Association between Job Stress and Insomnia in Korean Workers

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Abstract: Association between Job Stress and Insomnia in Korean Workers: Hwan-Cheol KIM, *et al*. Department of Occupational and Environmental Medicine, Inha University Hospital, Korea— Objective: We investigated the association between job stress and insomnia in a large nationwide samples of Korean workers. **Methods:** In this cross-sectional study, a total of 8,155 workers from a nationwide sample were recruited. We surveyed the subjects' socio-demographic and work-related characteristics and seven subscales of occupational stress using the Korean Occupational Stress Scale Short Form. Each subscales of job stress was dichotomized into higher or lower group by respective median scores. Insomnia was defined as having at least one of the three sleep symptoms. we performed multivariate logistic regression analysis to identify association between job stress and insomnia. **Results:** We found that individuals with relatively high job stress experienced insomnia significantly more frequently, and the significance was maintained even after adjustment for confounding variables(high job demand: OR: 1.30, 95% CI: 1.14–1.47; insufficient job control: OR: 1.13, 95% CI: 0.99–1.29; inadequate social support: OR: 1.30, 95% CI: 1.14–1.47; job insecurity: OR: 1.25, 95% CI: 1.11–1.44; organizational injustice: OR: 1.27, 95% CI: 1.12–1.44; lack of reward: OR: 1.18, 95% CI: 1.04–1.34; discomfort in occupational climate: OR: 1.38, 95% CI: 1.22–1.57; total job stress: OR: 1.45, 95% CI: 1.28–1.64). **Conclusion:** This study suggested that job stress is possible risk factor for insomnia and that particularly discomfort in occupational climate and inadequate social support have more strong relation to insomnia in Korea.
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Key words: Insomnia, Job stress, Korean occupational stress scale (KOSS)

Sleep disorders are medical conditions that disrupt sleeping patterns and cause several physical, mental and emotional health problems[1]. One of the most common sleep disorders is insomnia. It is characterized by difficulty with sleep induction, awakening during the night, and early-morning awakening and, in general, occurs more frequently in older people or women[2,3]. Insomnia can be brought on by psychosocial causes, comorbid medical disorders, and other factors (i.e., overuse of caffeine and alcohol, jet leg, and prescription drugs)[2–5]. Occupational risk factors, such as shift work and job stress, can be also linked to insomnia[6,7].

Insomnia impacts many aspects of life from individual health and well-being to social or occupational areas. In particular, insomnia at work deserves much attention. Poor sleep not only affects workers individual health problems, such as impairment of cognitive function, and current and subsequent affective diseases[8,9], but is associated with economic hardship in terms of poor work performance, absenteeism, and increases in accidents at work[9,10]. In addition, as mentioned above, work-related conditions can be an important factor of disturbed sleep[3,6]. For example, shift work is a well-known occupational risk factor for insomnia, and there is emerging evidence that individuals with shift work are at higher risk for lack of sleep[7,11]. Job stress has also been suspected to be an occupational risk factor for insomnia with the evidence showing a significant relationship between job stresses and sleeping problems

including insomnia[12–14]. Recent studies from Japan reported that the feeling useful to others in the workplace was negatively associated with sleep disturbance and workplace bullying mediated between job strain and sleep disturbance[15, 16].

Despite numerous studies have been conducted in Europe and Japan, little research on job stress and sleep has been conducted in the Korean context. Considering that job stress is a fairly common problem in the majority of workers with the existence of cultural differences in the perceptions of stressors, more studies need to clarify the effect of job stress on insomnia. There may be international differences in the significance and magnitude of associations due to variations in cultural contexts. Furthermore, although previous researches focused on aspects of job design, namely task related workplace stressors such as job demand and job control, consideration of work stressors related to interpersonal conflict, organizational injustice, occupational climate may be important.

Korean employees have faced unique work environments insofar as changes in the social and economical sectors and in the general cultural milieu have triggered high levels of job stress[17]. South Korea has experienced rapid social and economic changes since the 1997 economic crisis. Structural changes in the form of organizational downsizing and restructuring, as well as instability in the labor market, have increased job insecurity and created both physical and psychological stress among Korean employees[18, 19]. Furthermore, Korean cultural values and practices favoring authoritarianism, collectivism, regionalism, and kinship ties are starkly different from the horizontal organization and rationalism of Western societies and exert a critical influence on the workplace infrastructure. In the context of perceived obligations to informal but entrenched networks based on cultural affiliations, effective communication among employees is often superseded by social gatherings scheduled after official work hours[17]. Gender discrimination, with roots in Korea's Confucian tradition, also continues to plague many workplaces[20, 21].

