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Effort-Reward Imbalance and Depression in Japanese Medical Residents

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Abstract: Effort-Reward Imbalance and Depression in Japanese Medical Residents: Yumi SAKATA, *et al.* Department of Occupational Mental Health, Graduate School of Medical Sciences, Kitasato University—The effort-reward imbalance is an important psychosocial factor which is related to poor health among employees. However, there are few studies that have evaluated effort-reward imbalance among medical residents. The present study was done to determine the association between psychosocial factors at work as defined by the effort-reward imbalance model and depression among Japanese medical residents. We distributed a questionnaire to 227 medical residents at 16 teaching hospitals in Japan at the end of August 2005. We asked participants to answer questions which included demographic information, depressive symptoms, effort-reward imbalance, overcommitment and social support. Depression was evaluated using the Japanese version of the Center for Epidemiologic Studies-Depression (CES-D) scale. The effort-reward imbalance and overcommitment were assessed by the Effort-Reward Imbalance (ERI) questionnaire which Siegrist developed. Social support was determined on a visual analog scale. Logistic regression analysis was performed to determine the associations between effort-reward imbalance and depressive symptoms. Depressive symptoms were found in 35 (29.2%) 1st-year residents and 21 (27.6%) 2nd-year residents. The effort-reward ratio >1 (OR, 8.83; 95% CI, 2.87–27.12) and low social support score (OR, 2.77, 95% CI, 1.36–5.64) were associated with depressive symptoms among medical residents. Effort-reward imbalance was independently related to depression among Japanese medical residents. The present study suggests that balancing between effort and reward at work is important for medical residents' mental health. *(J Occup Health 2008; 50: 498–504)*

Key words: Depression, Effort-reward imbalance, Social support, Medical resident

Medical workers stress has gained increased concern in recent years, and for medical residents, it's an important problem. The resident period is important in the training of new physicians and is burdensome physically and mentally[1)]. Medical residents face a lot of stressful factors, such as long work hours, excessive "on call" responsibilities, fear of making mistakes, handling life-and-death situations, demand of patient care[2)] and sleep deprivation[3)].

Undesirable emotional states including depression, anger, anxiety, fatigue, and mental health problems often occur during medical resident years[4–6)]. A review of nine cohort studies which investigated the prevalence and predictors of mental health problems in doctors during postgraduate years showed depression was often observed during the first postgraduate year[7)].

The theoretical stress model is applied to reduce the stress in the workplace. To assess occupational stress, several kinds of theoretical models have been studied[8, 9)]. Recently, a stress model of effort-reward imbalance (ERI) at work formulated by Siegrist has attracted attention as a new evaluation method of occupational stress[10)].

The focus of this model is on the non-reciprocity of social exchange at work (i.e., high-cost/low-gain conditions in the work contract), which is associated with adverse health[11–14)]. A review by Tsutsumi and Kawakami showed the association of the effort-reward imbalance with psychosomatic symptoms, psychiatric symptoms of distress, burnout, cardiovascular disease and physiologic

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functions including heart rate, secretion of adrenaline and cortisol[15]. Additionally, symptoms of depression were strongly related to effort-reward imbalance in workplaces[15].

The ERI model is valid for demonstrating a stressful work environment and predicts health conditions among a wide range of working populations[13, 16, 17], which is an indicator of medical workers health problems[17–19]. However, there are few studies on the effort-reward imbalance among medical residents[20, 21]. The purpose of this study was to determine the association between psychosocial factors at work, defined by the ERI model, and depressive symptoms among Japanese medical residents.

Methods

Participants

The participants in the present study were medical residents (post-graduate years one and two) working in the residency programs at 16 general hospitals located throughout Japan (3 in the Hokkaido/Tohoku area, 2 in the Kanto area, 1 in the Chubu area, 4 in the Kansai area, and 6 in the Kyushu area). The hospitals belonged to two major clinical teaching hospital groups. Eight hospitals, which had 3 or fewer medical residents, were excluded from this study and two hospitals refused to participate in this study. The residents were in a 2-yr rotation program of various specialties, which included fields such as internal medicine, surgery, pediatrics, obstetrics/gynecology, emergency medicine, anesthesiology, psychiatry, radiology. During their residency program, the residents worked 5 days a week, and 2 or 3 times per week they worked overnight shifts.

