

# The impact of long working hours on psychosocial stress response among white-collar workers

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*Received September 18, 2015 and accepted August 1, 2016*

*Published online in J-STAGE August 6, 2016*

**Abstract:** This study examined the association between long working hours and psychosocial stress responses. In total, 1,122 white-collar workers from a company in Korea completed self-administered questionnaires following a lecture about the study aim, procedures, and confidentiality. Psychosocial stress responses were evaluated using the Psychosocial Well-being Index - Short Form (PWI-SF), and psychosocial working conditions were evaluated with the Korean Occupational Stress Scale - Short Form (KOSS-SF). Multivariate logistic regression analysis was performed after adjusting for demographic variables and psychosocial working conditions to examine associations between long working hours and psychosocial stress responses. In comparison with the reference group, which worked 40–44 hours per week, the crude odds ratio (OR) of the respondents who worked 60 or more hours was 4.56 (95% confidence interval (CI), 2.55–8.15) in terms of psychosocial stress responses. After adjusting for demographic variables, the adjusted OR of those working  $\geq 60$  hours was 5.61 (95% CI, 3.01–10.47). After adjusting for both demographic variables and psychosocial working conditions, the adjusted OR of those working  $\geq 60$  hours was 3.25 (95% CI, 1.56–6.79). This study found that long working hours are significantly related to psychosocial stress responses among white-collar workers in one Korean company.

**Key words:** Korea, Long working hours, Psychosocial working conditions, Psychosocial stress response, KOSS-SF, PWI-SF

## Introduction

Long working hours have recently emerged as an important topic within the Korean business community. According to the European Foundation for the Improvement of Living and Working Conditions and the International Labor Office (ILO), long working hours are “work time that is equal to or exceeds 48 hours a week”. The crite-

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rion of 48 hours represents an international consensus in this regard. The purpose of working-time regulations is to guarantee that workers are protected from extremely long periods of labor and to provide adequate rest and holiday time as a way to replenish workers’ resources<sup>1</sup>). According to statistics from the Organization for Economic Cooperation and Development (OECD), Korea had the highest average number of hours worked per week between 1980 and 2005<sup>2</sup>). The typical average work week was 49 hours in 2006, 48 in 2007, 47 in 2008 and 2009, 46 in 2010, 45 in 2011 and 2012, and 44 in 2013<sup>2</sup>). Although the average number of hours worked per week has been decreasing

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over time, the Korean work week remains long in comparison with those of other OECD countries. Data from the OECD show that the average number of hours actually worked by Korean workers in 2012 was 2163, which was the second highest among the OECD countries following Mexico. Indeed, the comparable figures in other countries were 1788 in the US, 1760 in New Zealand, 1735 in Japan, 1489 in France, and 1388 in Germany<sup>3</sup>). Since 2012, Korea has stipulated a legal limit of 40 hours of work per week and 8 hours of work per day, excluding rest periods. According to the Korean Labor Standards Act, working hours can be extended by up to 12 hours per week by agreement between the parties<sup>4</sup>).

Previous studies have reported that long working hours increase the risk of depression<sup>5, 6</sup>, diabetes mellitus<sup>7</sup>, stroke<sup>8</sup>, and coronary heart disease<sup>8-12</sup>). Thus, long working hours are known to be associated with specific clinical diseases. However, from a preventive perspective, the pre-clinical psychosocial stress responses of healthy workers are also important in terms of the screening and management of those who have not yet reached the clinical stage of a disorder. Many studies have reported an association between long working hours and a preclinical psychosocial response. Some showed that long working hours increased the risk of the psychosocial stress response in both males and females<sup>13</sup>), and others found this only in females<sup>14</sup>) or males<sup>15, 16</sup>). However, these results are controversial because the definition of long working hours varied among the studies<sup>14, 17</sup>), some were subject to the shift work effect<sup>15, 17</sup>), and psychosocial working conditions such as job demand, control, social support and workplace climate were seldom considered in the study design<sup>13-15</sup>). We investigated the white-collar workers working 40 hours or more per week and compared the psychosocial responses to 4-hr increases in working hours up to 60 or more of work per week. Additionally, our study evaluated comprehensive psychosocial working conditions as a mediator and didn't include the shift workers to eliminate any effect of shift work. If long work hours exert an independent effect on preclinical psychosocial stress responses, it would be very important to elucidate the effect size of working hours to plan and prioritize the foci of workplace health-promotion programs. The purpose of this study was to clarify the independent effect of long working hours on preclinical psychosocial stress responses.

