 273 men and 453 women. Gender-specific weights were created to correct for nonresponse and oversampling (SA James et al., unpublished data, 1996).

Study Variables

Study participants were interviewed in their homes by trained interviewers²¹ (also SA James, unpublished data, 1996). Information was collected on cigarette smoking, alcohol consumption, physical exercise, and psychosocial and economic resources, including education, marital status, social support, ability to pay for basics, and home ownership. Height (with shoes off) and body weight were measured. By means of a standard mercury sphygmomanometer, three consecutive, sitting blood pressures were taken on the right arm 15 minutes into the interview. Systolic and diastolic blood pressure were estimated by averaging the second and third readings. Hypertension was defined as systolic blood pressure equal to or greater than 160 mmHg or diastolic blood pressure equal to or greater than 95 mmHg or taking antihypertensive medication.

Midway through the hour-long interview, respondents were administered Karasek's job-content instrument.²² Nine questions on job skills and authority were used to define the decision-latitude component of job strain. Decision-latitude scores range from a low of 12 to a high of 48. Five questions define job demands, with scores again ranging from 12 to 48. High scores on decision latitude represent a high level of decision-making authority and control over one's job, while high scores on job demands represent taxing physical and mental demands at work. Following the approach of Karasek,²² job strain was defined as a score less than the median on decision latitude but greater than the median on job demands. Data for men and women were pooled to determine median cutpoints in order to allow for gender comparisons. The median scores for decision latitude and job

demands were similar for men and women, and results were not materially different when gender-specific median score cutpoints were used.

The following variables were considered potential confounders: age, body mass index, occupation as measured by the Hollingshead job prestige scale,²³ education, marital status, a global measure of perceived stress,²⁴ smoking status, alcohol consumption, exercise, and level of physical exertion at work.²² Body mass index, occupation, and stress were also considered potential effect modifiers.

Statistical Analyses

Decision latitude and job demands were divided into quartiles. Gender-specific means and proportions were calculated for all potential confounders across the four levels of decision latitude and job demands to determine whether the latter two variables were related to the former in expected ways.

Logistic regression analysis was conducted when hypertension prevalence was the outcome; multiple linear regression was used when mean blood pressure was the outcome. All analyses conducted were gender-specific. Initially, models were tested with job strain as the exposure; this was followed by separate models testing decision-latitude and psychological-demands scores as the primary predictors. Potential confounders and effect modifiers were included if they reached statistical significance ($P < .05$). Because blood pressure rose sharply around age 45 (especially for women), age was dichotomized as below age 45 versus age 45 and above. Owing to the low prevalence of smokers and alcohol consumers in this sample (Table 2), both of these variables were also represented as dichotomies. The final models included a continuous measure of body mass index, Hollingshead occupation score, and level (1 = low, 4 = high) of physical exertion at work, as well as age dichotomized as below age 45 versus age 45 and above, alcohol consumption (drinker vs abstainer), and strenuous physical exercise, defined as physical activity three or more times per week sufficiently strenuous to perspire.

Results

Gender-specific demographic and job-strain characteristics of the sample are shown in Table 2. The mean age for men was 38.5 years; their mean body mass index was 27.0. A majority (65%) of men

TABLE 2—Characteristics of Employed Black Adults, Aged 30 through 55, by Sex: Pitt County, North Carolina, 1993

	Men	SE	Women	SE
No.	273		453	
Mean age, y	38.5	.48	38.9	.38
Mean systolic blood pressure	125.2	.94	121.6	.85
Mean diastolic blood pressure	82.2	.83	78.3	.60
Job status		.03		.03
White collar, ^a %	19.3		37.4	
Blue collar, ^b %	80.7		62.6	
Education				
≤12 years, %	36.5	.03	26.7	.03
13–15 years, %	32.2	.03	29.2	.03
≥16 years, %	31.3	.03	44.0	.03
Mean body mass index	27.0	.29	30.4	.36
Mean stress score ^c	20.2	.33	21.2	.25
Married, %	65.1	.03	50.3	.03
Nonsmokers, %	58.6	.04	76.8	.02
Alcohol abstainers, %	50.3	.04	79.7	.02
Strenuous exercisers, ^d %	42.6	.04	32.5	.03
Job strain, %	19.6	.03	26.9	.03
Mean decision-latitude score	35.0	.35	34.8	.30
Mean job-demands score	29.6	.36	32.0	.32

^aHollingshead occupation score = 5–9.

