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Does Race/Ethnicity Moderate the Association Between Job Strain and Leisure Time Physical Activity?

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Abstract

Background—Racial/ethnic minorities report myriad barriers to regular leisure time physical activity (LTPA), including the stress and fatigue resulting from their occupational activities.

Purpose—We sought to investigate whether an association exists between job strain and LTPA, and whether it is modified by race or ethnicity.

Methods—Data were collected from 1,740 adults employed in 26 small manufacturing businesses in eastern Massachusetts. LTPA and job strain data were self-reported. Adjusted mean hours of LTPA per week are reported.

Results—In age and gender adjusted analyses, reports of job strain were associated with LTPA. There was a significant interaction between job strain and race or ethnicity ($p = .04$). Whites experiencing job strain reported 1 less hr of LTPA per week compared to Whites not reporting job strain. Collectively, racial/ethnic minorities reporting job strain exhibited comparatively higher levels of LTPA compared to their counterparts with no job strain, although patterns for individual groups did not significantly differ.

Conclusions—Job strain was associated with LTPA in a lower income, multiethnic population of healthy adult men and women. The association between job strain and LTPA was modified by race or ethnicity, highlighting the importance of investigating the differential effects of psychosocial occupational factors on LTPA levels by race or ethnicity.

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INTRODUCTION

Regular physical activity (PA) is associated with a reduced risk of obesity, cardiovascular disease, diabetes, and some cancers (1–3). It has been estimated that up to 17% of chronic disease deaths can be attributed to physical inactivity (4). Despite the clear and well-established benefits of regular PA, sedentary behavior is pervasive (5).

The burden of excess disease incidence and mortality associated with physical inactivity may disproportionately affect racial/ethnic minorities living in the United States (6–8). Numerous studies, for example, have shown a higher prevalence of inactivity (primarily during leisure time) among Blacks than Whites, even after adjusting for social class (9–13). In 2002, the prevalence of no leisure time physical activity (LTPA) among adults was 37.6% for Hispanics, 31.85% for Blacks, 23.95% for Asians, and 21.2% for Whites (5).

Many in racial/ethnic minority groups report myriad barriers to regular LTPA, including conflicting demands, limited time, and few locations for safe exercise (14–16), as well as the stress and fatigue resulting from their occupational activities (17–22). For example, Airhihenbuwa, Kumanyika, Agurs, and Lowe (23) found that Black and Latina women in lower income strata reported being incapable of engaging in LTPA due to the psychosocial demands imparted by their workday activities—a finding that has been supported elsewhere (24,25).

We hypothesized that individuals in occupational positions characterized by job strain might be less physically active compared to those not experiencing job strain. The Karasek demand-control (or job strain) model identifies two primary dimensions of the psychosocial occupational environment: (a) the psychological demands of the job (job demands), and (b) the ability to use skill or authority to exert control over work responsibilities (decision latitude or job control) (26). The model posits that job strain results when job demands exceed the limits of a worker's control; positions characterized by high job strain are hypothesized to be the most deleterious for health-related outcomes (26). Indeed, tests of the model have repeatedly shown independent effects for job control and demands in relation to health-related outcomes, but evidence supporting the job strain interaction term is mixed (27–30).

Job strain and its constituent components (job demands and job control) might be associated with physical inactivity via the provision of excess fatigue and the resulting perceived need for extended periods of recovery after work (31). Consistent with this notion, PA has been positively associated with job control (31–34), and inversely related with both job demands (31) and generalized occupational stress; most of these studies have been conducted, however, among mostly White samples (35,36). Most recently, Kouvonen et al. (37) found among a large sample of over 46,000 Finnish public sector employees that adult women and men in high job strain positions reported significantly lower levels of LTPA than those with low strain jobs. However, null findings have also been reported (34,38–40).

Few studies have systematically examined the relation between job strain and LTPA in a racially and ethnically diverse sample. We posited that racial/ethnic minorities might be more likely to occupy positions characterized by job strain, given evidence of inequities in labor market practices (41–44), including their heightened exposure to adverse workplace characteristics (44–48). Accordingly, we suspected that compared to Whites, racial/ethnic minorities might display more profound decrements in LTPA resulting from job strain.

METHODS

Study Design

These data are from the Harvard Cancer Prevention Program Project—Healthy Directions Study, which is composed of two randomized controlled trials, one in health centers (49), and one in small businesses (50). The overall study aims and sampling strategies are published in greater detail elsewhere (49,50).

These analyses are based on baseline data collected in the Healthy Directions—Small Business study (50), a randomized controlled trial in which the worksite was the unit of randomization and intervention. Worksites were identified using the Dun and Bradstreet database to locate small businesses with Standard Industrial Classification codes 20 to 39 (manufacturing industries) and employing between 50 and 150 employees. Additional inclusion criteria included the following: (a) employing a multi-ethnic population (defined as 25% of workers being first-or second-generation immigrants or people of color), (b) having a turnover rate of less than 20% in the previous year, (c) being autonomous in decision-making power to participate in a study, and (d) agreeing to be randomly assigned to the intervention condition. One hundred thirty-three companies met the eligibility criteria and of these, 26 agreed to participate (51).

