Title
Psychosocial job factors and biological cardiovascular risk factors in Mexican workers.

Journal
American journal of industrial medicine, 58(3)

ISSN
0271-3586

Authors
Garcia-Rojas, Isabel Judith
Choi, BongKyoo
Krause, Niklas

Publication Date
2015-03-01

DOI
10.1002/ajim.22410

Peer reviewed

Psychosocial Job Factors and Biological Cardiovascular Risk Factors in Mexican Workers

ARTICLE *in* AMERICAN JOURNAL OF INDUSTRIAL MEDICINE · FEBRUARY 2015

Impact Factor: 1.74 · DOI: 10.1002/ajim.22410

3 AUTHORS, INCLUDING:

BongKyoo Choi

University of California, Irvine

34 PUBLICATIONS **372** CITATIONS

SEE PROFILE

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 58:331–351 (2015)

Psychosocial Job Factors and Biological Cardiovascular Risk Factors in Mexican Workers

Isabel Judith Garcia-Rojas, MD, MPH, PhD,[1]* BongKyoo Choi, ScD, MPH, PhD,[2] and Niklas Krause, MD, MPH, PhD[3]

Background *Psychosocial job factors (PJF) have been implicated in the development of cardiovascular disease. The paucity of data from developing economies including Mexico hampers the development of worksite intervention efforts in those regions.*
Methods *This cross-sectional study of 2,330 Mexican workers assessed PJF (job strain [JS], social support [SS], and job insecurity [JI]) and biological cardiovascular disease risk factors [CVDRF] by questionnaire and on-site physical examinations. Alternative formulations of the JS scales were developed based on factor analysis and literature review. Associations between both traditional and alternative job factor scales with CVDRF were examined in multiple regression models, adjusting for physical workload, and socio-demographic factors.*
Results *Alternative formulations of the job demand and control scales resulted in substantial changes in effect sizes or statistical significance when compared with the original scales. JS and JI showed hypothesized associations with most CVDRF, but they were inversely associated with diastolic blood pressure and some adiposity measures. SS was mainly protective against CVDRF.*
Conclusion *Among Mexican workers, alternative PJF scales predicted health outcomes better than traditional scales, and psychosocial stressors were associated with most CVDRF.* Am. J. Ind. Med. 58:331–351, 2015.

KEY WORDS: psychosocial job stressors; job content questionnaire; occupational health; blood glucose; blood cholesterol; adiposity indicators; blood pressure; smoking; leisure-time physical activity

INTRODUCTION

Working conditions in Mexico are often stressful. For example, eight out of ten employees in Mexico work overtime (more than 40 hr/week) without compensation [Vargas-Hernández, 2011]. Overtime has been shown to increase adverse health outcomes and promote unhealthy behaviors [Taris et al., 2011]. Moreover, job insecurity and unemployment, which have also been associated with poor health [Virtanen et al., 2013], are highly prevalent in this country [Noriega-Elío et al., 2009]. Mexico's current economic crisis has forced workers to start jobs in the informal economy (approximately 28% of the economically active population worked in the informal sector by the end of 2011 [Instituto Nacional de Estadística y Geografía, 2011]) or to emigrate to the United States [Sanchez-Roman et al., 2006].

During the past few decades, Mexican companies, compelled by regulatory legislation, have made extensive efforts to manage physical work environmental hazards. Indeed, the Department of Labor and Social Welfare has

[1]Environmental Health Sciences Department, Fielding School of Public Health, University of California, Los Angeles, California
[2]Center for Occupational and Environmental Health, University of California, Irvine, California
[3]Department of Environmental Health Sciences and Department of Epidemiology, Fielding School of Public Health, University of California, Los Angeles, California
*Correspondence to: Isabel Judith Garcia-Rojas, MD, MPH, PhD, Avenue José Vasconcelos #172-4D Col. Condesa CP 06140 Mexico, D.F. E-mail: isabel24@ucla.edu

Accepted 5 November 2014
DOI 10.1002/ajim.22410. Published online in Wiley Online Library (wileyonlinelibrary.com).

established numerous Mexican Official Standards that, among other things, regulate biological, chemical, and physical exposures in the workplace [Secretaría del Trabajo y Previsión Social, 2012]. However, psychosocial aspects of work have received little attention in research and prevention. This may be due to a lack of awareness of their existence and possible health effects. When such factors are investigated, the dominant assumption is that these factors arise from individual characteristics rather than the work environment, further hampering research and intervention efforts [Carayon et al., 2006].

Psychosocial factors differ from traditional environmental exposures as their recognition and impact are determined by both objective and cognitive environmental components [Warren, 2006]. In addition, the most widely applied current theories of the health effects of psychosocial job factors hypothesize interactions between these factors [Karasek, 1979; Siegrist and Peter, 1994]. The demand–control model [Karasek, 1979], evaluates an imbalance between two main psychosocial job domains: psychological job demands and the amount of worker control (also known as decision latitude). According to this model, high strain jobs (characterized by low job control and high psychological job demands) are the most deleterious for health, while the lowest health risk is expected for low strain jobs (high job control and low psychological job demands) [Karasek, 1979]. This model was later expanded by incorporating work-related social support as a potential buffer for the effect of job strain and became the demand–control–support model [Johnson and Hall, 1988]. Isostrain is defined as the combination of high job strain and low social support at work. The job content questionnaire (JCQ) is the instrument used to measure these constructs [Karasek et al., 1998].

The JCQ has been translated in 23 different languages (http://www.jcqcenter.org) and has been widely used worldwide in different socioeconomic strata and cultures, including Mexico [Juárez-Garcia, 2007; de Araujo and Karasek, 2008; Maizura et al., 2010; Chien et al., 2011; Gómez-Ortiz, 2011]. Job strain has been identified as a risk factor for a number of health outcomes, including cardiovascular disease [Belkic et al., 2004], psychological disorders [Stansfeld and Candy, 2006; Bonde, 2008], and musculoskeletal disorders [Mantyniemi et al., 2012]. Even though the Job-Demand-Control-Support model has consistently been shown to predict employee strain and wellbeing in the psychosocial environment, further research is needed to broaden the applicability and generalizability of this model in different cultures [Ibrahim and Ohtsuka, 2012].

Although most studies point to a positive association between psychosocial work stressors and cardiovascular disease risk factors (CVDRF) or cardiovascular disease [Backe et al., 2012; Kivimaki et al., 2012; Choi et al., 2013; Landsbergis et al., 2013], the literature also includes some findings of inverse or null associations [Eaker et al., 2004; Olesen et al., 2012; Rosenthal and Alter, 2012; Szerencsi et al., 2012].

In Mexico, the relationship between psychosocial factors and health outcomes has barely been explored. Pioneer research among Mexican nurses has shown a positive relationship between job strain, high blood pressure and cardiovascular symptoms, and between job insecurity and high blood pressure [Juárez-Garcia, 2007]. Additionally, the applicability of international research to Mexican conditions needs exploration as Mexican workers are embedded in a different organizational culture and may be exposed to factors distinctive to that culture. In fact, considering variables relevant to a country's specific socioeconomic and cultural situation is important when assessing psychosocial work factors [Juárez-García, 2004]. For example, job insecurity is more severe in Latin America than in developed countries due to economic instability [Martinez et al., 2010]. To fill this research gap and to provide stakeholders with objective data based on a Mexican-working population, this study aims to assess the prevalence of psychosocial job factors (PJF; job strain, isostrain, job insecurity, and their subdomains) and their associations with CVDRF in a sample of Mexican workers drawn from different companies. We hypothesize that psychological job demands, job strain, isostrain, and job insecurity are positively associated with CVDRF. On the other hand, we expect inverse associations between decision latitude, social support, and CVDRF. We also expect that alternative JCQ scales consisting of less but more theoretically and psychometrically more robust items will yield more accurate associations between PJF and CVDRF.

MATERIALS AND METHODS

Study Design

The "Mexican Institute of Social Security (IMSS) and Companies' Collaboration Model to Promote Workers' Healthy Behaviors" is a prospective study of a 6-month worksite wellness program. IMSS' researchers promoted participation in this study among affiliated companies located in Mexico City and recruited workers from eight different worksites, including a government public health services department, an airline company, a pharmaceutical company, a metalworking (tools manufacture) company, a cooking utensils factory, a plastic factory, a printing company, and a tire manufacturing company. Companies were selected on the basis of their willingness to engage in the study's activities and consented to be part of either a control group (baseline and follow-up surveys) or an intervention group (baseline survey plus intervention and follow-ups). A health risk assessment, including a questionnaire and biological measurements, was performed at baseline, at 6 months, 1 year, and 2 years after

the beginning of the study. We used only the baseline data for this cross- sectional study.

The average participation rate was 58.5% of a total of 3,985 workers. The company with the lowest participation rate included the airline company (37.3%), followed by the tire company (54.7%). Two companies—the metalworking company and the plastic factory—achieved complete (100%) participation. Overall, 2,330 workers answered a health risk assessment questionnaire that included a Spanish version of the Job Content Questionnaire (JCQ), demographic and organizational characteristics, individual risk factors for cardiovascular disease, and personal history of diabetes, hypertension, cardiovascular disease, and other self-reported medical conditions. A team of medical doctors, nurses, physical activity experts, and social workers conducted the fieldwork. A research coordinator trained this team for 20 hours before the study's onset.

Recruitment of Workers

IMSS' researchers met with each company's directors to introduce the study. After agreeing to participate, employers authorized the research team to promote workers' participation in the study throughout the company. As an incentive, workers were offered a complete physical examination and blood tests for free and were assured complete confidentiality. All data were collected during the day shift. The research team remained in each of the companies for about a week to include as many workers as possible but no efforts were made to reach workers on sick leave or disability. Workers' participation was voluntary.

Measures

Measurement of exposure (psychosocial job factors)

To evaluate exposure to psychosocial job factors (PJF) based on the demand-control-support model [Johnson and Hall, 1988; Karasek and Theorell, 1990], a Spanish version of the Job Content Questionnaire (JCQ) [Cedillo and Karasek, 2003] was used. Four main scales for job control, job demands, social support, and job insecurity were measured with this questionnaire. Acceptable internal consistency and predictive validity of this Spanish version of the JCQ have been reported in previous studies [Cedillo, 1999; Cedillo and Karasek, 2003; Juárez-García, 2004, 2005, 2007].

The job control scale (nine standard JCQ items), also named "job decision latitude," incorporates two complementary subscales: "skill discretion" (six items) and "decision-making authority" (three items). The skill discretion subscale assesses opportunities for learning, developing creativity and skills, and experiencing variety in job tasks. The decision-making authority subscale evaluates autonomy in doing one's job and the ability to make or participate in work-related decisions. The psychological job demands scale (five standard JCQ items) assesses mental effort, quantity of work, and time restrictions to do one's job. Four JCQ items each measured social support from coworkers and supervisors. Finally, job insecurity was measured by four JCQ items asking about job stability and frequency of layoffs.

Because the JCQ was originally generated and mainly applied in developed countries, we explored its psychometric properties in this Mexican population. We determined the internal consistency of each scale by calculating Cronbach alpha values and assessed the underlying structure by performing exploratory factor analysis, using principal components analysis and varimax rotation (results not shown). Consistent with previous research [Karasek et al., 1998; Gómez-Ortiz, 2011], we found that the "repetitive work" item in our questionnaire had a low factor loading on the decision latitude scale; therefore, we built an alternative eight-item job decision latitude scale without the "repetitive work" item. Additionally, we considered an alternative psychological demands scale that excluded the items "work fast" and "work hard" because these items may be understood as physical demands rather than psychological by people in physically demanding occupations, and their inclusion in the psychological demand scale has been shown to compromise the validity of this scale [Choi et al., 2008, 2012]. We present results for both the "original" (five-item job demands and nine-item job decision latitude) and the "alternative" (three-item job demands and eight-item job decision latitude) scales as well as their derived job strain and isostrain variables in this paper. Cronbach alphas for the different psychosocial job factor scales were: 0.57 and 0.39 for the original (5 items) and alternative (3 items) psychological job demands, respectively; 0.75 and 0.79 for the original and alternative decision latitude, respectively, 0.74 and 0.90 for coworker and supervisor support, respectively; and 0.38 for job insecurity.

The JCQ was scored using the formulas described in the JCQ user's guide [Karasek et al., 1985]. Both continuous and categorical variables of job strain, isostrain, and job insecurity were created for this study. Continuous variables provide more measurement precision and power to detect associations while categorical variables are useful for comparison with the literature that is based mostly on categorical definitions of job strain. A "job strain ratio" was calculated by multiplying the psychological demands scale score times two and dividing the result by the decision latitude scale score [Karasek et al., 1985]. "High job strain" as a categorical variable was defined as the combination of high psychological demands (score above the sample median on job demands) and low decision latitude (score below the sample median on job decision

latitude). Two alternative versions of this "high job strain" categorical variable were created: one compared the high job strain group to all other workers ("no high job strain"), the other to the "low strain" group only. The latter provides a stronger contrast by excluding groups with intermediate levels of exposure but is also based on a smaller sample of workers who fall into either the high or low strain quadrants of the JCQ model, excluding workers in the active or passive quadrants. A continuous variable of isostrain was calculated by subtracting decision latitude and total support from psychological demands scores [Rugulies and Krause, 2005]. A categorical variable of isostrain was defined as the combination of high job strain and low social support (score below the sample median of total coworker and supervisor support). Job insecurity was coded as a continuous variable and also as a binary variable based on a median split.