^bHollingshead occupation score = 1–4.

^cPossible range 10–40.

^dPhysical activity ≥3 times/wk and usually perspire.

were married. Nineteen percent of men held white-collar jobs, as defined by a Hollingshead occupation score of 5 or more. Thirty-one percent of men had 16 or more years of formal education. Approximately half abstained from alcohol; 59% did not smoke; and 43% exercised strenuously.

The mean age for women was 38.9 years; their mean body mass index was 30.4. Fifty percent of the women were married; 37% held white-collar jobs, and 44% had 16 years or more years of formal education. A majority (77%) of the women were nonsmokers and abstained from alcohol (80%). More than half (68%) of the women did not engage in strenuous physical exercise.

Job strain was more prevalent among women (27%) than among men (20%). The average decision-latitude score in the current study was similar to those reported in other studies^{10,11} and did not differ among men and women. The average job-demands score, also similar to those reported in other studies,^{10,11} was higher in females (mean score = 32) than in males (mean score = 30).

In univariate analysis (data not shown), mean occupation and education scores for men increased as decision latitude increased ($P \leq .0005$). Supervising others at work was also associated with higher ($P \leq .0005$) decision-latitude

scores for men. These three variables were similarly associated with decision latitude for women, suggesting that the decision-latitude variable performed as expected for both sexes. For men, both physical exertion ($P \leq .0005$) at work and a global measure of perceived stress ($P = .015$) increased as job demands increased. For women physical exertion at work was positively associated with job demands ($P \leq .0005$), but global perceived stress scores were not ($P = .17$).

Regression models that adjusted for the six empirically verified confounders (age, body mass index, Hollingshead occupation score, physical exertion at work, alcohol consumption, and strenuous exercise) were used to test the study hypothesis. As Table 3 shows, job strain was not associated with any of the three outcomes for either men or women. All estimated differences, whether in hypertension prevalence or mean systolic and diastolic blood pressure, were small, with the 95% confidence interval including the null value in all cases.

Decision latitude and job demands were then substituted for job strain in multiple linear regression models, with the aforementioned six covariates controlled for (Table 4). Both exposures were scored continuously, rather than as categories, to preserve information. The 20th and 80th percentiles of decision latitude

TABLE 3—Multivariate Regression Analyses^a of Job Strain, Systolic and Diastolic Blood Pressure, and Prevalence of Hypertension among Men and Women Aged 30 through 55 in the Pitt County Study

Sex	Job Strain	Systolic Blood Pressure Difference (95% CI)	Diastolic Blood Pressure Difference (95% CI)	High Blood Pressure OR (95% CI)
Men	No	...	...	...
	Yes	-2.8 (-7.71, 2.20)	.1 (-4.11, 4.29)	1.3 (.50, 3.29)
Women	No	...	...	...
	Yes	-.4 (-4.13, 3.40)	.7 (-2.03, 3.35)	1.1 (.58, 2.22)

Note. OR = odds ratio; CI = confidence interval.

^aAnalyses adjusted for age, body mass index, occupation, physical exertion at work, alcohol consumption, and exercise. Men and women with no job strain were the reference categories.