The National Study for Development and Standardization of Occupational Stress was conducted in order to develop and standardize the Korean occupational stress scale (KOSS)[17]. According to a qualitative analysis of this national study, many occupational stressors of Korean workers have similar characteristics found in the occupational stress measurement developed in western societies. However, "discomfort in occupational climate" and "inadequate social support" seem to be more important stressors for Korean workers[17]. Recent study using KOSS document that in contrast to western studies of occupational stress, "inadequate social support" and "discomfort in occupational climate" are the most powerful predictors and are more predictive of depression than either job

demands or job control[22].

The aim of this study was to investigate the association between insomnia and job stress assessed by the KOSS in employees recruited from a nationwide sample in Korea, and then to analyze which components of occupational stress is more strongly associated with insomnia in Korea. Because of the unique Korean occupational culture as described above, our hypothesis is that "discomfort in occupational climate" and "inadequate social support" might have more strong relation to insomnia in Korea.

Subjects and Methods

Subjects

This is cross-sectional study among workers recruited from a nationwide sample in Korea. A random (cluster) sample was taken in two stages. A proportional sample was selected based on the Korean Standard Industrial Classification followed by a sample based on the size of company (e.g. workplaces with 50 or fewer employees, 50–99, 100–299, and 300 or more). We explained about the contents of survey to the workers and obtained their consent to the use of survey results in the research. A total of 12,000 questionnaires were distributed during August 2006 and 8,466 were recovered from September to October 2006, showing a response rate of 70.5%. With excluding 311 replied inadequately, we analyzed 8,155 questionnaires. The study protocol was approved by the Institutional Review Board of Korea University Hospital.

Methods

1) General characteristics and work-related characteristics

We surveyed the subjects' socio-demographic characteristics including age, gender, marital status (married/unmarried/divorced or bereaved), education level (9 yr or less/10–12 yr/13 yr or more), alcohol consumption, smoking habit, and exercise habit, and checked whether they had a disease treated. In addition, we asked work-related questions such as Industrial type (manufacturing/others), company size, employment status (regular/temporary/seasonal), work schedule (daytime/2-shift/3-shift), job type (white collar/blue collar), weekly working hours, and tenure.

2) Job stress

This study used the Korean Occupational Stress Scale (KOSS) developed by Chang *et al*. and the internal consistency and factor- and construct-validity of the scale have been confirmed to be excellent among the Korean population[17]. It was developed to measure workers' job stress factors and to determine the causes of Korean workers' job stress in Korean specific situation. Instead of the basic form with 43 questions, its simplified form (KOSS-SF) with 24 questions, which was restructured for field diagnosis, was used. KOSS-SF consists of the

following seven subscales: high job demand (four items), insufficient job control (four items), inadequate social support (three items), job insecurity (two items), organizational injustice (four items), lack of reward (three items), and discomfort in occupational climate (four items). Each question uses a 4-point Likert scale. We obtained the score of each area using the scoring method proposed by the developers. In this study, the internal reliability coefficient (Cronbach's alpha) of KOSS by area was 0.659 for high job demand, 0.706 for insufficient job control, 0.650 for inadequate social support, 0.692 for job insecurity, 0.723 for organizational injustice, 0.717 for lack of reward, and 0.664 for discomfort in occupational climate, and the overall internal reliability coefficient of the 24 questions was 0.803. Appendix 1 presented details of the subscales and each questionnaire item.

　　3) Sleep

Some of questions on insomnia from Sleep Disorders Questionnaire (SDQ)[23] were revised and used. The SDQ is a brief self-report insomnia questionnaire, which permits the rapid evaluation of insomnia based on the DSM-IV and ICSD-R criteria[24]. The first three questions in this SDQ concern symptoms of insomnia. Insomnia was defined as having at least one of the following three sleep symptoms: "Do you have difficulty getting to sleep at night?" "Do you awaken during the night and have trouble getting back to sleep?" "Do you awaken too early in the morning and have trouble getting back to sleep?" The time frame for the questions was the past month and the response categories for questions were "never or rarely", "sometimes", and "often". If subjects answered "often" to at least one of the three questions, he or she was defined as a "case" of insomnia.

