

## Short Communication

### Relationship between Effort-Reward Imbalance, Low Social Support and Depressive State among Japanese Male Workers

MISUZU WATANABE<sup>1</sup>, MASAHIRO IRIE<sup>2,3</sup> and FUMIO KOBAYASHI<sup>1</sup>

<sup>1</sup>Department of Health and Psychosocial Medicine, Aichi Medical University School of Medicine, <sup>2</sup>Institute for Occupational Health Science, Aichi Medical University School of Medicine and <sup>3</sup>Institute of Health Science, Kyushu University, Japan

**Key words:** Effort-reward imbalance, Overcommitment, Social support, Depressive state, Work stress

#### Introduction

The globalisation of the world economy is rapidly increasing<sup>1</sup>. In response to such changes, work stress has gained increased concern all over the industrialized world, particularly in the Western countries<sup>2</sup>. Siegrist<sup>3</sup> recently highlighted work stress from the standpoint of the imbalance between high effort and low reward due to a lack of reciprocity at work. This effort-reward imbalance (ERI) model includes two components: (1) ERI, the ratio between extrinsic efforts (psychological and physical demands on the job) and low rewards (salary, esteem, and status control); and (2) overcommitment (OC), an intrinsic psychological coping style associated with the inability to withdraw from work obligations. It is posited that OC amplifies the adverse effects of ERI on health, because overcommitted people exaggerate their efforts beyond the levels normally considered appropriate<sup>4</sup>. The ERI model claims that the combination of high effort spent and low reward received at work induces an adverse effect on workers' psychological and physical (particularly cardiovascular) health<sup>5–7</sup>. In Japan, Tsutsumi *et al.*<sup>8,9</sup> developed the Japanese version of the ERI questionnaire, and reported that the ERI model is useful in studying current occupational stress and in evaluating the risk of depression among Japanese workers, but most of the previous studies did not investigate the complete individual effect of ERI (excluded OC) or OC (excluded ERI) on workers' health.

Apart from the ERI model, it has generally been proposed that social support should be considered as a

buffering factor in determining the stress effect<sup>10</sup>. There is much evidence that socially integrated individuals have lower illness and mortality rates than more socially isolated ones<sup>11</sup>. In work stress models, such as the job strain model<sup>12</sup> or the NIOSH general job stress model<sup>13</sup>, social support plays a significant role as a stress buffering factor on health outcomes. We therefore hypothesized that social support also has an impact on the influence of the ERI model on workers' health, but this issue has scarcely been investigated, particularly in countries outside of Europe.

The present study was therefore conducted on Japanese male workers to confirm our hypothesis. We investigated how ERI, OC and social support were completely individually or combinedly associated with depressive states of workers. Subjects were limited to males, because the number of females in the corporation investigated was too small to conduct the following analyses. Additionally, we intended to exclude the influence of gender differences in the ERI model, which has been presented in previous studies<sup>6</sup>.

#### Subjects and Methods

Of the 396 male workers in a corporation, 340 workers agreed to participate in this study (response rate 85.9%). They ranged in age from 19 to 65 yr (mean of 40.0) and consisted of 142 white and 198 blue collar workers. All participants gave written consent before joining the study. Participants then underwent a self-rating questionnaire. Items included in the questionnaire were: age, education, job sector, occupational status, mean work hours per weekday, a Japanese version of the ERI questionnaire developed by Tsutsumi *et al.*<sup>14</sup>, the Center for Epidemiologic Studies Depression scale (CES-D)<sup>15</sup>, and social support items from the NIOSH general job stress instrument<sup>13</sup>. This social support question consisted of 12 items which assess support levels from the immediate supervisor (boss), other people at work, and others outside of the workplace, such as the spouse, friends and relatives. A high score in social support means low support. In the assessment of the effort-reward ratio, Tsutsumi *et al.*<sup>16</sup> recently reported that a logarithmic-transformed ratio indicated an improvement in the statistical fit. The effort-reward ratio was therefore estimated as a continuous measure by logarithmic transformation in this study. The upper one-fifth was classified as ERI. The upper one-third rank of the OC scoring was classified as OC. A depressive state was defined as a dichotomized variable, with the cut-off point at a score of 16, based on a tested Japanese version of CES-D<sup>17</sup>. With regard to social support, the participants were classified into high and low groups according to the median score. In the total sample, Cronbach's alpha was 0.81 for effort, 0.88 for reward, 0.78 for OC, 0.85 for social support and 0.84 for CES-D. Because of missing values, we could analyze