## Subjects and Methods

### *Study population*

Korean workers experience longer working hours compared with workers in OECD<sup>2, 3</sup>) and EU<sup>18</sup>) countries. Between the times of two surveys of Korean working conditions conducted in 2006 and 2010, the average number of working hours per week decreased from 51.3 to 47.6 hours, but the proportion of workers who work for more than 48 hours increased from 45.0% to 49.5%<sup>18</sup>). The targeted Korean company has, in recent years, experienced rapid growth and an increasing number of complaints regarding long working hours. As a result, many problems related to psychosocial working conditions, including work overload, conflicts in the work environment, and ambiguity related to job responsibilities have arisen, leading many workers to change jobs. Furthermore, the responsibilities associated with jobs have increased, especially among white-collar workers, which have led to employees being forced to work for longer hours. Thus, the prevalence of employees who work long hours has increased during the past decades. For these reasons, external professional evaluations of the work environment and the health and safety of white-collar workers are needed.

Researchers presented a 30-minute lecture addressing the study aim and procedures and emphasizing policies to protect personal information to a total of 1674 white-collar workers. In a subsequent session, attendees who agreed to participate in this study completed self-administered questionnaires. The final sample size was 1122, yielding a response rate of 67%. The study procedure was reviewed and approved by the Institutional Review Board of Inje University Busan Paik Hospital.

### *Measurement of variables*

The self-administered questionnaires investigated general and work-related characteristics, including gender, age, marital status, educational level, position, weekly working hours, psychosocial working conditions, and psychosocial stress responses. The sample was divided into four age groups: 20–29, 30–39, 40–49, and 50 years and older; three groups according to marital status: never married, married, and divorced or widowed; four groups according to educational level: high school, community college ( $\leq 3$  years of education), university (4 years), and more than graduate school; three groups according to position: staff or clerk, assistant manager, and manager and higher; and five groups according to hours worked per week: 40–44, 45–49, 50–54, 55–59, and 60 and more.

Psychosocial working conditions were evaluated using the Korean Occupational Stress Scale - Short Form (KOSS-SF)<sup>19</sup>, which is composed of the following seven subscales: (i) job demands, (ii) insufficient job control, (iii) inadequate social support, (iv) job insecurity, (v) unsatisfactory organizational system, (vi) lack of reward, and (vii) unsatisfactory workplace climate. For purposes of comparison, the datasets were divided into quartiles: the lowest quartile (Q1), second-lowest quartile (Q2), second-highest quartile (Q3), and highest quartile (Q4). The psychosocial working conditions were considered as a mediator in our conceptual model.

Psychosocial stress responses were evaluated with the Psychosocial Well-being Index - Short Form (PWI-SF), which was developed based on the General Health Questionnaire-60 (GHQ-60) to determine levels of psychosocial stress responses in general populations. Its reliability and validity have been established for Korean workers. Respondents score each item on a four-point Likert scale (0-1-2-3), and scores are summed to determine levels of psychosocial stress responses, with higher scores indicating higher levels of stress responses. We categorized the study population into three groups, as recommended by previous studies: a high-risk stress group (more than 27 points), a potential group (9-26 points), and a healthy group (lower than 8 points)<sup>20, 21</sup>. However, in subsequent analyses, we combined the healthy and potential groups into a potential-stress group for comparison with the high-risk stress group because the healthy group accounted for less than 5% of the sample. Missing PWI or KOSS scores were replaced with median values.

#### *Statistical analysis*

The general characteristics and psychosocial working conditions according to psychosocial stress group are provided in the form of descriptive statistics. We used the  $X^2$  test to evaluate general characteristics and the Wald test for trends in weekly working hours and psychosocial working conditions. Multivariate logistic regression analysis was performed to clarify the association between long working hours and psychosocial stress responses. We included two stress groups as the bimodal dependent variables, and the variables that appeared to be associated with psychosocial stress responses were treated as the independent variables. Participants working 40-44 hours per week were used as the reference group. We calculated the odds ratios (ORs) and 95% confidence intervals (95% CIs) of six models. Univariate logistic regression analysis was initially performed for models I-II, followed by mul-

tivariate logistic regression analysis for models III-VI: (1) model I and II: crude ORs; (2) models III and IV: total/male-only ORs adjusted for general characteristics (gender, age, marital status, educational level, and position); and (3) models V and VI: total/male-only ORs additionally adjusted for psychosocial working conditions (gender, age, marital status, educational level, position, and KOSS scores). The analysis was performed using SPSS version 21, and statistical significance was set at  $p < 0.05$ .