Statistical analysis

　　In order to analyze difference in insomnia experience according to general characteristics (gender, age, marital status, education level, drinking habit, smoking habit, exercise habit, BMI, the presence of disease treated), and work-related characteristics (business category, company size, employment type, work system type, job category, weekly working hours, length of service), we performed chi-square test. Each subscale of job stress was dichotomized into higher or lower group (reference) by respective median scores according to gender. Using the subscales of job stress (higher group/lower group) as independent variables, and insomnia experience (yes/no) as a dependent variable, we performed bivariate logistic regression analysis and obtained the odds ratio (OR). Then, with adjusting for potential confounders, we performed multivariate logistic regression analysis and calculated adjusted odds ratio. All statistical analyses were stratified by gender because of significant differences in insomnia by gender ($p<0.001$). Furthermore, we tested gender interaction by applying interaction terms. All

analyses in this study used SPSS 12.0 and the statistical significance level was set uniformly at 0.05.

Results

Participants' general characteristics

　　Participant characteristics according to gender are shown in Table 1. Age, marital status, educational level, alcohol consumption, smoking habit, exercise, BMI, disease treated, industrial type, company size, employment status, work schedule, job type, working time, and tenure were significantly ($p<0.05$) different between male and female (Table 1).

Association between the subjects' general characteristics and insomnia experience

　　Of the subjects (8,155 workers), 32.9% (2,692) replied that they had insomnia. The percentage was higher among female workers (36.1%) than among male ones (31.9%) ($p<0.001$). In males, the prevalence of insomnia tended to increase with age ($p<0.001$; 29.6%, 28.1%, 36.2%, and 39.8% for male aged <30, 30–39, 40–49, and ≥50 yr, respectively). Marital status was associated with insomnia only in males, the insomnia experience rate was higher in the divorced/bereaved group (46.9%) than in the unmarried group (30.9%) and the married group (32.8%) ($p=0.011$). A higher prevalence of insomnia was detected in the less educated (9 yr or shorter) workers (38.9% for male; 47.3% for female, respectively), and according to drinking frequency, it was highest in those drinking 3 times or more a week (39.0% for male; 53.4% for female, respectively). The prevalence of insomnia was highest among female workers that were current-smokers (53.6%), and lowest among those that were non-smokers (34.7%) ($p=0.007$). In addition, according to BMI, the insomnia experience rate was highest in those whose BMI was below 18.5 kg/m^2 (39.5%), and lowest in those of 25.0 kg/m^2 or higher (28.9%) only in male ($p=0.007$). For males, those with a disease treated (42.1%) experienced insomnia more frequently than those without (31.2%) ($p<0.001$). Besides, regular exercise was not in a statistically significant correlation with insomnia in the both males and females. There are evidences of a gender interaction on differences in insomnia experience according to smoking habit (interaction $p=0.033$) and BMI (interaction $p=0.040$) (Table 2).

Association between the subjects' work-related characteristics and insomnia experience

　　The insomnia experience rate was lower in manufacturing industry (31.0%) than in those of other industrial categories (34.0%) only in males ($p=0.020$). It was highest as 37.8% among male workers in a company with fewer than 50 employees, and lowest in those at a company with 300 or more employees (30.0%) ($p=0.004$). According to employment status, with males in temporary employment