Measurement of outcomes (CVDRF)

All measurements were conducted at a specified workstation located inside of each of the company's premises. To assess blood glucose and total blood cholesterol levels, nurses in the different worksites took a fingerstick capillary sample using an "Accutrend" device (Roche laboratories, Indianapolis, IN). All workers were asked to fast for 12 hr before their sample was taken before the morning shift (from 6 to 9:00am depending on the company).

To measure height, weight, and waist and hip circumferences, workers stepped on a floor scale with a stadiometer wearing light clothing and no shoes. Body mass index (kg/m^2) was calculated as the weight divided by the square of the height. Nurses used a body tape measure to determine waist circumference at an intermediate line between the costal border and the iliac crests. Hip circumference was measured as the maximum circumference around the gluteus zone [World Health Organization, 2008]. Continuous and dichotomous variables were created from these measures, the latter using the World Health Organization's cutoff values [World Health Organization, 2000].

Although both waist circumference and waist-hip ratio are closely correlated with body mass index, we used all three measures to facilitate comparisons with other studies. Waist-hip ratio has been considered as the best predictor for mortality from cardiovascular disease associated with obesity [Welborn and Dhaliwal, 2007] and waist circumference provides "an independent prediction of cardiovascular risk over and above that of body mass index" [National Heart Lung and Blood Institute, 1998].

Blood pressure was measured manually by two research nurses using a sphygmomanometer and following the National Health and Nutrition Examination Survey (NHANES) protocols [Centers for Disease Control and Prevention, 1993]. However, only one reading was taken due to time constraints, instead of the three consecutive readings proposed by the NHANES protocol. Workers rested for about 5 min before the measurement, which was taken on their left arm while sitting. High blood pressure was determined as a systolic blood pressure equal to or greater than 140 mm Hg or diastolic blood pressure equal to or greater than 90 mm Hg. Workers with a history of hypertension were coded as hypertensive regardless of blood pressure measures.

Smoking was assessed by the question "Do you smoke cigarettes?" Possible answers included: "No, I have never smoked", "Yes, occasionally", and "Yes, I currently smoke daily" and the latter two were combined as "current smokers". Leisure-time physical activity was evaluated with a single question "Do you exercise?" Possible answers included "Occasionally or never", "Daily", "Two to three times per week". We built a dichotomous variable collapsing the latter two answer options into one category. Alcohol drinking was defined as "occasionally drinking more than three glasses of alcoholic beverages."

Confounders

Potential confounders were defined as predictors of CVDRF, which were also associated with psychosocial job exposures but were not the direct result of these exposures. Such variables include age [Martocchio, 1989; Anderson, 1999], gender, marital status [Vanagas et al., 2004; Hansen and Andersen, 2008], leisure-time physical activity [Yang et al., 2010], education, income [Grotto et al., 2008], type of worksite [Steenland et al., 2000; Musich et al., 2006; Hansen and Andersen, 2008], smoking, and alcohol drinking [Heikkila et al., 2012; Mayo-Clinic, 2012]. Occupational physical activity level categorized by the interview team as either light, moderate, or vigorous was also considered. Interaction by gender was also explored but in none of the models the interaction term was statistically significant ($P > 0.2$). All of these potential confounders were assessed by the health risk assessment questionnaire. A more detailed rationale for the selection of each covariate as potential confounder with additional references is provided in Supplementary Appendix 1.

Analysis

Differences in sociodemographic variables, health behaviors, and CVDRF between individuals with and without job strain, isostrain, and job insecurity were examined using chi-square tests. For each psychosocial job factor, we built separate regression models, using linear regression for continuous CVDRF and logistic regression for binary outcomes. We present unadjusted simple regression models (model 1) and models incrementally adjusting for physical

workload (as measured by the JCQ physical demands item and occupational activity level; model 2), individual worker characteristics (model 3) including demographic (age, gender), behavioral (alcohol, leisure-time physical activity, smoking), and socio-economic factors (education, income, marital status, worksite, seniority). We additionally adjusted for key biological CVDRF other than behavioral including blood glucose, total blood cholesterol, body mass index, and systolic blood pressure (model 4). Finally, we controlled for PJF other than the one explored in the main association (model 5). The independent effects of the main components of job strain and isostrain, that is, psychological and physical job demands, job decision latitude, and supervisor and coworker social support were also investigated separately. The Holm method was applied to adjust for multiple hypothesis testing[1] [Aickin and Gensler, 1996]. Such adjustment needs to be considered very conservative [Rothman, 1990]. Continuous JCQ scales and subscales were centered by subtracting the mean to each value and standardized by dividing by the standard deviation to increase comparability of effect estimates across PJF. All analyses were conducted using STATA 12.0 software.

Ethical Procedures

All workers provided signed informed consent. The study was reviewed and approved by IMSS Institutional Review Board (IRB), which has an approved assurance and registration from the Office for Human Research Protections, US Department of Heath and Human Services [Department of Health and Human Services, 2009] (registry number IORG0002957). For our study, we also obtained approval from the University of California, Los Angeles (UCLA) IRB (IRB#10–000652-CR-00002). The UCLA IRB's Federal-wide Assurance with the Department of Health and Human Services is FWA00004642.

RESULTS

Characteristics of the Study Population

Characteristics of the study sample are displayed in Table I. The proportion of workers exceeding different norms is displayed at the end of Table I. Correlations among the various PJF are shown in Supplementary Appendix 2.

[1] Steps to perform the Holm procedure: (1) Rank *P*-values from smallest to largest; (2) Compare smallest *P*-value to alpha/m (m = number of tests run); (3) Compare second smallest *P*-value to alpha/(m-1); (4) Compare third smallest *P*-value to alpha/(m-2) and so on; (5) Stop at first time you get non-significant results.

Multivariate Associations of Psychosocial Job Factors With CVDRF

Beta coefficients (or odds ratios for smoking and leisure-time physical activity) and 95% confidence intervals from linear regression models of the association between job strain, isostrain, job insecurity and their subscales, and CVDRF are shown in Tables II to V with incremental adjustment for physical workload (model 2), individual worker characteristics (model 3), biological CVDRF (model 4), and other PJF (model 5).

Blood glucose levels

In most cases, job strain was positively rather than negatively associated with blood glucose, but the associations were not statistically significant (Table II). Exposure to isostrain (measured as a continuous variable) was positively associated with blood glucose levels, while the categorical measure showed an inverse association. However, none of these findings were statistically significant. Job insecurity and blood glucose levels were inversely associated. This association changed direction and lost statistical significance when adjusting for workers' individual characteristics and other CVDRF.

Total blood cholesterol levels

Psychological and physical job demands were inversely associated with total blood cholesterol but these associations were not statistically significant after adjusting for potential confounders (Table II). Social support from coworkers and supervisors showed a statistically significant protective effect against high cholesterol levels. In fully adjusted models, workers with high total social support had 2.96 mg/dl lower total blood cholesterol levels (95% CI −5.04, −0.88).

Only the original job strain ratio scale was inversely associated with blood cholesterol, no other job strain or isostrain variables were significantly associated with blood cholesterol. Finally, a strong positive and statistically significant relationship between job insecurity and blood cholesterol ($\beta = 4.27$) became weaker and was no longer statistically significant in models 3–5 (β between 0.86 and 1.36).

Adiposity indicators[2]

As expected, psychological job demands had a positive association with adiposity indicators (Table III). After adjusting for all potential confounders (model 5), there were positive statistically significant associations between the original psychological job demand scale and two adiposity indicators

[2] Tables for waist circumference and waist-hip ratio are presented in Supplementary Appendix 3.

TABLE I. Characteristics of Mexican worker sample. Mexican Institute of Social Security Study 2009 (n = 2,330)

Variable	n	Frequency (%)
Socio-demographic		
Worksites		
Public health	123	5.3
Airline	703	30.2
Pharmaceutical	185	7.9
Tools manufacture	161	6.9
Cooking utensils manufacture	108	4.6
Plastic factory	95	4.1
Printing company	627	26.9
Tire manufacture	328	14.1
Occupation		
Managers	114	4.9
Professionals	365	15.7
Technicians & associated professionals	268	11.5
Clerical support workers	254	10.9
Service & sales workers	17	0.7
Craft & related trades workers	220	9.4
Plant & machine operators & assemblers	342	14.7
Elementary occupations	750	32.2
Labor type		
White-collar	1018	43.7
Blue-collar	1312	56.3
Contract type		
Permanent	1868	80.2
Temporary	457	19.6
Missing	4	0.2
Shift		
Morning	1294	55.5
Evening	53	2.3
Night	20	0.9
Mixed	935	40.1
Double shift	22	0.9
Missing	6	0.3
Seniority		
5 years or less	1256	53.9
6 to 25 years	966	41.5
More than 25 years	106	4.5
Missing	2	0.1
Gender		
Male	1576	67.6
Female	754	32.4
Age		
≤35	1085	46.6
36–45	678	29.1
46–55	444	19.0
≥56	121	5.2
Missing	2	0.1
Married	1161	50.1
Non-married	1166	49.8
Missing	3	0.1
Education		
Middle school or less	1036	44.5
High school or technical degree	639	27.4
College or graduate degree	652	28.0
Missing	3	0.1
Monthly income (in Mexican pesos)[a]		
Low (<4,500)	963	41.3
Medium (4,500–10,500)	737	31.6
High (>10,500)	624	26.8
Missing	6	0.3
Health behaviors/CVDRF		
Alcohol drinking[b]		
Yes	1799	77.2
No	531	22.8
Smoking		
Yes	1087	46.7
No	1243	53.3
Leisure-time physical activity		
Yes	596	25.6
No	1734	74.4
Diabetes[c]		
Yes	160	6.9
No	2170	93.1
Hypercholesterolemia[d]		
Yes	193	8.3
No	2136	91.7
Overweight/obesity[e]		
Determined by body mass index		
Yes	1558	66.9
No	772	33.1
Determined by waist circumference		
Yes	1278	54.8
No	1052	45.2
Determined by waist-hip ratio		
Yes	1469	63.1
No	861	36.9
Hypertension[f]		
Yes	403	17.3
No	1927	82.7

[a]$1.00 US dollar ≈ $13.00 MX pesos. As of January 2013, the minimum wage in Mexico was $64.76MX per day, which is approximately equivalent to $5 US dollars [Sistema de AdministraciónTributaria, 2012].
[b]Occasionally drinking more than three glasses of alcoholic beverages.
[c]Determined by self-report and on-site measurement; classified using the World Health Organization cutoff ≥126 mg/dl.
[d]On-site measurement classified using AHA cutoff ≥200 mg/dl.
[e]Overweight/obesity was determined using the World Health Organizations [2000] cutoffs: Body mass index ≥25 kg/m^2, waist circumference >94 cm in men, and >80 cm in women, and waist-hip ratio >1.00 in men and >0.85 in women.
[f]Determined by self-report and on-site measurement; classified using the American Heart Association (AHA) cutoffs (systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg).

TABLE II. Associations Between Psychosocial Job Factors, Blood Glucose Levels, and Total Blood Cholesterol: Results (Standardized Beta Coefficients and 95% Confidence Intervals) From Multiple Linear Regression With Incremental Adjustment for Physical Workload, Individual Worker Characteristics, Biological Cardiovascular Disease Risk Factors, and Other Psychosocial Job Factors. Mexican Institute of Social Security Study 2009 (n = 2,330)

