Revista de Enfermagem
do Centro-Oeste Mineiro
2017;7:e1328
DOI: 10.19175/recom.v7i0.1328
www.ufsj.edu.br/recom

RECOM
REVISTA DE ENFERMAGEM DO CENTRO-OESTE MINEIRO

Original Article

ALTA EXIGÊNCIA NO TRABALHO E ALTO RISCO CARDIOVASCULAR EM FUNCIONÁRIOS DE UMA UNIVERSIDADE PÚBLICA

JOB STRAIN AND HIGH CARDIOVASCULAR RISK IN EMPLOYEES OF A PUBLIC UNIVERSITY

ALTA DEMANDA EN EL TRABAJO Y ALTO RIESGO CARDIOVASCULAR EN FUNCIONARIOS DE UNA UNIVERSIDAD PÚBLICA

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RESUMO

Objetivo: estimar a associação entre a alta exigência no trabalho e o elevado risco cardiovascular. **Métodos:** estudo epidemiológico transversal, desenvolvido com 211 trabalhadores do campus saúde de uma universidade pública do Estado de Minas Gerais. A alta exigência no trabalho foi definida com base no modelo demanda-controle de Karasek, enquanto o elevado risco cardiovascular, a partir do escore de *Framingham*. A associação entre a alta exigência no trabalho e o elevado risco cardiovascular foi estimada pela Razão de Prevalência (RP) e seu Intervalo de Confiança de 95% (IC 95%), ajustada por potenciais fatores de confusão e calculada por meio da regressão de Poisson. **Resultados:** a alta exigência no trabalho e o elevado risco cardiovascular estavam presentes em 28,4% e 28,0% dos participantes. Após a análise multivariada, a alta exigência no trabalho manteve-se associada ao elevado risco cardiovascular (RP = 3,67; IC 95%: 1,40-9,59). **Conclusão:** a prevalência do elevado risco cardiovascular foi alta nos trabalhadores expostos ao estresse psicoemocional no ambiente de trabalho. Portanto, esse achado deve ser considerado nas discussões sobre melhoria da qualidade de vida e na promoção da saúde dos trabalhadores com modificações no processo e nas relações de trabalho.

Descritores: Condições de trabalho; Estresse psicológico; Fatores de risco; Obesidade abdominal; Doenças cardiovasculares; Enfermagem.

ABSTRACT

Objective: to estimate the association between job strain and high cardiovascular risk. **Methods:** this was a cross-sectional epidemiological study developed with 211 employees in the health field of a public university in Minas Gerais State, Brazil. The job strain was defined according to the Karasek demand-control model while the risk of high cardiovascular issues was based on the Framingham score. The relationship between job strain and high cardiovascular risk was estimated using the Prevalence Ratio (PR) and its 95% Confidence Interval (95% CI), adjusted for potential confounding factors, and calculated through the Poisson regression. **Results:** job strain and high cardiovascular risk were present in 28.4% and 28.0% of participants, respectively. After the multivariate analysis, job strain remained independently associated with high cardiovascular risk (PR = 3.67; 95% CI: 1.40-9.59). **Conclusions:** the prevalence of elevated cardiovascular risk was high among workers exposed to psycho-emotional stress in the workplace. This finding should be considered in new policies regarding the workers' quality of life and health promotion that may culminate with changes in labor relationships.

Descriptors: Working conditions; Stress, psychological; Risk factors; Abdominal, obesity; Cardiovascular diseases; Nursing.

RESUMEM

Objetivo: Estimar la asociación entre el estrés laboral y alto riesgo cardiovascular. **Métodos:** Se trata de un estudio transversal, desarrollado con 211 funcionarios del campus salud de una universidad pública del Estado de Minas Gerais, Brasil. Estrés laboral fue definido de acuerdo con el modelo de demanda-control de Karasek, mientras que un alto riesgo cardiovascular se basó en la puntuación de *Framingham*. La relación entre estrés laboral y alto riesgo cardiovascular se estimó mediante Razón de Prevalencia (RP) y su Intervalo de Confianza del 95% (IC 95%), ajustado por posibles factores de confusión, calculados a través de la regresión de Poisson. **Resultados:** Estrés laboral y alto riesgo cardiovascular estaban presentes en el 28,4% y el 28,0% de los participantes, respectivamente. Tras el análisis multivariante, el estrés laboral se mantuvo asociado independientemente con alto riesgo cardiovascular (RP = 3,67; IC 95%: 1,40-9,59). **Conclusiones:** La prevalencia de riesgo cardiovascular elevado fue alta entre los trabajadores expuestos al estrés psico-emocional en el lugar de trabajo. Este hallazgo se debe considerar en las nuevas políticas en materia de calidad de vida de los trabajadores y la promoción de la salud primordial que puede culminar con los cambios en las relaciones laborales.

