



# Suicidal ideation and long work hours by gender in Korean employees: The Kangbuk Samsung Workplace Mental Health Study

## A cross-sectional study

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## ABSTRACT

**Purpose:** This study investigated the relationship between increased working hours and suicidal ideation among Korean full-time employees by gender.

**Methods:** Participants were employees from 54 companies and local government organizations in Korea, aged 19 to 68, who completed a self-reported questionnaire on sociodemographic factors, daily perceived stress, resilience, depressive symptoms, and suicidal ideation. Of the initial 15,360 respondents, participants who worked less than 40 hours were excluded. The final sample size was 9,326 (5,652 men, 3,674 women). Sociodemographic factors and psychological characteristics of participants with suicidal ideation were analyzed using Student's t-tests and chi-square tests for continuous and categorical variables, respectively. Hierarchical logistic regression analyses were performed using suicidality as the dependent variable respectively for all participants, for male, and female. Furthermore, we used these results to compare differences between men and women associated with regard to long working hours to better understand how long working hours correlate with suicidal ideation; further, we examined the impact of gender on this relationship.

**Results:** In univariate analyses, suicidal ideation was associated with increased working hours. Hierarchical logistic regression analyses of sociodemographic and psychological factors found no association between long working hours and suicidal ideation for the participants overall. However, they showed significant differences between men and women, such that long working hours were associated with suicidal ideation in men but were non-significant for women.

**Conclusion:** Suicidal ideation is associated with long working hours among Korean male full-time workers, while other factors are more likely to lead to suicidal ideation among female workers. Suicide prevention measures for employees should thus be developed based on gender.

**Keywords:** Gender difference; Long working hours; Suicidal ideation

## INTRODUCTION

Considerable efforts have been made worldwide to decrease suicide rates, including in South Korea [1]. Despite this, South Korea still has the highest suicide rate among Organisation for Economic Cooperation and Development (OECD) member nations [2]. To date, efforts to prevent suicide have been concentrated on mental care, restriction of access to deadly means, and techniques for identifying at-risk persons [1]. However, considering the steady rise in suicide rates among economically active young adults [3], it is equally important to stress suicide prevention measures for the employed. “Chronic long working hours” is the second most prevalent reason for mental illness, including suicide, directly after “acute stressful events” for Korean employees [4].

As reported by the OECD in 2019, the average annual working hours of Korean employees were 1,957 hours—231 hours longer than the average of 1,726 hours in OECD countries and the third longest working hours among reported countries [5]. The mechanism of increased working hours leading to greater suicidal ideation has been frequently discussed in previous studies. The frequency of depression and anxiety is increased by longer work hours and has a negative effect on the hours and quality of sleep [6]. These mental health conditions are closely related to suicidal ideation [7]. Furthermore, longer working hours act as a risk factor for cerebro-cardiovascular diseases, such as stroke, myocardial infarction, and aortic dissection, impairing the physical health of individuals and making them vulnerable to suicidal ideation [4]. Nevertheless, longer working hours were independently related to suicide ideation, even after controlling for mental and physical health conditions as confounding factors in earlier investigations [8]. Accordingly, there is the argument that longer working hours decrease the amount of time individuals can spend with their families and friends, causing social isolation, absence of communication, and familial conflict [9], potentially heightening suicidal ideation [10].

The likelihood of suicidal ideation was higher among those who worked 60 hours or more per week than in those who worked fewer than 52 hours per week, according to a study that used cross-sectional analyses to examine the association between working hours and suicidal ideation among Korean employees [11]. However, no statistically significant difference was found in suicidal ideation between employees who worked 60 hours or more per week and those who worked 52 to 60 hours per week, thus failing to show a dose-response relationship [11]. Another study found that, compared to the

group that worked 31 to 40 hours per week, suicidal ideation steadily rose in those who worked 41–50, 51–60, and 60 hours or more per week, demonstrating a dose-response relationship [12]. However, the participants of this study were only young employees aged 20 to 35 [12].