Procedures

At the end of August 2005, a self-administered questionnaire was distributed to all 227 medical residents with a letter explaining the purpose of the study, that the survey was voluntary, and that if they did not answer they would not incur any personal disadvantages. To ensure confidentiality, no names of any residents were on the questionnaires. The purpose of the study was explained to the person in charge of the survey at each training hospital (the director of medical residency program), and after that the person distributed and collected the anonymous questionnaires in a closed envelope. This study protocol was approved by the clinical training hospital committee of each hospital and the human research ethics committee of Kitasato University School of Medicine, Japan.

Measurements

Demographic variables

The demographic information collected was the participant's age, gender, year of residency, single or cohabitation, and frequency of overnight shifts and lifestyle including alcohol consumption, exercise and smoking. Social support was assessed using a visual analog scale (0, no support; 100, optimal support) and was dichotomized as the mean of the score. The question was "in the last 2 wk, how much social support which you needed have you received from your friends, families and colleagues?"

Effort-reward imbalance

The effort-reward imbalance was assessed by the Japanese version of the effort-reward imbalance (ERI) questionnaire. The ERI model is a theoretical concept proposed by Siegrist that assesses adverse health effects of stressful experience at work[10]. This model defines stressful experience at work as an imbalance between high effort expended and low reward received.

The ERI questionnaire contains 23 Likert-scaled items, which consist of two extrinsic components "extrinsic (situational) effort" (6 Likert scale items) and "occupational reward" (11 Likert scale items), and one intrinsic component "overcommitment" (6 Likert scale items). Responses to the items of effort and reward are scored on a 5-point scale (1=no stressful experience, 5=very high stressful experience), and the items of overcommitment are scored on a 4-point scale (1=complete disagreement, 4=complete agreement with statement). "Extrinsic (situational) effort" is assessed by measuring the intensity of distress produced by time pressure, high levels of responsibility, overtime, and increasing demands, and "occupational reward" consists of three factors: money, esteem and career opportunities assessed by measuring lack of esteem by colleagues and superiors, insufficiencies of salary and career rewards, job insecurity, poor promotion prospects, and forced occupational changes. According to the theoretical formulation, a ratio between the two scales of effort and reward (weighted by the item number) is calculated to assess the degree of imbalance between high cost and low gain at work. This ratio is studied using a dichotomous variable defining exposed people by a ratio over one (effort-reward ratio >1: high, ≤1: low). Overcommitment is the personal characteristic that reflects the tendency to be absorbed in work excessively. Overcommitment is studied by using a dichotomous variable defining exposed people to high levels of overcommitment by the upper tertile of the distribution among the study population.

Assessment of depression

Depressive symptoms were assessed by the Japanese version of the Center for Epidemiologic Studies Depression (CES-D) scale[22]. The questionnaire has been used widely to measure depressive symptoms in the community population and also used as a screening tool

Table 1. Demographic Characteristics of Participants (n=196)

Variables	No. (%)
Gender	
Male	149 (76.0)
Age	
24–29	163 (83.1)
30–34	25 (12.8)
35–39	7 (3.6)
40–44	1 (0.5)
Year of residency	
1	120 (61.2)
Civil status	
Single	158 (80.6)
Alcohol consumption	
Two or more times per a week	73 (37.2)
Once per a week	88 (44.9)
Never	35 (17.9)
Exercise	
Yes	65 (33.2)
Smoking	
Yes	38 (19.4)
CES-D total points	
≥19	56 (28.6)
Effort/Reward	
>1	24 (12.2)
Overcommitment	
High	87 (44.4)
Social support	
High	108 (55.1)
	Mean (SD)
Frequency of overnight shifts	
(time/month)	7.1 (2.8)
CES-D score	14.9 (10.4)
Social support	64.3 (21.1)

SD, standard deviation.
Overcommitment, the exposure variables were dichotomized at the upper tertile mean. Social support, the exposure variables were dichotomized at the mean.

for depression[23, 24]. The CES-D is a 20-item self-report measure that focuses on depressive symptoms within the last week.