Descriptores: Condiciones de trabajo; Estrés psicológico; Factores de riesgo; Obesidad abdominal; Enfermedades cardiovasculares; Enfermería.

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How to cite this article

Xavier HC, Damasceno EC, Silqueira SMF, et al. Job Strain and High Cardiovascular Risk in Employees of a Public University. Revista de Enfermagem do Centro-Oeste Mineiro. 2017;7:e1328. [Access_____]; Available in:______.Doi: http://dx.doi.org/10.19175/recom.v7i0.1328

INTRODUCTION

Cardiovascular diseases (CVD) represent a relevant public health problem on a global scale and account for one-third of all deaths in the world population[1].

In Brazil, CVD totaled 28.2% of all deaths in 2012, being the main cause of mortality[2]. In addition, they resulted in a high number of hospital admissions generating great social and economic burden. According to the Ministry of Health, almost 20% of the total spent to cover hospitalizations performed by the Unified Health System in 2014 were consumed in the payment of hospitalizations due to CVD[3]. This group of diseases also determines a high number of requests for early retirement due to disability and the granting of medical leave[4].

The World Health Organization (WHO) recognizes the multifactorial nature of CVD, with emphasis on social determinants and non-modifiable risk factors (globalization, urbanization, aging, income, education, and housing), modifiable or behavioral risk factors (unhealthy diet, smoking, physical inactivity, harmful alcohol consumption, and psycho-emotional stress), and metabolic risk factors (hypertension, obesity, diabetes, and dyslipidemia)[5].

Therefore, as previously presented, psycho-emotional stress is an important risk factor for CVD that can be modified and has been extensively studied in the recent years. This determinant seems to be related to the greater reactivity of the cardiovascular system, contributing to the development of CVD[6].

Thus, many authors agree that the work environment is an important source of psycho-emotional stress, increasing the number of professionals affected by CVD[7]. One of the models proposed and used worldwide to measure the exposure to psycho-emotional stress at work is the Karasek's demand-control model[8]. It is estimated that the combination of high psychological demand and low work control, named as job strain, is positively associated with the occurrence of CVD because the professional is more frequently exposed to psycho-emotional stress during the workday[7, 9].

In Brazil, the relationship between job strain and hypertension was evaluated in women in only one cross-sectional study that showed no significant association[10]. High blood pressure is only one component of the overall cardiovascular risk assessment. In this perspective, international scientific investigations are scarce and their findings are contradictory[11-12].

Hence, the present study aimed to analyze the association between job strain and high cardiovascular risk using the Framingham score as the outcome marker[13].

METHODS

This was a cross-sectional epidemiological study that was developed with workers in the health field of a public university in the State of Minas Gerais, Brazil, which includes the academic units, School of Nursing and School of Medicine, and the General Hospital.

The workers are classified in the academic units as administrative technicians (secretaries, drivers, cleaning staff, security staff, and etc.) and college professors. The workers in the General Hospital are senior level professionals (doctors, nurses, psychologists, nutritionists, physiotherapists, occupational therapists, pharmacists, dentists, social workers, biomedical professionals, and etc.), technicians (nursing and laboratory aides), and administrative technicians.

The inclusion criteria were age between 30 and 65 years because the Framingham score, which is the outcome variable of the present investigation, is only applied to this age group[14]. All workers who met this criterion, according to information from the institutions' human resources departments, were invited to participate in the study, totaling approximately 2,172 individuals. This invitation was made through websites, information murals, and the delivery of printed invitations to the directors of each sector.