Table 1. Participants characteristics according to gender

		Male (N=6,126)		Female (N=2,029)		p-value [b]
		N [a]	%	N [a]	%	
Age (yr)	≤29	1,296	22.2	795	41.3	<0.001
	30–39	2,562	43.9	560	29.1	
	40–49	1,396	23.9	441	22.9	
	≥50	580	9.9	131	6.8	
Marital status	Never married	2,301	38.6	954	48.3	<0.001
	Married	3,596	60.3	984	49.8	
	Divorces or widowed	64	1.1	36	1.8	
Educational year (yr)	≤9	334	5.6	167	8.4	<0.001
	10–12	2,701	44.9	858	43.1	
	≥13	2,979	49.5	964	48.5	
Drinking frequency	≤1 per month	1,376	22.7	1,043	52.9	<0.001
	2–4 per month	1,308	21.6	473	24.0	
	1–2 per week	2,318	38.3	366	18.6	
	≥3 per week	1,050	17.3	88	4.5	
Smoking habits	Never	1,672	27.5	1,891	96.4	<0.001
	Current	3,378	55.5	56	2.9	
	Former	1,032	17.0	14	0.7	
Regular exercise	No	3,763	61.5	1,629	80.9	<0.001
	Yes	2,352	38.5	385	19.1	
BMI (kg/m^2)	<18.5	81	1.4	259	15.4	<0.001
	18.5–24.9	4,063	70.5	1,308	77.9	
	≥25.0	1,623	28.1	112	6.7	
Current disease treated	No	5,760	94.0	1,985	97.8	<0.001
	Yes	366	6.0	44	2.2	
Industrial type	Manufacturing	4,290	70.0	1,103	54.4	<0.001
	Others	1,836	30.0	926	45.6	
Number of employees	<50	662	10.8	273	13.5	<0.001
	50–99	2,389	39.0	653	32.2	
	100–299	1,504	24.6	550	27.1	
	≥300	1,571	25.6	553	27.3	
Employment status	Regular	4,991	89.5	1,522	81.6	<0.001
	Temporary	438	7.9	254	13.6	
	Seasonal	146	2.6	89	4.8	
Work schedule	Day work	4,486	76.5	1,511	78.9	<0.001
	2-shift	753	12.8	270	14.1	
	3-shift	627	10.7	135	7.0	
Job type	White collar	2,511	45.5	1,108	61.6	<0.001
	Blue collar	3,007	54.5	690	38.4	
Working time (h/wk)	≤40	2,322	44.1	890	53.4	<0.001
	41–59	2,172	41.2	584	35.0	
	≥60	775	14.7	193	11.6	
Tenure (yr)	<1	1,104	19.4	477	25.9	<0.001
	1–5	2,064	36.3	794	43.1	
	5–9	940	16.5	324	17.6	
	≥10	1,583	27.8	249	13.5	

[a] The number of participants; some responses were omitted. [b] p-value was based on the chi-square test.

showing highest prevalence of insomnia (39.0%) (p=0.001), and according to work schedule, highest in 3-shift workers (43.5% for males; 46.7% for females, respectively) and lowest in non-shift workers (28.7% for males; 32.4% for females, respectively). In terms of job type, the prevalence of insomnia was higher in blue collar workers (35.1% for males; 40.4% for females, respectively) than in white collar workers (p<0.001, in both males and

Table 2. Association between general characteristics and insomnia according to gender

	Male			Female			Gender interaction
	No of case[a]/total[b]	%	*p*-value[c]	No of case[a]/total[b]	%	*p*-value[c]	
Total	1,952/6,126	31.9		732/2,029	36.1		<0.001
Age (yr)							
≤29	383/1,296	29.6	<0.001	277/795	34.8	0.195	0.602
30–39	721/2,562	28.1		192/560	34.3		
40–49	506/1,396	36.2		173/441	39.2		
≥50	231/580	39.8		54/131	41.2		
Marital status							
Never married	755/2,301	32.8	0.011	340/954	35.6	0.102	0.763
Married	1,112/3,596	30.9		349/984	35.5		
Divorces or widowed	30/64	46.9		19/36	52.8		
Educational yr							
≤9	130/334	38.9	<0.001	79/167	47.3	0.003	0.130
10–12	938/2,701	34.7		307/858	35.8		
≥13	846/2,979	28.4		325/964	33.7		
Drinking frequency							
≤1 per month	409/1,376	29.7	<0.001	361/1,043	34.6	0.001	0.446
2–4 per month	367/1,308	28.1		152/473	32.1		
1–2 per week	743/2,318	32.1		142/366	38.8		
≥3 per week	410/1,050	39.0		47/88	53.4		
Smoking habits							
Never	510/1,672	30.5	0.311	656/1,891	34.7	0.007	0.033
Current	1,102/3,378	32.6		30/56	53.6		
Former	327/1,032	31.7		7/14	50.0		
Regular exercise							
No	1,206/3,763	32.0	0.682	599/1,629	36.8	0.093	0.179
Yes	742/2,352	31.5		124/385	32.2		
BMI (kg/m^2)							
<18.5	32/81	39.5	0.007	90/259	34.7	0.371	0.040
18.5–24.9	1,326/4,063	32.6		466/1,308	35.6		
≥25.0	469/1,623	28.9		47/112	42.0		
Disease(s) treated							
No	1,798/5,760	31.2	<0.001	716/1,985	36.1	0.968	0.172
Yes	154/366	42.1		16/44	36.4		