Wada *et al*. examined the validity of the CES-D for depression among Japanese workers by a receiver operating characteristic curve and showed that the optimal cut-off score was 19[25]. In the present study, the CES-D score of 19 or more was determined as indicating depressive symptoms.

Statistical analysis

Demographic variables were analyzed descriptively to show the participant's age, gender, year of residency, frequency of overnight work, specialty, alcohol consumption and exercise. The effort score, the reward score and depression score of each specialty were compared by using one-way layout analysis of variance. The associations between the variables and depressive symptoms were determined using the *t*-test and chi-square test. Moreover, logistic regression analysis was performed to examine the independent effect of effort-reward imbalance on depressive symptoms. We adjusted for age, gender, year of residency, frequency of overnight work, alcohol consumption, exercise and smoking, overcommitment and social support. The results are shown as odds ratios with 95% confidence intervals. Statistical analysis was conducted with the SPSS software, version 11.5 (SPSS, Inc., Chicago, IL).

Results

Of the 227 residents enrolled, 196 (120 1st-year residents, 76 2nd-year residents) participated in this study. The response rate was 86.3%. Table 1 shows the demographic and psychosocial characteristics of the participants. Of the 196 respondents, 149 (76.0%) were men, and 47 (24.0%) were women. The mean age (standard deviation) of participants was 27.3 (2.9) yr. A total of 56 (28.6%) showed depressive symptoms determined by a CES-D score of 19 or more, and 24 (12.2%) showed effort-reward imbalance determined by an effort-reward ratio >1.

Table 2 shows the mean scores (standard deviation) of effort, reward and overcommitment according to specialities. There were not statistically significant differences in the effort, reward and overcommitment scores between specialities using one-way layout analysis of variance.

Table 3 describes the association of depressive symptoms with the socio-demographic variables using the *t*-test and chi-square test. Residents with depressive symptoms showed a lower mean score of social support by the *t*-test than those without depressive symptoms. Depressive symptoms were found among 35 (29.2%) 1st-year residents and 21 (27.6%) 2nd-year residents, 44 (29.5%) men and 12 (25.5%) women. There were significant differences in the prevalence of depressive symptoms between residents with and without effort-reward imbalance ($p<0.001$), overcommitment ($p=0.001$), and insufficient social support ($p=0.001$) as revealed by the chi-square test. We did not find significant differences in the prevalence of depressive symptoms between men and women ($p=0.597$) or between 1st-year residents and 2nd-year residents ($p=0.817$).

The results of logistic regression analysis on associations between the study variables and depressive symptoms are shown in Table 4. We adjusted for age, gender, year of residency, frequency of overnight shifts, alcohol consumption, exercise and smoking, overcommitment and social support. There were

Table 2. Effort, reward and overcomitment scores according to specialities

Specialties	No. (%)	Effort Mean (SD)	Reward Mean (SD)	Overcommitment Mean (SD)
Internal medicine	69 (35.2)	15.7 (4.5)	45.8 (7.3)	14.3 (3.3)
Surgery	44 (22.4)	16.1 (4.3)	44.5 (7.4)	13.9 (3.4)
Emergency medicine	17 (8.7)	14.9 (4.6)	45.1 (5.8)	14.6 (3.6)
Pediatrics	21 (10.7)	15.6 (4.9)	47.1 (8.0)	14.3 (2.4)
Obstetrics/gynecology	12 (6.1)	14.0 (6.0)	45.3 (11.5)	14.4 (4.1)
Anesthesiology	13 (6.6)	15.6 (4.0)	45.1 (5.8)	13.2 (2.2)
Psychiatry	5 (2.6)	14.0 (3.4)	48.0 (5.3)	12.8 (2.6)
Radiology	6 (3.1)	14.3 (3.8)	49.0 (8.2)	14.3 (2.7)
Others	9 (4.6)			

Values are expressed as n (%) and mean (SD).

