

# Job stress as a risk factor for absences among manual workers: a 12-month follow-up study

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*Received January 30, 2015 and accepted July 8, 2015*

*Published online in J-STAGE July 23, 2015*

**Abstract:** This study was conducted to evaluate the impact of job stress on absence from work caused by illnesses and accidents through a prospective research design. A total of 2,349 manual workers were included in this analysis. In the first survey, job stress was determined using the Korean Occupational Stress Scale-Short Form. In the second survey, information on absence due to accidents or illnesses during the past one year was obtained through a questionnaire. The relationship was analyzed using a logistic regression model with multiple imputation. After adjusting for confounding variables for males, absence due to accidents was statistically associated with high job demand, insufficient job control, inadequate social support, and organizational injustice. In addition, high job demands and organizational injustice were related to increased absence due to illnesses in both genders. A lack of reward was associated with increased absence due to illnesses among female workers. We found that job stress was associated with a higher risk of absence caused by accidents or illnesses of manual workers.

**Key words:** Job stress, Absence, Accident, Illness, Manual worker

## Introduction

The International Labor Organization currently recommends an eight-hour work day<sup>1)</sup>. According to a survey conducted by the Organization for Economic Cooperation and Development, the average work hours for Koreans amounted to 2,163 h per yr in 2012, which breaks down to slightly more than eight hours per day<sup>2)</sup>. Workers doing manual jobs, in particular, spend a major part of their lives at work and are exposed to various job-related factors of potential harm that might affect, directly and indirectly,

their mental and physical health. These harmful factors can be categorized differently depending on the measure, but they are normally grouped into three categories: physical factors such as vibration, noises, dust, and low/high temperature; chemical factors such as hazardous chemical compounds; and psychosocial factors such as job stress<sup>3)</sup>.

Absence from work is defined as a “state of not being present at the designated place of work during a normally scheduled work period.” Absence can result from many reasons including illnesses, accidents, injuries, and personal circumstances, all of which could occur individually or in connection. Some European studies have estimated that the average length of absence was 3–6% of total work hours, which is equivalent to 2.5% of the Gross Domestic Product<sup>4)</sup>. Absence caused by illness lowers overall pro-

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ductivity and increases the cost for an organization. It also reflects the health status of the workers as working environment and conditions of the employing establishment might affect the health and disease prevalence among workers<sup>5</sup>). Accordingly, absence caused by illness is often adopted as an index to measure a worker's health, his or her home life, and business productivity, among other factors<sup>6</sup>). Absence caused by accidents, however, is relatively less utilized as an index, although growing attention is being paid to accidents especially in highly industrialized countries, because the working population is rapidly aging and the loss of work hours caused by a worker's treatment and recovery process following an accident directly increases overall accident-related cost<sup>7</sup>).

Many studies have examined the influence of job stress as the dimensions of job demand-control-support (JDCS) model on health and well-being<sup>8-10</sup>). Workers with more job demand and less job control are more likely to experience greater levels of stress than workers with fewer demands and more job control<sup>10</sup>). Social support from colleagues and supervisors at work in a given situation could affect the stress process<sup>11</sup>). Although there is a certain degree of gender difference, a large volume of data suggests that high job demand at work and poor support from colleagues, both of them subscales of job stress, are related to the prevalence of accidents at work<sup>12, 13</sup>). Studies in various occupational groups have shown the links of work-related absence to job stressors, such as reward imbalance<sup>14</sup>), organizational injustice<sup>15</sup>), safety climate at work<sup>16</sup>), or insecurity about the job<sup>17</sup>).

Measures of workplace psychosocial stressors have been linked to the occurrence of cardiovascular<sup>18</sup>), common mental disorders<sup>19-21</sup>), and also musculoskeletal disorders<sup>22, 23</sup>), and have also found to predict sickness absence in some prospective studies<sup>24-27</sup>). These studies are predominantly based on the JDCS model and focus on a low risk population. They have consistently found that low decision latitude is related to a high level of sickness absence<sup>28</sup>). However, the evidence about the effects of psychological demands or social support at work on such absence is still unclear<sup>29</sup>).