[a] The number of subjects experienced insomnia. [b] The number of participants; some responses were omitted. [c] *p*-value was based on the chi-square test.

females). According to weekly mean working hours, with males in those working 41–59 h (33.0%) showing highest prevalence of insomnia (33.0%) (*p*=0.020). There are no evidences of a gender interaction on differences in insomnia experience according to the work related factors (Table 3).

Association between job stress and insomnia experience

Table 4 presents the odds ratio (OR) of insomnia experience according to job stress level was obtained through binary logistic regression analysis. For males, insufficient job control (OR: 1.28, 95% CI: 1.14–1.43),

inadequate social support (OR: 1.42, 95% CI: 1.27–1.59), job insecurity (OR: 1.35, 95% CI: 1.21–1.50), organizational injustice (OR: 1.26, 95% CI: 1.26–1.41), lack of reward (OR: 1.30, 95% CI: 1.17–1.45), discomfort in occupational climate (OR: 1.31, 95% CI: 1.18–1.47), and total job stress (OR: 1.57, 95% CI: 1.41–1.76) were significantly associated with insomnia. For females, high job demand (OR: 1.33, 95% CI: 1.10–1.60), job insecurity (OR: 1.33, 95% CI: 1.10–1.60), discomfort in occupational climate (OR: 1.31, 95% CI: 1.09–1.58), and total job stress (OR: 1.24, 95% CI: 1.04–1.49) were significantly associated with insomnia. The association between the insomnia and

Table 3. Association between work-related characteristics and insomnia according to gender

	Male			Female			Gender interaction
	No of case[a]/total[b]	%	*p*-value[c]	No of case[a]/total[b]	%	*p*-value[c]	
Industrial type							
Manufacturing	1,328/4,290	31.0	0.020	390/1,103	35.4	0.462	0.524
Others	624/1,836	34.0		342/926	36.9		
Number of employees							
<50	250/662	37.8	0.004	106/273	38.8	0.617	0.727
50–99	746/2,389	31.2		227/653	34.8		
100–299	484/1,504	32.2		204/550	37.1		
≥300	472/1,571	30.0		195/553	35.3		
Employment status							
Regular	1,535/4,991	30.8	0.001	538/1,522	35.3	0.620	0.067
Temporary	171/438	39.0		91/254	35.8		
Seasonal	42/146	28.8		36/89	40.4		
Work schedule							
Day work	1,288/4,486	28.7	<0.001	489/1,511	32.4	<0.001	0.856
2-shift	295/753	39.2		122/270	45.2		
3-shift	273/627	43.5		63/135	46.7		
Job type							
White collar	692/2,511	27.6	<0.001	356/1,108	32.1	<0.001	0.937
Blue collar	1,055/3,007	35.1		279/690	40.4		
Working time (h/wk)							
≤40	676/2,322	29.1	0.020	309/890	34.7	0.143	0.120
41-59	716/2,172	33.0		203/584	34.8		
≥60	244/775	31.5		81/193	42.0		
Tenure (yr)							
<1	335/1,104	30.3	0.495	160/477	33.5	0.632	0.987
1–5	641/2,064	31.1		279/794	35.1		
5–9	310/940	33.0		122/324	37.7		
≥10	513/1,583	32.4		92/249	36.9		

[a] The number of subjects experienced insomnia. [b] The number of participants; some responses were omitted. [c] *p*-value was based on the chi-square test.

total job stress was stronger among males than females (gender interaction *p*=0.031) (Table 4).