Characteristics of eligible worksites are described in greater detail elsewhere (52), and there were no significant differences between worksites that consented to participate and those that did not. Briefly, among all eligible worksites, just under 40% of all employees were persons of color or first- or second-generation U.S. immigrants (39.4% participated; 47.8% refused). Approximately one half of eligible worksites anticipated increasing the size of their workforce in the next year (53.9% participated; 49.0% refused), one fourth had a history of site-based health promotion activities (26.9% participated; 24.8% refused), and most had a history of occupational health and safety programs (88.5% participated; 84.6% refused).

Data were collected in-person among individuals who were permanent employees and worked 20 hr or more per week on site. Workers participated in an interviewer-administered survey in English, Portuguese, Spanish, or Vietnamese on company time. Of the 2,069 eligible employees in the 26 baseline sites, 1,740 completed the survey (84% response rate, range = 70–98% across sites) (50).

MEASURES

Job Strain

Given the logistical considerations necessary to conduct this study in the target worksites, job strain was assessed using a modified version of the Karasek Job Content Questionnaire (53). Modifications were guided by expert consultations and constituted a reduction in the number of questions utilized to assess the job strain components. The measure included two psychological job demand items (job makes conflicting demands and job requires working fast), one item to assess decision authority (lot of say about what happens on job), and two items to assess skill discretion (job requires learning new things, and job involves doing same things over and over). Job control was created as a weighted sum of decision authority and skill discretion. A worker was assigned to the job strain category if his or her psychological demand was greater than the national median, whereas job control was below the national median. Based on our expert consultations (Jeff Johnson and Paul Landsbergis, personal consultation), we decided a priori to utilize validated national median thresholds to minimize bias resulting from intersite variation in job strain estimates, thus facilitating generalizability of the study findings. National medians were obtained (54,55) and rescaled to adjust for the number of items used in our study.

Leisure Time Physical Activity

LTPA was self-reported using a semiquantitative activity questionnaire that was originally developed and validated in a population of nurses and in a separate population of health professionals (56,57). The instrument was modified based on pilot testing in the target population and validated using accelerometers. Participants reported how often in the last 4 weeks they engaged in eight types of activities: walking for exercise; jogging; running; bicycling; aerobics or aerobic dancing; playing soccer, rugby, basketball or lacrosse; playing baseball, football, bowling or lifting weights; and other activities that get you at least a little bit out of breath. Occupational activity was assessed by asking participants how many hours a week they spent doing heavy physical activities at work such as moving heavy equipment or lifting heavy boxes. Responses were coded into hours per week of activity. In the validation study (58), we found that the Spearman correlation of total hours of PA as recorded on the accelerometers and by self-report was 0.53.

Race or Ethnicity

Participants were asked whether they belonged to any of five racial or ethnic groups: American Indian (including Alaska Native), Asian or Pacific Islander, Hispanic, Black or African American, or White. Participants responded *yes* or *no* to each group as read. We coded those who reported being of Hispanic or Latino origin in the Hispanic group regardless of any other responses. For the remaining participants, those who reported only one racial or ethnic group were categorized in that group. Respondents who selected more than one group were classified as multiple-heritage and were subsequently classified as those who included White and those who did not. For analysis, because of our desire to examine racial or ethnic variation, we selected those whose responses were grouped into one of the following four categories: Hispanic, non-Hispanic White (White, including those who were classified as multiple-heritage "White"), non-Hispanic Black (Black), and Asian or Pacific Islander (Asian).

Sociodemographic Characteristics

Participants reported their date of birth, which was used to calculate age in years. Education was self-reported as the highest level of school finished ranging from "elementary" through "postgraduate degree." This was collapsed into three categories due to small numbers: high school diploma or less, some post-high school, bachelor degree or more. Each participant's work-site provided information as to whether the individual was in a managerial or nonmanagerial position.

Data Analyses

All analyses were conducted incorporating the clustering of respondents in worksites using mixed model analysis of covariance with business included as a random effect (59). We selected exposure variables (job strain, job demands, and job control) and covariates based on our a priori expectations regarding the potential for racial or ethnic differences in the association between job strain, its components, and LTPA.

Our analyses were limited to the 1,576 individuals (90.6% of sample) enrolled at baseline who reported LTPA and job strain data. We additionally excluded participants who were missing data on either age or gender (n = 18), were missing data on race or ethnicity (n = 7), or who reported being of mixed race or ethnicity (n = 103) or Native American (n = 6) to facilitate interpretation and discussion of the findings. This resulted in a final study sample of 1,442 male (n = 958, 66%) and female (n = 484, 34%) participants with a mean age of 43.2 (SD = 11.7). Most participants had above a high school education (54%) and worked in nonmanagerial positions (84%). Our multivariable analyses were limited to 1,430 due to missing data.