Although a large body of research to date has looked at the impact of job stress on absenteeism, very limited studies have examined the effects of different sources of job stress on absence due to illnesses or accidents of manual workers. Moreover, most previous studies were cross-sectional and confined the participants to small groups or groups with particular characteristics, and focused only on a limited subscale of job stress. Hence, it has been difficult

to grasp the exact scope of the impact of different aspects of job stress on absence for specific types of workers. In this context, the present study set out to estimate and analyze the impact of broad aspects of job stress on absence from work caused by illnesses and accidents for manual workers through a prospective research design.

## Subjects and Methods

### *Study participants*

The present study was carried out as a one-year prospective study with participants recruited from a group of people working at 23 manufacturing companies in the Incheon area who were registered for health examinations at the department of occupational and environmental medicine at a university hospital. In Korea, workers are required to undergo health examinations on a regular basis under the Industrial Safety and Health Act. At the first round of surveys conducted in 2009, a total of 3,572 workers filled out a self-reporting questionnaire that explored personal/occupational characteristics and job stress. In 2010, the second round of surveys was carried out on the workers from the same business entities by asking them to respond to a self-reporting questionnaire in which they were asked about their own absences; 2,956 subjects responded to the second questionnaire (recovery rate of 82.8%). Of these, 607 workers with poor responses to job stress (more than one missing value in each of the subscales) or with missing values on absence were excluded, yielding 2,349 respondents for the final analysis.

General characteristics covered gender, age, marital status, education, and the duration of daily sleep. Age was divided into four ranges: under 30, 30-39, 40-49, and over 50, while marital status was chosen from among unmarried, married, and widowed/divorced. Education level was chosen from middle school or lower, high school, and university, and the duration of sleep was divided into under 6 h, 6-8 h, and 9 h or over.

Occupational characteristics included type of employment (permanent vs. temporary), type of work (shift vs. non-shift), length of employment (under 1 yr, 1-4 yr, 5-9 yr, and 10 yr or over), and weekly work hours (40 h or under, 41-59 h, and 60 h or over).

The study protocol was approved by the institutional review board of Inha University Hospital. Informed written consent was given by the responders. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration

of 1975, as revised in 2000.

#### *Measurement of job stress*

The independent variable, job stress, was assessed using the short form of the Korean Occupational Stress Scale (KOSS-SF), which was prepared and validated by the National Study for Development and Standardization of Occupational Stress<sup>30</sup>. The tool consisted of 24 questions, each of which was answered using a four-point Likert scale: “I do not agree at all,” “I do not agree,” “I agree,” and “I agree very much.” There were seven subscales of job stress: high job demand, insufficient job control, job insecurity, inadequate social support, organizational injustice, lack of reward, and discomfort in occupational climate. An acceptable answer was expected for at least 17 items. We included subjects with a maximum of one missing value in each of the subscales. The missing values of respondent were replaced by the mean of the existing values of the respondent on the question. Scores for each substrate were calculated based on the formula developed by the original scale designers. Respondents were then divided into two groups—a high stress group and a low stress group—based on how much their total scores deviated from the median<sup>30</sup>.

#### *Measurement of absence due to accidents and illnesses*

The dependent variable was whether or not a worker had been absent from work because of an accident or illness during the past one year. Those who responded “yes” to either (1) “Have you ever been absent from work because of any accident occurring at work in the past year?” or (2) “Have you ever been absent from work due to illness in the past year?” were included in the absence group.

