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Original article

## Association Between Flexible Work Arrangement and Sleep Problems Among Paid Workers: Using 6th Korean Working Conditions Survey



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### ABSTRACT

**Background:** As social distancing persists and interest in work-life balance grows, more companies are adopting flexible work policies. While there have been studies on sleep disorders associated with different types of work, such as shift work, research exploring the relationship between flexible work schedules and sleep disorders is still limited, particularly among Korean workers.

**Methods:** We performed a secondary analysis of the 6<sup>th</sup> Korean Working Conditions Survey, focusing on 31,243 paid workers out of a total of 50,538 participants. We defined flexible workers as those who set their own working hours. Sleep disorders were divided into three categories: ‘difficulty falling asleep,’ ‘frequent waking during sleep,’ and ‘waking up feeling exhausted and fatigued.’ Using scores derived from three specific symptoms, the Minimal Insomnia Symptoms Scale (MISS) was calculated to assess the prevalence of insomnia. We used chi-square tests to analyze demographic and job-related differences. A multivariate logistic regression analysis was employed to identify any relationship between flexible work schedules and sleep disorders.

**Results:** Significant differences were found between flexible and non-flexible workers regarding age, income level, education level, and job type. Flexible workers reported sleep-related symptoms significantly more often. The odds ratio for insomnia was 1.40 (95% CI 1.21–1.61). For males, the odds ratio was 1.68 (1.36–2.08).

**Conclusion:** This study establishes a correlation between flexible work schedules and sleep disorders among Korean salaried workers. Potential causes could include changes in circadian rhythm, increased work demands, and extended working hours. To precisely determine causality and associated diseases, further research is required.

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### 1. Introduction

Flexible work arrangements are systems that provide flexibility in terms of working hours, location, workload, and continuity of work [1,2]. According to Republic of Korea’s Labor Standards Act, this is a system that allows workers and employers to adjust their

working hours and days, or to choose and improve their working hours and locations, in order to harmonize work-life balance and improve efficiency in manpower utilization [3]. As interest in quality of life rises [4], and with the backing of corporations and government support [5], alongside advances in IT technology [6,7], these flexible work arrangements are becoming more prevalent.

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The adoption of flexible work arrangements has surged in the aftermath of the COVID-19 pandemic [8]. In the United States and Europe, about half of all workers have adopted flexible working arrangements [9]. According to Statistics Korea, the percentage of flexible workers rose from 4.6% in 2015 to 14.2% in 2020, an increase of more than a third [10]. While the spread of flexible work is not a new phenomenon, COVID-19 has certainly accelerated this trend. In a survey of Korean companies, 51.1% of those implementing flexible work arrangements stated that they plan to continue and expand this work system even after COVID-19 subsides [11]. Therefore, the flexible work arrangement trend will persist and continue to spread worldwide [6,12].

Sleep disorders represent one of the major health issues, with about 5% of Koreans suffering from chronic insomnia. The number of patients with sleep disorders has increased by 7.9% annually over the past five years [13]. Sleep problems not only lead to an increased risk of accidents due to poor concentration and sleepiness [14], but they also have detrimental effects on mental health, exacerbating symptoms of depression and anxiety [15]. Moreover, sleep disorders have been associated with a higher risk of chronic diseases such as coronary artery disease [16–19], stroke [18,20], obesity [20,21], and diabetes [22,23].

Previous studies relating to flexible work arrangements have reported that they help to reduce stress levels [24,25] and have a positive impact on physical health and symptoms [26,27]. Nevertheless, there have been relatively few studies focused on sleep health, and the existing results are inconsistent [25,28].

This study attempted to confirm a significant relationship between flexible work arrangements and sleep problems, utilizing data from the 6<sup>th</sup> Korean Working Conditions Survey (KWCS). Through this study, we intend to understand the impact of flexible work arrangements on the sleep health of paid workers in Korea, thereby contributing to the development of future working environments.