Because the evidence for a gender difference in the effect of job stress on the insomnia was scarce, male and female were combined in the multivariate logistic regression models. In the Model 1, adjusted for gender, age, marital status, education level, industrial type, company size, employment status, work schedule, job type, and weekly working hours, those who perceived high job stress in each subscales and in the total score were more likely to suffer from insomnia than those who perceived low job stress (high job demand: OR: 1.31, 95% CI: 1.16–1.48; insufficient job control: OR: 1.16, 95% CI: 1.02–1.31; inadequate social support: OR: 1.29, 95% CI: 1.14–1.46; job insecurity: OR: 1.26, 95% CI: 1.12–1.42; organizational injustice: OR: 1.28, 95% CI: 1.14–1.45; lack of reward: OR: 1.20, 95% CI: 1.06–1.35; discomfort

in occupational climate: OR: 1.36, 95% CI: 1.21–1.53; total job stress OR: 1.46, 95% CI: 1.29–1.64). Adjusting for health behavior (Model 2) did not change the association, except for insufficient job control. Finally, after additional adjustment for disease treated (depression, hypertension, diabetes mellitus, *et al.*) (Model 3), those who perceived high job stress in each subscales and in the total score were more likely to suffer from insomnia (high job demand: OR: 1.30, 95% CI: 1.14–1.47; insufficient job control: OR: 1.13, 95% CI: 0.99–1.29; inadequate social support: OR: 1.30, 95% CI: 1.14–1.47; job insecurity: OR: 1.25, 95% CI: 1.11–1.44; organizational injustice: OR: 1.27, 95% CI: 1.12–1.44; lack of reward: OR: 1.18, 95% CI: 1.04–1.34; discomfort in occupational climate: OR: 1.38, 95% CI: 1.22–1.57; total job stress: OR: 1.45, 95% CI: 1.28–1.64) (Table 5). In the multivariate analyses, there are no evidences of a gender interaction

Table 4. Association between job stress and insomnia according to gender: Bivariate logistic regression models

	Male		Female		Gender interaction
	No of case[a]/total[b]	Odds ratios (95% CI)	No of case[a]/total[b]	Odds ratios (95% CI)	
High job demand					
Low	874/2,850	1.00	288/885	1.00	0.097
High	1,043/3,173	1.11 (0.99–1.23)	428/1,096	1.33 (1.10–1.60)	
Insufficient job control					
Low	730/2,536	1.00	277/804	1.00	0.278
High	1,187/3,487	1.28 (1.14–1.43)	439/1,177	1.13 (0.94–1.37)	
Inadequate social support					
Low	1,114/3,836	1.00	403/1,129	1.00	0.006
High	803/2,187	1.42 (1.27–1.59)	313/852	1.05 (0.87–1.26)	
Job insecurity					
Low	971/3,355	1.00	399/1,190	1.00	0.876
High	946/2,668	1.35 (1.21–1.50)	317/791	1.33 (1.10–1.60)	
Organizational injustice					
Low	946/3,209	1.00	318/926	1.00	0.439
High	971/2,814	1.26 (1.13-1.41)	398/1,055	1.16 (0.96-1.39)	
Lack of reward					
Low	738/2,581	1.00	340/959	1.00	0.060
High	1,179/3,442	1.30 (1.17–1.45)	376/1,022	1.06 (0.88–1.27)	
Discomfort in occupational climate					
Low	1,012/3,455	1.00	295/901	1.00	0.992
High	905/2,568	1.31 (1.18–1.47)	421/1,080	1.31 (1.09–1.58)	
Total job stress					
Low	797/2,966	1.00	342/1,015	1.00	0.031
High	1,120/3,057	1.57 (1.41–1.76)	374/966	1.24 (1.04–1.49)	

[a] The number of subjects experienced insomnia. [b] The number of participants; some responses were omitted.

on differences in insomnia experience according to the job stress (data not shown).

Discussion

This study was performed in order to examine correlation between job stress and insomnia in around 8,200 workers sampled from workplaces of various sizes (from small size to large size). We found that individuals with relatively high job stress experienced insomnia significantly more frequently, and the significance was maintained even after adjustment for demographic characteristics and job-related characteristics that might work as confounding variables.

Our findings are in general agreement with previous studies from Europe and Japan on the relationship between job stress and sleeping problems. Nevertheless, there are some discrepancies in the other of significance among job stressors between Korea and western societies. In contrast to western studies of job stress, inadequate social support and discomfort in occupational climate are more predictive of insomnia than either job control or lack of reward.

