



## Original Article

## Association Between Work Conditions and Smoking in South Korea

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## ABSTRACT

**Background:** A variety of sociodemographic factors, such as gender, age, household income, and educational level, influence individuals' likelihood of smoking. Work-related factors may also be linked to smoking behavior. We sought to investigate the relationship between smoking and work environment in South Korea.

**Methods:** We analyzed data from the Fifth Korean National Health and Nutrition Examination Survey to determine whether there was an association between smoking and occupation type (e.g., manual, nonmanual, or service work), night-shift work, and hours worked/week (e.g., <40, 40–48, 49–60, or >60 hours) for 4,685 workers. Regression models were adjusted for sociodemographic variables such as age, recent alcohol consumption, hours slept, educational level, and household income.

**Results:** The prevalence of smoking was 50.1% in men and 7.2% in women. For women, manual workers had 2.34 times [95% confidence interval (CI): 1.02–5.36] greater odds of smoking compared with nonmanual workers, whereas service workers had 2.37 times greater odds (95% CI: 1.28–4.40). Furthermore, women who worked 49–60 hours had 2.21 times greater odds of smoking (95% CI: 1.10–3.75) as compared with women who worked 40–48 hours.

**Conclusion:** Women who work long hours or who are employed in service or manual positions are more likely to smoke. These results indicate a need in South Korea to target these specific groups when creating nonsmoking policies.

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## 1. Introduction

The risk of coronary artery disease, sudden death, arteriosclerosis, and hypertensive diseases is much higher in smokers, as are multiple forms of cancer, including lung and laryngeal cancer [1]. In the United States, smoking is responsible for more than 438,000 premature deaths every year [2], and the potential life span loss is 13.2 years for men and 14.5 years for women [3]. In South Korea, disease due to smoking is also severe; the disability-adjusted life years per 100,000 individuals for smoking-related cancers are 2,038.9 for men and 732.2 for women [4]. Smoking in the workplace can cause respiratory disease and cancer through synergistic effects with other toxic substances. Moreover, smoking can indirectly affect nonsmokers adversely [5]. Following the creation of the National Health Promotion Act in 1995, Korea has attempted to

reduce smoking among workers using broad policies such as designating smoke-free buildings [6]. However, when Jang et al [5] analyzed data from the 2007–2009 Korean National Health and Nutrition Examination Survey (KNHANES), they reported that although the prevalence of smoking declined over the study period, it remained high; in 2009, 51.1% of adult male workers and 6.1% of adult female workers were smokers. Some studies indicate that work conditions are related to smoking. For example, individuals who work long hours or work night shifts, or those whose jobs involve a high level of manual labor have trouble trying to quit [7–10]. One study found that a high percentage of night-shift workers are smokers, and members of this group have a tendency to smoke in the workplace [11]. Another study reported that the prevalence of smoking increases with the number of hours worked [12], possibly because long hours elicit emotional stress, which can make

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smoking cessation difficult [13]. However, not all studies have found a strong correlation between work environment and smoking. For example, Lallukka et al [14] reported no association between unfavorable working conditions and smoking.

Most studies that have identified a relationship between work environment and smoking have been carried out in the United States and Europe. Few studies have been performed in Asian countries where smoking is relatively common. Therefore, using data from KNHANES V (2010), we investigated the association between smoking and workplace characteristics, such as type of occupation, night-shift work, and work hours.

## 2. Materials and methods

The KNHANES is a national survey carried out by the Korea Centers for Disease Control and Prevention to evaluate the health and nutrition of Koreans. During the first (1998), second (2001), and third (2005) surveys, a short-term survey system of 2 or 3 months was implemented every 3 or 4 years. In the fourth (2007–2009) survey, a new sampling method was introduced in which an independent rolling probability sample, representative of the entire country, was taken every year. This method was also used in the fifth (2010–2012) survey. Two sampling frames were created by dividing residential areas into general areas and apartment areas [15]. Health surveys, examinations, and nutrition surveys were administered to clusters of 20 households. Using structured interviews, trained interviewers visited select households and collected information on demographics; social, economic, and professional characteristics; health conditions; and health behaviors.