Table 3. Comparison of the characteristics between depressed and non-depressed residents

Variables	Depressed residents (n=56) No. (%)	Non-depressed residents (n=140) No. (%)	*p* value
Gender			0.597
Male	44 (29.5)	105 (70.5)	
Female	12 (25.5)	35 (74.5)	
Year of residency			0.817
1	35 (29.2)	85 (70.8)	
2	21 (27.6)	55 (72.4)	
Effort/reward			<0.001
≤1	39 (22.5)	134 (77.5)	
>1	17 (73.9)	6 (26.1)	
Overcommitment			0.001
High	35 (40.2)	52 (59.8)	
Low	21 (19.3)	88 (80.7)	
Social support			0.001
High	20 (18.5)	88 (81.5)	
Low	36 (40.9)	52 (59.1)	
Exercise			0.067
Yes	13 (20.0)	52 (80.0)	
No	43 (32.8)	88 (67.2)	
Alcohol consumption			0.409
Yes	44 (27.3)	117 (72.7)	
No	12 (34.3)	23 (65.7)	
Smoking			
Yes	9 (23.7)	29 (76.3)	0.298
No	47 (29.7)	111 (70.3)	
	Mean (SD)	Mean (SD)	
Age	27.6 (22.3)	27.3 (3.0)	0.402
Frequency of overnight shifts (time/month)	7.1 (2.9)	7.2 (2.8)	0.777
Social support	67.2 (22.3)	57.2 (15.7)	0.012

Values are expressed as n (%) and mean (SD). Analyses were performed using chi-square test and *t*-test.

Table 4. Multiple logistic analyses regarding factors associated with depressive symptoms

Variables	OR (95%CI)	*p* value
Age (continuous)		
	0.97 (0.85 to 1.10)	0.650
Female		
	1.46 (0.61 to 3.50)	0.402
Year of residency		
2	0.95 (0.45 to 2.01)	0.893
Frequency of overnight shifts (continuous)	0.90 (0.78 to 1.03)	0.121
Alcohol consumption		
Yes	1.31 (0.52 to 3.29)	0.560
Exercise		
No	1.64 (0.74 to 3.65)	0.225
Smoking		
Yes	0.80 (0.31 to 2.05)	0.638
Effort/Reward		
>1	8.83 (2.87 to 27.12)	<0.001
Overcommitment		
High	1.99 (0.95 to 4.14)	0.067
Social Support		
Low	2.77 (1.36 to 5.64)	0.005

Adjusted for gender, year of residency, frequency of overnight shifts (continuous), alcohol consumption, exercise, smoking , ERI, overcommitment, social support. OR, odds ratio; CI, confidence interval.

significant associations of effort-reward ratio >1 (OR, 8.83; 95% CI, 2.87–27.12) and low social support (OR, 2.77; 95% CI, 1.36–5.64). Age, gender, year of residency, the frequency of overnight shifts, alcohol consumption, exercise and smoking were not significantly associated with depressive symptoms.

Discussion

The aim of this study was to determine the psychosocial factors associated with depressive symptoms for a sample of Japanese medical residents. Effort-reward imbalance and low social support were independently associated with depressive symptoms among medical residents similar to those in other working populations[26, 27].

Many residents have feelings of anxiety, depression, defeat, anger, fatigue, and confusion[28, 29] and other psychiatric symptoms and some use psychoactive substances[30, 31]. Reuben demonstrated that 28.7% of interns tested were depressed[32]. Ford and Wentz reported that 33% of interns rated themselves as depressed[33]. In our finding, 56 (28.6%) of the residents were evaluated to be depressed, which is similar to results of the studies of Reuben and Ford[32, 33].