We define "discomfort in occupational climate" refers to the imbalance or inconvenience caused by sub-cultures commonly found in the informal sector of the company. In KOSS, discomfort in occupational climate evaluates the degree of collectivism among workers that includes dining out after work, inconsistency of job order, authoritarian climate, and gender discrimination. The association between discomfort in occupational climate and insomnia must be understood in the context of particular characteristics of the Korean culture. The Korean occupational climate is based strongly on collectivism; this differs from the Western horizontal occupational climate, which is based on a culture favoring individualism. Though after work dining together in Korea possesses some positive features because important work-related decisions may be made in these informal settings, this non-official organizational process can create work-family conflict and interfere with formal work obligations. Furthermore, many employees feel compelled to drink alcohol and participate in order to please and bond with supervisors. Women often cannot attend because of home life demands and/or distaste of drinking. There have been marked increases in women's educational and

Table 5. Association between job stress and insomnia: Multivariate logistic regression models: odds ratios (ORs) and 95% confidence intervals (CIs)

	Model 1	Model 2	Model 3
High job demand			
Low	1.00	1.00	1.00
High	1.31 (1.16–1.48)	1.29 (1.14–1.47)	1.30 (1.14–1.47)
Insufficient job control			
Low	1.00	1.00	1.00
High	1.16 (1.02–1.31)	1.13 (0.99–1.28)	1.13 (1.00–1.29)
Inadequate social support			
Low	1.00	1.00	1.00
High	1.29 (1.14–1.46)	1.30 (1.15–1.48)	1.30 (1.14–1.47)
Job insecurity			
Low	1.00	1.00	1.00
High	1.26 (1.12–1.42)	1.25 (1.11–1.42)	1.25 (1.11–1.42)
Organizational injustice			
Low	1.00	1.00	1.00
High	1.28 (1.14–1.45)	1.27 (1.13–1.44)	1.27 (1.12–1.44)
Lack of reward			
Low	1.00	1.00	1.00
High	1.20 (1.06–1.35)	1.19 (1.05–1.34)	1.18 (1.04–1.34)
Discomfort in occupational climate			
Low	1.00	1.00	1.00
High	1.36 (1.21–1.53)	1.39 (1.23–1.57)	1.38 (1.22–1.57)
Total job stress			
Low	1.00	1.00	1.00
High	1.46 (1.29–1.64)	1.45 (1.28–1.64)	1.45 (1.28–1.64)

Model 1: Adjusted for gender, age, marital status, education level, industrial type, company size, employment status, work schedule, job type, and weekly working hours. Model 2: Adjusted for variables included in model 1 and alcohol consumption, smoking, exercise, and BMI. Model 3: Adjusted for variables included in model 2 and disease(s) treated (depression, hypertension, diabetes mellitus, *et al.*).

occupational opportunities in Korea, women still suffer higher levels of gender discrimination. Their lives are markedly restricted by the cultural values associated with Confucianism[25]. Therefore, both collectivism and gender discrimination, derived from specific feature of Korean culture, may contribute to the experience of insomnia in Korean employees.

Our finding about inadequate social support confirms results from previous studies in western countries and Japan which reported that low social support in workplace was correlated with insomnia[6, 26]. Recent study document that support at work could protect workers from harmful effects of job stress on insomnia[16]. Because conflict with supervisors or colleagues was shown to be an important stressor in a qualitative study in Korea, we defined "inadequate social support" as a direct stressor. Within hierarchical and authoritative work structure, workers with inadequate social supports (i.e., uncomfortable or inappropriate relationships with supervisors or coworkers,

and lack of emotional support from friends or relatives) are very important stressor. Furthermore, lifetime employment at one company places more pressure on interpersonal relationships. If there are conflicts in human relationship at work, the expectations engendered by the familial atmosphere make it more difficult to adapt. Therefore, inadequate social support could be the more powerful predictor of insomnia for Korean workers than for workers from western cultures where expectations of work relationship are not as important.

We define "organizational injustice" as problems resulting from unreasonableness or unfairness of organizational policy, operational systems, or formal structure of the company. Recent study has shown that organizational injustice is associated with increased risk of poor sleep quality[27] and the degree of insomnia reflecting underpayment was significantly lower among nurses whose supervisors were trained in interactional justice[28]. These studies demonstrate that organizational

justice may contribute to the increased risk of insomnia.

