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Effects of perceived job stress on depressive symptoms in blue-collar workers of an electrical factory in Japan

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KAWAKAMI N, HARATANI T, ARAKI S. Effects of perceived job stress on depressive symptoms in blue-collar workers of an electrical factory in Japan. *Scand J Work Environ Health* 1992;18:195–200. This three-year prospective study on the effects of job stress on depressive symptoms over time was conducted among male blue-collar workers in an electrical factory in Japan. Data were collected at yearly intervals by means of postal questionnaires. Initially ten job stress variables, five major covariates, and depressive symptoms (Zung Self-Rating Depression Scale) were measured. In the yearly examinations, depressive symptoms were measured for a total of 468 respondents. The results indicated that job unsuitability was a significant predictor of depressive symptoms in the second and third year, after control for the initial covariates and depressive symptoms. Lack of control over workplace and poor human relations at the workplace were significantly associated with depressive symptoms after one and two years, respectively. Job unsuitability and poor human relations at the workplace seem to be risk factors for long-lasting depressive symptoms in Japanese blue-collar workers.

Key words: depression, factory workers, follow-up, Japanese, longitudinal studies, men, occupational stress, psychological tests.

Depressive symptoms have been employed in industrial settings as a useful measure of the mental health and well-being of workers (1, 2). In the last decade, many studies have shown that job stress is associated with depressive symptoms among workers (3–9). Self-reported measures of depressive symptoms do not always indicate the presence of clinical depression, however, and in recent years have been considered as measures of nonspecific psychological distress (10, 11). But they still seem to be a convenient and useful measure of psychological outcomes vis-à-vis job stress.

Previous investigators have reported that, in general, two groups of job stressors strongly correlate with depressive symptoms. The first group is related to job role or job content, such as role ambiguity (3, 4), underutilization of skills, inadequate resources, ambiguity about the future, and nonparticipation in decision making (3). The second group consists of human relations at work (ie, social support from supervisors and co-workers) (4, 8). On the other hand, in these studies, job overload or job complexity was only weakly or not significantly correlated with depressive symptoms. Karasek (6) has pointed out that high job demand without autonomy is more important in predicting depressive symptoms than job demand itself. In a recent study by Billings & Moos (7), the correla-

tions of depressive symptoms with work involvement and poor support from superiors and co-workers were somewhat greater than the correlation with work pressure, although all the correlations were significant. These findings suggest that stressors related to job role or content and poor human relations at the workplace rather than job overload are important risk factors for depressive symptoms in industrial workers. These findings are consistent with those of a report by House (12) in which perceived work rewards were significantly related to neurotic symptoms while quantitative overload was not.

Most of these studies were cross-sectional, and thus the direction of the observed associations is still not clear. In his six-year follow-up study Karasek (6) showed that an increase in job strain was significantly associated with an increase in depressive symptoms. Recently, Bromet et al (13) conducted a one-year follow-up study and reported that job demand and its interaction with co-worker support are important predictors of psychiatric symptoms and broad affective disorders. These few longitudinal studies suggested that job stress is one of the causes of depressive symptoms and, perhaps, depressive disorders. However, such longitudinal studies with only one follow-up period provided limited information because the way the risk of depression due to job stress changes over time is unknown. In particular, what has not been adequately investigated is whether job stress is related to long-term risk for depressive symptoms. In the previous studies, the relative importance of a certain job stress, such as poor intrinsic work rewards or poor social support at the workplace, was assessed only on the basis of the magnitude of the correlations between job stress and depressive symptoms. The temporal course of the

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effects of job stress should be taken into consideration in the assessment of the relative importance of job stress, because some job stress may be chronic or enduring while other job stress may be acute or short-termed and chronic or enduring job stress is probably a more important risk factor for illness than acute or short-termed job stress.

The present study was carried out to assess the effects of job stress on depressive symptoms over a three-year period among male blue-collar workers in an electrical factory in Japan. The effects of selected sources of job stress on depressive symptoms repeatedly measured each year of the follow-up were examined, initial depressive symptoms and other possible confounders being controlled for.

Subjects and methods

Subjects

A total of 1266 full-time employees of an electrical factory in a suburb of Tokyo was surveyed in 1984 (ie, at T_0). A questionnaire concerning background data, job stress, and depressive symptoms was sent to each of the subjects. A total of 1152 (91%) of the workers responded.

Detailed analyses were undertaken for all of the male blue-collar workers aged 20 to 49 years who responded to the survey ($N = 504$); they consisted of machine operators, assemblers, production inspectors, and mechanics. Four hundred and sixty-eight of the workers completed all of the questions and were followed prospectively for the succeeding three years. The mean age of the subjects was 37.8 (SD 8.6) years. During the follow-up period, they were surveyed once a year with a postal questionnaire and their depressive symptoms were assessed (ie, at T_1 , T_2 , and T_3). The follow-up rates were 92, 90, and 83% at T_1 , T_2 , and T_3 , respectively.