## **Results**

Table 1 presents the general characteristics of the study population. Male workers accounted for 91.8% of the sample, most workers were married (61.8%), and workers aged 30-39 years comprised more than half the total sample (57.0%). Female workers and single workers were more likely to meet criteria for inclusion in the high-risk group. Those with more than a university education accounted for 77.6% of the sample, and staff members or clerks accounted for 44.0% of the sample. Groups working 45-49 hours and 50-54 hours per week constituted 33.2% and 32.4% of the sample, respectively. Participants with long working hours were more likely to be in the high-risk stress group. Psychosocial working conditions were categorized into four quartiles from the lowest (Q1) to the highest (Q4). Responses to questions about job demand, inadequate social support, lack of reward, and unsatisfactory workplace climate showed that more than half of those in the highest quartile belonged to the high-risk stress group.

Table 2 shows the association between hours worked per week and psychosocial stress responses. Multivariate logistic regression analysis was performed on psychosocial stress responses. As working hours increased, the ORs also increased in all models. Compared with the reference group who worked 40-44 hours in a week, the ORs for those working  $\geq 60$  and 55-59 hours per week were 4.56 (95% CI 2.55-8.15) and 2.08 (95% CI 1.25-3.47), respectively, in model I (crude ORs in total) and 4.49 (95% CI 2.46-8.19) and 1.96 (95% CI 1.14-3.35), respectively, in model II (crude ORs in male only). The ORs adjusted by the general characteristics of participants working  $\geq 60$  and 55-59 hours per week were 5.61 (95% CI 3.01-10.47) and 2.56 (95% CI 1.48-4.44), respectively, in model III (adjusted ORs in total) and 4.92 (95% CI 2.60-9.33) and 2.18 (95% CI 1.23-3.87) in model IV (adjusted ORs in males only). The ORs adjusted for the general characteristics and psychosocial working conditions of participants