#### *Statistical analyses*

All statistical analyses were stratified by gender. The dependent variables are absence due to accidents and absence due to illnesses over the past 12 months, separately. Differences in absence according to the subjects’ general characteristics, their work-related characteristics, and job stress were analyzed through a  $\chi^2$  test. We calculated the gender-specific odds ratio (OR) of job stress subscales for absence using four multivariate logistic regression models with multiple imputation (for handling missing data): two genders X two outcomes (i.e., absence due to accidents and absence due to illnesses). Age and potential confounding variables entered into each final models included those that were significant in a  $\chi^2$  test ( $p \leq 0.2$ ); (1) Model for

absence due to accidents in male was adjusted for age, educational status, sleeping time, shift work, tenure, and working hours; (2) Model for absence due to accidents in female was adjusted for age, sleeping time, employment status, and tenure; (3) Model for absence due to illnesses in male was adjusted for age, marital status, sleeping time, employment status, shift work, tenure, and working hours; (4) Model for absence due to illnesses in female was adjusted for age, marital status, educational status, shift work, and tenure. Missing data in confounding variables were imputed with the Markov Chain Monte Carlo method, which assumes that the variables with missing data are multivariate normal and missing at random. This method has been shown to produce accurate results even when data are missing on dichotomous variables<sup>31</sup>. The data were analyzed using SPSS v18.0 software (SPSS Inc., Chicago, IL, USA).

## **Results**

Table 1 compares general and occupational characteristics, and job stress between the study group and dropout/exclusion group. There was significant difference in age, educational level, and employment status between the two groups: the study group was younger than the dropout/exclusion group and the proportions of college or higher or regular employment were higher in the study group than those in the dropout/exclusion group. However, there were no statistical significances in gender, marital status, sleeping time, shift work, tenure, and working hours. Among the job stress subscales, the mean score of insufficient job control in the study group was significantly lower than the dropout/exclusion group. There is no significant difference in other stress variables between the study group and the dropout/exclusion group.

Table 2 shows the general and occupational characteristics and absence due to accidents according to gender. As far as absence caused by accidents was concerned, there was no significant difference between genders (male, 3.0%; female, 2.4%,  $p=0.432$ ). Among males, there were statistically significant differences in absence due to accidents by education level; the proportions of absentees were 14.7% in the middle school or lower group, 3.2% in high school, and 1.5% in college or more ( $p < 0.001$ ). Significant differences were also found by shift work (4.2% in non-shift workers; 1.7% in shift workers,  $p=0.002$ ), job tenure (8.3% in those with less than a year; 4.6% in those with 1–4 yr; 2.8% in those with 5–9 yr; 2.5% in those with 10 yr or more,  $p=0.043$ ), and weekly mean working

**Table 1. Comparison of general and occupational characteristics between study and dropout/exclusion groups**

	Study group		Dropout/exclusion group		<i>p</i> -value <sup>†</sup>
	Mean (SD)	N* (%)	Mean (SD)	N* (%)	
Total		2,349 (65.8)		1,223 (34.2)	
Gender					
Male		1,807 (76.9)		935 (76.5)	0.750
Female		542 (23.1)		288 (23.5)	
Age (yr)	37.25 (9.83)		39.84 (10.85)		<0.001
Marital status					
Never married		650 (31.6)		188 (33.5)	0.131
Married		1,386 (67.3)		362 (64.4)	
Divorced or widowed		24 (1.2)		12 (2.1)	
Educational status					
≤Middle school		44 (2.2)		51 (9.3)	<0.001
High school		1,322 (64.8)		348 (63.2)	
≥College		675 (33.1)		152 (27.6)	
Sleeping time (h/d)	6.71 (1.18)		6.73 (1.17)		0.784
Employment status					
Regular		2,121 (92.3)		535 (84.7)	<0.001
Temporary		176 (7.7)		97 (15.3)	
Shift work					
No		801 (35.9)		232 (38.7)	0.194
Yes		1,433 (64.1)		367 (61.3)	
Tenure	12.55 (8.50)		12.29 (9.73)		0.545
Working h/wk	45.36 (8.18)		45.13 (7.91)		0.533
Job stress		2,349 (80.0)		586 (20.0)	
High job demand	43.83 (17.31)		42.81 (16.91)		0.201
Insufficient job control	56.35 (19.21)		59.09 (21.48)		0.005
Inadequate social support	38.54 (16.81)		40.09 (19.75)		0.079
Job insecurity	34.25 (20.09)		33.88 (22.69)		0.711
Organizational injustice	45.61 (17.39)		46.20 (20.51)		0.527
Lack of reward	45.24 (18.63)		46.41 (20.86)		0.214
Discomfort in occupational climate	32.52 (15.66)		32.82 (17.64)		0.708