## 2. Materials and methods

### 2.1. Study participants

This study is a secondary analysis of data from the 6<sup>th</sup> KWCS (2020–2021), conducted by the Occupational Safety and Health Research Institute (OSHRI) within the Korea Occupational Safety and Health Agency. The KWCS, based on the European Working Conditions Survey (EWCS) and the Labor Force Survey of the United Kingdom, encompasses various aspects of the work environment such as work patterns, employment type, occupation, industry, exposure to risk factors, and employment stability, among workers. The KWCS is an interview-based survey of employed persons aged 15 and over, conducted in a one-on-one interview format through household visits by an interviewer. The data can be downloaded from the website of the Korea Occupational Safety and Health Institute (<https://oshri.kosha.or.kr/>) [29]. Of the 50,538 KWCS participants, 31,489 paid workers were selected as the study subjects, excluding only those with missing data. The exclusion of employers and self-employed workers. Employers and self-employed workers were excluded to increase the study's validity and reliability, as their labor characteristics and environments differ from those of paid workers (Fig. 1).

### 2.2. Variables

#### 2.2.1. Flexible working

The status of flexible working was determined using a self-reported questionnaire. The specific question was, “How are your working time arrangement set?” We considered participants as a

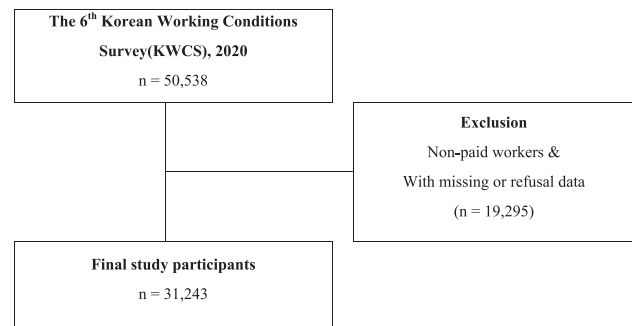


Fig. 1. Schematic diagram depicting study population.

flexible worker when they answered “You can adapt your working hours within certain limits (e.g. flextime)” or “Your working hours are entirely determined by yourself”.

#### 2.2.2. Sleep disorder

Participants were asked the following questions regarding their perception of sleep disorder into three categories: “difficulty in falling asleep”, “waking up repeatedly during sleep (frequent waking)” and “waking up with a feeling of exhaustion and fatigue (waking without feeling refreshed)” Each category was scored on a 5-point scale and were classified based on their frequency into “daily” (4 points), “several times a week” (3 points), “several times a month” (2 points), “less often” (1 point), and “never” (0 points). “Daily” (4 points), “several times a week” (3 points), and “several times a month” (2 points) were classified as having sleep problems; “less often” (1 point) and “never” (0 points) were classified as not having sleep problems. The Minimal Insomnia Symptoms Scale (MISS) was used to assess insomnia. The MISS is a screening tool for the measurement of insomnia in people between 20 and 64 years of age and has 3 components. The total score was calculated by summing the scores for each subcomponent and ranged from 0 to 12, with scores  $\geq 6$  being considered insomnia and scores  $< 6$  being considered normal sleep [1].

#### 2.2.3. Covariates

**2.2.3.1. General characteristics.** For general characteristics, sex, age, education level, monthly income, and chronic comorbidities were included. Age was classified into below 15–39 years, 40–49 years, 50–59 years, and over 60 years. Education levels were divided into four groups: less than middle school (below 9 years), High school (10–12 years), and College or higher (above 13 years). Monthly income was classified into lower than 2 million KRW, 2–3 million KRW, 3–4 million KRW, and 4 million KRW or more. Participants' chronic disease status was recorded as ‘yes’ or ‘no’.

**2.2.3.2. Occupational characteristics.** The occupational classification of the study subjects was classified based on the 7th Korean Standard Occupational Classification [30] and the types of occupations were simplified into office workers (managers, experts and related workers, and office workers), service workers and sales workers, and manual workers (skilled agricultural, forestry, and fishery workers; craft and related workers; equipment/machine operating and assembling workers; elementary workers).

The legally permissible working hours in Korea are defined as 8 hours a day and 40 hours a week, and overtime working hours are limited to less than 12 hours a week. Therefore, if the working hours exceeded 52 hours a week, it was defined as long working hours in this study.

A respondent was classified as a shift worker if they answered ‘I work shifts’ in the questionnaire on their type of work.