Numerous previous findings have indicated that increased working hours are associated with increased suicidal ideation. Moreover, the fact that the prevalence of suicidal ideation, suicide attempt rate, and suicide mortality differ between men and women has often been discussed in previous studies [13]. Meanwhile, only a few studies have examined how working hours and changes in suicidal ideation relate to gender. It is crucial to investigate factors associated with suicidal ideation separately based on gender to improve suicide prevention measures [14]. This study also considered the possibility that gender could impact the findings. It investigated the relationship between increased working hours and suicidal ideation among Korean full-time employees by gender to better understand how long working hours correlate with suicidal ideation.

## METHODS

### Participants of the study

Voluntary participants in the study (Koreans aged 19 to 68) attended a mental health checkup program at the Workplace Mental Health Institute, Kangbuk Samsung Hospital, in Seoul, Korea [15], upon invitation from their companies. Kangbuk Samsung Workplace Mental Health Institute is conducting studies to prevent suicide and improve employees' mental health. Some of these cases were included in this study. Participants were employees from 54 companies and local government organizations, which were classified as follows based on the United States Standard Industrial Classification division structure [16]. Seventeen service companies (six providing educational services, three providing health services, three providing business services, two hotels, and three video game arcade services), 13 companies in the field of finance, insurance, and real estate (five insurance companies, three commercial banks, four asset-backed securities, one real estate operator [no developers] and lessor), 10 public administrative bodies, nine companies in the field of manufacturing, three transportation and communication companies (one transportation company and two broadcasting companies), one company in the field of construction, and one company in the field of wholesale trade.

With a starting sample size of 15,360 respondents, the cur-

rent study was conducted between June 2015 and October 2019. Those whose questionnaires were incomplete or lacked sociodemographic data were rejected. Those who worked less than 40 hours per week were also rejected since it was unclear if the participant was a permanent worker. This data could be a confounder because job insecurity critically impacts suicidal ideation [17]. It is likely that those who work less than 40 hours per week are temporary workers, and it has been argued that such job insecurity may lead to increased suicidal ideation in these workers [18]. Based on the Labor Standards Act of Korea, statutory weekly work hours are 40 hours, so we chose 40 hours as the cut-off. The final sample size was 9,326 (5,652 men and 3,674 women). The study was approved by the Institutional Review Board of Kangbuk Samsung Hospital (IRB no. KBSMC 2019-01-042), which disregarded the need for informed consent because we solely used de-identified data typically gathered at workplace mental health screening exams.

## Measures

### *The sociodemographic factors*

Age, gender, educational attainment, marital status, job grade, and years at the current job (job duration) were the sociodemographic variables for this study. Job grade was categorized into four groups: executives, managers (general managers, deputy general managers, managers), staff (assistant manager, senior staff, staff), and others.

### *Daily perceived stress*

The Korean version of the 10-item Perceived Stress Scale (PSS), which gauges the extent to which circumstances in one's life are deemed stressful, was used to measure daily perceived stress. It is a self-reported questionnaire, and replies are graded on a Likert scale ranging from 1 (never) to 5 (very often), with 5 being the highest score. The Korean version of the PSS had a Cronbach's alpha of 0.795.

### *Depressive symptoms*

The Korean version of the 20-item Center for Epidemiological Studies Depression (CES-D) scale was used to measure depressive symptoms. It is a self-reported questionnaire with responses measured on a four-point Likert scale ranging from 0 to 3. Cronbach's alpha for the Korean version of the CES-D was 0.918.

### *Resilience*

Resilience was assessed using the Korean version of the Con-

nor-Davidson Resilience Scale (K-CD-RISC). The self-reported K-CD-RISC consists of 25 items measured on a five-point Likert scale ranging from 0 to 4 points. The K-CD-RISC had a Cronbach's alpha of 0.953.

### *Assessment of working hours*

The self-report question "How many hours do you work on average per week in your current job?" was used to determine the number of working hours for 1 week (excluding meals and breaks).