The sample size was estimated as 224 participants based on the following parameters: 95% confidence level; 80% statistical power; and expected outcome frequency of 10% in the group not exposed to job strain. This proportion was based on previous studies carried out in other countries[7, 9, 11, 12]; Prevalence Ratio of 2.50; and Ratio of 1 exposed to 1 not exposed.

During the data collection period, which occurred between April and November of 2010, a total of 218 employees voluntarily sought out the team of researchers. Participants who presented some physical disability that could make it impossible to measure the clinical and anthropometric variables (n = 2), and pregnant women or those in the postpartum period of up to one year were excluded because these conditions could influence the results of anthropometric measurements, particularly body weight and waist circumference (WC) (n = 5).

Thus, the final sample consisted of 211 participants, which allowed the maintenance of all described parameters, except for the confidence level that decreased to 94%.

Data collection included the collaboration of previously trained interviewers who applied a questionnaire composed of questions related to demographic, socioeconomic, lifestyle, and work activity aspects. At the end of the interview, a physical examination was performed to measure anthropometric variables and blood pressure. These procedures were performed in a room in the School of Nursing equipped with the necessary materials for data collection.

The dosing of lipids and glucose plasma levels was performed by a contracted clinical analysis laboratory; participants should fast for 12 to 14 hours and abstain for 48 hours from alcohol intake and physical activity.

The study's outcome variable was the cardiovascular risk, calculated through the Framingham score, which presents the following components: age; total cholesterol; HDL-c; systolic and diastolic blood pressure; smoking; and diagnosis of diabetes. Each of these elements receives a specific score according to the individual's values and gender[13].

Age was self-reported while gender was assigned by the interviewer.

Regarding the biochemical analysis, blood samples were collected in the laboratory and centrifuged; serum and plasma samples were stored in a refrigerator at 4 ºC and analyzed by automated equipment (COBAS MIRA PLUS, Roche) that was regularly calibrated. The concentrations of total cholesterol, triglycerides, and glucose were determined by an enzymatic colorimetric method. The concentration of HDL-c was also measured by a colorimetric enzymatic method after the precipitation of the LDL-c and VLDL-c fractions by phosphotungstic acid and magnesium chloride.

Blood pressure was measured according to standardized recommendations[14]. In all, three readings were performed on the participant's right arm at intervals of two minutes in between using a calibrated mercury column sphygmomanometer. The mean of the three readings was recorded as the definitive value for data analysis.

Smoking was assessed based on the following questions: "Are you or have you ever smoked, that is, have you smoked at least 100 cigarettes in your life?" And "How many cigarettes do you currently smoke in a day?". The participant was classified as a smoker in the case of a positive answer to the first question and the indication of some number in the answer to the second question. The participant was considered former smoker in the case of a positive answer to the first question and an answer of zero in the second question. The participant was classified as a non-smoker in the case of a negative answer to the first question. Non-smokers and former smokers were grouped in the non-smoking category for the calculation of the Framingham score.

Hyperglycemia was diagnosed based on a fasting blood glucose value ≥ 100 mg/dl[15].

In this study, participants were classified according to their cardiovascular risk in low/medium (<20%) and high (≥ 20%).

The study's exposure variable was the job strain measured by means of a questionnaire based on the Karasek's demand-control model[8], which has been widely used in the health area to evaluate association with CVD[16] and is already validated in the Portuguese version for the Brazilian population[17].

To characterize the working demand, the questionnaire had 5 questions that involved the following aspects: speed to perform tasks; the intensity of work; excessive work; insufficient time to carry out activities; and conflicting demands. The questions had the following options as answers: "frequently", "sometimes", "rarely," and "never or almost never", each of which received a score of 1 to 4 (1 indicating low demand and 4 indicating high demand). The total score for working demand was obtained with the sum of the scores of each question, ranging from 5 to 20.

The questionnaire had 6 questions regarding work control with the following aspects: opportunity to learn new things; need for specialized skills/expertise; decision power; repetitive work; power to choose among activities; and power to choose how to carry out the activities. The response options and punctuation for each were the same given the alternatives of working demands (1 indicating low control and 4 indicating high control). The total score for work control was obtained by the sum of the scores of each question, ranging from 6 to 24.