	Glucose [mg/dl]					Blood cholesterol levels [mg/dl]				
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Psychological job demands (5 items)[a]	−0.55 (−1.66, 0.57)	−0.97 (−2.19, 0.24)	−0.26 (−1.47, 0.94)	−0.27 (−1.50, 0.97)	−0.32 (−1.54, 0.89)	−1.35 (−3.31, 0.61)	−0.84 (−2.97, 1.28)	−1.28 (−3.29, 0.73)	−1.78 (−3.99, 0.44)	−1.63 (−3.69, 0.42
Alt. psychological job demands (3 items)[b]	0.67 (−0.45, 1.78)	0.54 (−0.63, 1.71)	0.61 (−0.51, 1.73)	0.72 (−0.43, 1.87)	0.43 (−0.74, 1.61)	0.56 (−1.40, 2.53)	0.92 (−1.13, 2.97)	−0.03 (−1.90, 1.85)	−0.50 (−2.57, 1.56)	−0.85 (−2.84, 1.14)
Physical demands	0.95 (−0.16, 2.06)	N/A	0.70 (−0.54, 1.95)	0.64 (−0.64, 1.91)	1.03 (−0.32, 2.38)	−2.04* (−4.00, −0.08)	N/A	−1.55 (−3.64, −0.55)	−1.88 (−4.17, 0.41)	−1.00 (−3.29, 1.30)
Decision latitude (9 items)[c]	−0.06 (−1.18, 1.05)	−0.11 (−1.24, 1.02)	−0.39 (−1.51, 0.73)	−0.75 (−1.89, 0.38)	−0.81 (−2.08, 0.46)	0.02 (−2.04, 1.91)	−0.06 (−2.04, 1.91)	−0.32 (−2.19, 1.56)	−0.88 (−2.89, 1.22)	1.29 (−0.86, 3.44)
Alt. decision latitude (8 items)[d]	−0.06 (−1.17, 1.05)	−0.12 (−1.25, 1.00)	−0.41 (−1.52, 0.70)	−0.80 (−1.92, 0.33)	−0.85 (−2.12, 0.41)	−0.17 (−2.14, 1.79)	−0.22 (−2.19, 1.75)	−0.32 (−2.18, 1.54)	−0.81 (−2.83, 1.21)	1.16 (−0.98, 3.29)
Coworker support	0.02 (−1.09, 1.14)	−0.10 (−1.23, 1.03)	0.55 (−0.53, 1.63)	0.38 (−0.71, 1.48)	0.96 (−0.18, 2.11)	−1.78 (−3.74, 0.18)	−1.70 (−3.68, 0.27)	−2.27* (−4.08, −0.46)	−2.62* (−4.58, −0.67)	−2.45* (−4.38, −0.51)
Supervisor support	0.43 (−0.68, 1.54)	0.33 (−0.80, 1.47)	−0.16 (−1.25, 0.93)	−0.07 (−1.17, 1.04)	0.29 (−0.94, 1.52)	−3.46* (−5.41, −1.50)	−3.79* (−5.77, −1.81)	−2.02* (−3.84, 0.20)	−1.91 (−3.87, 0.06)	−2.25* (−4.33, −0.18)
Total support	0.30 (−0.81, 1.41)	0.17 (−0.96, 1.31)	0.17 (−0.91, 1.25)	0.15 (−0.95, 1.25)	0.76 (−0.47, 1.99)	−3.24* (−5.19, −1.28)	−3.42* (−5.40, −1.44)	−2.50* (−4.31, −0.69)	−2.61* (−4.57, −0.65)	−2.96* (−5.04, −0.88)
Job strain ratio	−0.69 (−1.80, 0.42)	−0.97 (−2.15, 0.21)	−0.21 (−1.35, 0.93)	0.02 (−1.14, 1.18)	−0.08 (−1.33, 1.17)	−1.02 (−2.98, 0.94)	−0.57 (−2.64, 1.50)	−0.88 (−2.79, 1.03)	−0.81 (−2.87, 1.26)	−2.15* (−4.26, −0.03)
Alt. job strain ratio[e]	0.27 (−0.85, 1.38)	0.16 (−0.99, 1.32)	0.37 (−0.72, 1.47)	0.62 (−0.50, 1.75)	0.50 (−0.74, 1.75)	0.36 (−1.60, 2.33)	0.64 (−1.38, 2.66)	−0.12 (−1.96, 1.71)	−0.26 (−2.27, 1.74)	−1.60 (−3.71, 0.50)
High job strain (categorical, ref. category: no high job strain)	0.09 (−2.60, 2.78)	−0.02 (−2.81, 2.76)	0.51 (−2.14, 3.15)	1.30 (−1.35, 3.96)	0.91 (−1.82, 3.65)	−0.76 (−5.50, 3.98)	−0.13 (−4.99, 4.74)	1.30 (−3.13, 5.74)	1.45 (−3.32, 6.22)	0.02 (−4.60, 4.64)
Alt. high job strain[e] (categorical, ref. category: no high job strain)	0.15 (−2.42, 2.72)	0.17 (−2.45, 2.79)	0.31 (−2.18, 2.79)	0.92 (−1.58, 3.42)	0.74 (−1.87, 3.34)	−0.34 (−4.87, 4.20)	−0.37 (−4.95, 4.21)	1.08 (−3.09, 5.24)	0.51 (−3.97, 4.99)	−0.64 (−5.04, 3.77)
High job strain (categorical, ref. category: low strain)	1.06 (−2.19, 4.31)	0.58 (−2.81, 3.97)	1.33 (−1.91, 4.57)	3.20 (−0.06, 6.46)	2.31 (−1.07, 5.68)	−0.99 (−6.72, 4.75)	0.03 (−5.91, 5.96)	0.67 (−4.75, 6.10)	0.33 (−5.53, 6.18)	−1.42 (−7.14, 4.30)
Alt. high job strain[e] (categorical, ref. category: low strain)	1.54 (−1.49, 4.57)	1.49 (−1.61, 4.60)	1.68 (−1.27, 4.64)	2.89 (−0.08, 5.86)	2.42 (−0.76, 5.60)	1.34 (−4.02, 6.70)	1.64 (−3.80, 7.08)	1.69 (−3.27, 6.65)	0.95 (−4.37, 6.27)	−1.15 (−6.54, 4.24)
Isostrain (continuous)	−0.26 (−1.37, 0.85)	−0.33 (−1.48, 0.82)	0.14 (−0.97, 1.26)	0.42 (−0.70, 1.55)	0.08 (−1.07, 1.24)	0.35 (−1.61, 2.31)	0.73 (−1.28, 2.74)	0.53 (−1.33, 2.40)	0.80 (−1.21, 2.81)	0.27 (−1.69, 2.22)
Alt. isostrain (continuous)[e]	0.28	0.28	0.50	0.79	0.39	1.14	1.37	0.80	0.92	0.50

(*Continued*)

TABLE II. (*Continued.*)

	Glucose [mg/dl]					Blood cholesterol levels [mg/dl]				
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
	(−0.83, 1.40)	(−0.85, 1.42)	(−0.60, 1.59)	(−0.31, 1.90)	(−0.75, 1.52)	(−0.82, 3.11)	(−0.62, 3.36)	(−1.03, 2.63)	(−1.06, 2.90)	(−1.43, 2.43)
Isostrain (categorical)	−2.63	−2.66	−1.46	−0.04	−1.36	2.91	3.63	4.52	4.11	4.76
	(−6.00, 0.75)	(−6.13, 0.81)	(−4.76, 1.84)	(−3.37, 3.29)	(−4.69, 1.98)	(−3.06, 8.88)	(−2.45, 9.71)	(−1.01, 10.05)	(−1.84, 10.05)	(−0.87, 10.41)
Alt. isostrain[e] (categorical)	−2.79	−2.64	−1.70	−0.59	−1.63	1.73	1.57	2.21	0.68	2.18
	(−5.92, 0.35)	(−5.83, 0.55)	(−4.74, 1.33)	(−3.63, 2.45)	(−4.69, 1.44)	(−3.81, 7.26)	(−4.02, 7.16)	(−2.87, 7.29)	(−4.75, 6.10)	(−3.01, 7.38)
Job insecurity (continuous)	−1.35*	−1.39*	0.55	0.81	0.70	2.05* (0.09, 4.01)	1.94	0.99	0.99	0.84
	(−2.46, −0.24)	(−2.52, −0.26)	(−0.55, 1.66)	(−0.30, 1.93)	(−0.44, 1.84)		(−0.04, 3.92)	(−0.86, 2.84)	(−1.01, 2.98)	(−1.09, 2.77)
Job insecurity (categorical)	−2.48*	−2.58*	−0.52	0.74	0.60	4.27* (0.21, 8.34)	4.22* (0.12, 8.32)	1.36	0.86	1.35
	(−4.79, −0.18)	(−4.92, −0.23)	(−1.75, 2.79)	(−1.55, 3.02)	(−1.72, 2.91)			(−2.44, 5.17)	(−3.24, 4.97)	(−2.56, 5.26)

*P-value < 0.05.

Model 1: simple linear regression model (unadjusted).

Model 2: adjusted by physical workload (physical demands and occupational activity level).

Model 3: additionally adjusted by individual worker characteristics including demographic (age, gender), behavioral (smoking, alcohol, leisure-time physical activity) and socio-economic factors (education, income, marital status, worksite, seniority).

Model 4: additionally adjusted by other biological CVDRF (systolic blood pressure, total blood cholesterol levels [in glucose models], blood glucose levels [in cholesterol models], and body mass index).

Model 5: additionally adjusted for psychosocial factors other than the one in the main association (for e.g., job demands models were adjusted by decision latitude, total support, and job insecurity; decision latitude models were adjusted by job demands, total support, and job insecurity; social support models were adjusted by job demands, decision latitude, and job insecurity, etc.).

[a]Five-item psychological demands (original JCQ psychological demand subscale).

[b]Alternative three-item psychological demands (this subscale does not include physical demands, it is based solely on the following three items: "I am not asked to do an excessive amount of work", "I have enough time to get the job done", "I am free from conflicting demands others make").

[c]Nine-item decision latitude (original JCQ decision latitude subscale).

[d]Alternative eight-item decision latitude (the repetitive item was dropped because it was not confirmed in factor analysis).

[e]Alternative scale calculated using three-item psychological job demands and eight-item decision latitude subscales.

TABLE III. Associations Between Psychosocial Job Factors and Body Mass Index: Results (Standardized Beta Coefficients and 95% Confidence Intervals) From Multiple Linear Regression With Incremental Adjustment for Physical Workload, Individual Worker Characteristics, Biological Cardiovascular Disease Risk Factors, and Other Psychosocial Job Factors. Mexican Institute of Social Security Study 2009 (n = 2,330)

	Body mass index [kg/m^2]				
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Psychological job demands (5 items)[a]	0.14 (0.03, 0.31)	0.20* (0.01, 0.39)	0.22* (0.03, 0.41)	0.17 (−0.02, 0.37)	0.23* (0.05, 0.42)
Alt. psychological job demands (3 items)[b]	0.25* (0.08, 0.43)	0.30* (0.12, 0.48)	0.24* (0.06, 0.41)	0.14 (−0.04, 0.32)	0.24* (0.06, 0.42)
Physical demands	−0.07 (−0.24, 0.10)	N/A	−0.17 (−0.37, 0.03)	−0.24* (−0.44, −0.03)	−0.27* (−0.47, −0.06)
Decision latitude (9 items)[c]	0.26* (0.09, 0.44)	0.27* (0.10, 0.45)	0.19* (0.01, 0.37)	0.19* (0.01, 0.37)	0.32* (0.13, 0.52)
Alt. decision latitude (8 items)[d]	0.25* (0.08, 0.43)	0.26* (0.09, 0.44)	0.19* (0.01, 0.37)	0.19* (0.01, 0.36)	0.35* (0.15, 0.54)
Coworker support	−0.03 (−0.21, 0.14)	−0.01 (−0.18, 0.17)	−0.03 (−0.20, 0.15)	−0.03 (−0.20, 0.14)	−0.13 (−0.31, 0.04)
Supervisor support	−0.20* (−0.38, −0.03)	−0.20* (−0.38, −0.03)	−0.20* (−0.37, −0.02)	−0.22* (−0.39, −0.04)	−0.33* (−0.52, −0.14)
Total support	−0.15 (−0.33, 0.02)	−0.14 (−0.32, 0.03)	−0.14 (−0.32, 0.03)	−0.16 (−0.33, 0.01)	−0.30* (−0.49, −0.11)
Job strain ratio	−0.06 (−0.24, 0.11)	−0.05 (−0.24, 0.13)	0.02 (−0.16, 0.20)	0.00 (−0.18, 0.18)	0.00 (−0.19, 0.19)
Alt. job strain ratio[e]	0.07 (−0.10, 0.25)	0.09 (−0.08, 0.27)	0.09 (−0.09, 0.26)	0.02 (−0.15, 0.20)	0.05 (−0.14, 0.25)
High job strain (categorical, ref. category: no high job strain)	−0.37 (−0.79, 0.06)	−0.39 (−0.83, 0.04)	−0.28 (−0.71, 0.14)	−0.33 (−0.74, 0.09)	−0.44* (−0.86, −0.02)
Alt. high job strain[e] (categorical, ref. category: no high job strain)	−0.28 (−0.68, 0.12)	−0.32 (−0.73, 0.09)	−0.25 (−0.64, 0.15)	−0.26 (−0.65, 0.13)	−0.35 (−0.75, 0.05)
High job strain (categorical, ref. category: low strain)	−0.42 (−0.93, 0.09)	−0.39 (−0.92, 0.14)	−0.33 (−0.85, 0.18)	−0.41 (−0.92, 0.10)	−0.54* (−1.05, −0.02)
Alt. high job strain[e] (categorical, ref. category: low strain)	−0.18 (−0.66, 0.29)	−0.18 (−0.66, 0.30)	−0.18 (−0.66, 0.29)	−0.31 (−0.77, 0.16)	−0.43 (−0.91, 0.06)
Isostrain (continuous)	−0.10 (−0.27, 0.08)	−0.10 (−0.28, 0.08)	−0.02 (−0.20, 0.16)	−0.03 (−0.21, 0.14)	0.01 (−0.17, 0.18)
Alt. isostrain (continuous)[e]	−0.01 (−0.19, 0.16)	−0.01 (−0.18, 0.17)	0.02 (−0.15, 0.20)	−0.02 (−0.19, 0.15)	0.04 (−0.13, 0.22)
Isostrain (categorical)	−0.54* (−1.07, 0.00)	−0.59* (−1.13, −0.05)	−0.47 (−0.99, 0.06)	−0.37 (−0.89, 0.15)	−0.40 (−0.92, 0.11)
Alt. isostrain[e] (categorical)	−0.32 (−0.81, 0.17)	−0.40 (−0.90, 0.10)	−0.31 (−0.79, 0.18)	−0.16 (−0.63, 0.31)	−0.16 (−0.64, 0.31)
Job insecurity (continuous)	−0.26* (−0.43, −0.09)	−0.27* (−0.44, −0.09)	−0.14 (−0.31, 0.04)	−0.17 (−0.35, 0.00)	−0.15 (−0.33, 0.02)
Job insecurity (categorical)	−0.23 (−0.59, 0.14)	−0.21 (−0.58, −0.15)	−0.11 (−0.48, 0.25)	−0.12 (−0.48, 0.24)	−0.13 (−0.49, 0.22)

*P-value < 0.05.

Model 1: simple linear regression model (unadjusted).