### *Suicidal ideation*

A self-reported dichotomous question with a "Yes" or "No" response choice was used to gauge the respondent's level of suicidal ideation. It asked if they had ever thought about killing themselves ("Over the last year, have you ever felt you would be better off dead?") in the previous year.

## Statistical analysis

The current study calculated how the study population's sociodemographic and psychological traits were distributed. For univariate analyses, we used Student's t-tests to compare the means of continuous variables and chi-square tests to compare the proportions of categorical variables between participants with and without suicidal ideation. We conducted hierarchical logistic regression analyses to determine the impact of working hours on employee suicidality. Firstly, for all participants (working hours 40), a hierarchical logistic regression analysis was done using suicidal ideation as the dependent variable. Secondly, both men and women underwent the same analysis. Finally, we used these results to compare differences between men and women associated with long working hours to better understand how long working hours correlate with suicidal ideation and the impact of gender.

The relationship between sociodemographic factors and suicidal ideation was examined in Model 1. To test the relationships between working hours and suicidal ideation beyond the effects of sociodemographic factors, perceived stress, resilience, and depressive symptoms, daily perceived stress and resilience were added to Model 2, depressive symptoms to Model 3, and working hours to Model 4. The cut-off for statistical significance was 0.05. The Complex Samples module of the PASW statistics software package version 18 (SPSS Inc., Chicago, IL, USA), was used.

**PRECISION AND FUTURE MEDICINE**  
Suicidal ideation and long work hours by gender

**Table 1.** Sociodemographic and psychological characteristics of the study participants according to the presence or absence of suicidal ideation

Characteristic	Total (n=9,326)	No-SI group (n=8,113, 79.9%)	SI group (n=1,882, 20.1%)	P-value <sup>a)</sup>
Age (yr)	39.5±9.1	39.7±9.3	38.6±8.5	<0.001
Age distribution (yr)				<0.001
≤34	3,413 (34.1)	2,755 (34.0)	658 (35.0)	
35–44	3,411 (34.1)	2,670 (32.9)	741 (39.4)	
>44	3,171 (31.7)	2,688 (33.1)	483 (25.7)	
Gender				<0.001
Men	5,920 (59.2)	5,005 (61.7)	915 (48.6)	
Women	4,075 (40.8)	3,108 (38.3)	967 (51.4)	
Job duration (yr)	11.6±9.6	11.7±9.7	10.8±9.1	<0.001
Job grade				<0.001
Executives	246 (2.4)	223 (2.7)	22 (1.2)	
Manager group	2,659 (26.4)	2,202 (27.1)	440 (23.4)	
Staff group	6,680 (66.4)	5,322 (65.6)	1,315 (69.9)	
Other	474 (4.7)	366 (4.5)	105 (5.6)	
Educational level				0.257
Below high school, college degree	2,996 (32.1)	2,421 (31.8)	575 (33.3)	
University, master's, and doctorate degree	6,335 (67.9)	5,181 (68.2)	1,154 (66.7)	
Marital status				<0.001
Never married	3,018 (32.3)	2,379 (31.3)	639 (37.0)	
Married	6,080 (65.2)	5,060 (66.6)	1,020 (59.0)	
Separated, divorced, or widowed	233 (2.5)	163 (2.1)	70 (4.0)	
PSS score	16.5±5.6	15.5±5.3	20.2±5.3	<0.001
K-CD-RISC score	63.8±15.7	65.8±15.1	55.2±15.4	<0.001
CES-D score	9.8±9.4	7.9±7.7	17.3±11.4	<0.001
Working hours (hr)	50.8±9.2	50.7±9.0	51.3±9.6	0.005

Values are presented as mean ± standard deviation or number (%).

No-SI group, participants without suicidal ideation; SI group, participants with suicidal ideation; PSS, Perceived Stress Scale; K-CD-RISC, Korean version of the Connor-Davidson Resilience Scale; CES-D, Center for Epidemiologic Studies Depression Scale.

