

A Simultaneous Evaluation of Occupational Stress and Depression in Patients with Lifestyle-related Diseases

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Abstract

Objective Karoshi, which is the Japanese term for death from over-work, is usually the extreme result of cardiovascular diseases, and occupational stress plays a pivotal role in the pathogenesis. Depression is closely associated with atherosclerotic cardiovascular disease. The present study was undertaken to examine the relationship between occupational stress and depression.

Methods We enrolled 231 consecutive outpatients with lifestyle-related diseases such as diabetes, hyperlipidemia and hypertension were enrolled. Occupational stress was measured by qualitative constructs assessing job control, job demands, and worksite social support using a job content questionnaire (JCQ). The job strain index measured by the ratio of job demands to job control was used as an indicator of the occupational stress. Depression was evaluated by the Self-rating Depression Scale (SDS).

Results A univariate linear regression analysis showed the SDS scores to be positively correlated with job demands and the job strain index and negatively correlated with job control and worksite social support. Multiple regression analyses to predict the SDS scores demonstrated that job demands were positively associated with SDS scores and job control and worksite social support were negatively associated with SDS scores after controlling for other variables. The job strain index was positively related to SDS scores.

Conclusion Occupational stress expressed as the job strain index was strongly associated with depression. By simultaneously using the SDS and JCQ, the health conditions of patients could be classified based on occupational stress and mental stress, and this classification could help to promote a healthy work environment and guide individual workers.

Key words: mental stress, job stress, coronary artery disease, karoshi, stress check system

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Introduction

Karoshi, which is Japanese term for death from over-work, is usually the extreme result of cardiovascular diseases. Even though the problem was widely recognized in the 1980s, many people are still dying or killing themselves after being subjected to excessive occupational stress. Compensation for work-related death caused by stroke or cardiovascular disease has increased in Japan. According to statistics from the Health, Labor and Welfare Ministry of Japan, there were 106 instances of compensation in 2009 and 133 in 2013. Therefore, there is a compelling need to ensure the

reduction of occupational stress. Through an amendment of the Occupational Safety and Health Act on June 25, 2014, a mandatory stress check system will commence in Japan at the end of 2015. This stress check system will include an assessment of worker stress status, the results of which will be provided to each worker. The results will be analyzed in each workplace to enable the identification of the stressors, thus leading to improvements in the work environment. With such an effort, the prevention of mental health-related disorders, including karoshi, is therefore anticipated.

Although it is difficult to evaluate the precise extent of occupational stress, there are several methods including the effort-reward imbalance model and demand-control model.

Regarding the demand-control model, the job content questionnaire (JCQ) developed by Karasek is one of the most commonly used scales to assess environmental job stressors (1). Occupational stress can be measured by qualitative constructs such as job control, job demands and worksite social support. Job strain refers to a situation where job control which is a person's ability to make decisions and use their skills at work is low and the job demands, which include the pace and mental intensity of the work are high. Many investigations have demonstrated that the validity of the JCQ to evaluate occupational stress among Japanese employees (2). Previous investigations indicated that the job strain index, an indicator of occupational stress based on the ratio of job demands to job control, was an independent risk factor for cardiovascular diseases and hypertension in workers (3-5).

Previous clinical and epidemiological investigations have provided evidence that depression is closely associated with atherosclerotic cardiovascular disease. For example, Wulsin et al. performed a meta-analysis to examine the relative risk of depression for the onset of coronary artery disease (6). They reported that the combined overall relative risk of depression for the onset of coronary artery disease was 1.64 [95% confidence interval (CI)=1.41-1.90]. Furthermore, depression exerts a significantly negative impact on the prognosis of patients with coronary artery disease. According to the results of a meta-analysis, post-myocardial infarction depression is associated with a 2- to 2.5-fold increased risk of an impaired cardiovascular outcome (7). Given its importance in the pathogenesis of coronary artery diseases, depression is a pivotal factor linking occupational stress and karoshi. In the present investigation, the relationships between occupational stress as evaluated by the JCQ and depression were examined in outpatients with lifestyle-related diseases such as diabetes, hyperlipidemia and hypertension.