Although our primary interest lies in understanding the association between job strain and LTPA, we also evaluated its constituent components, job demands and job control, consistent with previous investigations (31–34). Thus, we considered job strain, job demands, and job control as exposures and examined their association with LTPA in age and gender adjusted analyses. In multivariable models, we included an interaction term for race or ethnicity and the psychosocial occupational exposure as well as potential confounders, which included education, managerial status, heavy occupational physical activity, and race or ethnicity. We report adjusted mean hours of LTPA per week and Tukey–Kramer adjusted *p* values.

RESULTS

The mean and median job demands scores were 4.32 (*SD* = 1.54) and 4.00, respectively. The mean and median job control scores were 4.49 (*SD* = 1.15) and 5.00, respectively. Twenty-eight percent of the sample reported experiencing job strain. As is shown in Table 1, participants reporting no job strain were slightly older and a higher percentage of college graduates were found in the no job strain group (24% vs. 11%). Managers were much more likely to report not experiencing job strain (21% vs. 6%). Men were more likely to report job strain than women (74% vs. 68%). Individuals reporting higher levels of heavy occupational physical activity were also more likely to report job strain ($p < .0001$). Contrary to predictions, racial/ethnic minorities were no more likely than Whites to be in the job strain group ($p = .19$).

Among the entire sample, there was an overall mean of 5.64 (*SD* = 4.73) hr per week of LTPA. Hispanics had the highest level of LTPA (*M* = 6.38 hr per week), whereas Asians had the lowest levels (*M* = 3.93 hr per week). Blacks (*M* = 5.14 hr per week) and Whites (*M* = 5.70 hr per week) had similar LTPA levels. LTPA was also similar in both the job strain and no job strain groups.

Job demands were not significantly related to LTPA in age and gender adjusted analyses (Table 2). However, job strain and job control were significantly associated with higher LTPA. However, only job strain had a significant interaction with race or ethnicity ($p = .04$), indicating that the association between job strain and LTPA differed across racial or ethnic groups (Table 3). Therefore, based on our a priori interests in examining effect modification by race or ethnicity, we limited our multivariable analyses to job strain.

In the multivariable model, age, gender, education, and heavy occupational activity were each significant predictors of LTPA. Whites who reported experiencing job strain had nearly 1 hr less of LTPA per week (1.03, $p = .05$), compared to Whites who did not experience job strain. Contrary to predictions, racial/ethnic minorities experiencing job strain collectively reported more hours of LTPA per week than their counterparts not reporting job strain (Figure 1); however, differences for individual racial or ethnic groups did not significantly differ (Blacks = 1.55, $p > .05$; Hispanics = 0.53, $p > .05$; Asians = 0.23, $p > .05$). Asians reported the lowest levels of LTPA in both the job strain (4.01 hr per week) and no job strain (3.78 hr per week) strata. Similarly, among all participants not experiencing job strain, Hispanics (5.99 hr per week) and Whites (6.04 hr per week) had the highest levels of LTPA.

DISCUSSION

The results of this study support our hypothesis that race or ethnicity modifies the association between job strain and LTPA. However, contrary to our expectations, only for Whites was job strain significantly associated with lower levels of LTPA. By contrast, racial/ethnic minorities reporting job strain exhibited comparatively higher levels of LTPA compared to their counterparts with no job strain, although these patterns did not significantly differ within individual racial or ethnic groups. Interestingly, racial/ethnic minorities in our sample were no

more likely than Whites to occupy high job strain occupations. This investigation highlights the importance of examining racial or ethnic variation in correlates of LTPA patterns. When examining only the main effects of job strain on LTPA, an inverse association is present. However, when race or ethnicity is considered as a potential modifier, we found that the inverse association holds only for Whites.

Job strain and its constituent components, job control and job demands, have previously been associated with a host of deleterious chronic disease outcomes (29,30). There is comparatively less evidence linking job strain with behavioral risk factors, particularly LTPA. Among a predominately White sample of workers (33), Hellerstedt and Jeffery found that men with low job control reported lower levels of PA; they found no job strain effects on LTPA among either male or female participants. Brisson et al. found that high job strain was associated with a higher prevalence of sedentary behavior among male white-collar workers in Canada (32). Finally, Kouvonen et al. (37) recently showed, in a Finnish sample, that male and female public sector employees in high strain jobs reported 2.56 and 4.39 fewer metabolic equivalent hours per week of LTPA, respectively, compared to their low job strain counterparts. Our findings for White participants are consistent with these previous investigations. However, racial/ethnic minorities reporting job strain in our sample demonstrated comparatively higher levels of LTPA than did Whites.