Received Feb 20, 2003; Accepted Nov 1, 2003

Correspondence to: M. Watanabe, Department of Health and Psychosocial Medicine, Aichi Medical University School of Medicine, Nagakute-cho, Aichi 480-1195, Japan  
(e-mail: misuzuwan@aichi-med-u.ac.jp)

**Table 1.** Demographic and psychosocial characteristics of the participants

Demographic and psychosocial variables	Category	n	%
Age (yr)	<30	67	24.5
	30–40	95	34.8
	40–50	60	22.0
	≥50	51	18.7
Job sector	White collar	124	45.4
	Blue collar	149	54.6
Occupational status	Subordinate	199	72.9
	Manager	74	27.1
Education	High (Beyond college)	118	43.2
	Low (Others)	155	56.8
Mean work hours	Shorter (<10 h/d)	158	57.9
	Longer (≥10 h/d)	115	42.1
Effort-reward imbalance (ERI) <sup>†</sup>	Non-ERI	202	74.0
	ERI	71	26.0
Overcommitment (OC)	Non-OC	181	66.3
	OC	92	33.7
Social support <sup>††</sup>	Low	142	52.0
	High	131	48.0
Depressive state	No (CES-D score<16)	155	56.8
	Yes (CES-D score ≥16)	118	43.2

<sup>†</sup>Classification by logarithmic ERI values. <sup>††</sup>Classification by a median score.

data in a total of only 273 participants. The demographic and psychosocial characteristics of the participants are shown in Table 1.

The SAS software (version 8.02, SAS Institute Inc., Cary, NC) was used for all statistical analyses. Simple logistic regression analyses were carried out to observe the relationships between the depressive state as the dependent variable and the studied variables as the independent variables (Table 2). In order to evaluate not only individual (excluding the influence of other selected factors), but also combinatorial, relationships of the significantly selected factors, by simple logistic regression analyses, to the depressive state, we performed a multiple logistic regression analysis. In this analysis, the dummy variables, which show each individual factor and all kinds of their combinations except for the reference variable (all factors are negative), were used as the independent variables. The effect of the odds ratio (OR) and its 95% confidence interval (CI) of the independent variables on the depressive state were then calculated. Moreover, the OR of interaction was calculated by the following equation.

$$OR = OR [(+,+)] / OR [(+,-)] \text{ OR } [(-,+)]$$

The (+,+) shows that both factors are positive, and (+,-) or (-,+) shows that only one factor is positive. The standard error of OR was estimated based on the estimated

variance-covariance of the logistic model, and Wald statistics were used for the significance test.

## Results

As shown in Table 2, significant positive associations were found between low social support, ERI, OC and depressive state in the simple logistic regression analyses. Then we estimated the effects (OR and its 95 % CI) of ERI, OC, or low social support itself, and their various combinations, on the depressive state in the multiple logistic regression analysis (Table 3). Neither ERI, OC, nor low social support was significantly associated with the depressive state by themselves. But low social support, when combined with ERI and/or OC, aggravated the risk of the depressive state in comparison with the reference group which showed high social support, non-ERI, and non-OC. The risk became most prominent when ERI, OC and low social support were all combined. Nevertheless, there were no significant interactions between ERI and OC (OR of interaction=3.34,  $p=0.31$ ), ERI and social support (OR of interaction=3.05,  $p=0.31$ ), or OC and social support (OR of interaction=2.63,  $p=0.31$ ).