The ERI model explains occupational stress from the viewpoint of socioeconomic aspects in service occupations and professions, particularly those dealing with person-based interaction. However, the effort-reward imbalance has not yet been much explored among physicians including medical residents. Although the validity of the Japanese version of ERI has been widely examined among several subjects in the workplace[34], the model has not been verified yet among medical residents.

However, the ERI model could be an effective stress index in clinical training, as in other service occupations and professions. It is an important reward element for the medical residents that their work can be admitted (reward related to approval by colleagues and superiors and self esteem), although it may be rare for insufficiencies of salary and career rewards, job insecurity, poor promotion prospects, to be a problem for medical residents. Furthermore, support from colleagues is also an important reward element which the ERI model can detect. Accordingly, the application of the ERI model in this research would seem rational.

As far as we know, reports on the efforts reward imbalance and the self-reported health among physicians consist of only two cross-sectional studies and one cohort study[20, 21, 35]. Li *et al*. published a study that evaluated the influence of the effort-reward imbalance on the health function of Chinese physicians[35]. The participants were

more experienced physicians than those in the present study. They showed gender differences in the adverse effects of social factors, job strain and the effort-reward imbalance on health function. In a cohort study of Swiss residents, followed up over a 2-yr time period, high ERI (the upper quartile of the ratio between effort and reward) and overcommitment (the upper quartile of the overcommitment scale), respectively, showed a negative influence on the participants' physical and mental health[21].

There have been studies on the associations between the effort-reward imbalance and depression in working populations. In a cross-sectional study of 680 participants, 504 men and 176 women employees exposed to major organizational changes, ERI (ratio between effort and reward greater than 1) (OR, 3.33; 95% CI, 1.18–9.43) was found to be a risk factor for depressive symptoms among men, and low levels of social support (OR, 4.39; 95% CI, 1.37–14.0) among women was associated with depressive symptoms[28]. In a cross-sectional study of 213 Japanese workers, ERI (logarithmically transformed effort-reward ratio greater than the top quintile) (OR, 4.13; 95% CI, 1.39–12.28) and overcommitment (OR, 2.56; 95% CI, 1.01–6.47) were independently related to depression after adjustment for work environment factors[27].

Our findings agree with previous results, that there are associations between the effort-reward imbalance and depression. We found that the effort-reward imbalance was associated with depression (OR, 8.83; 95% CI, 2.87–27.12) among medical residents. The result shows that application of the stress index by ERI would be appropriate for medical residents, and that the effort-reward imbalance at work would be an important risk factor for depressive symptoms among medical residents.

Moreover, for medical residents, important stressful aspects appear to be interference with social support, especially inadequate support from allied health professionals and supervision of more junior residents[36]. Our results showed similar findings that low social support was an important associating factor with depression. However, in this study, social support from family and from colleagues at the workplace was combined and we could not clarify the factor which was associated with depressive symptoms between family and colleagues support.

There are some limitations of this study that need to be considered. First, the study design is cross-sectional, therefore, we cannot derive any conclusions on the causality of the observed association between the effort-reward imbalance and depression. Second, although studies of doctors often experience difficulties in obtaining responses to a questionnaire, we had a high response rate of 86.3% in the present study. However, we do not know if our results are applicable to other medical residents as we did not compare respondents with non-respondents to protect the anonymity of the residents, nor did we examine histories of drug use, such as antidepressants, antipsychotic drugs, mood stabilizers, etc. or family histories or any past histories of mental disorders.

Despite these limitations, this study provides useful information for better understanding of medical residents' mental health. This study suggests that balancing effort and reward and having adequate social support at workplaces may be important factors for improving depression in medical residents. However, for more definitive results, longitudinal studies and further investigations are warranted.

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