Among job stress factors identified in this study using KOSS, high job demand, insufficient job control, job insecurity, and lack of reward increase the morbidity of insomnia are supported by previous studies. High job demand means the burden that a worker feels from his/her job, and involves pressure for time, increasing workload, responsibility, excessive burden, etc.[17]. In this study as well, those with high job demand appeared to experience insomnia 1.30 times more frequently than those with low job demand. Akerstedt *et al.*[29] reported that high job demand caused sleep disorders in Swedish workers, and studies on Japanese workers using Karasek's DCM model also reported that job demand and job strain are related with sleep disorders including insomnia[13, 14, 30, 31]. Nomura *et al.*[32] also reported that the frequency of insomnia experience was only half in those whose job control was above average. Our study also observed correlation between low job control and insomnia. According to previous studies, job change or unemployment influences sleeping health[33], and workers who experienced unemployment during an economic recession experience sleep disorder more frequently than those who maintain their employment status continuously[34]. In this study as well, similarly, workers with high job stress from job insecurity experienced insomnia more frequently. Lack of reward is a concept derived from the Effort-Reward Imbalance (ERI) model, and high stress in this area reflects high effort and low reward. There have been few studies that examined the relation of the ERI model with insomnia, but Utsugi *et al.* found that high ERI increased the risk of insomnia[14]. In our study as well, workers with severely inadequate reward experienced insomnia more frequently.

The mechanism of causal relation between job stress and sleeping health has not been explained clearly, but researchers suggested possible mechanisms as follows. First, some studies[35, 36] found that job stress is related with the increase of cortisol, and it was reported that cortisol and the activity of hypothalamic-pituitary-adrenal (HPA) axis are associated with sleep disorder[37, 38]. Accordingly, the activation of HPA axis by job stress is likely to cause sleep disorder. Second, psychosocial stress including job stress may cause unhealthy life habits such as drinking, smoking, and insufficient exercise and these life habits may work as factors disrupting sleep[39, 40]. Third, mental disorder like depression is a representative factor that affects sleep[41]. Several studies proved that those with relatively high job stress are more likely to experience depression or depressive symptoms[42, 43]. Accordingly, workers with high job stress have a high risk of mild depressive symptoms, even if not depression, and consequently, job stress can be a factor contributing to insomnia experience. Fourth, though it cannot be proven by a cross-sectional study like this study, the causal relation may be reversed, that is, sleep disorder may affect job stress. Workers suffering a sleep disorder like insomnia may have an inadequate relation with their colleagues or superiors and have difficulty in concentrating on their job and executing their works properly[44]. What is more, these problems may result in low productivity or disadvantages to their employment status, which may, in turn, increase job stress[34, 45]. In this way, workers with sleep disorder are likely to perceive higher job stress.

One of the strengths of the study is a large sample size to produce reliable result. Because we collected the subjects proportional to industrial classification and size of company and obtained a response rate of over 70%, some generalizability can be expected, although they are not truly representative. Studies with such a large number of workers are rare throughout the world, and particularly in Korea this is the first large-scale research. Furthermore, this study is considered meaningful in that it examined the association of the various factors of job stress with insomnia. Despite the strength, this study has several limitations. First, data including job stress and insomnia were obtained using self-administered questionnaires, so there is a possibility of recall/reporting bias. Thus, the results of this study need to be verified using objective sleep tests such as overnight polysomnograhy. Second, as this is a cross-sectional study, we cannot exclude the possibility that workers unhealthy, with high job stress or with poor sleeping health might have retired from or left their job and, as a result, there might be the effect of healthy workers. Third, because around 30% of the sampled subjects did not participate in the survey, there can be a response bias if job stress and insomnia are different between those who replied and those who did not. There can also be a response bias because our research team did not investigate data on those who did not answer including their reason for not answering and their demographic and job-related characteristics.

In spite of these limitations, we confirmed association between job stress and insomnia but could not suggest the causal relation between the two factors. The use of longitudinal panel design would strengthen the ability to make causal arguments regarding these associations. Considering that job stress is associated with several health problems including insomnia, prevention strategies to manage and reduce stress at work might be beneficial for workers health and economy. Additionally, giving attention to specific stressor (e.g., interpersonal conflict, organizational injustice and occupational climate) promote the mental health of workers.

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