Model 2: adjusted by physical workload (physical demands and occupational activity level).

Model 3: additionally adjusted by individual worker characteristics including demographic (age, gender), behavioral (smoking, alcohol, leisure-time physical activity) and socio-economic factors (education, income, marital status, worksite, seniority).

Model 4: additionally adjusted by other biological CVDRF (systolic blood pressure, total blood cholesterol levels, and blood glucose levels).

Model 5: additionally adjusted for psychosocial factors other than the one in the main association (for example, job demands models were adjusted by decision latitude, total support, and job insecurity; decision latitude models were adjusted by job demands, total support, and job insecurity; social support models were adjusted by job demands, decision latitude, and job insecurity, etc.).

[a]Five-item psychological demands (original JCQ psychological demand subscale).

[b]Alternative three-item psychological demands (this subscale does not include physical demands, it is based solely on the following three items: "I am not asked to do an excessive amount of work", "I have enough time to get the job done", "I am free from conflicting demands others make").

[c]Nine-item decision latitude (original JCQ decision latitude subscale).

[d]Alternative eight-item decision latitude (the repetitive item was dropped because it was not confirmed in factor analysis).

[e]Alternative scale calculated using three-item psychological job demands and eight-item decision latitude subscales.

TABLE IV. Associations Between Psychosocial Job Factors and Blood Pressure: Results (standardized Beta Coefficients and 95% Confidence Intervals) From Multiple Linear Regression With Incremental Adjustment for Physical Workload, Individual Worker Characteristics, Biological Cvdrf, and Other Psychosocial Job Factors. Mexican Institute of Social Security Study 2009 (n = 2,330)

Variable	Systolic Blood Pressure [mmHg]					Diastolic Blood Pressure [mmHg]				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
Psychological job demands (5 items)[a]	−0.47* (−0.88, −0.06)	−0.38 (−0.82, 0.06)	−0.31 (−0.76, 0.13)	−0.41 (−0.84, 0.02)	−0.34 (−0.78, 0.09)	−0.38* (−0.67, −0.09)	−0.31 (−0.63, 0.00)	−0.32* (−0.63, 0.00)	−0.39* (−0.69, −0.08)	−0.34* (−0.64, −0.03)
Alt. psychological job demands (3 items)[b]	−0.07 (−0.48, 0.34)	0.00 (−0.43, 0.42)	−0.10 (−0.52, 0.31)	−0.25 (−0.65, 0.15)	−0.18 (−0.60, 0.24)	−0.17 (−0.46, 0.12)	−0.10 (−0.41, 0.20)	−0.15 (−0.44, 0.15)	−0.24 (−0.52, 0.04)	−0.17 (−0.47, 0.13)
Physical demands	−0.20 (−0.61, 0.21)	N/A	−0.28 (−0.74, 0.19)	−0.21 (−0.66, 0.24)	0.01 (−0.48, 0.50)	−0.27 (−0.56, 0.02)	N/A	−0.07 (−0.39, 0.26)	−0.02 (−0.33, 0.30)	0.13 (−0.22, 0.47)
Decision latitude (9 items)[c]	0.40 (−0.01, 0.81)	0.35 (−0.06, 0.77)	−0.09 (−0.51, 0.32)	−0.18 (−0.59, 0.22)	−-0.40 (−0.85, 0.06)	0.48* (0.19, 0.78)	0.44* (0.15, 0.73)	0.14 (−0.16, 0.43)	0.09 (−0.20, 0.37)	0.04 (−0.28, 0.36)
Alt. decision latitude (8 items)[d]	0.39 (−0.02, 0.80)	0.35 (−0.06, 0.77)	−0.06 (−0.47, 0.35)	−0.15 (−0.55, 0.25)	−0.39 (−0.85, 0.06)	0.48* (0.19, 0.77)	0.45* (0.16, 0.74)	0.17 (−0.12, 0.46)	0.12 (−0.16, 0.40)	0.04 (−0.27, 0.36)
Coworker support	0.31 (−0.10, 0.72)	0.35 (−0.06, 0.76)	0.18 (−0.22, 0.58)	0.22 (−0.16, 0.61)	0.30 (−0.11, 0.71)	−0.04 (−0.33, 0.25)	−0.05 (−0.35, 0.24)	−0.07 (−0.36, 0.21)	−0.04 (−0.32, 0.23)	−0.11 (−0.40, 0.18)
Supervisor support	0.17 (−0.24, 0.58)	0.15 (−0.26, 0.57)	0.08 (−0.32, 0.48)	0.23 (−0.15, 0.62)	0.29 (−0.15, 0.73)	0.22 (−0.07, 0.51)	0.19 (−0.11, 0.48)	0.03 (−0.26, 0.31)	0.13 (−0.14, 0.41)	0.00 (−0.31, 0.31)
Total support	0.27 (−0.14, 0.68)	0.28 (−0.13, 0.69)	0.15 (-0.25, 0.55)	0.27 (−0.12, 0.66)	0.37 (−0.07, 0.81)	0.13 (−0.16, 0.42)	0.10 (−0.20, 0.39)	−0.02 (−0.30, 0.26)	0.07 (−0.21, 0.34)	−0.07 (−0.38, 0.24)
Job strain ratio	−0.66* (−1.07, −0.24)	−0.57* (−1.01, −0.14)	−0.21 (−0.64, 0.22)	−0.20 (−0.62, 0.21)	−0.08 (−0.53, 0.36)	−0.66* (−0.95, −0.37)	−0.60* (−0.91, −0.29)	−0.36* (−0.67, −0.06)	−0.37* (−0.66, −0.08)	−0.32* (−0.64, 0.00)
Alt. job strain ratio[e]	−0.29 (−0.71, 0.12)	−0.23 (−0.66, 0.20)	−0.11 (−0.53, 0.30)	−0.17 (−0.57, 0.22)	−0.03 (−0.48, 0.41)	−0.41* (−0.70, −0.12)	−0.35* (−0.65, −0.05)	−0.23 (−0.53, 0.06)	−0.27 (−0.56, 0.00)	−0.21 (−0.53, 0.10)
High job strain (categorical, ref. category: no high job strain)	−0.61 (−1.60, 0.38)	−0.32 (−1.34, 0.69)	0.23 (−0.75, 1.21)	0.44 (−0.50, 1.39)	0.68 (−0.29, 1.66)	−0.76* (−1.46, −0.06)	−0.51 (−1.24, 0.21)	−0.23 (−0.93, 0.46)	−0.11 (−0.79, 0.56)	0.02 (−0.68, 0.71)
Alt. high job strain[e] (categorical, ref. category: no high job strain)	−0.68 (−1.63, 0.26)	−0.59 (−1.55, 0.36)	−0.13 (−1.05, 0.78)	−0.01 (−0.89, 0.88)	0.24 (−0.69, 1.17)	−0.78* (−1.45, −0.11)	−0.66 (−1.34, 0.01)	−0.37 (−1.03, 0.28)	−0.30 (−0.93, 0.33)	−0.18 (−0.84, 0.48)
High job strain (categorical, ref. category: low strain)	−1.33 (−2.53, 0.14)	−1.01 (−2.25, 0.23)	−0.26 (−1.46, 0.93)	−0.07 (−1.23, 1.19)	0.33 (−0.88, 1.53)	−1.50* (−2.34, −0.65)	−1.25* (−2.13, −0.37)	−0.83 (−1.68, 0.02)	−0.74 (−1.56, 0.08)	−0.56 (−1.42, 0.30)
Alt. high job strain[e] (categorical, ref. category: low strain)	−0.74 (−1.85, 0.38)	−0.57 (−1.70, 0.56)	−0.03 (−1.12, 1.06)	0.02 (−1.03, 1.08)	0.46 (−0.68, 1.60)	−1.14* (−1.93, −0.34)	−0.98* (−1.79, −0.18)	−0.58 (−1.36, 0.19)	−0.54 (−1.29, 0.20)	−0.39 (−1.20, 0.42)
Isostrain (continuous)	−0.58* (−0.99, −0.17)	−0.50* (−0.93, −0.08)	−0.09 (−0.50, 0.33)	−0.09 (−0.49, 0.31)	−0.03 (−0.44, 0.39)	−0.56* (−0.85, −0.27)	−0.49* (−0.79, −0.19)	−0.21 (−0.50, 0.08)	−0.22 (−0.51, 0.06)	−0.11 (−0.40, 0.18)

(*Continued*)

TABLE IV. (*Continued.*)

Variable	Systolic Blood Pressure [mmHg]					Diastolic Blood Pressure [mmHg]				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
Alt. isostrain (continuous)[e]	−0.36	−0.31	−0.04	−0.08	−0.02	−0.43*	−0.38*	−0.17	−0.20	−0.08
	(−0.77, 0.05)	(−0.73, 0.11)	(−0.45, 0.36)	(−0.47, 0.31)	(−0.42, 0.39)	(−0.72, −0.14)	(−0.67, −0.08)	(−0.46, 0.12)	(−0.48, 0.07)	(−0.37, 0.20)
Isostrain (categorical)	−1.14	−0.98	−0.17	0.13	0.25	−1.52*	−1.34*	−0.85	−0.68	−0.48
	(−2.39, 0.11)	(−2.25, 0.29)	(−1.39, 1.06)	(−1.05, 1.31)	(−0.94, 1.45)	(−2.40, −0.64)	(−2.24, −0.43)	(−1.72, 0.02)	(−1.52, 0.16)	(−1.33, 0.37)
Alt. isostrain[e] (categorical)	−1.34*	−1.34*	−0.68	−0.51	−0.41	−1.55*	−1.45*	−0.96*	−0.86*	−0.67
	(−2.50, −0.19)	(−2.51, −0.17)	(−1.80, 0.44)	(−1.59, 0.57)	(−1.50, 0.69)	(−2.37, −0.73)	(−2.28, −0.62)	(−1.76, −0.17)	(−1.63, −0.09)	(−1.45, 0.11)
Job insecurity	−0.70*	−0.69*	−0.32	−0.25	−0.20	−0.85*	−0.83*	−0.50*	−0.46*	−0.43*
	(−1.11, −0.29)	(−1.10, −0.28)	(−0.73, 0.08)	(−0.64, 0.14)	(−0.61, 0.20)	(−1.14, −0.56)	(−1.12, −0.54)	(−0.79, −0.22)	(−0.74, −0.18)	(−0.72, −0.14)
Job insecurity (categorical)	−1.00*	−0.93*	−0.57	−0.46	−0.37	−1.47*	−1.42*	−0.87*	−0.79*	−0.72*
	(−1.84, −0.15)	(−1.78, −0.07)	(−1.41, 0.27)	(−1.26, 0.35)	(−1.19, 0.46)	(−2.07, −0.87)	(−2.03, −0.82)	(−1.47, −0.28)	(−1.37, −0.22)	(−1.30, −0.13)

*P-value < 0.05.

Model1: simple linear regression model (unadjusted).

Model 2: adjusted by physical workload (physical demands and occupational activity level).

Model 3: additionally adjusted by individual worker characteristics including demographic (age, gender), behavioral (smoking, alcohol, leisure-time physical activity) and socio-economic factors (education, income, marital status, worksite, seniority).

Model 4: additionally adjusted by other biological CVDRF (total blood cholesterol levels, blood glucose levels, and body mass index).

Model 5: additionally adjusted for psychosocial factors other than the one in the main association (for example, job demands models were adjusted by decision latitude, total support, and job insecurity; decision latitude models were adjusted by job demands, total support, and job insecurity; social support models were adjusted by job demands, decision latitude, and job insecurity, etc.).

[a]Five-item psychological demands (original JCQ psychological demand subscale).

[b]Alternative three-item psychological demands (this subscale does not include physical demands, it is based solely on the following three items: "I am not asked to do an excessive amount of work", "I have enough time to get the job done", "I am free from conflicting demands others make").

[c]Nine-item decision latitude (original JCQ decision latitude subscale).

[d]Alternative eight-item decision latitude (the repetitive item was dropped because it was not confirmed in factor analysis).

[e]Alternative scale calculated using three-item psychological job demands and eight-item decision latitude subscales.