**Table 1. General characteristics and psychosocial working conditions by psychosocial stress response** n(%)

|                                      | Psychosocial stress group |                        |                        | p value* |
|--------------------------------------|---------------------------|------------------------|------------------------|----------|
|                                      | Total                     | Potential stress group | High risk stress group |          |
| Gender                               |                           |                        |                        |          |
| Male                                 | 1,030                     | 688 (66.8)             | 342 (33.2)             | 0.005    |
| Female                               | 92                        | 48 (52.2)              | 44 (47.8)              |          |
| Age                                  |                           |                        |                        |          |
| 20–29                                | 164                       | 105 (64.0)             | 59 (36.0)              | 0.130    |
| 30–39                                | 639                       | 408 (63.8)             | 231 (36.2)             |          |
| 40–49                                | 207                       | 139 (67.1)             | 68 (32.9)              |          |
| ≥50                                  | 112                       | 84 (75.0)              | 28 (25.0)              |          |
| Marital status                       |                           |                        |                        |          |
| Never married                        | 414                       | 262 (63.3)             | 152 (36.7)             | 0.245    |
| Married                              | 693                       | 466 (67.2)             | 227 (32.8)             |          |
| Divorced or widowed                  | 15                        | 8 (53.3)               | 7 (46.7)               |          |
| Educational status                   |                           |                        |                        |          |
| High school                          | 134                       | 91 (67.9)              | 43 (32.1)              | 0.502    |
| College ( ≤ 3 years)                 | 117                       | 77 (65.8)              | 40 (34.2)              |          |
| University ( 4 years)                | 705                       | 452 (64.1)             | 253 (35.9)             |          |
| ≥ Graduate school                    | 166                       | 116 (69.9)             | 50 (30.1)              |          |
| Position                             |                           |                        |                        |          |
| Staff or Clerk                       | 494                       | 323 (65.4)             | 171 (34.6)             | 0.049    |
| Assistant manager                    | 349                       | 215 (61.6)             | 134 (38.4)             |          |
| ≥ Manager                            | 279                       | 198 (71.0)             | 81 (29.0)              |          |
| Weekly working hours                 |                           |                        |                        |          |
| 40–44                                | 126                       | 95 (75.4)              | 31 (24.6)              | <0.001   |
| 45–49                                | 372                       | 260 (69.9)             | 112 (30.1)             |          |
| 50–54                                | 364                       | 244 (67.0)             | 120 (33.0)             |          |
| 55–59                                | 168                       | 100 (59.5)             | 68 (40.5)              |          |
| ≥60                                  | 92                        | 37 (40.2)              | 55 (59.8)              |          |
| Job demand                           |                           |                        |                        |          |
| Q1 lowest                            | 229                       | 186 (81.2)             | 43 (18.8)              | <0.001   |
| Q2                                   | 198                       | 147 (74.2)             | 51 (25.8)              |          |
| Q3                                   | 419                       | 283 (67.5)             | 136 (32.5)             |          |
| Q4 highest                           | 276                       | 120 (43.5)             | 156 (56.5)             |          |
| Insufficient job control             |                           |                        |                        |          |
| Q1 lowest                            | 145                       | 115 (79.3)             | 30 (20.7)              | <0.001   |
| Q2                                   | 415                       | 315 (75.9)             | 100 (24.1)             |          |
| Q3                                   | 210                       | 127 (60.5)             | 83 (39.5)              |          |
| Q4 highest                           | 352                       | 179 (50.9)             | 173 (49.1)             |          |
| Inadequate social support            |                           |                        |                        |          |
| Q1 lowest                            | 137                       | 113 (82.5)             | 24 (17.5)              | <0.001   |
| Q2                                   | 411                       | 312 (75.9)             | 99 (24.1)              |          |
| Q3                                   | 243                       | 152 (62.6)             | 91 (37.4)              |          |
| Q4 highest                           | 331                       | 159 (48.0)             | 172 (52.0)             |          |
| Job insecurity                       |                           |                        |                        |          |
| Q1 lowest                            | 136                       | 103 (75.7)             | 33 (24.3)              | <0.001   |
| Q2                                   | 308                       | 244 (79.2)             | 64 (20.8)              |          |
| Q3                                   | 264                       | 179 (67.8)             | 85 (32.2)              |          |
| Q4 highest                           | 414                       | 210 (50.7)             | 204 (49.3)             |          |
| Unsatisfactory organizational system |                           |                        |                        |          |
| Q1 lowest                            | 258                       | 188 (72.9)             | 70 (27.1)              | <0.001   |
| Q2                                   | 156                       | 119 (76.3)             | 37 (23.7)              |          |
| Q3                                   | 226                       | 165 (73.0)             | 61 (27.0)              |          |
| Q4 highest                           | 482                       | 264 (54.8)             | 279 (45.2)             |          |
| Lack of reward                       |                           |                        |                        |          |
| Q1 lowest                            | 258                       | 215 (83.3)             | 43 (16.7)              | <0.001   |
| Q2                                   | 253                       | 187 (73.9)             | 66 (26.1)              |          |
| Q3                                   | 279                       | 171 (61.3)             | 108 (38.7)             |          |
| Q4 highest                           | 332                       | 163 (49.1)             | 169 (50.9)             |          |
| Unsatisfactory workplace climate     |                           |                        |                        |          |
| Q1 lowest                            | 217                       | 185 (85.3)             | 32 (14.7)              | <0.001   |
| Q2                                   | 198                       | 154 (77.8)             | 44 (22.2)              |          |
| Q3                                   | 416                       | 252 (60.6)             | 164 (39.4)             |          |
| Q4 highest                           | 291                       | 145 (49.8)             | 146 (50.2)             |          |

\*p value by X<sup>2</sup> test for general characteristics and the Wald test for trends for weekly working hours and psychosocial working conditions