The exposure variable was constructed based on the stratification of the demand and control scales in halves, based on the medians of total scores. Subsequently, these fractions were combined, generating four quadrants: low strain = low demand and high control; active = high demand and high control; passive = low demand and low control; high strain/job strain = high demand and low control.

The covariables included in the present study were social support at work, work shift, the duration of the work shift, time on the job, formal study years, family monthly income, physical activity during free time, alcohol consumption, WC, and plasma triglyceride levels.

The Karasek's demand-control questionnaire also presents 6 questions about social support at work that involves the following aspects: work environment; relationship with other workers; support from co-workers; understanding from co-workers, if not on a good day; relationship with bosses; and satisfaction in working with colleagues.

The options among answers were: "I totally agree," "I agree more than I disagree," "I disagree more than I agree," and "I totally disagree," each with a score of 1 to 4 (1 indicating low support and 4 indicating high support).

The total score for social support at work was obtained by the sum of scores of each question, ranging from 6 to 24. Social support works potentially as a factor that decreases stress at work, that is, the greater the support the lower the emotional exhaustion(8).

For the characterization of the sample, this variable was dichotomized by dividing the scale in halves using the median as the reference. The lower part of the scale indicated low support and the upper part indicated a high support.

The work shift, defined as the period of the day when the participant was working, was categorized into: daytime (between 7:00 am and 7:00 p.m.) and night time (between 7:00 p.m. and 7:00 a.m.).

The duration of the work shift was evaluated based on the total hours of work performed by participants. Subsequently, this variable was categorized as: <40 hours; 40-60 hours; and ≥ 61 hours.

The total working time was evaluated based on the total number of months in which the participants exercised their activities in the same work environment. This variable was categorized as: < 60 months; 60 - 120 months; and ≥ 121 months.

The formal study years were self-reported by participants. This variable was categorized as: ≤ 8 years; 9 - 11 years; and ≥ 12 years.

The participant's family monthly income was self-reported. For this, the interviewee was asked to inform the sum of the monthly income from each family working member. This variable was divided into minimum wages (MW) based on the November 2010 value (R$ 510.00). Subsequently, the family income was categorized as: < 3 MW; 3-5 MW; and ≥ 6 MW.

The physical activity measurement estimate was performed with the International Physical Activity Questionnaire (IPAQ - long version)(18), which is widely used at the national and international level. In the data analysis, the dimension "recreational physical activities" was considered. The weekly frequency was multiplied by the time in minutes of each physical activity. Thus, the weekly load of physical activity included that during free time, which was later categorized into: sedentary lifestyle (0 minutes); 1 - 149 minutes; and ≥ 150 minutes.

The participant's consumption of alcoholic beverage was evaluated from the following question: "Do you usually consume alcohol?" The alternatives of answers were: a) I do not consume; b) yes; c) yes, but not in the last 30 days; or d) I never consumed. In the case of positive answers for alternatives b or c, the participant was classified as consuming alcoholic beverages. In the case of positive for alternatives a or d, the participant was classified as not consuming alcoholic beverages.

WC was measured according to standard recommendations(19).In total, three measures of WC were performed and the average was considered as the definitive value for data analysis.

An inelastic tape was placed on the individual in a horizontal plane and in the midpoint between the lower part of the last costal arch and the upper part of the upper anterior iliac crest. The measurement was read at the end of a normal expiration to the nearest millimeter. Subsequently, WC was categorized according to gender in: normal [< 80 cm (females), < 94 cm (males));risk level 1 [80 - 87.9 cm (females), 94 - 101.9 cm (males)];and risk level 2 [≥ 88 cm (females), ≥ 102 cm (males)].

Triglyceride levels were categorized as: <150 mg/dl and ≥ 150 mg/dl[20].

A database was built from the information obtained in the interviews with the help of the Epi Info version 3.3.2 program; the data analysis used the Statistical Software for Professionals program (Stata) version 9.1.

The characterization of the studied population was performed by calculating the absolute and relative frequencies of the work demand-control categories according to the demographic, socioeconomic, lifestyle, anthropometric, biochemical, and working conditions, as well as the Framingham score and of its components. Statistical differences were assessed using the Pearson's chi-square test or the Fisher's exact test when indicated.