TABLE V. Associations Between Psychosocial Job Factors, Current Smoking and Leisure-time Physical Activity: Results (standardized Odds Ratios and 95% Confidence Intervals) From Logistic Regression With Incremental Adjustment for Physical Workload, Individual Worker Characteristics, Biological Cvdrf, and Other Psychosocial Job Factors. Mexican Institute of Social Security Study 2009 (n = 2, 330)

	Current smoking [yes/no]					Leisure-time physical activity [yes/no]				
Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Psychological job demands (5 items)[a]	1.01 (0.93, 1.10)	0.98 (0.90, 1.07)	1.00 (0.91, 1.11)	0.98 (0.88, 1.09)	0.98 (0.89, 1.09)	0.93 (0.85, 1.02)	0.94 (0.85, 1.04)	0.89* (0.80, 0.99)	0.94 (0.83, 1.05)	0.90 (0.80, 1.01)
Alt. psychological job demands (3 items)[b]	1.01 (0.93, 1.10)	0.98 (0.90, 1.07)	1.00 (0.91, 1.09)	1.00 (0.90, 1.11)	0.96 (0.87, 1.06)	0.90* (0.81, 0.98)	0.91* (0.82, 1.00)	0.88* (0.80, 0.98)	0.91 (0.82, 1.02)	0.91 (0.82, 1.02)
Physical demands	1.06 (0.97, 1.14)	N/A	0.95 (0.86, 1.05)	1.00 (0.89, 1.12)	0.95 (0.85, 1.06)	1.00 (0.91, 1.10)	N/A	1.03 (0.92, 1.15)	1.04 (0.92, 1.17)	1.09 (0.96, 1.23)
Decision latitude (9 items)[c]	0.97 (0.90, 1.06)	0.98 (0.90, 1.06)	0.98 (0.90, 1.07)	0.97 (0.88, 1.07)	1.02 (0.92, 1.13)	1.14* (1.03, 1.25)	1.15* (1.04, 1.26)	1.11* (1.01, 1.24)	1.16* (1.04, 1.29)	1.07 (0.95, 1.20)
Alt. decision latitude (8 items)[d]	0.98 (0.91, 1.07)	0.98 (0.90, 1.07)	0.98 (0.90, 1.08)	0.98 (0.88, 1.08)	1.02 (0.92, 1.14)	1.14* (1.03, 1.25)	1.15* (1.04, 1.26)	1.12* (1.01, 1.24)	1.17* (1.05, 1.31)	1.06 (0.95, 1.20)
Coworker support	0.97 (0.90, 1.05)	0.98 (0.90, 1.06)	0.95 (0.87, 1.04)	0.95 (0.86, 1.05)	0.96 (0.87, 1.05)	1.16* (1.06, 1.28)	1.18* (1.08, 1.30)	1.15* (1.04, 1.27)	1.16* (1.05, 1.29)	1.14* (1.04, 1.27)
Supervisor support	0.92 (0.85, 1.00)	0.93 (0.85, 1.01)	0.90* (0.82, 0.99)	0.93 (0.84, 1.03)	0.90* (0.81, 0.99)	1.10* (1.00, 1.21)	1.12* (1.02, 1.23)	1.15* (1.03, 1.27)	1.15* (1.03, 1.27)	1.10 (0.98, 1.23)
Total support	0.93 (0.86, 1.01)	0.94 (0.86, 1.02)	0.91* (0.83, 0.99)	0.93 (0.84, 1.02)	0.90 (0.82, 1.00)	1.16* (1.05, 1.27)	1.18* (1.07, 1.30)	1.17* (1.06, 1.30)	1.18* (1.06, 1.31)	1.15* (1.02, 1.29)
Job strain ratio	1.02 (0.94, 1.11)	1.00 (0.92, 1.09)	1.02 (0.93, 1.12)	1.01 (0.91, 1.12)	0.98 (0.89, 1.09)	0.87* (0.79, 0.96)	0.87* (0.78, 0.96)	0.86* (0.77, 0.95)	0.86* (0.77, 0.96)	0.88* (0.78, 0.99)
Alt. job strain ratio[e]	1.02 (0.94, 1.11)	1.00 (0.92, 1.09)	1.02 (0.93, 1.11)	1.02 (0.92, 1.12)	0.97 (0.87, 1.07)	0.87* (0.79, 0.96)	0.87* (0.79, 0.96)	0.87* (0.78, 0.96)	0.87* (0.78, 0.97)	0.90 (0.80, 1.01)
High job strain (categorical, ref. category: no high job strain)	1.16 (0.95, 1.41)	1.14 (0.93, 1.40)	1.18 (0.95, 1.47)	1.23 (0.97, 1.56)	1.14 (0.91, 1.44)	0.78* (0.62, 0.99)	0.78* (0.61, 0.99)	0.80 (0.62, 1.03)	0.81 (0.63, 1.05)	0.87 (0.67, 1.13)
Alt. high job strain[e] (categorical, ref. category: no high job strain)	1.19 (0.99, 1.44)	1.19 (0.98, 1.44)	1.17 (0.95, 1.44)	1.22 (0.98, 1.52)	1.12 (0.90, 1.39)	0.94 (0.76, 1.17)	0.94 (0.76, 1.18)	0.95 (0.76, 1.20)	0.94 (0.74, 1.19)	1.05 (0.82, 1.34)
High job strain (categorical, ref. category: low strain)	1.04 (0.82, 1.32)	0.99 (0.77, 1.27)	1.02 (0.78, 1.33)	1.06 (0.80, 1.41)	0.96 (0.72, 1.27)	0.77 (0.58, 1.01)	0.77 (0.58, 1.03)	0.81 (0.60, 1.09)	0.84 (0.61, 1.15)	0.92 (0.87, 1.13)
Alt. high job strain[e] (categorical, ref. category: low strain)	1.16 (0.93, 1.44)	1.13 (0.90, 1.41)	1.14 (0.90, 1.46)	1.19 (0.92, 1.55)	1.05 (0.81, 1.37)	0.79 (0.62, 1.02)	0.79 (0.61, 1.02)	0.82 (0.63, 1.07)	0.82 (0.62, 1.09)	0.94 (0.70, 1.25)
Isostrain (continuous)	1.04 (0.96, 1.13)	1.03 (0.95, 1.12)	1.05 (0.96, 1.15)	1.04 (0.94, 1.14)	1.05 (0.95, 1.15)	0.85* (0.77, 0.93)	0.84* (0.76, 0.92)	0.84* (0.76, 0.94)	0.83* (0.75, 0.93)	0.82* (0.74, 0.92)
Alt. isostrain (continuous)[e]	1.03 (0.95, 1.12)	1.02 (0.94, 1.11)	1.03 (0.94, 1.13)	1.03 (0.94, 1.14)	1.03 (0.94, 1.13)	0.84* (0.77, 0.93)	0.84* (0.76, 0.92)	0.85* (0.76, 0.93)	0.83* (0.75, 0.93)	0.83* (0.74, 0.92)
Isostrain (categorical)	1.27 (0.99, 1.63)	1.25 (0.97, 1.62)	1.35* (1.03, 1.78)	1.33 (0.99, 1.79)	1.33* (1.01, 1.77)	0.80 (0.59, 1.07)	0.78 (0.58, 1.06)	0.75 (0.55, 1.03)	0.77 (0.56, 1.07)	0.72* (0.52, 0.99)
Alt. isostrain[e] (categorical)	1.43* (1.13, 1.80)	1.42* (1.13, 1.80)	1.44* (1.12, 1.86)	1.42* (1.08, 1.85)	1.43* (1.10, 1.85)	0.92 (0.70, 1.20)	0.90 (0.69, 1.18)	0.88 (0.66, 1.16)	0.90 (0.67, 1.20)	0.84 (0.63, 1.12)
Job insecurity	1.08 (1.00, 1.18)	1.09* (1.00, 1.18)	1.04 (0.95, 1.14)	1.04 (0.95, 1.15)	1.03 (0.93, 1.13)	1.10* (1.01, 1.21)	1.11* (1.01, 1.21)	1.03 (0.93, 1.14)	1.06 (0.96, 1.18)	1.08 (0.97, 1.19)
Job insecurity (categorical)	1.21* (1.03, 1.44)	1.22* (1.03, 1.45)	1.14 (0.95, 1.38)	1.16 (0.95, 1.42)	1.12 (0.92, 1.35)	1.21* (1.00, 1.47)	1.21* (1.00, 1.46)	1.09 (0.89, 1.34)	1.14 (0.92, 1.41)	1.18 (0.95, 1.46)

*P-value < 0.05.

Model 1: simple logistic regression model (unadjusted).

Model 2: adjusted by physical workload (physical demands and occupational activity level).

Model 3: additionally adjusted by individual worker characteristics including demographic (age, gender), behavioral (smoking (in physical activity models), leisure-time physical activity (in smoking models), alcohol) and socio-economic factors (education, income, marital status, worksite, seniority).

Model 4: additionally adjusted by other biological CVDRF (systolic blood pressure, total blood cholesterol levels, glucose, and body mass index).

Model 5: additionally adjusted for psychosocial factors other than the one in the main association (for example, job demands models were adjusted by decision latitude, total support, and job insecurity; decision latitude models were adjusted by job demands, total support, and job insecurity; social support models were adjusted by job demands, decision latitude, and job insecurity, etc.).

[a]Five-item psychological demands (original JCQ psychological demand subscale).

[b]Alternative three-item psychological demands (this subscale does not include physical demands, it is based solely on the following three items: "I am not asked to do an excessive amount of work", "I have enough time to get the job done", "I am free from conflicting demands others make").

[c]Nine-item decision latitude (original JCQ decision latitude subscale).

[d]Alternative eight-item decision latitude (the repetitive item was dropped because it was not confirmed in factor analysis).

[e]Alternative scale calculated using three-item psychological job demands and eight-item decision latitude subscales.

(body mass index and waist circumference). Physical job demands and supervisor support appeared to be protective against high adiposity. In fully adjusted models, each additional standard deviation in physical job demands was associated with 0.27 kg/m^2 lower body mass index ($\beta = -0.27$, 95% CI -0.47, -0.06), and each standard deviation increase in supervisor support was associated with 0.33 kg/m^2 lower body mass index ($\beta = -0.33$, 95% CI -0.52, -0.14) and with 0.64 cm lower waist circumference ($\beta = -0.64$, 95% CI -1.09, -0.19).

Decision latitude, contrary to expectations, was positively associated with body mass index and waist circumference. Among all the measures of job strain, only the inverse association between high job strain (using the original scale) and body mass index was statistically significant. Exposure to isostrain (as measured with the categorical alternative subscales) was significantly associated with higher waist-hip ratio in model 5 ($\beta = 0.07$, 95% CI 0.01, 0.14). Job insecurity showed an inverse relationship with weight indicators, which was statistically significant for waist circumference ($\beta = -0.48$, 95% CI -0.90, -0.06) and waist-hip ratio ($\beta = -0.03$, 95% CI -0.05, -0.01) after controlling for all potential confounders.

Blood pressure

Contrary to expectation, continuous and categorical measures of job strain were inversely associated with diastolic blood pressure but statistical significance was lost after adjusting for potential confounders, with the exception of job strain ratio (original scale) (Table IV). Isostrain showed inverse associations with diastolic blood pressure across models 1–5 that were statistically significant for the alternative categorical scale in models 1–4. Job insecurity was inversely associated with systolic blood pressure but the association weakened and lost statistical significance after adjustment in models 3, 4, and 5. Job insecurity, however, showed a consistent inverse and statistically significant association with diastolic blood pressure in all models.

Smoking

Psychological job demands, physical job demands, decision latitude, and job strain did not show any statistically significant associations with smoking (Table V). However, one standard deviation increase in supervisor support was associated with 10% reduced risk of smoking in fully adjusted models (OR = 0.90, 95% CI 0.81, 0.99). The original isostrain variable showed a statistically significant 33% higher risk of smoking compared to workers not exposed to isostrain (OR = 1.33, 95% CI 1.01, 1.77) after adjusting for all potential confounders. The alternative isostrain variable based on categorical measures of job strain and low support also showed a statistically significant effect (OR = 1.43, 95% CI 1.10, 1.85). Job insecurity was also significantly associated with the risk of smoking, but only in models 1–2.

Leisure-time physical activity

Psychological job demands were associated with less leisure-time physical activity but this relationship was statistically significant only in models 1–3 (Table V).As hypothesized, decision latitude, coworker support, and supervisor support were positively associated with physical activity. One standard deviation higher total support at work was associated with 15% higher odds of leisure-time physical activity (OR = 1.15, 95% CI 1.02, 1.29). Both job strain and isostrain were associated with reduced leisure-time physical activity; one standard deviation higher job strain ratio and isostrain (continuous variable) were associated with 12% and 18% lower odds of leisure-time physical activity, respectively. Contrary to expectations, job insecurity had a consistent positive effect on leisure-time physical activity, but the statistical significance of this association disappeared in models 3–5.

Summary of the comparison of the original and alternative scales in relation to CVDRF

Out of 245 comparisons, 50 (20%) showed a difference greater than twofold (change above 200%). The greatest change was a 54-fold difference between the alternative categorical operationalization of high job strain (ref. category: low strain) and blood cholesterol levels (model 2). Change in direction of association between scales happened in 12.6% of cases. Although the original scales yielded more statistically significant results than alternative scales (34% vs. 16% of cases, respectively), the alternative scales resulted more often (61% of cases) in effect changes more in direction of expected relationships according to previous research (i.e., indicating a detrimental effect of adverse PJF on CVDRF). Differences between the original and alternative decision latitude scales were not as prominent as the ones found for the psychological demands scale (see Supplementary Appendix 4 for a more detailed description of the comparison between scales).

DISCUSSION

Our study of 2,330 Mexican workers in eight worksites provided some support for the relationships we hypothesized between PJF and cardiovascular risk factors: High job strain was associated with reduced leisure-time physical activity. Workers reporting isostrain showed higher odds of smoking and lower odds of leisure-time physical activity. Social support seemed to protect against high blood cholesterol levels, overweight/obesity, smoking, and reduced leisure-time physical activity. On the other hand, some psychosocial work factors (e.g., decision latitude, job strain, and job insecurity) showed unexpected associations with diastolic blood pressure and some adiposity measures.

In general, continuous exposure measures were more strongly associated with outcomes and reached statistical significance more often than associations using categorical exposure variables. This is in line with expectations because categorization of continuous measures introduces misclassification error. Therefore, we recommend using continuous variables in addition to the more traditional and most widely used categorical operationalizations of job strain, especially for making causal inferences. Also, as expected, categorical measures of high job strain using low strain as a reference showed stronger associations with the study outcomes than those using no high strain as a reference due to the higher contrast among exposure categories.