**Table 2.** Association between long working hours and psychosocial stress response

| Working hours<br>(h/wk) | Crude                   |                         | Adjusted                        |                                    |                               |                                    |
|-------------------------|-------------------------|-------------------------|---------------------------------|------------------------------------|-------------------------------|------------------------------------|
|                         | Model I<br>Total        | Model II<br>Male only   | Model III <sup>a</sup><br>Total | Model IV <sup>b</sup><br>Male only | Model V <sup>c</sup><br>Total | Model VI <sup>d</sup><br>Male only |
|                         | OR (95% CI)             | OR (95% CI)             | OR (95% CI)                     | OR (95% CI)                        | OR (95% CI)                   | OR (95% CI)                        |
| 40–44                   | 1.00 (reference)        | 1.00 (reference)        | 1.00 (reference)                | 1.00 (reference)                   | 1.00 (reference)              | 1.00 (reference)                   |
| 45–49                   | 1.32 (0.83–2.10)        | 1.23 (0.75–2.01)        | 1.46 (0.91–2.36)                | 1.31 (0.78–2.17)                   | 1.10 (0.64–1.88)              | 0.94 (0.52–1.70)                   |
| 50–54                   | 1.51 (0.95–2.39)        | 1.38 (0.84–2.25)        | <b>1.69 (1.03–2.76)</b>         | 1.47 (0.87–2.48)                   | 1.11 (0.63–1.96)              | 0.99 (0.53–1.83)                   |
| 55–59                   | <b>2.08 (1.25–3.47)</b> | <b>1.96 (1.14–3.35)</b> | <b>2.56 (1.48–4.44)</b>         | <b>2.18 (1.23–3.87)</b>            | 1.56 (0.82–2.99)              | 1.33 (0.67–2.67)                   |
| ≥60                     | <b>4.56 (2.55–8.15)</b> | <b>4.49 (2.46–8.19)</b> | <b>5.61 (3.01–10.47)</b>        | <b>4.92 (2.60–9.33)</b>            | <b>3.25 (1.56–6.79)</b>       | <b>3.00 (1.38–6.51)</b>            |

Adjusted ORs from multivariate logistic regression analysis.

<sup>a</sup> Adjusted for age, marriage, education, position, gender

<sup>b</sup> Adjusted for age, marriage, education, position

<sup>c</sup> Adjusted for age, marriage, education, position, the Korean Occupational Stress Scale, gender

<sup>d</sup> Adjusted for age, marriage, education, position, the Korean Occupational Stress Scale

working ≥60 hours per week was 3.25 (95% CI 1.56–6.79) in model V (adjusted ORs in total) and 3.00 (95% CI 1.38–6.51) in model VI (adjusted ORs in males only).

## Discussion

This study identified an association between long working hours and psychosocial stress responses. According to the univariate analysis, higher levels of psychosocial stress responses were observed in groups who worked more than 55 hours per week. After adjusting for general characteristics in models III–IV, a positive association was observed between working more than 55 hours per week and psychosocial stress responses. After adjustment for both general characteristics and psychosocial working conditions in models V–VI, the data showed that psychosocial stress responses increased among those who worked more than 60 hours per week. These results are consistent with several previous studies<sup>13, 15, 16, 22</sup>. Therefore, we concluded that long working hours are an independent risk factor for psychosocial stress responses among white-collar workers in one Korean company.

We used the PWI score as a proxy for responses to psychosocial working conditions in our study and compared these data with the appropriate figures in other studies conducted in Korea. Ryu *et al.*<sup>23</sup> reported that 14.3% of railroad workers (male dominant, 95.6%) belonged to the high-risk stress group. Ha *et al.*<sup>24</sup> observed high stress in 24.9% of male firefighters. Kim *et al.*<sup>25</sup> reported that 25.1% of female hospital nurses were at a high risk of stress. In our study, 34.4% of workers belonged to the high-risk stress group. Participants in this study reported higher levels of psychosocial stress responses compared with other occupational groups. Females (47.8%) experi-

enced higher levels of psychosocial stress responses compared with males (33.2%). This may be a reflection of the poor working conditions of Korean female workers with respect to unreasonable promotion and reward systems<sup>26</sup>. We also considered the possibility that females may tend to view similar life events as more negative compared with males, to be more vulnerable to interpersonal stressors (e.g., as social rejection)<sup>27</sup>, and to ruminate more when they experience unpleasant emotions or events<sup>28</sup>.

Previous studies have found strong correlations between psychosocial working conditions, such as high job demands, insufficient job control, inadequate social support, job insecurity, lack of rewards, and a negative occupational climate, and mental health or psychosocial stress responses<sup>24, 25, 29</sup>. Workers experiencing highly demanding jobs and a low level of decision-making latitude, low levels of social support or job security, unsatisfactory organizational system or climate, and unfair rewards tended to belong to the high-risk stress group. We found that workers with higher levels of occupational stress were more likely to belong to the high-risk stress group (Table 1). Furthermore, a significant relationship between working long hours and psychosocial stress responses was also observed in models V–VI after adjusting for the influence of these psychosocial working conditions. That is, workers who worked more than 60 hours per week had higher ORs compared with those who worked 40–45 hours. Based on these results, we expect working more than 60 hours per week to be an independent risk factor for poor psychosocial stress responses.