We speculate that LTPA may be utilized by some to facilitate behavioral management of the psychosocial stress imparted in positions characterized by job strain. There is also qualitative evidence indicating recognition of the stress-reducing properties of LTPA among racial/ethnic minorities (24,60,61). However, these messages may be complicated by conflicting themes; for example, some research has shown that some racial/ethnic minorities believe LTPA to be a possible determinant of stress (23). Unfortunately, we collected no psychosocial stress coping data in this study; additional investigation of this issue among racial/ethnic minorities might best inform future hypothesis generation.

Our findings are generally inconsistent with national LTPA prevalence data, which in 2002 showed that the highest rates of no LTPA were found for Hispanics (37.6%), followed by Blacks (31.85%), Asians (23.95%), and Whites (21.2%), respectively (5). This discrepancy is likely determined by differences in the measurement of LTPA and the potentially unique characteristics of our working class sample. Nevertheless, our findings highlight the need to disaggregate racial or ethnic prevalence statistics by socioeconomic position. Additionally, it will be increasingly important to broaden the attention paid to various sources of total PA in this population. Total PA among those in working class and racial/ethnic minority populations may not be derived exclusively via leisure pursuits, but may result from activities related to occupational responsibilities, domestic chores, child care, or walking for transportation (62, 63). Given that most existing self-report PA measures do not adequately characterize non-leisure time activities, the levels of PA assessed via current approaches may be greatly underestimated for those in working class groups (64–66). The attention paid to LTPA may also obscure our understanding of racial or ethnic differences in PA. This is a key concern for several reasons. First, it is largely unclear whether the recommended guidelines for daily PA are met or exceeded in working class populations through their higher reported levels of occupational, domestic, and transportation PA (66). The assumption that working class, multiethnic populations have lower total PA levels (when referring only to LTPA data) has the potential to severely impact the ability to effectively and appropriately intervene on the full range of behavioral disease risk factors (i.e. diet, screening, tobacco use). The efficacy of interventions designed to impact multiple risk factors may be challenged when intervention attention (based on underestimates of total PA) results in comparatively less time and effort devoted to addressing risk factors that are more pressing for disease prevention.

Several issues may affect interpretation of our findings. These data are cross-sectional, thus incurring all of the usual interpretive difficulties, including the potential for bidirectionality of the hypothesized associations. Our a priori interest in examining interaction models resulted in small cell sizes for some of the groups of interest. We may have lacked the power to detect some of the between-group job strain differences. Considering the pattern of these results, replication in a larger sample appears prudent. There may be some limitations resulting from our use of national job strain medians, including the potential for underestimation of assignment in the job strain category. However, use of other methods does not readily allow for standardization in the determination of job strain estimates and may result in job strain categorizations that are biased depending on the characteristics of the studied workplaces. Nevertheless, there may be limited generalizability of these findings to worksites that are dissimilar to those eligible for this study. Although our primary interest was in understanding the relation between job strain and LTPA, future work may consider further delineation of positions into categories referred to in the demand-control model as active (high job control, high job demands) and passive (low job control, low job demands). These categories may vary by race or ethnicity among those in working class populations and as such, might be differentially associated with LTPA.

We must note the possibility of measurement error as an explanation for these surprising findings. Although our measure was patterned on one that has been widely used previously to assess LTPA (56,57), it is possible that participants may have conflated LTPA with other sources of PA. Although the survey question on “other activities” was preceded by seven leisure-specific activities, some participants included domestic activities in their responses (over 50% of participants responded “none” to the question and many of the responses were leisure activities). This could result in residual confounding and may partly explain the high levels of leisure-time activity in this population. We utilized a self-reported, yet validated LTPA measure. However, we lacked information on moderate and low intensity occupational activities. It is possible that the job strain and race or ethnicity may have different associations with lower intensity occupational activities. Nevertheless, we included heavy occupational activity as a covariate because of its frequency in our study sample and because previous investigations (37) have not considered this variable as a potential confounder. Future research should consider the full range of occupational activity intensities. Finally, because of sample size considerations, we were unable to derive reliable validity estimates for the LTPA measure for each of the racial or ethnic groups under study; thus, we must note the possibility that racial or ethnic differences in valid reporting of LTPA could contribute to these findings.

Future work should examine the potential differential associations of job strain with LTPA in racially or ethnically diverse samples, particularly given the likely overrepresentation of racial/ethnic minorities in working class jobs. Our work supports that of Sorensen et al. (67) who have argued that the efficacy of behavioral interventions for traditionally underserved populations might be enhanced by attending to the range of social contextual features influencing health behavior practices.