Interestingly, alternative formulations of the job demand and control scales resulted in substantial changes in effect sizes or changed the statistical significance of results when compared with the original scales. Even though original scales showed more statistically significant associations, the alternative scales throughout this study showed better agreement with the literature and with this study's hypothesized associations between PJF and CVDRF. Also, the dropped items seemed to account for part of the inverse associations observed for blood pressure. For example, we found a stronger inverse association between job strain and diastolic blood pressure with the original scales, which may result from using ambiguous psychological demands items that could be misunderstood as questions about physical demands. In fact, the original JCQ physical demand item was inversely associated with blood pressure in models 1, 3, and 4.

Overall, using the alternative scales proved to be useful to determine associations due to psychological rather than physical demands. In all models, associations using the alternative versions showed better agreement to the literature and to this study's hypotheses than the original versions. If rewording the "work fast" and "work hard" items to differentiate mental and physical job demands is not possible, a three-item psychological demands scale should be considered in future occupational epidemiologic studies.

Associations Between Psychosocial Job Factors and CVDRF

Blood glucose levels

There was a tendency in the data for positive associations between psychological job demands, job strain, isostrain, job insecurity, and blood glucose levels, although these associations were not statistically significant. A positive association between job strain and diabetes or high glucose levels has been reported in the literature [Kawakami et al., 2000; Leynen et al., 2003; Heraclides et al., 2009]. The pathways by which job stressors may contribute to elevated blood glucose levels have been linked to cortisol levels, which are chronically elevated in stressful situations. Cortisol enhances hepatic release of glucose and decreases pancreatic insulin secretion, thus reducing the cellular absorption of glucose, and causing an increase in blood glucose levels [Heraclides et al., 2009].

Total blood cholesterol levels

In agreement with our findings, protective effects of social support systems on cholesterol levels have been reported in previous studies [Thomas et al., 1985; Uchino, 2004]. In regards to the association between job strain and total blood cholesterol, the literature is inconclusive and shows both positive [Kivimaki et al., 2002; Chandola et al., 2006; Djindjic et al., 2012; Catalina-Romero et al., 2013] and inverse [Alfredsson et al., 2002; Shirom et al., 2009] associations. Our results showed inconsistent associations between job strain and cholesterol. The mechanisms by which occupational stressors influence serum cholesterol remain to be fully elucidated. Some hypothesized mechanisms include unhealthy behaviors such as smoking, sedentary lifestyle, and high-calorie intake [Nyberg et al., 2013], suppression of LDL ("bad cholesterol") liver receptors resulting in an increase of endogenous cholesterol in the plasma [Goldstein et al., 1983], and excessive stimulation of the sympathetic nervous system, which may lead to an increased mobilization of fatty acids from the adipose tissue into the blood stream [Siegrist et al., 1988]. As can be seen in Table II, a strong positive association between job insecurity and cholesterol observed in models 1–2 is nearly completely explained by demographic and behavioral factors controlled for in models 3–5.[3] Clearly, some of the behavioral factors may be considered both mediating and confounding variables.

Adiposity

Psychological job demands were associated with body mass index and waist circumference, in agreement with previous research [Block et al., 2009; Choi et al., 2010]. Physical job demands and supervisor support showed an inverse association with adiposity measures, which has previously been associated with low physical job demands or sedentary work [Choi et al., 2010]. Risk of obesity may be reduced when supervisors not only support workers but also take a leadership role in promoting physical activity at work [Middlestadt et al., 2011; Dobson et al., 2013].

The literature on job strain and adiposity is inconclusive: positive [Choi et al., 2010; Fernandez et al., 2010], inverse [Nyberg et al., 2012] and null [Overgaard et al., 2004]

[3] Correlations between exposures (psychosocial job factors), cardiovascular disease risk factors, and demographics are included in Supplementary Appendix 5.

associations have been described. Our study is similarly inconclusive: the positive association between decision latitude and body mass index and waist circumference and the inverse associations between the original, categorical operationalizations of job strain and body mass index did not support our hypotheses; however, isostrain showed a positive, statistically significant association with waist-hip ratio in model 5. This study also indicates that the association between job strain and adiposity indicators can vary by the specific job strain measure (continuous vs. categorical variables; and original vs. alternative scales). Although categorical and original variables reached statistical significance more often and showed larger effect sizes, continuous and alternative operationalizations of the job strain scales led more often to observed associations that were in agreement to the literature and to our hypothesized associations between PJF and CVDRF.

Finally, both positive [Muenster et al., 2011] and inverse [Ferrie et al., 2002] associations between job insecurity and adiposity measures based on body mass index have been reported in the literature. Results from the current cross-sectional study are consistent with an inverse association. To our knowledge, no studies have explored the relationship between job insecurity and abdominal obesity as measured by either waist-hip ratio or waist circumference.

Inconsistent findings between psychosocial stressors and weight may be in part explained by different eating behaviors in response to stress. Stress has been shown to have a dual effect on eating patterns, depending on the stressor's severity and chronicity. On the one hand, stress may suppress appetite and on the other hand, it may induce consumption of energy-dense food [Torres and Nowson, 2007]. Unfortunately, we were unable to explore this explanation in our study because information on eating patterns was not available.

Blood pressure

Although many studies have reported a positive association between job strain and blood pressure [Gilbert Ouimet et al., 2013; Landsbergis et al., 2013], null or inverse associations have also been reported [Winkleby et al., 1988; Reed et al., 1989; Albright et al., 1992; Olesen et al., 2012]. Possible reasons for our unexpected (inverse) findings include the following:

(a) We cannot rule out the possibility that the self-reported measurement of job strain in this study contributed to unexpected results. For example, in a cross-sectional study of bus drivers, investigators found an inverse relationship between self-reported job stress and blood pressure (although the questionnaire in the study included items about diverse driver-specific work stressors and was different from the JCQ used in the current study) and a positive association between objective measurements of job stressors and blood pressure [Greiner et al., 2004].

(b) Due to time constraints, only one measurement of blood pressure was made instead of the three measurements used in standard protocols [Centers for Disease Control and Prevention, 1993]. However, there is no reason to believe that any resulting measurement error would systematically differ among subjects with and without job strain and would have biased results in one direction. Instead, such random non-differential measurement error is likely to bias results towards the null hypothesis of no effect.

(c) Unlike other studies with positive associations between job strain and blood pressure [Schnall et al., 1998; Landsbergis et al., 2003; Juárez-Garcia, 2007], this study did not evaluate ambulatory blood pressure (ABP). ABP is a better predictor of cardiovascular risk than casual blood pressure (CBP) measurement because CBP measurements may over- or underestimate true blood pressure levels, due to a "white-coat effect" [Manios et al., 2008], "masked hypertension" [Landsbergis et al., 2013], non-compliance with antihypertensive medication, or individual fluctuations of the day-night blood pressure patterns. In fact, a higher prevalence of white-coat effect has been reported among workers without job strain [Belkic et al., 2001]. If such was the case in our study population, workers without job strain could show higher levels of casual blood pressure and workers with high job strain lower levels, thus possibly explaining inverse associations. However, this argument is speculative and the inverse associations between diastolic blood pressure and PJF found in this study warrant further research in Mexican working populations using a longitudinal design [Gilbert-Ouimet et al., 2013; Schnall et al., 2013] and preferably repeat ambulatory blood pressure measurements.

The inverse relationship observed between job insecurity and blood pressure in this study differs from previous research [Pollard, 2001; Kalil et al., 2010]. Job insecurity has been associated with adverse health consequences [Ferrie et al., 1998; Ferrie, 2001; De Witte, 2005]. However, one study among workers from a company undergoing massive layoffs showed that anticipating job loss did not raise blood pressure [Schnall et al., 1992]. The latter study hypothesizes that responses of blood pressure to job insecurity may depend on workers' perceived control; that is, when job loss becomes an uncontrollable event, it may no longer be perceived as a threat and workers may stop worrying about it.

Smoking

After controlling for potential confounders, workers exposed to isostrain (as measured with the alternate subscales) had a 43% increase in the odds of smoking

compared to workers not exposed to isostrain (OR = 1.43, 95% CI 1.10, 1.85). We also found that workers with high levels of social support were 10% less likely to smoke than workers with low social support, consistent with findings from other researchers who reported that female smokers in low-support jobs smoked more [Jones et al., 2007].

In Mexico, as in other countries, smoking habits are mostly acquired at an early age before workers enter the labor market [Kuri-Morales et al., 2006]. The main reported effect of job strain on smoking is through increasing smoking intensity in light smokers [Rugulies et al., 2008; Azagba and Sharaf, 2011; Heikkila et al., 2012]. Smoking may also arise from the need to counteract negative emotions provoked by high strain jobs [Landsbergis et al., 1998], in particular those with low levels of social support (nicotine is mainly a stimulant). Nevertheless, inconsistent results have been reported when exploring the association between smoking and job characteristics [van Loon et al., 2000]; therefore, further investigations are required in this area.

Leisure-time physical activity

Decision latitude and total support at work were positively associated with leisure-time physical activity, whereas psychological job demands, job strain, and isostrain had an inverse effect on leisure-time physical activity. This is in accordance with recent findings on the association of PJF and physical activity [Choi et al., 2010; Fransson et al., 2012; Kouvonen et al., 2013].

Even though more research is needed on this topic, this study's findings highlight the importance of promoting job control and social support in the worksite so workers may adopt healthy behaviors such as leisure-time physical activity. To adopt and maintain physical activity, high levels of motivation are needed, which can be promoted by social support at work. Also, having high levels of job control could promote active behaviors at work and may provide workers the freedom to take time off work to exercise.

Context of Mexican workplaces

Interestingly, 44.5% of the working population sample in the current study had a low level of education (middle school or less) and 41% earned less than $350 US dollars per month. Except for cholesterol levels, high socioeconomic status (as measured by education) was associated with lower levels of cardiovascular risk factors and with higher odds of leisure-time physical activity. In regards to PJF, education level was inversely associated with job strain and isostrain but positively associated with job insecurity (results not shown).

In Mexico, where age discrimination is widespread, a high level of education does not necessarily guarantee a high-quality job or job security [Mancini, 2008; Hawley and Solache, 2014]. In general, high socioeconomic status is associated with better health [Adler and Ostrove, 1999]. On the other hand, job insecurity is expected to have detrimental effects on health [Laszlo et al., 2010]. The discrepancy of high socioeconomic status (as measured by education) and job insecurity found in this study population may have contributed to the inconsistent findings in regards to job insecurity and cardiovascular risk factors.

Turnover is also very common in Mexican companies. In this study, more than half of the sample population had worked for 5 or less years (low seniority). Job stress and unfair treatment are among the top five causes of turnover in the United States [Powell, 2012]. In Mexico, workers who experience job dissatisfaction, unhealthy working conditions, and low wages are more likely to quit their jobs and in some cases, move to the informal economy [Gonzalez-Rios, 2006; Romero and Cruthirds, 2009]. In the unstable Mexican economy, workers may just be grateful to have a job and their appraisal of the work environment may be colored by this appreciation of having any work. Therefore, psychosocial stress may be underreported by Mexican workers. A similar pattern has previously been described among non-Western immigrants in Denmark [Olesen et al., 2012].

Study limitations and strengths

The cross-sectional design of the study limits causal inferences although it is unlikely that undiagnosed and/or non-symptomatic CVDRF would result in reverse causation, that is, lead to greater exposure to job strain, low support, or job insecurity. The convenience sample of worksites with unknown representativeness limits generalizability of study results. However, the inclusion of different industries and occupations needs to be considered an advantage of this study compared to single occupation studies that suffer from lack of variation in working conditions. Our study shows wide variations in PJF across companies and between individuals necessary for detecting effects. The modest participation rate (58.5% overall) was mostly due to an inability of workers to take time off to participate in the study. Job strain has been shown to have an influence on survey response [Cifuentes et al., 2008]. If such was the case in our study, the associations between job strain and CVDRF may have been underestimated.

Information about medication was not collected in this study. To prevent misclassification of cases as non-hypertensive or non-diabetic resulting from workers' medically controlled blood pressure and glucose levels, we considered a personal history of hypertension/diabetes as a proxy measure for medication (no information about personal history of hypercholesterolemia was available). In a post-hoc analysis, such workers were excluded from our linear regression models (results not shown). The direction of associations remained the same in both models, suggesting that medication did not differentially influence our results.

The self-reported measurement of job strain in this study might have contributed to unexpected results to some extent. But we could not test this possibility in the current study due to the lack of non-questionnaire methods to assess job strain. We recommend using multiple methods (e.g., self-report, observation, qualitative methods, or administrative records) for assessing work stressors including job strain in future research.

Low values of Cronbach alpha were obtained for the alternative psychological job demand scale and for job insecurity. However, rather than indicating low reliability of such scales, these reduced alphas are a reflection of the small number of items [Streiner, 2003] with respect to the alternative psychological job demands scale, and the multidimensionality of the scale with regard to job insecurity [Karasek et al., 1998].

Over-adjustment may have occurred by adjusting for other CVDRF including possible behavioral mediators in models 3 and 4, and additionally for several PJF in model 5. However, other CVDRF are important to consider as they are associated with both exposure and outcome and may act as confounders. The influence on statistical significance of results was minor: in several associations of job factors with leisure time physical activity and in one instance of diastolic blood pressure, statistical significance was lost in model 5. In only one instance of leisure-time physical activity, statistical significance was gained in model 5. Additionally, correlations between the different CVDRF considered in this study were weak, no clustering of factors was evident, and multicollinearity was not an issue. Another study limitation was the lack of information on dietary habits, which may have resulted in some residual confounding, especially in our models for total blood cholesterol, weight outcomes, and blood pressure.