The independent associations of demand-control and other covariables with high cardiovascular risk were evaluated through the Poisson regression with robust variances based on a hierarchical conceptual model adapted from the WHO (Factors contributing to the development of cardiovascular disease and complications)[5].

In such a model, three blocks of variables are arranged: 1 - distal = social determinants and non-modifiable risk factors (demand-control of work, social support at work, work shift, the duration of the work shift, time on the job, years of formal study, and family income; 2 – intermediary = modifiable risk or behavioral factors (total physical activity during free time and consumption of alcoholic beverages); 3 - proximal = metabolic risk factors (WC and plasma triglyceride levels).

The research was approved by the Committee on Ethics and Research involving Human Beings of the Federal University of Minas Gerais (Protocol no. 066/09). All participants signed the Voluntary Informed Consent Term. The authors declare no conflicts of interest.

RESULTS AND DISCUSSION

The participants consisted of 37.9% males and 62.1% females. The subjects were classified according to the demand-control variable of work in low strain (19.9%), active (29.9%), passive (21.8%), and high strain/job strain (28.4%) (results not presented).

Most of the sample consisted of technical-level professionals, working in the daytime and less than 40 hours per week, less than 60 months in the current job, with 12 and more years of education, family income of 3 to 6 minimum wages, consumers of alcoholic beverages, and with a sedentary lifestyle. In addition, abdominal obesity {risk level 2 [WC ≥ 88 cm (females), WC ≥ 102 cm (males)) and hypertriglyceridemia (triglyceridemia ≥ 150 mg/dl) were diagnosed in 34.1% and 23.7% of the total sample, respectively (Table 1).

Concerning the comparison between participants according to the demand-control of work, greater proportions of technical level professionals, low social support at work, night time shift, low education, low family income, and sedentary lifestyle were observed among the people under high strain/job strain in relation to those under low strain (p <0.05) (Table 1).

Table 1 - Distribution of demand-control of work according to the general characteristics of the sample. Belo Horizonte, MG (2010).

Variables	Demand-control of work				Total	p-value
	Low strain	Active	Passive	High strain/Job strain		
	n (%)	n (%)	n (%)	n (%)	n (%)	
Categories of functions						0.001†
Administrative technicians	13 (31.0)	18 (28.6)	24 (52.2)	24 (40.0)	79 (37.4)	
Professors	6 (14.3)	6 (9.5)	0 (0.0)	0 (0.0)	12 (5.7)	
College level professionals	8 (19.0)	19 (30.2)	3 (6.5)	8 (13.3)	38 (18.0)	
Technical level professionals	15 (35.7)	20 (31.7)	19 (41.3)	28 (46.7)	82 (38.9)	
Social support at wok						0.018*
Low	13 (31.0)	37 (58.7)	21 (45.7)	35 (58.3)	106 (50.2)	
High	29 (69.0)	26 (41.3)	25 (54.3)	25 (41.7)	105 (49.8)	
Work shift						< 0.001*
Daytime	30 (71.4)	50 (79.4)	18 (39.1)	32 (53.3)	130 (61.6)	
Night time	12 (28.6)	13 (20.6)	28 (60.9)	28 (46.7)	81 (38.4)	