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References

1. International Agency for Research on Cancer WHO. IARC Handbooks of Cancer Prevention: Weight Control and Physical Activity. Vol. 6. Lyon, France: International Agency for Research on Cancer; 2002.
2. National Institutes of Health. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. Bethesda, MD: Department of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute; 1998.
3. U.S. Department of Health and Human Services. Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Disease and Obesity — 2003. Atlanta, GA: Centers for Disease Control and Prevention; 2003.
4. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. Journal of the American Medical Association 2004;291:1238–1245. [PubMed: 15010446]
5. Anonymous. Prevalence of no leisure-time physical activity—35 States and the District of Columbia, 1988–2002. MMWR Morbidity and Mortality Weekly Report 2004 Feb;:82–86. [PubMed: 14762333]
6. Sung JF, Harris–Hooker SA, Schmid G, et al. Racial differences in mortality from cardiovascular disease in Atlanta, 1979–1985. Journal of the National Medical Association 1992 Mar;:259–263. [PubMed: 1578501]
7. Stokols D, Allen J, Bellingham RL. The social ecology of health promotion: Implications for research and practice. American Journal of Health Promotion 1996 Mar–Apr;:247–251. [PubMed: 10159704]
8. Breslow L. Social ecological strategies for promoting healthy lifestyles. American Journal of Health Promotion 1996 Mar–Apr;:253–257. [PubMed: 10159705]
9. Crespo CJ, Keteyian SJ, Heath GW, Sempos CT. Leisure-time physical activity among US adults. Results from the Third National Health and Nutrition Examination Survey. Archives of Internal Medicine 1996;156:93–98. [PubMed: 8526703]
10. Brownson RC, Eyler AA, King AC, et al. Patterns and correlates of physical activity among US women 40 years and older. American Journal of Public Health 2000 Feb;:264–270. [PubMed: 10667189]
11. U.S. Department of Health and Human Services. Physical activity and health: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996.
12. Washburn RA, Kline G, Lackland DT, Wheeler FC. Leisure time physical activity: Are there Black/White differences? . Preventive Medicine 1992 Jan;:127–135. [PubMed: 1738764]
13. Anonymous. Prevalence of leisure-time and occupational physical activity among employed adults —United States, 1990. MMWR Morbidity and Mortality Weekly Report 2000 May;:420–424. [PubMed: 10905821]
14. Jones M, Nies MA. The relationship of perceived benefits of and barriers to reported exercise in older African American women. Public Health Nursing 1996;13(2):151–158. [PubMed: 8936249]
15. Heesch KC, Brown DR, Blanton CJ. Perceived barriers to exercise and stage of exercise adoption in older women of different racial/ethnic groups. Women and Health 2000;30(4):61–76.
16. King AC, Castro C, Wilcox S, et al. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. Health Psychology 2000 Jul;:354–364. [PubMed: 10907654]
17. Britton JA, Gammon MD, Kelsey JL, et al. Characteristics associated with recent recreational exercise among women 20 to 44 years of age. Women and Health 2000;31:81–96.
18. Grzywacz JG, Marks NF. Social inequalities and exercise during adulthood: Toward an ecological perspective. Journal of Health Social Behavior 2001 Jun;:202–220.
19. Caspersen CJ, Merritt RK. Physical activity trends among 26 states, 1986–1990. Medicine and Science in Sports and Exercise 1995 May;:713–720. [PubMed: 7674876]
20. Resnicow K, Wang T, Dudley WN, et al. Risk factor distribution among sociodemographically diverse African American adults. Journal of Urban Health 2001 Mar;:125–140. [PubMed: 11368192]
21. Verhoef MJ, Love EJ. Women and exercise participation: The mixed blessings of motherhood. Health Care Women International 1994 Jul–Aug:;:297–306.