Strengths of this study include its large sample size, the consideration of workers from both genders and all socioeconomic and age strata, and the use of both categorical and continuous variables for exposures and most outcomes. While categorical measures are helpful for comparisons with the literature, continuous measures retain more information, reduce misclassification, and increase the power to detect effects. In fact, in analyses not shown, most associations with dichotomous outcomes were in the same direction but, with few exceptions, these associations were not statistically significant.

Our study also makes a unique contribution by evaluating within the same study population the effects of alternative operationalizations of psychological demands and decision latitude scales and addressing the possibility that some of the original scales may have been interpreted as physical rather than PJF. Our results demonstrate that the choice of scale may lead to substantial differences in the magnitude of associations, and change in direction or statistical significance of associations.

Another strength of this study is that we examined associations between psychosocial job stressors and waist circumference and waist-hip ratio, which are deemed to be more predictive of cardiovascular disease risk than traditional measures of obesity based on body mass index [Welborn and Dhaliwal, 2007].

CONCLUSIONS

This study showed both positive and inverse associations between adverse PJF and CVDRF. Social support (in particular supervisor support) seems to play an important role in this population sample because many CVDRF were lower among workers with higher levels of social support. Using alternative scales for job demands and decision latitude (excluding ambiguous items) was presumably useful to determine associations due to psychological rather than physical job demands. In some instances, alternative operationalizations resulted in substantial changes in effect sizes or statistical significance of results when compared with the original scales.

We conclude that interventions at the worksite level are needed to reduce psychosocial stressors in order to improve workers' cardiovascular health. The unexpected results in regards to adiposity indicators and blood pressure point to the need for the development and use of more objective job stress measures but they should not detract from research findings on the potential negative health impacts of psychosocial job stressors. To our knowledge, this study is the first in a large Mexican population to explore the effects of psychosocial work factors on several CVDRF. We expect that our findings will allow employers to understand the importance of psychosocial work hazards and encourage them to implement interventions to control and prevent these hazards, thus optimizing the effects of any future efforts aimed to improve workers' health.

ACKNOWLEDGEMENTS

This work was supported by the NIH Fogarty grant 5D43TW000623, by the National Council of Science and Technology (CONACYT, grant Salud-2005-02-14451) in Mexico City, and by the Southern California NIOSH Education and Research Center, Grant Agreement Number T42 OH0084 from the Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official view of CDC. We express our gratitude to Drs. Victor Borja and Raul Sanchez-Roman from the Mexican Institute of Social Security for giving us access to this study's database. We also acknowledge Mrs. Jacqueline Durcudoy, for her involvement and excellent supervision of the fieldwork.

REFERENCES

Adler NE, Ostrove JM. 1999. Socioeconomic status and health: What we know and what we don't. Ann N Y Acad Sci 896:3–15.

Aickin M, Gensler H. 1996. Adjusting for multiple testing when reporting research results: The Bonferroni vs Holm methods. Am J Public Health 86:726–728.

Albright CL, Winkleby MA, Ragland DR, Fisher J, Syme SL. 1992. Job strain and prevalence of hypertension in a biracial population of urban bus drivers. Am J Public Health 82:984–989.

Alfredsson L, Hammar N, Fransson E, de Faire U, Hallqvist J, Knutsson A, Nilsson T, Theorell T, Westerholm P. 2002. Job strain and major risk factors for coronary heart disease among employed males and females in a Swedish study on work, lipids and fibrinogen. Scand J Work Environ Health 28:238–248.

Anderson GH. 1999. Effect of age on hypertension: Analysis of over 4,800 referred hypertensive patients. Saudi J Kidney Dis Transpl 10:286–297.

Azagba S, Sharaf MF. 2011. The effect of job stress on smoking and alcohol consumption. Health Econ Rev 1:1–14.

Backe EM, Seidler A, Latza U, Rossnagel K, Schumann B. 2012. The role of psychosocial stress at work for the development of cardiovascular diseases: A systematic review. Int Arch Occup Environ Health 85:67–79.

Belkic K, Landsbergis P, Schnall P, Baker D. 2004. Is job strain a major source of cardiovascular disease risk. Scand J Work Env Health 30: 85–128.

Belkic KL, Schnall PL, Landsbergis PA, Schwartz JE, Gerber LM, Baker D, Pickering TG. 2001. Hypertension at the workplace—An occult disease? The need for work site surveillance. Adv Psychosom Med 22:116–138.

Block JP, He Y, Zaslavsky AM, Ding L, Ayanian JZ. 2009. Psychosocial stress and change in weight among US adults. Am J Epidemiol 170:181–192.

Bonde JP. 2008. Psychosocial factors at work and risk of depression: A systematic review of the epidemiological evidence. Occup Environ Med 65:438–445.

Carayon P, Haims MC, Yang CL. 2006. Psychosocial work factors and work organization. In: Karwowski W, editor. International encyclopedia of ergonomics and human factors, 2nd edition - 3 Volume Set: CRC Press.

Catalina-Romero C, Calvo E, Sanchez-Chaparro MA, Valdivielso P, Sainz JC, Cabrera M, Gonzalez- Quintela A, Roman J. 2013. The relationship between job stress and dyslipidemia. Scand J Public Health 41:142–149.

Cedillo LA. 1999. Psychosocial risk factors among women workers in the maquiladora industry in Mexico. Ph.D. dissertation. Lowell, MA: University of Massachusetts.

Cedillo LA, Karasek R. 2003. Reliability and validity of the Spanish version of the Job Content Questionnaire among Maquiladora women workers. Lowell, MA: JCQ Center.

Centers for Disease Control and Prevention. 1993. National Health and Nutrition Examination Survey (NHANES) Manual—Pulse and blood pressure procedures for household interviewers. Rockville, MD: Department of Health and Human Services. 50 p.

Chandola T, Brunner E, Marmot M. 2006. Chronic stress at work and the metabolic syndrome: Prospective study. Brit Med J 332:521–525.

Chien TW, Lai WP, Wang HY, Hsu SY, Castillo RV, Guo HR, Chen SC, Su SB. 2011. Applying the revised Chinese Job Content Questionnaire to assess psychosocial work conditions among Taiwan's hospital workers. BMC Public Health 11:478.

Choi B, Kurowski A, Bond M, Baker D, Clays E, De Bacquer D, Punnett L. 2012. Occupation-differential construct validity of the Job Content Questionnaire (JCQ) psychological job demands scale with physical job demands items: A mixed methods research. Ergonomics 55:425–439.

Choi B, Kawakami N, Chang S, Koh S, Bjorner J, Punnett L, Karasek R. 2008. A cross-national study on the multidimensional characteristics of the five-item psychological demands scale of the Job Content Questionnaire. Int J Behav Med 15:120–132.

Choi B, Schnall P, Dobson M, Yang H, Landsbergis P, Baker D, 2010. Job control and job demands as risk factors for central obesity in US workers: A 9-year follow-up study. 4th ICOH-WOPS Conference, Amsterdam, Netherlands.

Choi B, Schnall P, Ko S, Dobson M, Baker D. 2013. Job strain and coronary heart disease. Lancet 381:448.

Choi B, Schnall PL, Yang H, Dobson M, Landsbergis P, Israel L, Karasek R, Baker D. 2010. Psychosocial working conditions and active leisure-time physical activity in middle-aged us workers. Int J Occup Med Environ Health 23:239-253.

Choi B, Schnall PL, Yang H, Dobson M, Landsbergis P, Israel L, Karasek R, Baker D. 2010. Sedentary work, low physical job demand, and obesity in US workers. Am J Ind Med 53:1088-1101.

Cifuentes M, Boyer J, Gore R, d'Errico A, Scollin P, Tessler J, Lerner D, Kriebel D, Punnett L, Slatin C. 2008. Job strain predicts survey response in healthcare industry workers. Am J Ind Med 51:281–289.

de Araujo TM, Karasek R. 2008. Validity and reliability of the job content questionnaire in formal and informal jobs in Brazil. Scand J Work Env Health Suppl 52–59.

De Witte H. 2005. Job insecurity: Review of the international literature on definitions, prevalence, antecedents and consequences. SA J Ind Psychol 31:1–6.

Department of Health and Human Services. 2009. Office for Human Research Protections' Database for Registered IRB Organizations, Institutional Review Boards and Approved Federalwide Assurances. In: Office for Human Research Protections, editor. Washington, D.C.: US Department of Health and Human Services.

Djindjic N, Jovanovic J, Djindjic B, Jovanovic M, Jovanovic JJ. 2012. Associations between the occupational stress index and hypertension, type 2 diabetes mellitus, and lipid disorders in middle-aged men and women. Ann Occup Hyg 56:1051–1062.

Dobson M, Choi B, Schnall PL, Wigger E, Garcia-Rivas J, Israel L, Baker DB. 2013. Exploring occupational and health behavioral causes of firefighter obesity: A qualitative study. Am J Ind Med 56:776–790.

Eaker ED, Sullivan LM, Kelly-Hayes M, D'Agostino RB, Sr., Benjamin EJ. 2004. Does job strain increase the risk for coronary heart disease or death in men and women? The Framingham Offspring Study. Am J Epidemiol 159:950–958.

Fernandez ID, Su H, Winters PC, Liang H. 2010. Association of workplace chronic and acute stressors with employee weight status: Data from worksites in turmoil. J Occup Environ Med 52(Suppl 1) : S34–S41.

Ferrie JE. 2001. Is job insecurity harmful to health. J R Soc Med 94: 71–76.

Ferrie JE, Shipley MJ, Marmot MG, Stansfeld SA, Smith GD. 1998. An uncertain future: The health effects of threats to employment security in white-collar men and women. Am J Public Health 88:1030–1036.

Ferrie JE, Shipley MJ, Stansfeld SA, Marmot MG. 2002. Effects of chronic job insecurity and change in job security on self reported health,

minor psychiatric morbidity, physiological measures, and health related behaviours in British civil servants: The Whitehall II study. J Epidemiol Community Health 56:450–454.

Fransson EI, Heikkila K, Nyberg ST, Zins M, Westerlund H, Westerholm P, Vaananen A, Virtanen M, Vahtera J, Theorell T, et al. 2012. Job strain as a risk factor for leisure-time physical inactivity: An individual-participant meta- analysis of up to 170,000 men and women: The IPD-Work Consortium. Am J Epidemiol 176:1078–1089.

Gilbert-Ouimet M, Trudel X, Brisson C, Milot A, Vezina M. 2013. Adverse effects of psychosocial work factors on blood pressure: Systematic review of studies on demand-control- support and effort-reward imbalance models. Scand J Work Environ Health.

Goldstein JL, Kita T, Brown MS. 1983. Defective lipoprotein receptors and atherosclerosis. Lessons from an animal counterpart of familial hypercholesterolemia. N Engl J Med 309:288–296.

Gómez-Ortiz V. 2011. Assessment of psychosocial stressors at work: Psychometric properties of the JCQ in Colombian workers. Revista Latinoamericana de Psicología 43:329–342.

Gonzalez-Rios M. 2006. La rotación de personal como un elemento laboral: Universidad Nacional Autónoma de Nuevo León.

Greiner BA, Krause N, Ragland D, Fisher JM. 2004. Occupational stressors and hypertension: A multi-method study using observer-based job analysis and self-reports in urban transit operators. Soc Sci Med 59:1081–1094.

Grotto I, Huerta M, Sharabi Y. 2008. Hypertension and socioeconomic status. Curr Opin Cardiol 23:335–339.

Hansen CD, Andersen JH. 2008. Going ill to work–What personal circumstances, attitudes and work-related factors are associated with sickness presenteeism. Soc Sci Med 67:956–964.

Hawley C, Solache S. 2014. Age discrimation flourishes in Mexico. Mexico: USA Today.

Heikkila K, Nyberg ST, Fransson EI, Alfredsson L, De Bacquer D, Bjorner JB, Bonenfant S, Borritz M, Burr H, Clays E, et al. 2012. Job strain and tobacco smoking: An individual-participant data meta-analysis of 166 130 adults in 15 European studies. PLoS ONE 7:e35463.

Heraclides A, Chandola T, Witte DR, Brunner EJ. 2009. Psychosocial stress at work doubles the risk of type 2 diabetes in middle-aged women: Evidence from the Whitehall II study. Diabetes Care 32:2230–2235.

Ibrahim RZ, Ohtsuka K. 2012. Review of the job demand-control and job demand-control-support models: Elusive moderating predictor effects and cultural implications. SE Asia Psychol J 1:10–21.

Instituto Nacional de Estadística y Geografía. 2011. Resultados de la Encuesta Nacional de Ocupación y Empleo Mexico: Instituto Nacional de Estadística y Geografía.

Johnson JV, Hall EM. 1988. Job strain, work place social support, and cardiovascular disease: A cross-sectional study of a random sample of the Swedish working population. Am J Public Health 78:1336–1342.

Jones F, O'Connor DB, Conner M, McMillan B, Ferguson E. 2007. Impact of daily mood, work hours, and iso- strain variables on self-reported health behaviors. J Appl Psychol 92:1731–1740.

Juárez-García A. 2004. Factores psicosociales relacionados con la salud mental en profesionales de servicios humanos en México. Ciencia y Trabajo 6:189–196.

Juarez-Garcia A. 2005. Factores psicosociales y personalidad en relación a la salud laboral: Universidad Nacional Autonoma de Mexico.