\*Some responses were omitted. <sup>†</sup> $\chi^2$  test or Student's *t*-test

hours (9.1% in those working 60 h or more; 3.1% in those working 41–59 h; 2.0% in those working less than 40 h, *p*=0.001). However, no significant difference in absence due to accidents was observed in male workers according to age, marital status, sleeping time, and employment status. Among females, significant differences were found by sleep duration, with 8.2% in the 6 h or under group having been absent from work, a significantly higher rate than in the other sleep duration groups (*p*=0.049). According to employment status, experience of absence due to accidents was higher in contingent female workers (7.0%) than in permanent female workers (2.1), although the difference was marginally significant (*p*=0.081).

Table 3 summarizes the general and occupational characteristics and absence due to illnesses according

to gender. Female workers (17.3%) were significantly more prone than males (6.0%) to absence due to illnesses (*p*<0.001). Among males, the rate of absence due to illnesses was highest for subjects <30 yr (13.1%), followed by 30–39 yr (7.4%), 40–49 yr (4.4%), and ≥50 yr (1.6%) (*p*<0.001). The rate of absence due to illnesses was highest in men who were unmarried (10.9%) and lowest in married men (4.7%) (*p*<0.001). The group of participants who slept for less than 6 h were most likely to be absent from work, followed by 6–8-h sleep groups (*p*=0.018). Male workers who had worked less than 1 yr showed the highest rate of absence (13.3%), whereas those who had worked more than 10 yr showed the lowest rate (4.4%) (*p*<0.001). There was no statistically significant difference in absence due to illnesses in male workers according to educational

**Table 2. General and occupational characteristics of participants with absence due to accidents according to gender**

	Male			Female		
	No. of case*/total**	%	<i>p</i> -value†	No. of case*/total**	%	<i>p</i> -value†
Total	55/1,807	3.0		13/542	2.4	
Age (yr)						
<30	5/198	2.5	0.961	10/394	2.5	0.334
30–39	24/713	3.4		1/109	0.9	
40–49	16/574	2.8		2/31	6.5	
≥50	10/321	3.1		0/8	0.0	
Marital status						
Never married	13/329	4.0	0.603	11/321	3.4	0.313
Married	31/1,215	2.6		2/171	1.2	
Divorced or widowed	0/20	0.0		0/4	0.0	
Educational status						
≤Middle school	5/34	14.7	<0.001	1/10	10.0	0.298
High school	29/904	3.2		11/418	2.6	
≥College	9/611	1.5		1/64	1.6	
Sleeping time (h/d)						
<6	12/207	5.8	0.120	4/49	8.2	0.049
6–8	31/1,228	2.5		8/382	2.1	
≥9	0/32	0.0		1/61	1.6	
Employment status						
Regular	48/1635	2.9	0.411	10/486	2.1	0.081
Temporary	5/133	3.8		3/43	7.0	
Shift work						
No	30/752	4.2	0.002	0/48	0.0	0.619
Yes	15/951	1.7		13/482	2.7	
Tenure						
<1	5/60	8.3	0.043	3/32	9.4	0.104
1–4	8/172	4.6		4/169	2.4	
5–9	10/351	2.8		5/223	2.2	
≥10	29/1,160	2.5		1/104	1.0	
Working h/wk						
≤40	16/818	2.0	0.001	3/148	2.0	0.419
41–59	22/710	3.1		8/364	2.2	
≥60	10/110	9.1		1/14	7.1	

\*The number of subjects experiencing absence due to accidents. \*\*The number of participants; some responses were omitted. †Based on the  $\chi^2$  test or Fisher's Exact test.

status, employment status, shift work, and working hours. Among females, significant differences were found by age (20.1%, 10.15, 12.9%, and 0.0% for women aged <30, 30–39, 40–49, and ≥50 yr, respectively,  $p=0.048$ ), marital status (20.9% 2.8% in never married women; 11.1% in married women,  $p=0.019$ ), and tenure (28.1% in those with less than a year; 21.9% in 1–4 yr; 16.1% in 5–9 yr; 9.6% in 10 yr or more,  $p=0.020$ ).