22. Eyler AA, Brownson RC, King AC, et al. Physical activity and women in the United States: An overview of health benefits, prevalence, and intervention opportunities. Women and Health 1997;26:27–49.
23. Airhihenbuwa CO, Kumanyika S, Agurs TD, Lowe A. Perceptions and beliefs about exercise, rest, and health among African–Americans. American Journal of Health Promotion 1995 Jul–Aug:;:426–429. [PubMed: 10150533]
24. Nies MA, Vollman M, Cook T. African American women's experiences with physical activity in their daily lives. Public Health Nursing 1999 Feb;:23–31. [PubMed: 10074819]
25. Henderson KA, Ainsworth BE. Researching leisure and physical activity with women of color: Issues and emerging questions. Leisure Science 2001;23:21–34.
26. Karasek, R.; Theorell, T. Healthy Work: Stress, Productivity, and the Reconstruction of Working Life. New York: Basic Books; 1990.
27. Steenland K, Johnson J, Nowlin S. A follow-up study of job strain and heart disease among males in the NHANES1 population. American Journal of Industrial Medicine 1997 Feb;:256–260. [PubMed: 9028443]
28. Elsass PM, Veiga JF. Job control and job strain: a test of three models. Journal of Occupational Health Psychology 1997 Jul;:195–211. [PubMed: 9552290]
29. de Lange AH, Taris TW, Kompier MA, et al. "The very best of the millennium": Longitudinal research and the demand-control-(support) model. Journal of Occupational Health Psychology 2003 Oct;: 282–305. [PubMed: 14570524]
30. Belkic KL, Landsbergis PA, Schnall PL, Baker D. Is job strain a major source of cardiovascular disease risk? . Scandinavian Journal of Work, Environment and Health 2004 Apr;:85–128.
31. Johansson G, Johnson JV, Hall EM. Smoking and sedentary behavior as related to work organization. Social Science Medicine 1991;32:837–846. [PubMed: 2028279]
32. Brisson C, Larocque B, Moisan J, et al. Psychosocial factors at work, smoking, sedentary behavior, and body mass index: A prevalence study among 6995 white collar workers. Journal of Occupational and Environmental Medicine 2000 Jan;:40–46. [PubMed: 10652687]
33. Hellerstedt WL, Jeffery RW. The association of job strain and health behaviours in men and women. International Journal of Epidemiology 1997 Jun;:575–583. [PubMed: 9222783]
34. Jonsson D, Rosengren A, Dotevall A, et al. Job control, job demands and social support at work in relation to cardiovascular risk factors in MONICA 1995, Goteborg. Journal of Cardiovascular Risk 1999 Dec;:379–385. [PubMed: 10817083]
35. Iwasaki Y, Zuzanek J, Mannell RC. The effects of physically active leisure on stress-health relationships. Canadian Journal of Public Health 2001 May–Jun:;:214–218.
36. Wu B, Porell F. Job characteristics and leisure physical activity. Journal of Aging Health 2000 Nov;: 538–559.
37. Kouvonen A, Kivimaki M, Elovainio M, et al. Job strain and leisure-time physical activity in female and male public sector employees. Preventive Medicine 2005 Aug;:532–539. [PubMed: 15917049]
38. Landsbergis PA, Schnall PL, Deitz DK, et al. Job strain and health behaviors: Results of a prospective study. American Journal of Health Promotion 1998 Mar–Apr:;:237–245. [PubMed: 10178616]
39. Reed DM, LaCroix AZ, Karasek RA, et al. Occupational strain and the incidence of coronary heart disease. American Journal of Epidemiology 1989 Mar;:495–502. [PubMed: 2916542]
40. van Loon AJ, Tijhuis M, Surtees PG, Ormel J. Lifestyle risk factors for cancer: the relationship with psychosocial work environment. International Journal of Epidemiology 2000 Oct;:785–792. [PubMed: 11034957]
41. Tomaskovic–Devey, D. Racial and Gender Inequality at Work: The Sources and Consequences of Job Segregation. Ithaca, NY: ILR Press; 1993.
42. Mishel, L.; Bernstein, J. The State of Working America, 1994–1995. Armonk, NY: Sharpe; 1994.
43. Hughes D, Dodge MA. African American women in the workplace: Relationships between job conditions, racial bias at work, and perceived job quality. American Journal of Community Psychology 1997 Oct;:581–599. [PubMed: 9485575]
44. Smith RA. Race, Gender and Authority in the Workplace: Theory and Research. Annual Review of Sociology 2002;28:509–542.