Juárez-Garcia A. 2007. Psychosocial work factors associated to blood pressure and cardiovascular symptoms among Mexican nurses. Salud Publica Mex 49:109–117.

Kalil A, Ziol-Guest KM, Hawkley LC, Cacioppo JT. 2010. Job insecurity and change over time in health among older men and women. J Gerontol B Psychol Sci Soc Sci 65B:81–90.

Karasek RA, Jr. 1979. Job demands, job decision latitude, and mental strain: Implications for job redesign. Admin Sci Quart 24:285–308.

Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. 1998. The Job Content Questionnaire (JCQ): An instrument for internationally comparative assessments of psychosocial job characteristics. J Occup Health Psychol 3:322–355.

Karasek R, Gordon G, Pietrokovsky C, Frese M, Pieper C, Schwartz J, Schirer D. 1985. Job content instrument: Questionnaire and user's guide Los Angeles. CA: University of Southern California.

Karasek R, Theorell T. 1990. Healthy work: Stress, productivity, and the reconstruction of working life. New York: Basic Books.

Kawakami N, Akachi K, Shimizu H, Haratani T, Kobayashi F, Ishizaki M, Hayashi T, Fujita O, Aizawa Y, Miyazaki S, et al. 2000. Job strain, social support in the workplace, and haemoglobin A1c in Japanese men. Occup Environ Med 57:805–809.

Kivimaki M, Leino-Arjas P, Luukkonen R, Riihimaki H, Vahtera J, Kirjonen J. 2002. Work stress and risk of cardiovascular mortality: Prospective cohort study of industrial employees. Brit Med J 325:857–862.

Kivimaki M, Nyberg ST, Batty GD, Fransson EI, Heikkila K, Alfredsson L, Bjorner JB, Borritz M, Burr H, Casini A, et al. 2012. Job strain as a risk factor for coronary heart disease: A collaborative meta-analysis of individual participant data. Lancet 380:1491–1497.

Kouvonen A, Vahtera J, Oksanen T, Pentti J, Vaananen AK, Heponiemi T, Salo P, Virtanen M, Kivimaki M. 2013. Chronic workplace stress and insufficient physical activity: A cohort study. Occup Environ Med 70:3–8.

Kuri-Morales PA, Gonzalez-Roldan JF, Hoy MJ, Cortes-Ramirez M. 2006. Epidemiology of tobacco use in Mexico. Salud Publica Mex 48 (Suppl 1):S91–S98.

Landsbergis PA, Dobson M, Koutsouras G, Schnall P. 2013. Job strain and ambulatory blood pressure: A meta-analysis and systematic review. Am J Public Health 103:e61–e71.

Landsbergis PA, Schnall PL, Deitz DK, Warren K, Pickering TG, Schwartz JE. 1998. Job strain and health behaviors: Results of a prospective study. Am J Health Promot 12:237–245.

Landsbergis PA, Schnall PL, Pickering TG, Warren K, Schwartz JE. 2003. Life-course exposure to job strain and ambulatory blood pressure in men. Am J Epidemiol 157:998–1006.

Landsbergis PA, Travis A, Schnall PL. 2013. Working conditions and masked hypertension. High Blood Press Cardiovasc Prev 20:69–76.

Laszlo KD, Pikhart H, Kopp MS, Bobak M, Pajak A, Malyutina S, Salavecz G, Marmot M. 2010. Job insecurity and health: A study of 16 European countries. Soc Sci Med 70:867–874.

Leynen F, Moreau M, Pelfrene E, Clays E, De Backer G, Kornitzer M. 2003. Job stress and prevalence of diabetes: Results from the Beltress Study. Arch Public Health 61:75–90.

Maizura H, Retneswari M, Moe H, Hoe VC, Bulgiba A. 2010. Job strain among Malaysian office workers of a multinational company. Occup Med (Lond) 60:219–224.

Mancini F. 2008. Trabajo e incertidumbre - la conformación socio-demográfica de la inseguridad laboral en México y Argentina. III congreso de la Asociación Latinoamericana de Población Córdoba, Argentina.

Manios ED, Koroboki EA, Tsivgoulis GK, Spengos KM, Spiliopoulou IK, Brodie FG, Vemmos KN, Zakopoulos NA. 2008. Factors influencing white-coat effect. Am J Hypertens 21:153–158.

Mantyniemi A, Oksanen T, Salo P, Virtanen M, Sjosten N, Pentti J, Kivimaki M, Vahtera J. 2012. Job strain and the risk of disability pension due to musculoskeletal disorders, depression or coronary heart disease: A prospective cohort study of 69,842 employees. Occup Environ Med 69:574–581.

Martinez G, De Cuyper N, De Witte H. 2010. Review of the job insecurity literature: The case of Latin America. Avances en Psicologia Latinoamericana 28:194–204.

Martocchio JJ. 1989. Age-related differences in employee absenteeism: A meta-analysis. Psychol Aging 4:409–414.

Mayo-Clinic. 2012. Risk factors for hypertension. Rochester, Minnesota: Mayo Clinic.

Middlestadt SE, Sheats JL, Geshnizjani A, Sullivan MR, Arvin CS. 2011. Factors associated with participation in work-site wellness programs: Implications for increasing willingness among rural service employees. Health Educ Behav 38:502–509.

Muenster E, Rueger H, Ochsmann E, Letzel S, Toschke AM. 2011. Association between overweight, obesity and self-perceived job insecurity in German employees. BMC Public Health 11:162.

Musich S, Hook D, Baaner S, Spooner M, Edington DW. 2006. The association of corporate work environment factors, health risks, and medical conditions with presenteeism among Australian employees. Am J Health Promot 21:127–136.

National Heart Lung and Blood Institute. 1998. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The evidence report. Clinical practice guidelines. Bethesda. MD: National Institutes of Health. 228 p.

Noriega-Elío M, Franco- Enríquez JG, Montoya-Ruiz A, Garduño-Andrade MA, León-Cruz LE, Martínez- Alcántara S, Cruz-Flores AC. 2009. Deterioration of health and working conditions in Mexico. Salud de los Trabajadores 17:61–68.

Nyberg ST, Fransson EI, Heikkilä K, Alfredsson L, Casini A, Clays E, De Bacquer D, Dragano N, Erbel R, Ferrie JE, et al. 2013. Job strain and cardiovascular disease risk factors: Meta-analysis of individual-participant data from 47,000 men and women. PLoS ONE 8:e67323.

Nyberg ST, Heikkila K, Fransson EI, Alfredsson L, De Bacquer D, Bjorner JB, Bonenfant S, Borritz M, Burr H, Casini A, et al. 2012. Job strain in relation to body mass index: Pooled analysis of 160,000 adults from 13 cohort studies. J Intern Med 272:65–73.

Olesen K, Carneiro IG, Jorgensen MB, Rugulies R, Rasmussen CD, Sogaard K, Holtermann A, Flyvholm MA. 2012. Associations between psychosocial work environment and hypertension among non-Western immigrant and Danish cleaners. Int Arch Occup Environ Health 85:829–835.

Overgaard D, Gyntelberg F, Heitmann BL. 2004. Psychological workload and body weight: Is there an association? A review of the literature. Occup Med (Lond) 54:35–41.

Pollard TM. 2001. Changes in mental well-being, blood pressure and total cholesterol levels during workplace reorganization: The impact of uncertainty. Work and Stress 15:14–28.

Powell J. 2012. Top 5 reasons for employee turnover. Seattle, WA: Scontrino-Powell.

Reed DM, LaCroix AZ, Karasek RA, Miller D, MacLean CA. 1989. Occupational strain and the incidence of coronary heart disease. Am J Epidemiol 129:495–502.

Romero EJ, Cruthirds KW. 2009. Understanding employee turnover patterns in Mexican maquiladoras. J of Centrum Cathedra 2:63–72.

Rosenthal T, Alter A. 2012. Occupational stress and hypertension. J Am Soc Hypertens 6:2–22.

Rothman KJ. 1990. No adjustments are needed for multiple comparisons. Epidemiology 1:43–46.

Rugulies R, Krause N. 2005. Job strain, iso-strain, and the incidence of low back and neck injuries. A 7.5-year prospective study of San Francisco transit operators. Soc Sci Med 61:27–39.

Rugulies R, Scherzer T, Krause N. 2008. Associations between psychological demands, decision latitude, and job strain with smoking in female hotel room cleaners in Las Vegas. Int J Behav Med 15:34–43.

Sanchez-Roman FR, Juarez-Perez CA, Aguilar Madrid, Haro-Garcia G, Borja- Aburto L, Claudio VH. 2006. Occupational health in Mexico. Int J Occup Environ Health 12:346–354.

Schnall P, Dobson M, Choi B, Landsbergis P, Ko S, Baker D. 2013. Conclusions about job strain and blood pressure findings misleading - Comment to Nyberg et al. Job strain and cardiovascular disease risk factors: Meta-analysis of individual-participant data from 47,000 men and women. PLoS ONE 8:e67323.

Schnall PL, Landsbergis PA, Pieper CF, Schwartz J, Dietz D, Gerin W, Schlussel Y, Warren K, Pickering TG. 1992. The impact of anticipation of job loss on psychological distress and worksite blood pressure. Am J Ind Med 21:417–432.

Schnall PL, Schwartz JE, Landsbergis PA, Warren K, Pickering TG. 1998. A longitudinal study of job strain and ambulatory blood pressure: Results from a three-year follow-up. Psychosom Med 60:697–706.

Secretaría del Trabajo y Previsión Social. 2012. Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo Mexico.

Shirom A, Melamed S, Rogowski O, Shapira I, Berliner S. 2009. Workload, control, and social support effects on serum lipids: A longitudinal study among apparently healthy employed adults. J Occup Health Psychol 14:349–364.

Siegrist J, Matschinger H, Cremer P, Seidel D. 1988. Atherogenic risk in men suffering from occupational stress. Atherosclerosis 69:211–218.

Siegrist J, Peter R. 1994. Job stressors and coping characteristics in work-related disease: Issues of validity. Work and Stress 8:130–140.

Stansfeld S, Candy B. 2006. Psychosocial work environment and mental health—A meta-analytic review. Scand J Work Environ Health 32:443–462.

Steenland K, Fine L, Belkic K, Landsbergis P, Schnall P, Baker D, Theorell T, Peter R, Karasek R, Marmot M, et al. 2000. Research findings linking workplace factors to cardiovascular disease outcomes. Occup Med - State Art 15:7–68.

Streiner DL. 2003. Starting at the beginning: An introduction to coefficient alpha and internal consistency. J Pers Assess 80:99–103.

Szerencsi K, van Amelsvoort LG, Viechtbauer W, Mohren DC, Prins MH, Kant I. 2012. The association between study characteristics and outcome in the relation between job stress and cardiovascular disease—A multilevel meta-regression analysis. Scand J Work Environ Health 38:489–502.

Taris T, Ybema J, Beckers DJ, Verheijden M, Geurts SE, Kompier MJ. 2011. Investigating the associations among overtime work, health behaviors, and health: A longitudinal study among full-time employees. Int J Behav Med 18:352–360.

Thomas PD, Goodwin JM, Goodwin JS. 1985. Effect of social support on stress-related changes in cholesterol level, uric acid level, and immune function in an elderly sample. Am J Psychiat 142:735–737.

Torres SJ, Nowson CA. 2007. Relationship between stress, eating behavior, and obesity. Nutrition 23:887–894.

Uchino BN. 2004. Social suppor and physical health: Understanding the health consequences of relationships. New Haven, CT: Yale University Press. 234 p.

van Loon AJ, Tijhuis M, Surtees PG, Ormel J. 2000. Lifestyle risk factors for cancer: The relationship with psychosocial work environment. Int J Epidemiol 29:785–792.

Vanagas G, Bihari-Axelsson S, Vanagiene V. 2004. Do age, gender and marital status influence job strain development for general practitioner. Medicina (Kaunas) 40:1014–1018.

Vargas-Hernández I. 2011. Working overtime again! In: CNNMexico editor Mexico: CNNExpansion.

Virtanen P, Janlert U, Hammarström A, 2013. Health status and health behaviour as predictors of the occurrence of unemployment and prolonged unemployment. Public Health 127:46–52.

Warren N. 2006. Psychosocial and work organization risk factors for work-related musculoskeletal disorders. In: Karwowski W, editor. International encyclopedia of ergonomics and human factors. 2nd edition. Boca Raton, FL: Taylor & Francis Group. pp. 2249–2253.

Welborn TA, Dhaliwal SS. 2007. Preferred clinical measures of central obesity for predicting mortality. Eur J Clin Nutr 61:1373–1379.

Winkleby MA, Ragland DR, Syme SL. 1988. Self-reported stressors and hypertension: Evidence of an inverse association. Am J Epidemiol 127:124–134.

World Health Organization. 2000. Obesity: Preventing and managing the global epidemic. Technical Report Series 894. Geneva: World Health Organization. 37 p.

World Health Organization. 2008. Waist circumference and waist-hip Ratio. Report of a World Health Organization Expert Consultation. Geneva, Switzerland: World Health Organization. 39 p.

Yang X, Telama R, Hirvensalo M, Hintsanen M, Hintsa T, Pulkki-Raback L, Viikari JS. 2010. The benefits of sustained leisure-time physical activity on job strain. Occup Med (Lond) 60:369–375.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher's web-site.

Disclosure statement: The authors declare no conflict of interest for this research.
Institution at which the work was performed: University of California, Los Angeles.