Materials and Methods

Patients

Between May 2014 and June 2015, 231 consecutive outpatients with lifestyle-related diseases including diabetes, hypertension and hyperlipidemia were recruited, and 29.4% of the enrolled subjects had coronary artery disease. The purpose of the present study was explained to the participants in the documents and written informed consent was obtained. The study was approved by the ethics committee of Kobe Rosai Hospital.

All enrolled patients were interviewed and clinically examined. Demographic information (age and sex) and medical history were recorded. Hypertension was defined as systolic pressure ≥ 140 mmHg or diastolic pressure ≥ 90 mmHg, or the use of antihypertensive drugs. Dyslipidemia was defined as plasma low-density lipoprotein ≥ 140 mg/dL, plasma triglycerides ≥ 150 mg/dL, or plasma high-density lipoprotein < 40 mg/dL or the use of lipid-lowering drugs. Diabetes mel-

litus was defined as a previous or current plasma fasting glucose ≥ 126 mg/dL or the use of hypoglycemic agents. The diagnosis of coronary artery disease was based on the guidelines of the Japanese Circulation Society and the coronary stenotic lesions were documented with coronary angiography.

Evaluation of occupational stress by the job content questionnaire

Occupational stress evaluated using the demands-control-support model was measured with the JCQ developed by Karasek (1). The JCQ includes scales for job demands (five items; score range, 12-48), job control (nine items; score range, 24-96) and worksite social support (eight items; score range, 8-32), with four-point response options from 1 (strongly disagree) to 4 (strongly agree). The job strain index, which is calculated by dividing job demands by job control, has been used as an indicator of the occupational stress with higher scores indicating greater strain.

Evaluation of depression by the self-rating depression scale

The Self-rating Depression Scale (SDS) designed by Zung was used to quantify the level of depression in patients experiencing depression-related symptoms (8). The SDS includes 10 positively worded items and 10 negatively worded items that assess the symptoms of depression. The item responses are rated from 1 to 4, and higher scores correspond to more frequent symptoms. Therefore, for each item, patients give a score according to whether the item has occurred: 1= never/very rarely/rarely; 2= once in a while/some of the time/occasionally; 3= relatively often/very often/often; 4= most of the time/always/almost always. The SDS scores were used to define four categories of depression severity: within the normal range (below 40 points); presence of minimal to mild depression (40-47 points); presence of moderate to marked depression (48-55 points); and presence of severe to extreme depression (56 points and above). In the present study, the subjects having scores over 40 points were defined as being depressed.

Statistical analysis

Continuous data are provided as the mean and standard deviation (SD). Categorical variables are displayed as a number (percentage). Univariate and multiple linear regression analyses were used to explore the relationship between the SDS score and the JCQ. A standardized coefficient and the 95% confidence interval (CI) were calculated after adjusting for sex, and the presence of coronary artery diseases, diabetes, hypertension, hyperlipidemia, and current smoking status. For collinearity problems, job demand, job control and worksite social support were used in Model 1 as variables of occupational stress, and the job strain indices were used in Model 2.

To evaluate the collinearity between variables, the variance inflation factor (VIF) was estimated in each model. If