Table 4 presents the gender-specific OR (with 95% CI) of job stress subscales for absence due to accidents. For male workers, groups with high scores for high job demand

(OR=2.11, 1.22–3.65), insufficient job control (OR=2.85, 1.59–5.09), inadequate social support (OR=2.12, 1.24–3.64), and organizational injustice (OR=1.81, 1.05–3.10) showed statistically significant crude ORs. After adjusting for confounding variables, statistically significant ORs were found for high job demand (OR=2.16, 1.21–3.86), insufficient job control (OR=2.16, 1.19–3.97), inadequate social support (OR=1.77, 1.00–3.10), and organizational injustice (OR=1.82, 1.04–3.19). No significant ORs were found for job insecurity, lack of reward, and discomfort in occupational climate. Conversely, for females, there were

**Table 3. General and occupational characteristics of participants with absence due to illnesses according to gender**

	Male			Female		
	No. of case*/total**	%	p-value†	No. of case/total	%	p-value†
Total	109/1,807	6.0		94/542	17.3	
Age (yr)						
<30	26/198	13.1	<0.001	79/394	20.1	0.048
30–39	53/714	7.4		11/109	10.1	
40–49	25/574	4.4		4/31	12.9	
≥50	5/321	1.6		0/8	0.0	
Marital status						
Never married	36/329	10.9	<0.001	67/321	20.9	0.019
Married	57/1,215	4.7		19/171	11.1	
Divorced or widowed	1/20	5.0		0/4	0.0	
Educational status						
≤Middle school	1/34	2.9	0.784	0/10	0.0	0.058
High school	55/903	6.1		80/418	19.1	
≥College	33/610	5.4		6/64	9.4	
Sleeping time (h/d)						
<6	23/207	11.1	0.018	12/49	24.5	0.449
6–8	70/1,228	5.7		62/382	16.2	
≥9	0/32	0.0		12/61	19.7	
Employment status						
Regular	101/1,635	6.2	0.168	82/486	16.7	0.275
Temporary	4/133	3.0		10/43	23.3	
Shift work						
No	50/753	6.6	0.198	4/48	8.3	0.088
Yes	49/951	5.2		88/482	18.3	
Tenure						
<1	8/60	13.3	<0.001	9/32	28.1	0.020
1–4	18/173	10.4		37/169	21.9	
5–9	28/351	8.0		36/223	16.1	
≥10	51/1,160	4.4		10/104	9.6	
Working h/wk						
≤40	43/818	5.3	0.134	20/148	13.5	0.483
41–59	54/711	7.5		67/364	18.4	
≥60	7/110	6.4		2/14	14.3	

\*The number of subjects experiencing absence due to illnesses. \*\*The number of participants; some responses were omitted. †Based on the  $\chi^2$  test or Fisher’s Exact test

no significant ORs for all subscales of job stress.

Table 5 presents the gender-specific OR (with 95% CI) of job stress subscales for absence due to illnesses. For males, when crude ORs were calculated for absence caused by illnesses in each substrate of job stress, high job demand (OR=1.81, 1.23–2.68), and organizational injustice (OR=1.55, 1.05–2.28) all were found to have statistically significant crude ORs. After adjusting for confounding variables, statistically significant ORs were found for high job demand (OR=1.75, 1.16–2.64), and organizational injustice (OR=1.63, 1.09–2.46). Borderline

significant ORs were found for lack of reward (OR=1.42, 0.95–2.14). For females, high job demand (OR=1.63, 1.04–2.55), and organizational injustice (OR=1.76, 1.13–2.76) were found to have statistically significant crude ORs. After adjusting for confounding variables, the ORs were 1.65 (95% CI 1.03–2.61) for high job demand and 2.23 (95% CI 1.38–3.60) for organizational injustice. No significant OR was observed for the remainder of the job stress subscales.