### 2.3. Statistical analysis

The statistical analyses were performed using SAS (version 9.4, SAS Institute, NC, USA). Frequency analysis was conducted for the baseline characteristics of the participants. The  $\chi^2$  test was used to assess the relationship between Flexible working with the participants' characteristics. Multiple logistic regression analyses were performed to calculate odds ratios (ORs) and 95% confidence intervals (CI) by adjusting for potential confounding factors, which were sex, age, education, monthly income, chronic comorbidities, job classification, long working hours, and shift work. In order to understand the factors affecting sleep disorder, only flexible workers were stratified, and logistic regression analysis was performed.

### 3. Ethics statement

The Institutional Review Board (IRB) of Gil Medical Center, Gachon University, approved this study (IRB No. GCIRB2021-380).

### 4. Results

#### 4.1. Baseline characteristics of the study participants according to flexible working

The baseline characteristics of the study participants ( $n = 31,243$ ) were analyzed to understand the distribution of flexible work arrangements and their association with various

**Table 1**  
Baseline study participants ( $n = 31,243$ ) according to flexible work

	Total participants		Flexible work				P-value
	n	%	No		Yes		
	n	%	n	%	n	%	
<b>Total subjects</b>	31,243	100	29,068	93.04	2,175	6.96	
<b>Sex</b>							0.6399
Men	14,616	46.78	13,609	93.11	1,007	6.89	
Women	16,627	53.22	15,459	92.98	1,168	7.02	
<b>Age</b>							<b>0.0242*</b>
15–39	10,783	34.51	10,079	93.47	704	6.53	
40–49	7,430	23.78	6,859	92.31	571	7.69	
50–59	7,151	22.89	6,650	92.99	501	7.01	
≥60	5,879	18.82	5,480	93.21	399	6.79	
<b>Education (academic years)</b>							<b>0.0005**</b>
below 9 years	3,854	12.34	3,641	94.47	213	5.53	
10–12 years	10,827	34.65	10,074	93.05	753	6.95	
above 13 years	16,562	53.01	15,353	92.70	1,209	7.30	
<b>Monthly income (₩10,000)</b>							<b>&lt;0.0001**</b>
<200	10,409	33.32	9,624	92.46	785	7.54	
200–299	10,426	33.37	9,871	94.68	555	5.32	
300–399	6,115	19.57	5,704	93.28	411	6.72	
≥400	4,293	13.74	3,869	90.12	424	9.88	
<b>Chronic disease</b>							<b>&lt;0.0001**</b>
No	28,492	91.19	26,578	93.28	1,914	6.72	
Yes	2,751	8.81	2,490	90.51	261	9.49	
<b>Job classification</b>							<b>&lt;0.0001**</b>
Office worker	13,340	42.7	12,374	92.76	966	7.24	
Service and sales workers	7,338	23.49	6,668	90.87	670	9.13	
Manual worker	10,565	33.82	10,026	94.90	539	5.10	
<b>Work hours(hours per week)</b>							0.1020
0–51	28,401	90.9	26,445	93.11	1,956	6.89	
≤52	2,842	9.1	2,623	92.29	219	7.71	
<b>Shift Work</b>							<b>0.0004*</b>
No	28,136	90.06	26,130	92.87	2,006	7.13	
Yes	3,107	9.94	2,938	94.56	169	5.44	
<b>Sleep disturbance</b>							
<b>Q1. Difficulty falling asleep</b>							<b>0.0002**</b>
No	27,826	89.06	25,941	93.23	1,885	6.77	
Yes	3,417	10.94	3,127	91.51	290	8.49	
<b>Q2. Waking up repeatedly during the sleep</b>							<b>&lt;0.0001**</b>
No	26,957	86.28	25,159	93.33	1,798	6.67	
Yes	4,286	13.72	3,909	91.20	377	8.80	
<b>Q3. Waking up with a feeling of exhaustion and fatigue</b>							<b>&lt;0.0001**</b>
No	25,487	81.58	23,849	93.57	1,638	6.43	
Yes	5,756	18.42	5,219	90.67	537	9.33	
<b>MISS score</b>							<b>&lt;0.0001**</b>
0–5(Normal sleep)	28,481	91.16	26,569	93.29	1,912	6.71	
≥6(Insomnia)	2,762	8.84	2,499	90.48	263	9.52	