Duration of work shift (hours/week)						0.936†
< 40	23 (54.8)	31 (49.2)	24 (52.2)	30 (50.0)	108 (51.2)	
40 – 60	16 (38.1)	22 (34.9)	17 (37.0)	22 (36.7)	77 (36.5)	
≥ 61	3 (7.1)	10 (15.9)	5 (10.9)	8 (13.3)	26 (12.3)	
Time on the job (months)						0.768*
< 60	19 (45.2)	31 (49.2)	20 (43.5)	23 (38.2)	93 (44.1)	
60 – 120	12 (28.6)	11 (17.5)	12 (26.1)	17 (28.3)	52 (24.6)	
≥ 121	11 (26.2)	21 (33.3)	14 (30.4)	20 (33.3)	66 (31.3)	
Education (years)						0.026†
1 – 8	4 (9.5)	5 (7.8)	8 (17.4)	13 (22.0)	30 (14.2)	
9 – 11	9 (21.4)	16 (25.0)	16 (34.8)	21 (35.6)	62 (29.4)	
≥ 12	29 (69.0)	43 (67.2)	22 (47.8)	25 (42.4)	119 (56.4)	
Family income (minimum wage)						0.042†
< 3	4 (9.5)	15 (23.8)	13 (28.3)	17 (28.3)	49 (23.2)	
3 – 5	22 (52.4)	19 (30.2)	19 (41.3)	28 (46.7)	88 (41.7)	
≥ 6	16 (38.1)	29 (46.0)	14 (30.4)	15 (25.0)	74 (35.1)	
Physical activity (minutes/week)						0.030*
Sedentary lifestyle	17 (40.5)	39 (61.9)	29 (63.0)	41 (68.3)	126 (59.7)	
1 – 149	8 (19.0)	6 (9.5)	8 (17.4)	11 (18.3)	33 (15.6)	
≥ 150	17 (40.5)	18 (28.6)	9 (19.6)	8 (13.3)	52 (24.6)	
Consumption of alcoholic beverage						0.749*
No	17 (40.5)	26 (41.3)	23 (50.0)	28 (46.7)	94 (44.5)	
Yes	25 (59.5)	37 (58.7)	23 (50.0)	32 (53.3)	117 (55.5)	
Waist circumference (cm)**						0.170*
< 80 (F); < 94 (M)	24 (57.1)	25 (39.7)	20 (43.5)	18 (30.0)	87 (41.2)	
80 – 88 (F); 94 – 102 (M)	8 (19.0)	13 (20.6)	12 (26.1)	19 (31.7)	52 (24.6)	
≥ 88 (F); ≥ 102 (M)	10 (23.8)	25 (39.7)	14 (30.4)	23 (38.3)	72 (34.1)	
Triglycerides (mgdl)						0.546*
< 150	35 (83.3)	45 (71.4)	36 (78.3)	45 (75.0)	161 (76.3)	
≥ 150	7 (16.7)	18 (28.6)	10 (21.7)	15 (25.0)	50 (23.7)	

*Pearson's chi-square; †Fisher's exact test; **F = female gender; M = male gender.

The majority of respondents were young (<40 years of age). The prevalence of hypercholesterolemia (cholesterolemia ≥ 200 mg/dl) and low HDL-c levels (<45 mg/dl) were 55.4% and 45.9%, respectively. Hypertension (systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg) was verified in 27.5% while hyperglycemia (glycemia ≥ 100 mg/dl) was diagnosed in 16.1% of participants. Smoking was reported by 12.3% and high cardiovascular risk was present in 28.0% of the sample. The frequency of high cardiovascular risk was higher among workers exposed to high strain/job strain (Table 2).

Table 2 - Distribution of demand-control of work according to the Framingham risk score and its components, Belo Horizonte, MG (2010).

Variables	**Demand-control of work**					**p-value**
	Low strain	**Active**	**Passive**	**High strain/Job strain**	**Total**	
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	
Age range (years)						0.342†
30 – 34	20 (47.6)	17 (27.0)	17 (37.0)	17 (28.3)	71 (33.6)	
35 – 39	5 (11.9)	13 (20.6)	9 (19.6)	8 (13.3)	35 (16.6)	
40 – 44	5 (11.9)	6 (9.5)	5 (10.9)	10 (16.7)	26 (12.3)	
45 – 49	8 (19.0)	12 (19.0)	6 (13.0)	13 (21.7)	39 (18.5)	
50 – 54	4 (9.5)	12 (19.0)	5 (10.9)	6 (10.0)	27 (12.8)	