It has been suggested that long working hours directly affect increasing job demand and indirectly affect the time for which workers are exposed to work-related stressors<sup>30</sup>. We consider job demand and other psychosocial work-



ing conditions as mediators in the pathway between long working hours and psychosocial stress responses. However, the relationship between long working hours and psychological stress responses is not fully explained by their association with job demand and other psychosocial working conditions. The independent effect of long working hours on psychosocial stress responses is evidenced by the decrement in the OR from 5.61 in model III to 3.25 in model V. In other words, long working hours directly influenced psychosocial stress responses. Interestingly, in a large cross-sectional Japanese study, the association between overtime work and stress responses disappeared after adjustment for self-assessed amount of work, mental workload, and sleeping time<sup>31</sup>). Sleeping time was not included as a mediator in our study; however, it is possible that sleep plays a role in the pathway between long working hours and psychosocial stress responses.

Our study showed slightly higher ORs among the total sample than among only male respondents. The ORs for all data in models I, III, and V were higher than were those of males only in models II, IV, and VI. We can assume that the ORs of female workers were slightly higher than those of male workers, even though we were unable to present the ORs of females due to the small proportion of female workers (less than 10%) in this study population. We were unable to confirm the difference in ORs between male and female workers in this study. However, Bannai *et al.*<sup>16</sup>) showed an increased risk for psychosocial distress only in males working >60 hours per week (adjusted OR=4.71,  $p<0.001$ ) compared with those working  $\leq 40$  hours per week. Artazcoz *et al.*<sup>15</sup>) reported that working 51–60 hours per week was associated with poor mental health status only in males (adjusted OR=2.06,  $p<0.001$ ). Neither of these studies found a significant association in female workers.

Based on previous studies, long working hours and psychosocial working conditions have negative effects on health in a variety of direct and indirect ways. First, incomplete recovery of physical resources is an important issue. Long working hours disturb the ability to restore one's resources by reducing resting time<sup>32</sup>). Without an adequate recovery period, psychophysiological systems remain strained<sup>33</sup>) and an activated hypothalamic-pituitary-adrenal axis (HPAA) could harm health<sup>34</sup>). Second, long working hours adversely affect the lifestyles of workers as a result of energy and time depletion. Workers also tend to engage in unhealthy habits (e.g., smoking, alcohol consumption, eating fast food, late-night snacking, lack of exercise, and irregular medication) under such conditions<sup>35, 36</sup>). Long

working hours can also reduce participation in healthy activities (e.g., physical activity, fruit and vegetable consumption)<sup>37</sup>). Third, an imbalance between work and the rest of one's life can have a negative impact on health because of the double burden of occupational and familial demands<sup>33, 38</sup>).

This study had a few limitations. First, its cross-sectional design rendered it difficult to identify causal relationships between long working hours and psychosocial stress responses. We can conclude only that there is an association between long working hours and psychosocial stress responses, but the causal features of this relationship, if any, require confirmation through a cohort or longitudinal study. Second, female workers constituted less than 10% of the total study population, and this group seldom worked more than 60 hours per week. As a consequence, we were unable to use the logistic regression model to analyze data from female participants after stratifying by gender. Third, we collected the data from white-collar workers in one company, so the findings cannot be generalized to the total Korean working population. Despite these limitations, our study also had strengths. We adjusted for comprehensive psychosocial working conditions as well as for gender, age, position, marital status, and educational level. This allowed us to conclude that long working hours are an independent risk factor for stress responses after considering the effects of other psychosocial working conditions as mediators. This study was able to establish an association between long working hours and preclinical psychosocial stress responses among white-collar workers in one Korean company. We suggest that the implementation of effective regulations regarding working hours and the management of psychosocial working conditions can be a successful way to reduce psychosocial stress responses and improve workers' health. A longitudinal study based on cumulative working hours may also be helpful in this regard.

## Acknowledgments

This work was supported by a grant from Research year of Inje University in 20140385 and the Occupational Safety and Health Research Institute, Korean Occupational Safety and Health Agency (2014-OSHRI-808). All authors declare that they have no conflicts of interest.

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