Our analyses were based on all adults who reported their average number of hours worked/week in the fifth (2010) KNHANES. Participants younger than 19 years and with missing information on working hours were excluded. In total, 2,486 men and 2,199 women were eligible. The outcome variable in this study was smoking. When a participant answered the question “Are you smoking now?” with “I smoke everyday” or “I sometimes smoke,” he or she was considered a current smoker. Ex-smokers were included in the nonsmoker category. Participants were assigned to employment categories based on their answers to the relevant survey items. Homemakers, students, and others were classified as “unemployed” and were excluded from the analysis. Participants classified as “nonmanual” workers included managers, professionals, and office workers. Participants classified as “manual” workers included individuals who worked in the agriculture, forestry, or fishery industries; who operated and assembled devices and machines; and who worked in construction. All other participants who reported employment information were classified as “service” workers. Participants who answered the question, “Do you usually work in the daytime (6:00 AM to 6:00 PM)?” with “I usually work in the daytime” comprised the “non-night-shift group,” whereas the remainder were assigned to the “night-shift group.” Article 53 of the Korean Labor Standards Act sets the upper limit on work hours at approximately 52 hours/week [16]. Because this limit does not include overtime work performed on holidays, work hours in Korea may be substantially longer. Kim et al [17] reported that the average Korean employee spends 48.57 hours/week in the workplace, with 20.72% of those employed working more than 60 hours/week. Working more than 60 hours/week has been associated with greater health problems. The Korean government has set 60 hours/week as the standard for dispensing compensation for death caused by overworking. According to this information, work hours were classified into the following categories: <40, 40–48, 49–60, and >60 hours/week.

Age, socioeconomic (e.g., education and household income), and health behavior variables (e.g., alcohol consumption, sleep) were also included in our analysis. Age was classified into three groups, namely, 19–39, 40–59, and ≥60 years old. Educational level was classified according to whether a participant had completed elementary school, middle school, high school, or college. Household income was divided into quartiles. Participants who reported not having taken a drink in the last year were classified as not having recently consumed alcohol and those who gave any other answer were considered to have recently consumed alcohol. Sleep was classified into the following categories: <5, 5–7, and >8 hours/night, on average.

The SAS 9.2 Statistical Package for Windows (SAS Institute, Inc., Cary, NC, USA) was used for performing statistical analyses. All analyses were stratified by gender. The weighted prevalence was calculated using the syntax *surveyfreq* in SAS. The population-based, adjusted odds ratios (ORs) for smoking were calculated by including the stratification, cluster, and weight variables provided by the KNHANES V.

Our study design was approved by the Institutional Review Board of the Catholic University of Korea (Approval ID: MC12EISI0150).

## 3. Results

Table 1 shows the sociodemographic characteristics of smokers in South Korea, stratified by gender. In adult workers who participated in the KNHANES V, the prevalence of smoking was 50.1% and 7.2% in men and women, respectively. The prevalence of smoking in men was found to be significantly different by age, recent alcohol consumption, and household income ( $p < 0.05$ ). However, there were no significant differences for educational level or for hours slept/night.

In women, the prevalence of smoking differed significantly by age, recent alcohol consumption, and educational level ( $p < 0.05$ ). The prevalence of smoking was 9.8%, 5.9%, and 2.9% in women aged

**Table 1**

Estimated smoking prevalence according to sociodemographic characteristics in South Korea, stratified by gender

	Male (2,486/ 16,274,718)	<i>p</i>	Female (2,199/ 11,637,516)	<i>p</i>
	% (SE) <sup>a</sup>		% (SE) <sup>a</sup>	
Total	50.1 (1.2)	<0.0001	7.2 (1.0)	<0.001
Age (y)				
19–39	55.4 (2.0)	<0.0001	9.8 (1.6)	0.004
40–59	50.1 (2.0)		5.9 (1.4)	
≥60	29.3 (2.1)		2.9 (1.0)	
Recent alcohol consumption				
Yes	52.6 (1.3)	<0.0001	8.7 (1.1)	0.003
No	33.0 (4.2)		3.2 (1.3)	
Household income				
Q1 (low)	44.8 (3.7)	0.0213	5.4 (2.0)	0.605
Q2	56.0 (2.8)		9.2 (1.7)	
Q3	50.4 (2.5)		6.7 (1.4)	
Q4 (high)	45.8 (2.2)		7.0 (2.3)	
Education				
<Elementary	46.0 (3.5)	0.3383	3.8 (1.4)	0.024
Middle school	48.3 (4.2)		12.6 (3.4)	
High school	52.7 (2.1)		8.6 (1.7)	
≥College	48.7 (2.0)		5.9 (1.3)	
Hours of sleep (per night)				
<5	39.6 (8.4)	0.1667	4.3 (4.1)	0.783
5–7	49.2 (1.5)		7.2 (1.1)	
≥8	52.9 (2.2)		7.5 (1.4)	

Data on male and female are presented as (sample number/total estimated Korean population).