## Discussion

The current study showed that social support was significantly related to the ERI model-associated

**Table 2.** Relationships between studied variables and depressive state by simple logistic regression analyses

Demographic and psychosocial variables	Standardized partial regression coefficient	p-value
Age	-0.10	0.156
Job sector	-0.07	0.306
Occupational status	-0.09	0.183
Education	0.02	0.720
Mean work hours	0.12	0.079
Social support	0.23	0.001
Effort-reward imbalance	0.19	0.005
Overcommitment	0.24	0.001

Note: Depressive state assessed by the CES-D score is a dependent variable. A high social support score means low support. See Table 1 regarding the category of each variable, except for age and mean work hours which were uncategorized.

**Table 3.** Individual and combined factors associated with a depressive state by multiple logistic regression analysis

Variables	N	Partial regression coefficient	SE	Odds ratio	95% CI	p-value
ERI (+) OC (-) LSS (-)	13	-0.38	0.70	0.68	0.17 – 2.70	0.588
ERI (-) OC (+) LSS (-)	23	0.00	0.51	1.00	0.37 – 2.73	0.996
ERI (-) OC (-) LSS (+)	65	0.29	0.35	1.34	0.67 – 2.66	0.412
ERI (+) OC (+) LSS (-)	16	0.82	0.55	2.28	0.77 – 6.76	0.137
ERI (+) OC (-) LSS (+)	20	1.02	0.51	2.79	1.03 – 7.56	0.044
ERI (-) OC (+) LSS (+)	33	1.26	0.43	3.51	1.51 – 8.14	0.004
ERI (+) OC (+) LSS (+)	21	2.62	0.67	13.7	3.69 – 50.65	0.000

Note: ERI=Effort-reward imbalance, OC=Overcommitment, LSS=Low social support. 95% CI=95% confidence interval.

(-) means non-ERI, non-OC or high social support and (+) means ERI, OC or low social support.

Reference of odds ratio is ERI (-) OC (-) LSS (-), and its number of subjects is 82. n=273.

depressive state in Japanese male workers. The risk of a depressive state was most aggravated when low social support was combined with ERI and OC. Nevertheless, the results seemed to be caused by an additional effect rather than an interactive effect. The existence of interactions was suggested by the large ORs of interactions; however, significant excess was not detected, possibly due to the small sample size and/or the logistic model's multicollinearity. There are some reports that investigated the effect of the ERI model and social support on workers' health. For instance, Stansfeld *et al.*<sup>7)</sup> reported that ERI and negative aspects of close relationships predicted the disturbance of physical, psychological, and social functioning. Kuper and colleagues<sup>18)</sup> found that the influence of ERI on the risk of coronary heart disease was noted among people with low social support at work. Our results using the depressive state as the outcome, seem to support such previous, particularly Kuper's, observations.

The relationships of ERI and OC to the depressive state by simple logistic regression analysis correspond with the findings of Tsutsumi *et al.*<sup>8)</sup>, who showed that both ERI and OC were independently associated with depression after adjustment for work environment factors. Unexpectedly, ERI or OC itself, as well as social support itself, did not have a significant impact on the depressive state in the multiple logistic regression analysis. The ERI itself was rather negatively associated with a depressive state, although it was not significant. The reason for the results is unknown; however, the small sample size, an error by chance, or tentative classifications of the ERI, OC or social support groups might have affected the results. Anyway it is suggested that the possible linkage of the ERI model to a depressive state relies heavily upon social support.

Nevertheless, the following limitations of our findings need to be taken into account. First, we could not completely neglect the possibility of causal relations of

the observed results. Otherwise, a detailed causation could not be clarified, in view of the cross-sectional design of the study. Second, several factors, such as a possible selection bias: good communicators were more likely to participate in this study, and the selectively missing data, as well as the small sample size and multicollinearity, might have affected the results. Third, the study of male, but not female, workers may limit the significance of this study. Fourth, we could not rule out the possibility that depressed workers rather than non-depressed workers reported their negative experience at work, and this might have affected the results.