**Table 4. Gender-specific odds ratios (OR) and 95% confidence intervals (CI) of job stress subscales for absence due to accidents**

	Male					Female						
	No. of case*/total**	%	Crude		Adjusted†		No. of case*/total**	%	Crude		Adjusted‡	
			OR	95% CI	OR	95% CI			OR	95% CI	OR	95% CI
<b>High job demand</b>												
Low	22/1,046	2.2	1.00		1.00		9/279	3.2	1.00		1.00	
High	33/761	4.3	2.11	1.22–3.65	2.16	1.21–3.86	4/263	1.5	0.46	0.14–1.52	0.41	0.12–1.39
<b>Insufficient job control</b>												
Low	17/999	1.7	1.00		1.00		6/362	1.7	1.00		1.00	
High	38/808	4.7	2.85	1.59–5.09	2.16	1.19–3.97	7/180	3.9	2.40	0.80–7.25	1.95	0.63–6.11
<b>Inadequate social support</b>												
Low	28/1,233	2.3	1.00		1.00		9/340	2.6	1.00		1.00	
High	27/574	4.7	2.12	1.24–3.64	1.77	1.00–3.10	4/202	2.0	0.74	0.23–2.44	0.81	0.22–2.92
<b>Job insecurity</b>												
Low	34/1,271	2.7	1.00		1.00		7/345	2.0	1.00		1.00	
High	21/536	3.9	1.48	0.85–2.58	1.58	0.89–2.83	6/197	3.0	1.52	0.50–4.58	1.55	0.48–5.10
<b>Organizational injustice</b>												
Low	25/1,078	2.3	1.00		1.00		6/305	2.0	1.00		1.00	
High	30/729	4.1	1.81	1.05–3.10	1.82	1.04–3.19	7/237	3.0	1.52	0.50–4.57	1.79	0.54–5.87
<b>Lack of reward</b>												
Low	26/983	2.6	1.00		1.00		5/280	1.8	1.00		1.00	
High	29/824	3.5	1.34	0.78–2.30	1.30	0.74–1.79	8/262	3.1	1.73	0.56–5.36	1.54	0.48–4.95
<b>Discomfort in occupational climate</b>												
Low	35/1,212	2.9	1.00		1.00		7/358	2.0	1.00		1.00	
High	20/595	3.4	1.17	0.70–2.04	1.25	0.69–2.23	6/184	3.3	1.69	0.56–5.10	1.79	0.54–5.87

\*The number of subjects experiencing absence due to accidents. \*\*The number of participants; some responses were omitted. †Adjusting for age, educational status, sleeping time, shift work, tenure, and working hours. ‡Adjusting for age, sleeping time, employment status, and tenure

## Discussion

We conducted a prospective study to investigate correlation between job stress and absence from work in 2,349 manual workers from 23 small- to medium-sized manufacturing companies in Incheon, South Korea. When all responses on absence were incorporated, 10.0% (234) of all participants had been absent from work due to either accidents or illnesses in the past year from the time of our first survey. Results of the second Korean Working Conditions Survey presented slight differences in the figures, with absence at 8.1% in the past year from the time of the survey<sup>32</sup>. We found that high job demand, insufficient job control, inadequate social support, and organizational injustice were associated with a higher risk of absence caused by accidents in male workers, yet, high job demand and organizational injustice were predictive of absence caused by illnesses in both genders.