SE, standard error.

<sup>a</sup> Weighted prevalence of smoking (standard error).

**Table 2**  
Estimated smoking prevalence according work-related characteristics in South Korea, stratified by gender

	Male (2,486/ 16,274,718)	<i>p</i>	Female (2,199/ 11,637,516)	<i>p</i>
	% (SE) <sup>a</sup>		% (SE)	
Occupation				
Nonmanual	48.0 (2.3)	0.436	4.7 (1.0)	0.039
Manual	51.8 (1.9)		6.9 (1.8)	
Service	49.2 (2.6)		9.4 (1.5)	
Night-shift work				
Yes	53.3 (1.3)	0.225	9.9 (1.0)	0.112
No	49.3 (3.1)		6.6 (2.0)	
Hours worked/week				
<40	50.9 (2.8)	0.239	5.5 (1.1)	0.008
40–48	46.9 (2.3)		6.8 (1.5)	
49–60	50.9 (2.2)		12.3 (2.5)	
>60	53.8 (2.6)		5.2 (1.8)	

Data on male and female are presented as (sample number/total estimated Korean population).

SE, standard error.

<sup>a</sup> Weighted prevalence of smoking (standard error).

19–39, 40–59, and ≥60 years, respectively. Smoking was more prevalent among women who had consumed alcohol recently (8.7%) than among those who had not (3.2%). The prevalence of smoking according to educational level was 3.8% for elementary school, 12.6% for middle school, 8.6% for high school, and 5.9% for college/university. The prevalence of smoking did not differ by household income or hours slept/night.

Table 2 shows the work-related characteristics of smokers in South Korea, stratified by gender. In male workers, there were no differences in smoking prevalence according to type of occupation, night-shift work, or hours worked. However, for women, smoking prevalence differed according to type of occupation (4.7% in nonmanual workers, 6.9% in manual workers, and 9.4% in service workers; *p* < 0.05). Similarly, the prevalence of smoking significantly differed (*p* < 0.05) by age: 5.5% (<40 years), 6.8% (40–48 years), 12.3% (49–60 years), and 5.2% (>60 years).

Table 3 shows the ORs for smoking according to work-related characteristics in men; Table 4 shows the same for women. The regression models for the adjusted ORs included age, recent alcohol consumption, household income, education level, and hours of sleep/night. For men, there was no significant association between smoking and type of occupation or night-shift work. However, for women, manual workers had 2.34 [95% confidence interval (CI): 1.02–5.36] times greater odds of smoking when compared with nonmanual workers, whereas service workers had 2.37 (95% CI: 1.28–4.40) times greater odds. Furthermore, women who worked

**Table 3**  
Odds ratios for smoking in Korean men according to work-related characteristics (N = 2,486)

	Crude OR (95% CI)	Adjusted OR (95% CI) <sup>a</sup>
Occupation		
Nonmanual	1	1
Manual	1.16 (0.91–1.50)	1.21 (0.86–1.70)
Service	1.05 (0.80–1.36)	0.89 (0.65–1.22)
Night-shift work		
No	1	1
Yes	1.17 (0.91–1.52)	1.11 (0.82–1.49)
Hours worked/wk		
<40	1.17 (0.90–1.53)	1.28 (0.96–1.71)
40–48	1	1
49–60	1.17 (0.10–1.51)	1.13 (0.86–1.48)
>60	1.32 (1.00–1.73)	1.28 (0.94–1.74)

CI, confidence interval; OR, odds ratio.

<sup>a</sup> Adjusted for age, recent alcohol consumption, household income, education, hours of sleep/night, type of occupation, night-shift work, and hours worked/week.

**Table 4**  
Odds ratios for smoking in Korean women according to work-related characteristics (N = 2,199)

	Crude OR (95% CI)	Adjusted OR (95% CI) <sup>a</sup>
Occupation		
Nonmanual	1	1
Manual	1.49 (0.76–2.93)	2.34 (1.02–5.36)
Service	2.10 (1.25–3.52)	2.37 (1.28–4.40)
Night-shift work		
No	1	1
Yes	1.55 (0.92–2.60)	1.38 (0.83–2.29)
Hours worked/wk		
<40	0.80 (0.45–1.42)	0.76 (0.41–1.42)
40–48	1	1
49–60	1.93 (1.10–3.39)	2.21 (1.10–3.75)
>60	0.74 (0.36–1.52)	0.75 (0.33–1.72)

CI, confidence interval; OR, odds ratio.