Methods

Depressive symptoms. Depressive symptoms were measured with the Zung Self-Rating Depression Scale (14). Previous research has found the scale to exhibit acceptable reliability and validity in both Japan and Western countries (15, 16). The subjects were asked to complete the scale at T_0 , T_1 , T_2 , and T_3 . The coefficient of internal consistency (Cronbach's alpha) was 0.81 for the present subjects. The subjects with scores greater than 48 (ie, mean plus one standard deviation) were defined as "depressed." With the use of this criterion, the prevalences of "depressed" workers were 13.0, 10.5, 9.8, and 11.3% at T_0 , T_1 , T_2 , and T_3 , respectively. There were no significant differences in the prevalence rates across the four surveys (Cochran Q test for 372 subjects who responded to all of the surveys, $P > 0.05$).

Predictor variables. Ten measures of job stress or stressors were assessed at T_0 . Seven scales of perceived job stress were developed on the basis of the results of factor analyses of 17 questions on job stress and were used to measure the psychosocial and physical work environment (17). The job overload scale (4 items) measured the amount of work and frequency of exhaustion after work, work pressure, and thinking about work at home. The poor physical environment scale (5 items) was represented by the number of problems experienced regarding temperature, brightness, noise, dust, and bad smell at the workplace. Items on lack of control over workplace and job unsuitability (ie, whether the job was not suitable for a worker's skills and abilities) were classified as one group in the factor analysis. However, the correlation between these items was low (Pearson r , 0.32). Thus the items were used as separate one-item scales measuring lack of control over workplace and job unsuitability. Poor human relations (3 items) measured the degree of problems in human relations at the workplace. Complicated machine operation was assessed with a one-item scale inquiring about the degree of complexity of operation required by machines which the subject used. The introduction of new machines and technology to the subject's workplace was also assessed on a one-item scale. One item inquiring about dissatisfaction with work results was not used to avoid overlapping of the content of measures of job stress and reaction to the stress (20).

The coefficients of internal consistency (Cronbach's alpha) for the scales of job overload, poor physical environment, and poor human relations at the workplace were 0.69, 0.64, and 0.60, respectively. The gamma coefficients for one-year stability of lack of control over workplace and job unsuitability was 0.56 and 0.74, respectively. No information was available concerning the reliability or stability of the scale on complicated machine operation or the introduction of new technology. The subjects were divided into two groups on the basis of their job stress scores (ie, approximately the upper 25% and the remaining 75%) so that those portions of the sample could be identified that could be considered "higher" or "lower" with respect to a given job stress measure.

Three objective measures of job stress assessed by single questions were as follows: shift work, recent job change (ie, change of position, workplace or job description within the preceding six months), and overtime (ie, hours per month). Overtime was dichotomized into less than and more than 50 (mean 36, SD 19) h per month.

Five covariates were included in certain multivariate analyses: age, marital status, education, type A behavior, and initial medical treatment. Age was categorized into three groups (ie, 20–29, 30–39, and 40–49 years of age). Marital status was dichotomized into married and not married. Length of education was dichotomized into less than nine years and nine or more

years (45 and 55% of the subjects, respectively). Type A behavior was measured with a five-item scale, the details of which have been described previously (17). Those subjects who had scores greater than the mean plus one standard deviation were defined as having a high tendency toward type A behavior. Medical treatment at T_0 was assessed by an interview conducted by trained nurses. The subjects were dichotomized on the basis of whether or not they had received medical treatment for any disease at T_0 .

The proportion of depressive symptoms in each year of the follow-up was compared among the groups classified on the basis of job stress variables by means of the chi-square test with Yates' correction in each of the groups with and without initial depressive symptoms. Binomial regression analysis for relative risk models using general linear interaction modeling (GLIM) (18) was employed to assess the unique effects of each job stress variable on depressive symptoms at T_1 , T_2 , and T_3 . Depressive symptoms at T_0 , age, marital status, education, medical treatment, and type A were entered into the equation first to control for these factors. Then the 10 job stress variables were entered and eliminated with the use of a backward stepwise procedure to determine the significant contribution to the model. The job stress variable with the smallest t-value (ie, estimated coefficient divided by standard error) was eliminated at each step. The significance of the effect of the variable was assessed with the chi-square approximation to the scaled deviance between models before and after the elimination of the variable (19). The criterion for the inclusion of variables was $P < 0.05$. Relative risk and its 95% confidence intervals for depressive symptoms of significant job stress variables were calculated on the basis of the standard

errors of the coefficients. The GLIM system release 3.77 was used in these analyses (19).