In conclusion, the results obtained indicate that social support plays a significant role in the effect of the ERI model on workers' depression, although its interactive effect remains unclear. It is therefore required not only to increase rewards and decrease efforts and OC, but also to increase social support, to prevent workers' depression relevant to the ERI model. Further investigations incorporating prospective studies with a larger working population are required in order to develop our findings.

## References

- 1) C Tennant: Work-related stress and depressive disorders. *J Psychosom Res* 51, 697–704 (2001)
- 2) S Holmes: Work-related stress: a brief review. *J R Soc Health* 121, 230–235 (2001)
- 3) J Siegrist: Adverse health effects of high-effort/low-reward conditions. *J Occup Health Psychol* 1, 27–41 (1996)
- 4) Matschinger H, Siegrist J, Siegrist K, Dittmann KH: Type A as a coping career-toward a conceptual and methodological redefinition. In: Schmidt TH, Dembroski TM, Blumchen G, eds. *Biological and Psychological Factors in Cardiovascular Disease*. Berlin: Springer, 1986: 104–126.
- 5) J Siegrist, R Peter, P Cremer and D Seidel: Chronic work stress is associated with atherogenic lipids and elevated fibrinogen in middle-aged men. *J Intern Med* 242, 149–156 (1997)
- 6) R Peter, L Alfredsson, N Hammar, J Siegrist, T Theorell and P Westerholm: High effort, low reward, and cardiovascular risk factors in employed Swedish men and women: baseline results from the WOLF Study. *J Epidemiol Community Health* 52, 540–547 (1998)
- 7) SA Stansfeld, R Fuhrer, MJ Shipley and MG Marmot: Work characteristics predict psychiatric disorder: prospective results from the Whitehall II Study. *Occup Environ Med* 56, 302–307 (1999)
- 8) A Tsutsumi, K Kayaba, T Theorell and J Siegrist: Association between job stress and depression among Japanese employees threatened by job loss in a comparison between two complementary job-stress models. *Scand J Work Environ Health* 27, 146–153 (2001)
- 9) A Tsutsumi, M Nagami, K Morimoto and T Matoba: Responsiveness of measures in the effort-reward imbalance questionnaire to organizational changes. A validation study. *J Psychosom Res* 52, 249–256 (2002)
- 10) Frese M: Social support as a moderator of the relationship between work stressors and psychological dysfunctioning: a longitudinal study with objective measures. *J Occup Health Psychol* 4, 179–192 (1999)
- 11) JS House, KR Landis and D Umberson: Social relationships and health. *Science* 241, 540–545 (1988)
- 12) RA Karasek Jr: Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q* 24, 285–307 (1979)
- 13) JJ Hurrell and MA McLaney: Exposure to job stress: A new psychometric instrument. *Scand J Work Environ Health* 14, 27–28 (1988)
- 14) A Tsutsumi, T Ishitake, R Peter, J Siegrist and T Matoba: The Japanese version of the Effort-Reward Imbalance Questionnaire: a study in dental technicians. *Work Stress* 15, 86–96 (2001).
- 15) LS Radloff: The CES-D Scale: A self-report depression scale for research in the general population. *Appl Psychol Meas* 1, 385–401 (1977)
- 16) A Tsutsumi, K Kayaba, M Nagami, A Miki, Y Kawano, Y Ohya, Y Odagiri and T Shimomitsu: The effort-reward imbalance model: experience in Japanese working population. *J Occup Health* 44, 398–407 (2002)
- 17) S Shima, T Shikano, T Kitamura and M Asai: New Self-Rating Scales for Depression. *Seishin Igaku* 27, 717–723 (1985)
- 18) H Kuper, A Singh-Manoux, J Siegrist and M Marmot. When reciprocity fails: effort-reward imbalance in relation to coronary heart disease and health functioning within the Whitehall II study. *Occup Environ Med* 59, 777–784 (2002)