Our findings are in general agreement with previous studies on the relationship between job stress and absence. Increases in job strain induced by high job demand and

insufficient job control were reported to be correlated with absence caused by illnesses<sup>33</sup>, and a large-scale cross-sectional study indicated that, even after adjusting for the confounding variables, a significant correlation was found between absence caused by illnesses and insufficient job control at work and low social support<sup>34</sup>. Insufficient job control was significantly associated with absence due to accidents, only in men. In contrast, women showed no difference in the risk of absence according to job control. There are a number of other cases that saw a similar lack of correlation<sup>35, 36</sup>. Comprehensive analyses on the type of employment (permanent vs. temporary) and absence caused by both accidents and illnesses showed that high job demand and insufficient job control at work had an effect on absence, with temporary workers showing a higher correlation<sup>37</sup>.

In agreement with previous studies<sup>11, 15</sup>, this study revealed that absence was related to organizational injustice, implying that the type of stress not only directly related to one's job but also connected to such organizational aspects as management system, resources, internal conflicts, and

**Table 5. Gender-specific odds ratios (OR) and 95% confidence intervals (CI) of job stress subscales for absence due to illnesses**

	Male						Female					
	No. of case*/total**	%	Crude		Adjusted†		No. of case*/total**	%	Crude		Adjusted‡	
			OR	95% CI	OR	95% CI			OR	95% CI	OR	95% CI
High job demand												
Low	48/1,046	4.6	1.00		1.00		39/279	14.0	1.00		1.00	
High	61/761	8.0	1.81	1.23–2.68	1.75	1.16–2.64	55/263	20.9	1.63	1.04–2.55	1.65	1.03–2.61
Insufficient job control												
Low	52/999	5.2	1.00		1.00		65/362	18.0	1.00		1.00	
High	57/808	7.1	1.38	0.94–2.04	1.32	0.89–1.97	29/180	16.1	0.88	0.54–1.42	0.79	0.48–1.30
Inadequate social support												
Low	72/1,233	5.8	1.00		1.00		61/340	17.9	1.00		1.00	
High	37/574	6.4	1.11	0.74–1.67	1.28	0.84–1.97	33/202	16.3	0.89	0.56–1.42	0.97	0.60–1.57
Job insecurity												
Low	74/1,271	5.8	1.00		1.00		61/345	17.7	1.00		1.00	
High	35/536	6.5	1.13	0.75–1.71	1.26	0.82–1.95	33/197	16.8	0.94	0.59–1.49	1.00	0.61–1.63
Organizational injustice												
Low	54/1,078	5.0	1.00		1.00		42/305	13.8	1.00		1.00	
High	55/729	7.5	1.55	1.05–2.28	1.63	1.09–2.46	52/237	21.6	1.76	1.13–2.76	2.23	1.38–3.60
Lack of reward												
Low	52/983	5.3	1.00		1.00		43/280	15.4	1.00		1.00	
High	57/824	6.9	1.33	0.90–1.96	1.42	0.95–2.14	51/262	19.5	1.33	0.85–2.08	1.39	0.88–2.20
Discomfort in occupational climate												
Low	69/1,212	5.7	1.00		1.00		62/358	17.3	1.00		1.00	
High	40/595	6.7	1.19	0.80–1.79	1.17	0.78–1.79	32/184	17.4	1.01	0.63–1.61	1.08	0.66–1.77

\*The number of subjects experiencing absence due to illnesses. \*\*The number of participants; some responses were omitted. †Adjusting for age, marital status, sleeping time, employment status, shift work, tenure, and working hours. ‡Adjusting for age, marital status, educational status, shift work, and tenure

communicational issues affecting absence<sup>15, 30</sup>). A recent study has shown that perceived injustice at work was significantly associated with an increased risk of occupational disease and absenteeism for Korean wage employees<sup>38</sup>). Moreover, employees who experienced low levels of organizational justice at work were more vulnerable to poor psychological and physical health problems and had a higher risk of sickness absences and injury<sup>39–45</sup>).