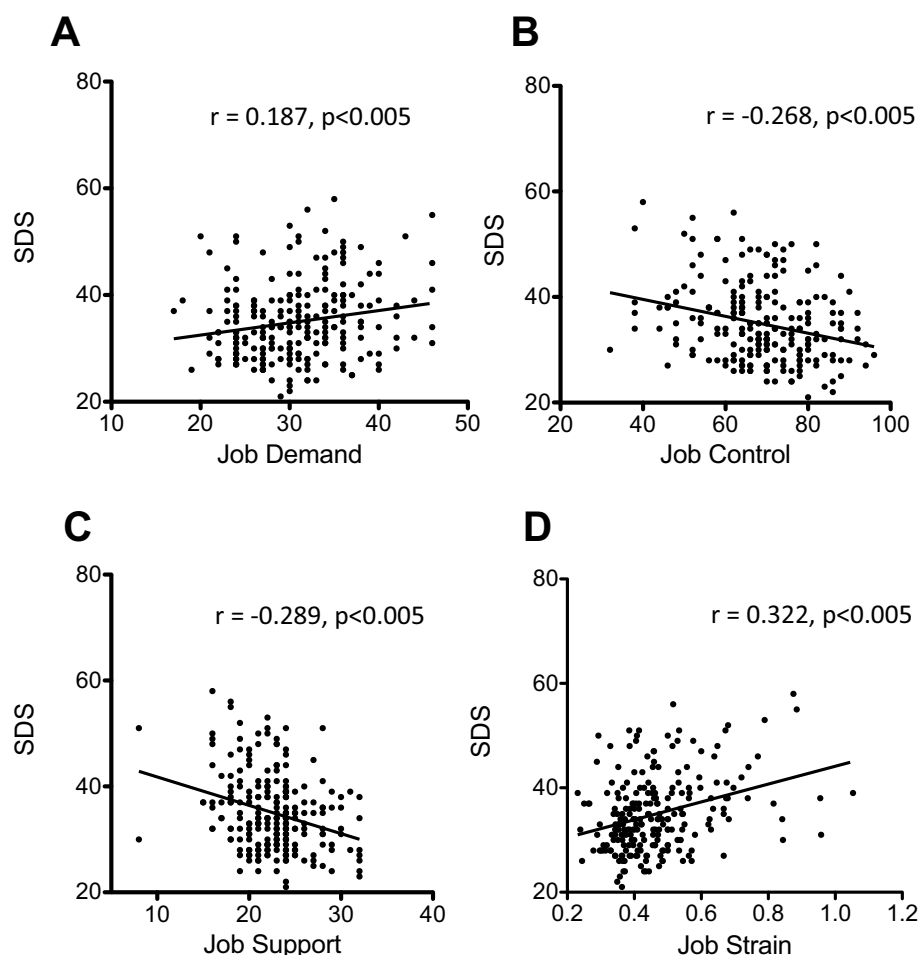


Figure 1. The relationship between depression and job demands, job control and workplace social support, and the job strain index in Japanese patients with lifestyle-related diseases.

Table 1. Patient Characteristics.

Age, mean (SD), y	57.0	8.8
Male sex, no. (%)	198	85.7
Diabetes no. (%)	74	32.0
Hypertension no. (%)	130	56.3
Hyperlipidemia no. (%)	160	69.3
Current smokers no. (%)	97	42.0
CAD (%)	68	29.4

CAD: coronary artery disease

the estimated VIF for one variable is over 10, there is a strong possibility of the existence of collinearity. Statistical analyses were performed using IBM SPSS Statistics Version 22. A *p* value of <0.05 was considered statistically significant.

Results

A total of 231 patients were enrolled in this study, and their characteristics are shown in Table 1. The relationship between occupational stress and depression was examined in Japanese patients with lifestyle-related diseases. A univariate linear regression analysis demonstrated that SDS scores were positively correlated with job demands and the job

strain index and negatively correlated with job control and worksite social support (Fig. 1).

Table 2 summarizes the results of multiple regression analyses to predict the SDS scores. In Model 1, job demands were positively associated with SDS scores and job control and worksite social support were negatively associated with SDS scores after the controlling for age, sex and the presence of coronary artery diseases, diabetes, hypertension, hyperlipidemia and current smoking status. In Model 2, the job strain index was positively related to SDS scores. The estimated VIFs indicated that there was little evidence for the existence of collinearity. Thus, a high job strain index was a considerable risk factor for depression.