45. Loomis D, Richardson D. Race and the risk of fatal injury at work. American Journal of Public Health 1998 Jan;:40–44. [PubMed: 9584031]
46. Elliott JR, Smith RA. Race, gender, and workplace power. American Sociology Review 2004;69:365–386.
47. Robinson JC. Exposure to occupational hazards among Hispanics, Blacks and non-Hispanic Whites in California. American Journal of Public Health 1989 May;:629–630. [PubMed: 2631689]
48. National Institute for Occupational Safety and Health. Fatal Injuries to Workers in the United States, 1980–1989: A Decade of Surveillance, National and State Profiles. Cincinnati, OH: Author; 1993. DHHS Publication No. (NIOSH) 93–108S
49. Emmons KM, Stoddard AM, Gutheil C, et al. Cancer prevention for working class, multi-ethnic populations through health centers: The healthy directions study. Cancer Causes and Control 2003;14:727–737. [PubMed: 14674737]
50. Hunt MK, Stoddard AM, Barbeau E, et al. Cancer prevention for working class, multiethnic populations through small businesses: The healthy directions study. Cancer Causes and Control 2003 Oct;:749–760. [PubMed: 14674739]
51. Barbeau E, Wallace L, Lederman R, et al. Recruiting small manufacturing worksites that employ multi-ethnic, low-wage workers to a cancer prevention research trial. Preventing Chronic Disease 2004;1:1–9.
52. Barbeau EM, Wallace L, Lederman R, et al. Recruiting small manufacturing worksites that employ multi-ethnic, low-wage workers to a cancer prevention research trial. Preventing Chronic Disease 2004;1:1–9.
53. Karasek, RA. Job Content Questionnaire and User's Guide. Lowell: University of Massachusetts Lowell, Department of Work Environment; 1985.
54. Schwartz J, Pieper C, Karasek R. A procedure for linking psychosocial job characteristics data to health surveys. American Journal of Public Health 1988;78:904–909. [PubMed: 3389426]
55. Karasek R, Brisson C, Kawakami N, et al. The job content questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics. Journal of Occupational Health Psychology 1998;3:322–355. [PubMed: 9805280]
56. Wolf AM, Hunter DJ, Colditz GA, et al. Reproducibility and validity of a self-administered physical activity questionnaire. International Journal of Epidemiology 1994 Oct;:991–999. [PubMed: 7860180]
57. Chasan–Taber S, Rimm EB, Stampfer MJ, et al. Reproducibility and validity of a self-administered physical activity questionnaire for male health professionals. Epidemiology 1996 Jan;:81–86. [PubMed: 8664406]
58. Wolin KY, Bennett GG, Haughton L, Emmons K, Sorensen G. Do social contextual factors act as barriers to physical activity intervention uptake in a lower income multi-ethnic population of adults?. Unpublished manuscript
59. Murray, DM. Design and analysis of group randomized trials. New York: Oxford University Press; 1998.
60. Young DR, Gittelsohn J, Charleston J, et al. Motivations for exercise and weight loss among African–American women: Focus group results and their contribution towards program development. Ethnicity Health 2001 Aug–Nov:;:227–245. [PubMed: 11696933]
61. Walcott–McQuigg JA, Prohaska TR. Factors influencing participation of African American elders in exercise behavior. Public Health Nursing 2001 May–Jun:;:194–203. [PubMed: 11359621]
62. Jacobs DR Jr, Ainsworth BE, Hartman TJ, Leon AS. A simultaneous evaluation of 10 commonly used physical activity questionnaires. Medicine and Science in Sports and Exercise Jan;1(993):81–91.
63. Masse LC, Ainsworth BE, Tortolero S, et al. Measuring physical activity in midlife, older, and minority women: issues from an expert panel. Journal of Womens Health 1998 Feb;:57–67.
64. Ainsworth BE. Issues in the assessment of physical activity in women. Research Quarterly for Exercise and Sport 2000 Jun;(2):S37–S42. [PubMed: 10925823]
65. Ainsworth BE. Challenges in measuring physical activity in women. Exercise and Sport Sciences Reviews 2000 Apr;:93–96. [PubMed: 10902093]

66. Ainsworth BE, Irwin ML, Addy CL, et al. Moderate physical activity patterns of minority women: The Cross-Cultural Activity Participation Study. Journal of Womens Health and Gender Based Medicine 1999 Jul–Aug:;:805–813.

67. Sorensen G, Emmons K, Hunt MK, et al. Model for incorporating social context in health behavior interventions: Applications for cancer prevention for working-class, multiethnic populations. Preventive Medicine 2003 Sep;:188–197. [PubMed: 12914824]