TABLE 4—Multivariate Regression Analyses^a of Decision Latitude, Job Demands, Systolic and Diastolic Blood Pressure, and Prevalence of Hypertension among Men and Women Aged 30 through 55 in the Pitt County Study

Sex	Job Strain Component Score	Systolic Blood Pressure Difference (95% CI)	Diastolic Blood Pressure Difference (95% CI)	High Blood Pressure OR (95% CI)
Decision latitude				
Men	20th percentile ^b	...	...	...
	80th percentile	-1.4 (-5.13, 2.40)	-1.1 (-4.25, 2.13)	.46 (.22, .96)
Women	20th percentile ^b	...	...	...
	80th percentile	1.1 (-1.93, 4.04)	.8 (-1.30, 2.97)	1.0 (.58, 1.73)
Job demands				
Men	20th percentile ^b	...	...	...
	80th percentile	-1.2 (-4.08, 1.77)	-.6 (-3.12, 1.84)	.9 (.51, 1.56)
Women	20th percentile ^b	...	...	...
	80th percentile	2.8 (-.06, 5.73)	1.9 (-.19, 3.96)	1.2 (.69, 2.14)

Note. OR = odds ratio; CI = confidence interval.

^aAnalyses adjusted for age, body mass index, occupation, physical exertion at work, alcohol consumption, and exercise.

^bReference category.

and psychological demands were chosen to illustrate any observed main and interaction effects. The only statistically significant association observed was for men, and it involved decision latitude and hypertension prevalence. Scoring at the 80th as compared with the 20th percentile on decision latitude was associated with more than a 50% reduction (odds ratio = .46, 95% confidence interval [CI] = .22, .96) in hypertension prevalence for men. The only contrast that approached statistical significance for women was a covariate adjusted 2.8 mmHg (95% CI = -.06, 5.73) higher mean systolic blood pressure for women

who scored at the 80th percentile, in contrast to the 20th percentile, on job demands.

Discussion

Job strain, the composite variable, was not predictive of higher mean blood pressures or higher hypertension prevalence for employed members of the Pitt County study population. The constituent variables, decision latitude and job demands, were related to differential risk for men and women, respectively. For men, high decision latitude was associated with more than a 50% decrease in the preva-

lence of hypertension. For women, a nonsignificant trend was noted for high job demands to be associated with higher mean systolic blood pressure.

There are several possible explanations for the null findings for job strain. First, the study participants who had elevated blood pressure ($\geq 160/95$ or taking antihypertensive medication) at baseline were not followed in 1993. It may be that individuals who were excluded for this reason also had higher job-strain scores. If so, this would bias the study findings toward the null. Unfortunately, job-strain questions were included only in the 1993 follow-up interview; hence, this potential explanation cannot be examined empirically. Questions were asked at baseline, however, about job security, future chances for promotion, and overall job satisfaction, and no associations were found between these variables and mean blood pressure.²³ This suggests that selective participation at follow-up, attributable to early exposure to job strain and concomitant elevated risk for hypertension, is an unlikely explanation of the null findings.

Second, if individuals with high blood pressure self-selected out of high-strain jobs, this would also lead to selection bias, weakening the expected positive association between job strain and hypertension risk. Some evidence²⁴ suggests that older individuals do self-select out of high-strain jobs; however, the extent to which this applies to the Pitt County cohort of 30- through 55-year-olds cannot be determined since historical job-strain information is lacking. We note, however, that there was a greater percentage of participants older than 45 years in the high job-strain category in our sample. Statistically controlling for age, as we did in all analyses, should have corrected for this potential source of confounding.

Third, Reed et al.¹⁰ noted potential problems with the exclusive use of current occupation data in studies on job strain, since such data do not take into account the potential effects of occupational mobility, which could also affect hypertension risk. In our study, the average length of employment on the current job was reasonably long, 8 years for men and 6 years for women. Moreover, the average length of employment in the current job did not differ between high and low job-strain categories for either men or women. Taken together, these two factors make recent occupational mobility an unlikely explanation for the null findings for job strain.