Discussion

This cross-sectional investigation clearly demonstrates the close relationship between the occupational stress and depression. We found that occupational stress expressed as the job strain index was strongly associated with depression. Furthermore, high job demands and low social support at the workplace were also associated with depression. Our findings are consistent with previous cross-sectional and longitudinal studies demonstrating that job strain and its com-

Table 2. A Multiple Regression Analysis Showing an Association between Depression and Occupational Stress.

	Model 1 (R ² =21.0%)					Model 2 (R ² 15.8%)				
	β	B	SE	p value	VIF	β	B	SE	p value	VIF
Age	-0.056	-0.046	0.055	0.408	1.255	-0.019	-0.015	0.055	0.779	1.167
Sex	-0.074	-1.537	1.333	0.250	1.158	-0.069	-1.414	1.353	0.296	1.129
CAD	-0.060	-0.959	1.027	0.351	1.165	-0.085	-1.346	1.052	0.201	1.167
HT	-0.107	-1.564	0.934	0.095	1.141	-0.104	-0.107	0.960	0.114	1.141
Diabetes	0.078	1.212	0.996	0.025	1.148	0.056	0.875	1.017	0.391	1.135
HL	-0.109	-1.709	1.055	0.107	1.261	-0.109	-1.702	1.078	0.116	1.247
Smoking	0.070	1.021	0.924	0.270	1.106	1.114	0.070	0.933	0.075	1.068
Job demands	0.169	0.207	0.078	0.008*	1.113	-	-	-	-	-
Job control	-0.177	-0.106	0.038	0.006*	1.138	-	-	-	-	-
Support	-0.238	-0.440	0.119	<0.001**	1.147	-	-	-	-	-
JSI	-	-	-	-	-	0.295	15.663	3.378	<0.001**	1.068

β : Standardized coefficient, B: Coefficient, SE: standard error, VIF: variance inflation factor, CAD: coronary artery disease, HT: hypertension, HL: hyperlipidemia, JSI: job strain index

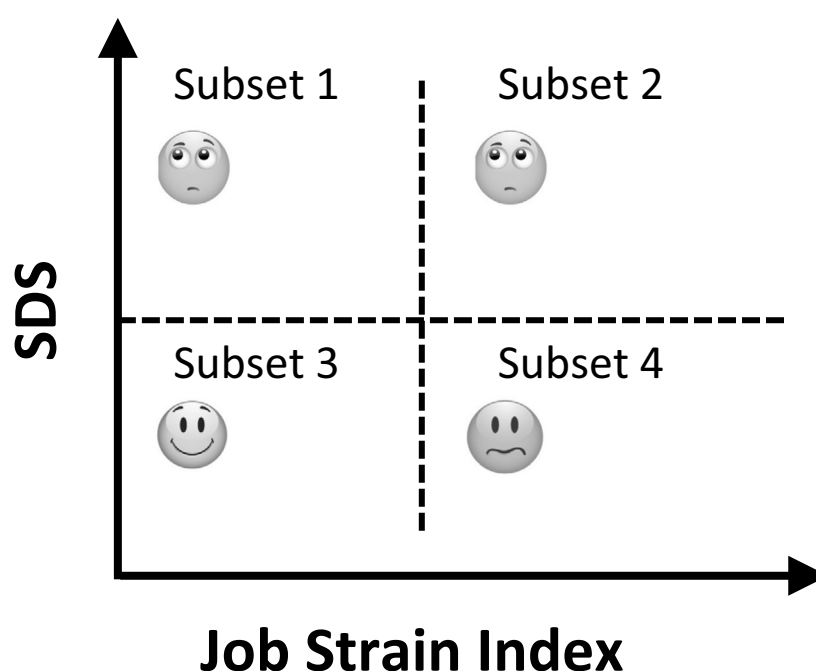


Figure 2. The classification of health conditions by using the SDS and JCQ simultaneously. The classification is based on the presence or absence of occupational stress and depression. Subset 1 consists of subjects with depression, but without occupational stress; subset 2 consists of subjects with occupational stress and depression; subset 3 consists of subjects with neither occupational stress nor depression; subset 4 consists of occupational stress, but without depression.