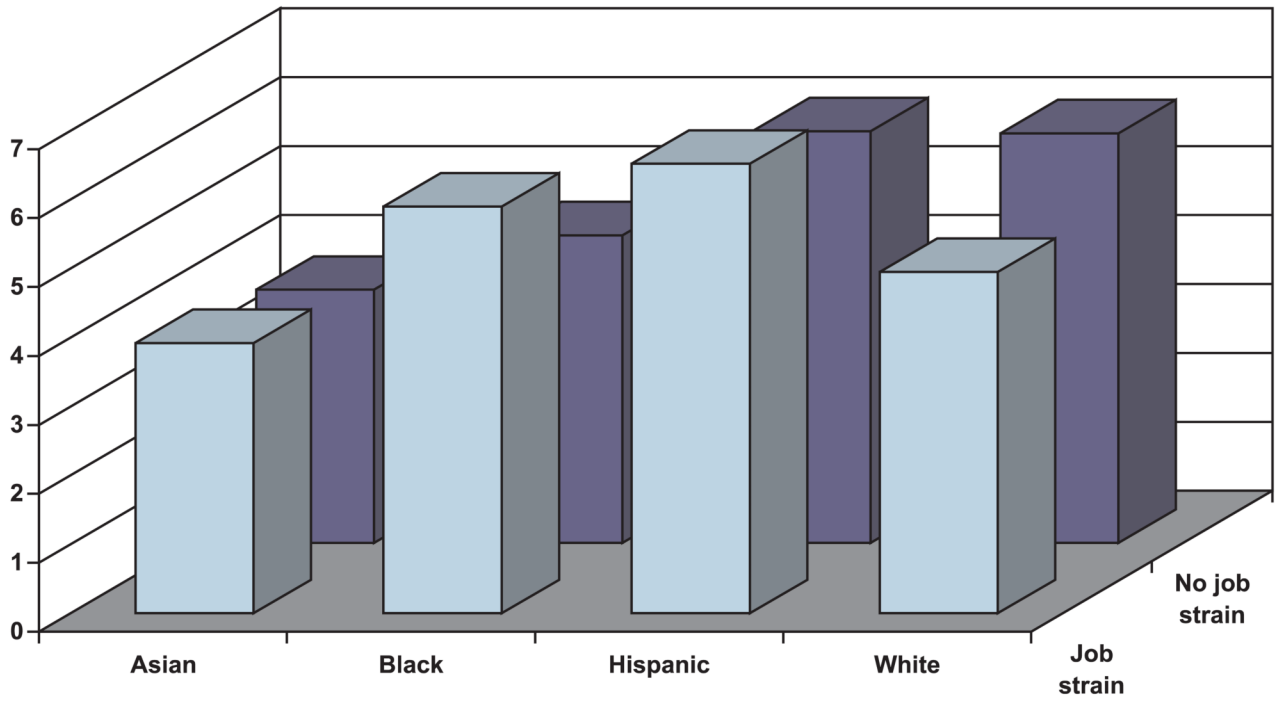

FIGURE 1.
Adjusted mean hours of physical activity per week jointly by race/ethnicity and job strain (*n* = 1,430). (Adjusted for education, managerial status, heavy occupational physical activity, and race/ethnicity.)

TABLE 1

Sociodemographic Characteristics of Study Sample

	Job Strain				
	No[a]		Yes[b]		
Characteristic	**N**	**%**	**N**	**%**	**Total N**
Gender					
Male	711	68	247	61	958
Female	328	32	156	39	484
Race					
Asian/Pacific Islander	70	7	33	8	103
Black	49	5	30	8	79
Hispanic	136	13	54	13	190
White	784	75	286	71	1,070
Education					
High school or less	440	43	212	53	652
Some post–high school	341	33	140	35	481
College graduate or more	253	24	45	11	298
Manager					
No	825	79	379	94	1,204
Yes	214	21	24	6	238
	M	*SD*	*M*	*SD*	
Age (years)	43.48	11.81	42.53	11.32	1,442
Leisure time physical activity (hours)	5.83	4.73	5.15	4.69	1,442
Psychological demands	4.08	1.64	4.93	0.99	1,442
Job control	5.00	0.86	3.18	0.64	1,442
Heavy occupational physical activity (hours)	8.06	.97	10.17	1.12	1,440

[a] n =1,039.

[b] n = 403.

[c] $N = 1,442$.

TABLE 2

Results of Individual Age and Gender-Adjusted Models of Psychosocial Work Factors and Leisure Time Physical Activity

Variable	Slope Estimate	SE	p	Slope Estimate	SE	p	Slope Estimate	SE	p
Job strain (no vs. yes)	0.68	0.27	.01						
Job demands				0.09	0.08	.25			
Job control							0.29	0.11	.01
Age	−0.06	0.01	< .0001	−0.06	0.01	< .0001	−0.06	0.01	< .0001
Gender (male vs. female)	1.78	0.27	< .0001	1.81	0.27	< .0001	1.77	0.27	< .0001

Note. N = 1,442.

TABLE 3

Adjusted Mean Hours of Physical Activity (PA) per Week by Participant Characteristics Computed From Multivariable Model

	Adjusted Mean PA (hr/week)[a]	SE	CI[b]	p
Job strain status by race/ethnicity				.03
No job strain				
Asian	3.78	0.61	(2.58, 4.98)	
Black	4.45	0.70	(3.08, 5.82)	
Hispanic	5.99	0.47	(5.07, 6.91)	
White	6.04	0.26	(5.53, 6.55)	
Job strain				
Asian	4.01	0.84	(2.36, 5.66)	
Black	6.00	0.92	(4.20, 7.80)	
Hispanic	6.52	0.68	(5.19, 7.85)	
White	5.01	0.36	(4.30, 5.72)	
Sex				< .0001
Men	5.98	0.32	(5.35, 6.61)	
Women	4.47	0.37	(3.74, 5.20)	
Manager				.17
No	4.99	0.29	(4.42, 5.56)	
Yes	5.47	0.42	(4.65, 6.29)	
Education				.02
High school or less	4.70	0.34	(4.03, 5.37)	
Some post–high school training	5.41	0.36	(4.70,6.12)	
BA/BS or more	5.56	0.40	(4.78, 6.34)	
Age (slope)				
+10 years	−0.63	0.11	(−0.85, −0.41)	< .0001
Heavy occupational physical activity (slope)				
+10 hr per week	0.20	0.09	(0.02, 0.38)	.03

Note. n = 1,430.

[a] The adjusted mean leisure time physical activity and its standard error (SE) were computed for each level of an explanatory variable, holding the other variables in the model constant.

[b] Confidence intervals (CIs) were obtained in the usual manner by multiplying the SE by the distributional value and adding/subtracting that value to the estimated mean. The CI provides possible values of the true mean that are consistent with the estimated value.