A fourth and final potential explanation of the null findings concerns the way blood pressure was measured in the current study as opposed to studies showing stronger associations. We used a standard mercury sphygmomanometer to measure blood pressure in the respondents' homes. Of the four studies that investigated the relationship between job strain and blood pressure utilizing a sphygmomanometer, rather than an ambulatory blood pressure monitor, two reported mixed results,^{9,20} and the other two^{10,14} had null findings. This contrasts to the seven ambulatory blood pressure-monitor studies, of which six reported positive associations.^{11,13,15-19} If the association between job strain and blood pressure emerges by first increasing blood pressure at work, then it is possible that readings taken in the home setting (on still relatively young adults) could produce attenuated associations between job strain and blood pressure level. Hence, using a sphygmomanometer, rather than the ambulatory blood pressure monitor, could lead to a loss of precision.²⁵

A significant, inverse association was noted between decision latitude and hypertension prevalence for men. While the finding is theoretically plausible, and has been observed by other investigators,⁹ uncontrolled confounding and chance remain alternative explanations. All known potential confounders were controlled for in the analyses. We also controlled for the influence of the Hollingshead occupation score, a measure of socioeconomic status (SES); the finding for decision latitude remained significant at the .05 level. The fact that the association involving decision latitude persisted after the Hollingshead occupation score was controlled for further decreases the likelihood that confounding (by SES) was responsible for the decision-latitude finding. The biological plausibility of the decision-latitude effect,²⁴ plus its observance by other investigators,⁹ renders chance an unlikely alternative explanation.

Potential confounders that we did not control for because of lack of data included social support at work,²⁶⁻²⁹ salary and promotion inequities, and work demands within the home, all potentially important to consider in studies involving women.¹⁶ We had a proxy measure for work demands in the home, namely the average number of hours spent each week fulfilling domestic duties. This variable, however, was not associated with job strain, decision latitude, job demands, or

the study outcomes, mean blood pressures and hypertension prevalence.

The cross-sectional data used in this study preclude the inference that decision latitude is causally linked to elevated risk for hypertension. Prospective data are required to clearly establish the correct temporal sequence of the reported association. Such prospective data would also decrease the risk of selection bias (i.e., individuals with high blood pressure being more likely to quit high-strain jobs, hence attenuating the association). Finally, prospective data would also clarify whether higher decision latitude protects men from higher blood pressure or whether men with higher blood pressure seek employment in high decision-latitude jobs.

Gender differences in the relationship between job strain and blood pressure need more detailed study. Decision latitude, but not job demands, was associated with hypertension risk in men, while the converse was true for women (i.e., for systolic blood pressure). Interestingly, while women had proportionally more white-collar workers and a higher percentage of persons with 16 or more years of education (44%) than males (33%), mean decision-latitude scores (a correlate of both occupation and education) were approximately equal for men (35.0) and women (34.8). In addition, proportionately fewer women than men were supervisors at each level of decision-latitude categories. This suggests that high educational attainment by African-American women in this study community does not lead to jobs with comparably high levels of skill and authority as it does for their male counterparts. Finally, the concept of decision latitude may not mean the same thing for men and women in this and other studies,^{15,16} a topic that clearly warrants further investigation.

In conclusion, we observed a weak relationship between blood pressure and the components of job strain (decision latitude and job demands) in this community-based sample of employed African-American men and women. Decision latitude was inversely associated with hypertension prevalence among men, while, for women, high job demands tended to be associated with higher systolic blood pressure.

More research is needed to determine why the hypothesized relationships between blood pressure and job strain (and its component variables) differ for Black men and women. Including the current study, research on job strain and

blood pressure among African Americans has led to mixed results. Perhaps Karasek's job-strain scales²⁹ need to be refined for use in geographical or ethnic minority populations that may differ in important ways from those with whom the job-strain model was initially developed. Finally, use of ambulatory blood pressure monitors and questions on social support at work should be routinely incorporated in future job-strain research. This may be necessary to enhance the validity of studies that focus on ethnic minority populations and on women of all ethnic and SES strata.²⁴

The theory positing adverse effects of job strain on blood pressure and other cardiovascular diseases is still under development. The job-strain research model represents an important step forward in social epidemiological investigations of cardiovascular disease risk; for this reason, future theoretical and methodological advances must be appropriately inclusive of women and ethnic minority populations. □

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