\*  $p < 0.05$ , \*\*  $p < 0.01$ .

demographic and occupational factors (Table 1). The study comprised 31,243 total participants, with a significant majority (93.04%) not engaged in flexible work arrangements. Both genders showed similar proportions in flexible work, with men at 6.89% and women at 7.02%. The age group distribution indicated that younger participants (15–39 years) were slightly less likely to be engaged in flexible work compared to older age groups. A notable gradient was observed in education levels, with higher academic attainment being associated with a higher likelihood of engaging in flexible work. Those earning 400,000 Won or more had the highest rate of flexible work (9.88%). Participants without chronic diseases were more likely to be in flexible work arrangements compared to those with chronic diseases. Office workers had a higher rate of flexible work (7.24%) compared to service, sales, and manual workers. There was no significant difference in work hours per week with regard to flexible work arrangements. Those not engaged in shift work were more likely to be in flexible work compared to those who did shift work. Participants reporting sleep disturbances, including difficulty falling asleep, waking up repeatedly during sleep, and waking up feeling exhausted, were more likely to be engaged in flexible work. Higher MISS scores, indicative of insomnia, were also associated with a higher likelihood of being in flexible work arrangements. The data shows that 9.52% of participants with a MISS score indicating insomnia ( $\geq 6$ ) were in flexible work, compared to 6.71% of those with normal sleep scores (0–5). Several variables, including age, education, income, presence of chronic disease, job classification, and aspects of sleep disturbance, showed statistical significance ( $p$ -value  $< 0.05$ ) in their association with flexible work.

#### 4.2. Comparison of MISS score mean and standard deviation amongst male and female workers by flexible work arrangement

In Table 2, the mean and standard deviation of the MISS scores among the study participants are displayed. The total subjects show that the average MISS score is slightly higher for flexible workers (mean = 2.40, SD = 2.52) compared to non-flexible workers (mean = 2.00, SD = 2.31). Among male participants, those in flexible arrangements had a slightly higher average MISS score (mean = 2.35, SD = 2.48) than their non-flexible counterparts (mean = 1.81, SD = 2.20). Female participants exhibited a similar pattern, with flexible workers scoring an average MISS score of 2.44 (SD = 2.55), slightly higher than non-flexible workers (mean = 2.17, SD = 2.39).

#### 4.3. Sex-stratified analysis of insomnia risk between flexible and non-flexible workers

Table 3 displays the results of regression analysis examining the association between flexible work status and the risk of insomnia calculated using the MISS score among the total subjects and stratified by sex. The risk of insomnia is 1.40 times higher among flexible workers compared to non-flexible workers, with a confidence interval of (1.21–1.61). Among males, flexible workers

**Table 2**  
Comparison of MISS score mean and standard deviation amongst male and female workers by flexible work arrangement

	N	Mean	SD	Non-flexible worker			Flexible worker		
				N	Mean	SD	N	Mean	SD
Total subjects	31,243	2.03	2.33	29,068	2.00	2.31	2,175	2.40	2.52
Male	14,616	1.85	2.23	13,609	1.81	2.20	1,007	2.35	2.48
Female	16,627	2.19	2.40	15,459	2.17	2.39	1,168	2.44	2.55

MISS, Minimal Insomnia Symptoms Scale; N, The number of subjects surveyed; SD, Standard Deviation.

**Table 3**  
Sex-stratified analysis of insomnia risk between flexible and non-flexible workers.

	MISS score $\geq 6$ (insomnia)	
	Non-flexible workers	Flexible workers
Total subjects	1	1.40 (1.21-1.61)
Male	1	1.68 (1.36-2.08)
Female	1	1.21 (0.99-1.46)

Data are presented as odds ratio (95 Confidence Interval).

The model was adjusted for age, sex, education level, monthly income, chronic comorbidities, job classification, long working hours and shift work.

MISS: Minimal Insomnia Symptoms Scale.

exhibit a 1.68 times higher risk of insomnia compared to non-flexible workers, with a confidence interval of (1.36–2.08). Among females, flexible workers have a 1.21 times higher risk of insomnia compared to non-flexible workers, with a confidence interval of (0.99–1.46).