55 – 59	0 (0.0)	3 (4.8)	3 (6.5)	3 (5.0)	9 (4.3)	
60 – 64	0 (0.0)	0 (0.0)	1 (2.2)	3 (5.0)	4 (1.9)	
Total cholesterol (mg/dl)						0.571†
< 160	6 (14.3)	7 (11.1)	6 (13.0)	12 (20.0)	31 (14.7)	
160 – 199	17 (40.5)	20 (31.7)	13 (28.3)	13 (21.7)	63 (29.9)	
200 – 239	12 (28.6)	18 (28.6)	13 (28.3)	17 (28.3)	60 (28.4)	
240 – 279	5 (11.9)	14 (22.2)	13 (28.3)	14 (23.3)	46 (21.8)	
≥ 280	2 (4.8)	4 (6.3)	1 (2.2)	4 (6.7)	11 (5.2)	
HDL-c (mg/dl)						0.782*
< 35	6 (14.3)	14 (22.2)	10 (21.7)	11 (18.3)	41 (19.4)	
35 – 44	9 (21.4)	17 (27.0)	9 (19.6)	21 (35.0)	56 (26.5)	
45 – 49	6 (14.3)	8 (12.7)	9 (19.6)	10 (16.7)	33 (15.6)	
50 – 59	10 (23.8)	14 (22.2)	9 (19.6)	10 (16.7)	43 (20.4)	
≥ 60	11 (26.2)	10 (15.9)	9 (19.6)	8 (13.3)	38 (18.0)	
SBP/DBP (mmHg)**, ***						0.439†
< 120 / < 80	16 (38.1)	26 (41.3)	11 (23.9)	16 (26.7)	69 (32.7)	
120 – 129 / 80 – 84	9 (21.4)	10 (15.9)	11 (23.9)	12 (20.0)	42 (19.9)	
130 – 139 / 85 – 89	5 (11.9)	16 (25.4)	9 (19.6)	12 (20.0)	42 (19.9)	
140 – 159 / 90 – 99	8 (19.0)	7 (11.1)	11 (23.9)	12 (20.0)	38 (18.0)	
≥ 160 / ≥ 100	4 (9.5)	4 (6.3)	4 (8.7)	8 (13.3)	20 (9.5)	
Hyperglycemia						0.741*
No	35 (83.3)	52 (82.5)	41 (89.1)	49 (81.7)	177 (83.9)	
Yes	7 (16.7)	11 (17.5)	5 (10.9)	11 (18.3)	34 (16.1)	
Smoking						0.075*
No	39 (92.9)	57 (90.5)	42 (91.3)	47 (78.3)	185 (87.7)	
Yes	3 (7.1)	6 (9.5)	4 (8.7)	13 (21.7)	26 (12.3)	
Cardiovascular risk						< 0.001†
Low/medium	38 (90.5)	50 (79.4)	32 (69.6)	32 (53.3)	152 (72.0)	
High	4 (9.5)	13 (20.6)	14 (30.4)	28 (46.7)	59 (28.0)	

*Pearson's chi-square; †Fisher's exact test; **SBP = systolic blood pressure, DBP = diastolic blood pressure; ***In the case of pressure measurements observed in different categories, the higher one was chosen.

Job strain (PR = 4.03, 95% CI = 1.53-10.58) was associated with high cardiovascular risk after adjusting for the variables of the distal group in the hierarchical theoretical model [social support at work, work shift, duration of the work shift, formal study years, and family monthly income (Table 3, model 1)].

The additional adjustment for variables of the intermediate block of the hierarchical theoretical model (physical activity during free time and consumption of alcoholic beverages) increased the strength of the association between job strain and high cardiovascular risk (PR = 4.20; 95% CI = 1.58-11.17) (Table 3, model 2).

Finally, after further adjustment for the variables of the proximal block in the hierarchical model (WC and triglyceride levels), the strength of the association between job strain and high cardiovascular risk decreased, however, it remained statistically significant (PR = 3.67 ; 95% CI = 1.40-9.59) (Table 3, model 3).

Table 3 - Association between demand-control of work and high cardiovascular risk. Belo Horizonte, MG (2010).

	Demand-control of work			
	Low strain	Active	Passive	High strain/Jobstrain
Participants with high cardiovascular risk	4	3		28
Total number of participants	42	3		60
Prevalence of high cardiovascular risk	9.5	).6	4	46.7
Model 1 – RP (IC 95%)	1.00 (reference)	.29 (0.83–6.30)	0 (0.88–7.09)	4.03 (1.53–10.58)
Model 2 – RP (IC 95%)	1.00 (reference)	2.36 (0.86–6.51)	8 (0.95–7.56)	4.20 (1.58–11.17)

Model 3 – RP (IC 95%)	1.00 (reference)	1.64 (0.60–4.52)	2.01 (0.70–5.75)	3.67 (1.40–9.59)

Model 1: adjusted for social support at work, work shift, duration of the work shift, time on the job, formal study years, and family monthly income.
Model 2: Model 1 more adjustment for total physical activity during free time and consumption of alcoholic beverages.
Model 3: Model 2 more adjustment for waist circumference and triglyceride levels.