We found that among men lack of reward increased the risk of sickness absence, though the difference was marginally significant. This result is consistent with previous studies on effort-reward imbalance and sickness absence<sup>10, 46</sup>). Several studies have investigated the relationship between job insecurity and sickness absence in various occupations, with inconsistent results<sup>13, 47, 48</sup>). In the present study, job insecurity did not predict absence. Although job insecurity and the absence of employees were measured differently in different studies, a recent study in Europe also did not find the association of high job insecurity at work with long-term sickness absence<sup>48</sup>). Contrary to previous studies that reported the associa-

tion of low levels of safety climate and work-related injuries<sup>12, 49</sup>), our findings indicated that it did not appear to affect absence caused by accidents or illnesses among manual workers.

Although the mechanism involved has not yet been clarified, perceived job stress can act as a stressor, and it may increase vulnerability to psychological and physical health problems through stress induced responses which, in turn, may increase the risk of absence in the workplace. Job stress can also have a negative impact on mental health<sup>20</sup>) and contribute to absence by lowering attentional and cognitive abilities and causing fatigue and lack of enthusiasm, all of which are conducive to accidents. Furthermore, heightened job stress might trigger excessive use of alcohol and tobacco<sup>50</sup>), which also can result in absence.

Previous studies examining gender and occupational injury found the sex disparity in occupational injury with female workers at higher risk compared with their male counterparts in manufacturing environment<sup>51, 52</sup>). Injury disparity in female workers can be explained by several factors. Previous studies found that a variety of psycho-



logical factors (i.e., skill underutilization, gender discrimination, and over-performance), lack of personal protective clothing and tools designed for women, adequate job training, and appropriate restroom facilities were associated with adverse psychological and physical outcomes<sup>53–55</sup>. However, we found that workers who experienced high job stress had an increased risk of absence due to accidents, but the effect was only significant in males. We suggest that not enough job detail information or potential risk factors (i.e., house-work time during weekdays) may bias the results toward the null.

#### *Limitations of the study*

There are a few limitations to the present study. First, we adopted a self-reported questionnaire to measure the level of job stress and absence from work, and, thus, it was possible that our respondents may have had recall bias. We argue that the degree of bias might have been relatively minor compared with previous cross-sectional studies, although each round of our surveys was one year apart, and, therefore, the possibility of memory distortion cannot be completely ruled out. An additional point to note is that the survey responses on the incidences of work absence based on one's subjective report might have offered less objectivity than an official work record or absence log data would have. Second, our analyses were conducted on the data that were collected from those who had participated in both rounds of the survey; those who only took part in the first round were not included. Possible differences in characteristics amongst the participants might have biased the results. When the analyzed study and dropout/exclusion groups were compared in terms of their characteristics, there were significant differences in some variables (i.e. age, educational status, employment status, and insufficient job control). This might have influenced the estimated impact of job stress on absence but not to a considerable degree given the lack of a statistically significant difference between the two groups' absence responses. But, the finding of mean score of insufficient job control for the dropout/exclusion group was significantly lower than the study group may be a potential bias for the study findings about job control. Finally, the number of missing data in some covariates such as sleeping time and educational status is large. These missing data may affect the results, although we handled missing data with imputation and adjusted for these variables in multivariate logistic regression models.

#### *Conclusions*

This prospective study contributes to the limited scientific literature on the relationship between the broad aspects of job stress and absence caused by accidents and illnesses. Evidence from the study indicates that high job demand, insufficient job control, inadequate social support, and organizational injustice are key factors associated with an increased risk of absence due to accidents in male workers. In addition, high job demands and organizational injustice were related to increased absence due to illnesses in both genders. A lack of reward was associated with increased absence due to illnesses among female workers. Job absence caused by accidents or illnesses is an important issue that merits continued attention and management. It deteriorates the quality of workers' lives on a personal level and imposes direct economic cost on the employer by decreasing overall labor productivity. Our results could be useful for guiding intervention programs related to the quality of workers' lives, in particular with the management of work absence in manual workers, addressing unfavorable work related psychosocial job stress.

#### **Acknowledgement**

This work was supported by INHA UNIVERSITY Research Grant.

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