## 5. Discussion

This study attempted to clarify the relationship between flexible work arrangements and sleep problems in Korean paid workers. As a result of the study, it was confirmed that flexible workers have significantly different general and occupational characteristics from non-flexible workers. Moreover, it was notably observed that flexible workers not only reported sleep-related symptoms more frequently but also had higher MISS scores than their non-flexible counterparts. This significant observation suggests a link between the adoption of flexible work arrangements and a decline in sleep quality, highlighting the potential impact of changing work patterns on the sleep health of workers.

Until now, most of the studies on flexible work have focused on sociological results such as motivation, stress, job satisfaction, work-life balance, and work productivity. Some studies have reported the relationship between flexible work and physical health, and the results show that flexible work has a positive effect on the health of workers, the number of days of absence, and the reduction of physical symptoms [31,32]. Regarding flexible work and sleep health, the positive effect of flexible work on reducing stress level is expected to be effective in improving sleep disorders, and among the types of flexible work, it is reported that the ease of taking a leave of absence significantly improved sleep disorders [25]. In addition, there are reports that sleep disorder-related symptoms such as insomnia and daytime sleepiness decrease as self-control of working hours is possible [28,33], but another study reports that there is no significant relationship [25].

Shift work and flexible work are similar in that working hours are not constant. Several studies have been reported on the negative effects of shift work on sleep health [34–36], but there is a difference between shift work and flexible work in that they can control work time on their own.

The effect of flexible work on sleep can be explained as follows. Firstly, sleep disorders can result from unhealthy sleep hygiene due to inappropriate allocation of personal resources. Flexible work allows individuals to make decisions about how, when, and where to allocate personal resources (time, physical and mental energy, finances) when faced with demands in both work and personal domains [37,38]. Therefore, the management and allocation of personal resources can lead to positive or negative outcomes. Adequate and controlled resource allocation can lead to positive outcomes, whereas inadequate resource availability or lack of control can lead to negative outcomes [38]. In the previous study, short-term forms of flexibility, such as the ease of taking time off for illness or other personal matters, significantly improved sleep difficulties, while compressed work weeks showed no improvement

in sleep quality [25]. Unhealthy sleep hygiene, such as irregular sleep patterns resulting from inefficient resource allocation, can lead to sleep disorders, which can ultimately lead to insomnia.

Secondly, there is a study that when flexible work is performed, the work demands and working hours increase [34,39]. According to a survey of more than 21,000 companies and 3.14 million people in 16 large cities in the United States, Europe, and the Middle East, daily working hours increased by an average of 48.5 minutes compared to before COVID-19 [40]. It was found that the average total working hours was 41.04 hours, the average weekly working hours of flexible workers was 44.33 hours, and the average weekly working hours of flexible workers was 39.51 hours, when we re-analyzed the data we used. Since long working hours can have negative effects on insomnia and short sleep [41,42], extending working hours can cause aggravation of sleep disorders.

This study is significant in that it is one of the first studies to analyze the relationship between flexible work arrangements and sleep problems for paid workers in Korea using large-scale national cross-sectional survey data that can represent Korean workers. The limitations of the study are as follows, and attention is required when interpreting the results. Since this study used existing data, various variables to explain the subject of the study were not reflected. In this study, it was measured through a self-report questionnaire related to sleep quality, but in the future, objective sleep quality can be measured using multiple sleep tests. In addition, various disturbance variables or intervention factors were controlled, but the effects of caffeine, smoking, and alcohol abuse could not be controlled. Also, as this study was based on a cross-sectional study design, causality could not be established. Lastly, there are various forms of flexible work, but in this study, there is a limit in that it has been investigated only in the form of flex time.

## 6. Conclusion

This study showed that workers who had performed flexible work had more sleep problems and insomnia. Further studies are needed to reveal the effect of flexible work arrangement for sleep health and following mental health such as depression or anxiety.

## Conflicts of interest

SK Kang has been the Editor-in-Chief of the Safety and Health at Work since January 2011, but had no role in the decision to publish this original article. No other potential conflicts of interest relevant to this article have been declared.

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