Results

Among those who were not depressed at T_0 , the rates of depressed workers were significantly higher for the subjects with higher scores of job unsuitability than for those with the lower scores at T_2 and T_3 (table 1). Similarly, the rate was significantly higher for the subjects with higher scores of job overload and lack of control over workplace than for the subjects with the lower scores of these scales at T_1 . The rate was significantly higher for the subjects with higher scores of poor human relations at the workplace than for the subjects with the lower scores at T_2 . Among those who were depressed at T_0 , the rates were not significantly different at any of the follow-ups between the groups classified on the basis of job overload, lack of control over workplace, job unsuitability, or poor human relations at the workplace ($P > 0.05$). For neither the subjects who were depressed nor those depressed at T_0 did the rates significantly differ in any year of the follow-up between the groups classified on the basis of other job stress variables (ie, poor physical environment, complicated machine operation, introduction of new machine technology, shift work, recent job change, or overtime) ($P > 0.05$).

The results of the stepwise binomial regression analyses indicated that lack of control over workplace was a significant predictor for depressive symptoms at T_1 (table 2). Job unsuitability was a significant predictor for depressive symptoms at T_2 and T_3 . Poor human relations at the workplace were significantly related to

Table 1. Rates of "depressed" workers in the follow-ups (T_1 , T_2 and T_3) by job overload, lack of control over workplace, job unsuitability, and poor human relations at the workplace for the male blue-collar workers who were not depressed and those who were depressed in the initial survey (T_0).

Job stress at T_0	Not depressed at T_0						Depressed at T_0					
	1st year (T_1)		2nd year (T_2)		3rd year (T_3)		1st year (T_1)		2nd year (T_2)		3rd year (T_3)	
	N	%	N	%	N	%	N	%	N	%	N	%
Job overload												
Higher	108	10**	104	7	96	9	31	42	31	39	32	41
Lower	267	3	259	5	240	5	25	52	25	40	21	52
Lack of control over workplace												
Higher	75	11*	74	7	50	10	18	56	18	50	19	53
Lower	300	4	289	5	286	5	38	42	38	34	34	41
Job unsuitability												
Higher	102	9	101	10*	91	14**	33	48	32	41	32	50
Lower	273	4	262	3	245	3	23	43	24	38	21	38
Poor human relations at the workplace												
Higher	76	7	75	11**	70	4	24	58	23	52	23	48
Lower	299	5	288	4	266	6	32	38	33	30	30	43

* $P < 0.05$, ** $P < 0.01$, significant difference between the higher and lower job stress groups (chi-square test with Yates' correction).

Table 2. Significant job stress variables for depressive symptoms in the follow-ups (T_1 , T_2 , and T_3) among male blue-collar workers: binomial regression for risk ratios using backward elimination with eight job stress variables by GLIM, controlling for depressive symptoms at T_0 and five covariates.^a

Follow-up period	Significant job stress variable ^b
One year (T_1) (N = 431)	Lack of control over workplace (1.71, 1.10—2.65)
Two years (T_2) (N = 419)	Job unsuitability (1.85, 1.28—2.68) Poor human relations at the workplace (1.94, 1.17—3.20)
Three years (T_3) (N = 389)	Job unsuitability (1.94, 1.08—3.46)

^a Eight job stress variables, depressive symptoms at T_0 , and five covariates (age, marital status, education, medical treatment, and type A) were entered into the equations first; then eight job stress variables were dropped stepwise using backward elimination (inclusion criteria: $P < 0.05$).

^b Estimated risk ratio and 95% confidence interval in parentheses.

depressive symptoms at T_2 . When similar analyses were made for the 375 subjects who were not depressed at T_0 , job overload was selected as a variable significantly related to depressive symptoms at T_1 ($P < 0.05$). The estimated risk ratios were 3.66 [95% confidence interval (95% CI) 1.52—8.80]. Job unsuitability was significantly associated with depressive symptoms at T_2 and T_3 ($P < 0.05$). The estimated risk ratios were 2.75 (95% CI 1.15—6.55) and 3.06 (95% CI 1.24—7.53), respectively. No other job stress variable was significantly associated with depressive symptoms at T_1 , T_2 , or T_3 ($P > 0.05$). In none of these analyses were the interaction terms of any combinations of two job stress variables selected as a significant predictor of depressive symptoms ($P > 0.05$).

During the three-year follow-up period, 28% of the subjects reported to have changed either their position, workplace, or job content. The rates of job change were not significantly different between the groups classified on the basis of any of the initial 10 job stress variables (chi-square test with Yates' correction, $P > 0.05$).