ponents are related to an increased risk of depression. A prospective general population-based study from Japan demonstrated that men, but not women, with high-strain jobs had a more than two-fold increased risk for stroke (9). Other studies have demonstrated that social support in the workplace is inversely associated with the incidence of coronary heart disease via the buffering effects on occupational stress (10, 11). Furthermore, lower social support in the workplace was associated with increased blood pressure and hyperlipidemia (12, 13). Thus, there is a close link between occupational stress, cardiovascular disease and stroke. Taken together with the present investigation, depression might be a key factor mediating the pathogenesis of these diseases in

the subjects experiencing high occupational stress.

The mechanisms by which depression induces and exacerbates cardiovascular diseases remain to be clarified; however, it is necessary to be considered such mechanisms from two perspectives; the physiological and behavioral responses (14). In terms of the physiological response, two major systems are activated, the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. Through the activation of the sympathetic nervous system, the vascular tone is increased, platelets are activated and blood pressure as well as the heart rate are increased. These physiological responses might contribute to the development of cardiovascular diseases. Alternatively, the activation of the

HPA axis could exacerbate glucose and lipid metabolism, leading to atherosclerotic heart disease. Moreover, mental stress also affects behavioral responses, such as smoking, alcohol abuse and avoidance of physical activity. Furthermore, mental stress may also be associated with poor medical adherence. These behavioral factors play a pivotal role in the pathogenesis of cardiovascular diseases. It is speculated that occupational stress could lead to cardiovascular diseases via the above-mentioned mechanism induced by depression.

Kitaoka-Higashiguchi et al. compared the SDS scores of Japanese workers based only on job demand and job control (15). They reported that the SDS scores were highest in high jobs demand and low job control conditions. Their findings are consistent with those of the present investigation. By using the SDS and JCQ simultaneously, the health conditions could be assessed based on two different aspects, occupational stress and mental stress. Given that the subjects with SDS scores over 40 points were defined as being depressed, and those with a job strain index over 0.50 were defined as having occupational stress, all subjects were divided into four subsets as shown in Fig. 2. This classification is based on the presence or absence of occupational stress and depression. Subset 3 represents those with neither occupational stress nor depression; subset 4 consists of subjects with occupational stress, but without depression; subset 1 consists of subjects with depression, but occupational stress; subset 2 consists of subjects with occupational stress and depression. The depression experienced by the subjects in the subset 2 is likely caused by excessive occupational stress whereas the subjects in subset 1 might suffer from stressors other than occupational stress such as family matters or personal reasons. The subjects in the subset 4 might be doing well because they are able to cope with occupational stress. Thus, this classification system could contribute to promoting healthy workplace and guide individual workers.

The research described herein is a cross-sectional research; therefore, the causal relationship between depression and job stress is unclear. We speculate that job stress could lead to depression. Alternatively, depression may also lead to inefficient work, which may induce greater self-evaluated job stress. Taken together, there is a possibility that a vicious cycle consisting of job stress and depression might exist.

A United Nations committee provided recommendations to the Japanese government in 2013 for the prevention of over-work. In response, the Karoshi Prevention Council of the Ministry of Health, Labor and Welfare of Japan recently released a basic policy including a goal to reduce the percentage of people working 60 hours or more per week to less than 5% by 2020. Additionally, a mandatory stress check system will be started at the end of 2015. These com-

prehensive approaches could reduce the number of cases of karoshi and ultimately and eliminate them. As part of these processes, a simultaneous evaluation by the JCQ and SDS seems to be useful for assessing health conditions in a clinical practice.

The authors state that they have no Conflict of Interest (COI).

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