<sup>a</sup> Adjusted for age, recent alcohol consumption, household income, education, hours of sleep/night, type of occupation, night-shift work, and hours worked/week.

49–60 hours/week had 2.21 (95% CI: 1.10–3.75) times greater odds of smoking as compared with those who worked 40–48 hours.

#### 4. Discussion

In this study, we found a high prevalence of smoking among female workers in manual or service positions. Previous studies of female workers also found that those who work in physically demanding jobs are more likely to smoke [12,18]. The authors of these previous studies hypothesized that because physically demanding blue-collar jobs are usually performed by men, women in such positions may use smoking as a means of negotiating their acceptance into a male-dominated work culture, where smoking is much more common [12]. In addition, the Minnesota Heart Survey found the highest prevalence of smoking among service workers, possibly because they are frequently exposed to smoking in the workplace [19]. Finally, it is known that the more stressful a job, the more likely a worker is to smoke [11], and women in the service sector are exposed to a higher rate of various stressors than are women in other fields [20].

Many studies report that long work hours are associated with an increase in adverse health behaviors, including smoking, alcohol consumption, and lack of exercise [21]. In our study, a significantly elevated odds of smoking was found among women working 49–60 hours/week compared with those working 40–48 hours. This finding is consistent with previous studies that have shown a positive correlation between work hours and smoking [22,23]. Long work hours can be a source of job-related stress, and, as mentioned earlier, individuals exposed to large amounts of stress are more vulnerable to nicotine addiction [24]. In addition, longer work hours are associated with a lower probability of smoking cessation [13]. Although previous findings appear to predict a positive linear association between long hours and smoking, in our study, women who worked >60 hours were less likely to smoke than those who worked 49–60 hours, although the difference was not statistically significant (OR: 0.75; 95% CI: 0.33–1.72). Smoking in women tends to be a taboo subject in South Korea, and most women are reluctant to smoke in public. As a result, women often smoke alone or in private spaces, and often outside of work hours. The longer the work hours, the more difficult it is to fit in a smoking break. Given the additional hours women spend performing domestic duties, it may be that the lower likelihood of smoking among women who work exceedingly long hours is due to a lack of time and space. Additional studies on female smoking patterns are thus needed.

In our study, the adjusted ORs for smoking were elevated in men and women who worked night shifts, but these were not statistically significant. In a study of 197,653 Swedish workers, Knutsson

and Nilsson [24] reported that night-shift workers were more likely to smoke. Smoking among night-shift workers may be high because they use cigarettes to stay alert and to ward off sleepiness and boredom. In addition, workers may feel more comfortable smoking at night. Because of lack of studies on the relationship between night-shift work and smoking, and the ambiguity of existing findings [14], additional longitudinal studies on night-shift work and smoking are needed.

In our study, it was only for women that work conditions were associated with smoking behavior. There are several possible explanations for this finding. First, women may be more sensitive to work conditions than men may. Job stress and depressive symptoms are more acute in women, even after controlling for type of occupation [25]. Although both men and women do manual work, women are more likely to be assigned simple, repetitive tasks rather than being employed in jobs such as construction, and therefore, their job satisfaction may be lower [26]. Lower job satisfaction may be linked to higher work-related stress [27]. We hypothesize that increased levels of work-related stress might mediate the relationship between smoking and occupational characteristics in women. Second, smoking is common among Korean men, even those of high socioeconomic status. In addition, smoking is not taboo for men. Perhaps, for the Korean man, the decision to smoke may be influenced more by social culture than by work conditions.

This study has a number of strengths. First, we drew up on a nationally representative data set. Second, we examined the effect of multiple work-related factors, including type of occupation, night-shift work, and average number of hours worked, on smoking. Third, this study was carried out in South Korea, where the prevalence of smoking is high and average weekly work hours are among the highest of all countries belonging to the Organization for Economic Cooperation and Development. Our study also has several limitations. First, because our study was cross-sectional, we cannot draw conclusions about causality. Second, everyone who disagreed with the statement “I usually work in the daytime” was classified as a night-shift worker; this categorization may not have captured other work hour possibilities. Future studies should use a larger number of work shift categories.

In conclusion, we investigated the relationship between work conditions and smoking. According to our results, women who work long hours (49–60 hours) or who hold manual or service positions should be considered primarily when crafting anti-smoking policies. Recently, interest in workers' health and the effects of long work hours on health has increased. This study provides information that can be used to improve work environments. However, additional studies are needed to clarify the direction of causality in the relationship between smoking and work environment.

### Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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