Discussion

In the present study, the results of binomial regression analyses indicated that job unsuitability and poor human relations at the workplace were significant predictors for depressive symptoms in the two- or three-year follow-up. It is suggested that these job stressors are important risk factors for long-lasting depressive symptoms among Japanese male blue-collar workers. In contrast, job overload and lack of control over workplace were significantly associated with depressive symptoms only at the one-year follow-up. The present study failed to indicate that job overload or lack of control over workplace is a risk factor for long-lasting depressive symptoms.

Job unsuitability was a significant predictor for depressive symptoms in the two- and three-year follow-ups. An important risk factor for long-lasting depressive symptoms might be a job that is not suitable for a worker's skills and abilities. The results are consistent with previous cross-sectional studies which reported that underutilization of skills (3) is an important risk factor for depressive symptoms. The results are also consistent with the higher percentage of job unsuitability observed for major depressive patients in our previous study (21).

The job change rate during the follow-up period was not significantly associated with any of the eight job stress variables. Thus the present results are not attributable to self-selection of job by workers suffering from job unsuitability. The following explanations are possible: (i) job unsuitability may last for a longer period because it mainly depends on the relationship between workers' skills and abilities and job contents, while other job stressors, such as job overload, may change more over time according to changes in situations at the workplace; (ii) it may be more difficult for workers to cope with job unsuitability than with other job stressors, as suggested by a previous finding (22) that the effects of work load on depression is more likely to be buffered by support from family members than those of role ambiguity, future ambiguity, and skill underutilization; and (iii) the present results might be explained by the theory of learned helplessness recently introduced to work settings (23). Such attributional style learned by workers suffering from job unsuitability could cause long-term depressive symptoms.

Human relations at the workplace were also found to be a significant predictor of depressive symptoms at the two-year follow-up. The results are consistent with the findings from previous cross-sectional studies (4, 7, 8) and a one-year follow-up study (13).

Job overload significantly correlated with depressive symptoms at the one-year follow-up. This finding agrees with the finding in a previous one-year follow-up study (13). The significant association between lack of control over workplace and depressive symptoms at the one-year follow-up is consistent with a cross-sectional observation (6). However, in the present study, these two job stressors did not seem to be risk factors for long-lasting depressive symptoms. In addition the effect of job overload was not clear in the case of initially depressed subjects. Such an interactive phenomenon might be attributable to "saturation" effects (20). Job overload may not be related to an increase in depressive symptoms once the symptoms increase to a certain level.

Unfortunately, change of job stress over time was not assessed in the present study. It is not clear whether depressive symptoms over time are caused by sustained job stress or whether depressive symptoms once evoked by job stress tend to continue for a long period even after job stress itself declines. Depressive symptoms also have a remittent nature. A previous survey of a

nonpatient working population showed that the mean duration of depressive symptoms was less than eight months (24). The present results do not necessarily suggest that job stress is related to the formation of a group of workers with continuous higher depressive symptoms over years. In the present study, in which depressive symptoms were assessed once a year, it was not clear whether job stress led to a chronic episode of depressive symptoms over years or to a sustained risk for frequent and intermittent depressive symptoms. More frequent (eg, once every six months) and repeated observation of both job stress and depressive symptoms is needed to clarify these issues.

The following methodological weakness should also be considered in the interpretation of the results. First, none of the objective job stress measures significantly correlated with depressive symptoms. The association between subjective measures of job stress and outcomes might be misleading because of response tendencies. Second, the present study did not include measures of personalities other than type A, which might be confounding in the association between job stress and depressive symptoms. Third, the reliability of the job stress scales used in the present study was moderate or not adequately examined. Lack of a significant association between the scales and depressive symptoms could be attributable to a low reliability of the scales. The present results should be examined with a more reliable measure. Finally, the job stress model adopted in the present study included only a limited number of the proposed theoretical models (1, 4, 12). To explain the possible psychological mechanisms attributable to the present results, further longitudinal study is needed to examine temporal relationships among job stressor, stress reaction, and health outcome, using both subjective and objective measures and considering several intervening variables. A recent cross-cultural study pointed out that human relations at the workplace are more important for psychological symptoms among Japanese managers than among American managers (25). In the present study, Japanese blue-collar workers seemed to be affected by job stresses similar to those previously reported in Western countries. However, some characteristics of Japanese factories, such as a tendency for workers to be employed for almost all of their worklife in the same company with few chances to change job or employment (26), may lead to long-term job unsuitability. Further studies are needed to replicate the present results and to permit an extension of these findings to female workers and to workers of other occupations in Japan, as well as to other countries.

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