In the present study, job strain was independently associated with high cardiovascular risk after adjusting for potential confounding factors. Thus, the prevalence of high cardiovascular risk in workers exposed to job strain was 3.67 times that of workers exposed to low strain, that is, 267% higher. Therefore, job strain possibly increases the vulnerability to the occurrence of CVD.

However, this result should be evaluated taking into account the following limitations: there is a possibility of "healthy worker bias" because, in general, individuals with better health conditions are carrying out work activities since this factor protects against early leave, dismissals, and early retirements(21).

Because this was a cross-sectional study, the relationships presented represent models of association, which nevertheless, is intrinsic to the design itself. Therefore, the safety in the relation of temporality and causality between the variables involved was reduced.

Despite these limitations, our results are corroborated by findings of a scientific investigation carried out with workers from Poland in which the relationship between job strain and high cardiovascular risk was evidenced(11). Conversely, in a study carried out with workers from Belgium, this association was not found(12). These two studies used the cross-sectional design.

In a recent study with a longitudinal design, it was observed that the incorporation of job strain as a component of the Framingham score did not improve the ability of this algorithm to predict the occurrence of coronary artery disease. On the other hand, the exposure to job strain significantly increased the incidence of this outcome(22).

Therefore, the job strain represented an independent risk factor for the incidence of coronary artery disease. Moreover, in that investigation, the hypothesis tested in the present study, that is, that the job strain is related to high cardiovascular risk, was not directly evaluated. Thus, the cardiovascular risk may be a mediator of the association between job strain and the incidence of CVD(22).

In studies showing CVD as outcomes, a strong relationship between the stressors at work and the incidence of cardiovascular events was observed. Thus, job strain has been pointed out as an important risk factor for the occurrence of CVD(7).

Most of the studies on the subject(7,9,11,12,22) used the demand-control model proposed by Karasek(8) as a measure of psycho-emotional stress in the workplace. This questionnaire has already been validated in several countries[8], including in Brazil in its Portuguese-language version(17); the job strain has been widely used as a measure of psycho-emotional stress in the workplace(7,9,11,12,22).

Job strain seems to involve mechanisms related to psycho-emotional stress including hyperactivity of the sympathetic nervous system and dysfunction of the hypothalamic-pituitary-adrenal axis(6, 23). Thus, it may be associated with greater reactivity and low recovery to psycho-emotional stress(24), which are two factors that increase cardiovascular risk(25).

The external validity of our findings should be interpreted cautiously because the studied sample is not probabilistic.

Conversely, this study presents the following potentialities: measurements obtained by appropriate and reliable techniques performed by rigorously trained interviewers; adjustment of variables using a multivariate analysis technique adequate for the type of study design; although the sample size guaranteed a confidence level of 94%, the strength of the association between independent and dependent variables was high (PR = 3.67, 95% CI = 1.40-9.59) with a level of statistical significance of 0.8% (p = 0.008).

FINAL CONSIDERATIONS

The present study was a pioneer in demonstrating that job strain is associated with high cardiovascular risk in professionals in the health field of a public university.

Therefore, this finding should be considered in the discussion about improvements in the quality of life and workers' primary health promotion in this sector with changes in the process and in labor relations.

It is suggested that managers of health sector units of public universities promote adequate staffing to demonstrate the need to increase the workforce in order to avoid overloading tasks. At the same time, they should strive to implement more democratic and participatory administrative models, increasing the autonomy of workers over their work activities.

Our results should be confirmed in other studies, preferably with a longitudinal design and based on the Brazilian population.

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Note: Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG).

Received in: 28/03/2016
Final version resubmitted on: 02/05/2017
Approved in: 10/05/2017

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