<sup>a)</sup>For categorical covariates, the P-value was generated using the chi-square test. For continuous covariates, P-values were generated from the analysis of variance.

## RESULTS

### Characteristics of the participants

The characteristics of the participants are outlined in Table 1 based on whether they had suicidal ideation or not. The mean ± standard deviation (SD) age of the 9,326 participants was 39.5 ± 9.1 years (range, 19 to 68), and 40.8% were women. The age distribution was: 19–34 years, 34.1%; 35–44 years, 34.1%; 44–68 years, 31.7%. The suicidal ideation group comprised 20.1% of the participants. The mean ± SD working hours of the participants were 50.8 ± 9.2 (range, 40 to 100),

and their job duration was 11.6 ± 11.6 years (range, 0 to 42). A total of 66.4% and 26.4% of the study population were in staff and manager positions, respectively. A total of 67.9% of the participants had a higher education level (University, master's, and doctorate degrees); 65.2% of the study's participants were married, compared to 32.3% who had never married. The mean PSS, K-CD-RISC, and CES-D scores were 16.5, 63.8, and 9.8, respectively.

In univariate analyses, participants with suicidal ideation were more likely to be younger ( $z=4.85$ ,  $P<0.001$ ), women ( $\chi^2=108.11$ ,  $P<0.001$ ), and single ( $\chi^2=46.81$ ,  $P<0.001$ ) than

the participants without suicidal ideation. They were also more likely to have shorter job duration ( $z=3.86$ ,  $P<0.001$ ) and lower job grades ( $\chi^2=31.63$ ,  $P<0.001$ ). However, educational level was not significantly associated with suicidal ideation ( $\chi^2=1.28$ ,  $P=0.257$ ). Additionally, compared to those who did not have suicidal ideation, those who did have higher PSS ( $z=-35.00$ ,  $P<0.001$ ), CES-D ( $z=-33.93$ ,  $P<0.001$ ), and lower K-CD-RISC ( $z=26.22$ ,  $P<0.001$ ) scores. Longer working hours were more prevalent among those with suicidal ideation ( $z=-2.68$ ,  $P=0.005$ ).

### Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for all participants

Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for all participants ( $n=9,326$ ) with sociodemographic factors, perceived daily stress, resilience, depressive symptoms, and working hours are summarized in Table 2. A significant overall model fit was seen in the results of all four hierarchical logistic regression models. Both the  $\chi^2$  (1,505.951,  $P<0.001$ ) and the Nagelkerke  $R^2$  values (0.242, explaining about 24.2% of the variance in the dependent variable) in the analysis of Model 4 show that the model was sufficient to explain suicidal ideation. The 16 variables in Model 4 significantly improved its explanation accuracy to 82.8% for the group membership of the dependent variable when evaluating the model's applicability in real-world applications according to classification accuracy. The significance of the link between each variable and suicidal thoughts was assessed using Wald statistics.

Age under 44, marital status of separated, divorced, or widowed, PSS, K-CD-RISC, and CES-D scores were significantly linked to suicidal ideation in the analysis of all our models. Nonetheless, age above 44, education level, job duration, executive job grade, and working hours were not statistically linked with suicidal ideation in the examination of all of our models. The job grades of managers, staff, and others were statistically associated with suicidal ideation in only Model 1. The marital status of single and married individuals became statistically non-significant in Models 2 and 3, respectively. Working hours for both men and women were not statistically linked to suicidal ideation after controlling for other variables ( $P=0.202$ ).

### Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for men

Results of the hierarchical logistic regression analysis using

suicidal ideation as the dependent variable for men ( $n=5,652$ ) with sociodemographic factors, perceived daily stress, resilience, depressive symptoms, and working hours are summarized in Table 3. A significant overall model fit was found in all four of the hierarchical logistic regression's models. Both the  $\chi^2$  (889.778,  $P<0.001$ ) and the Nagelkerke  $R^2$  value (0.253, explaining about 25.3% of the variance in the dependent variable) in the analysis of Model 4 suggested that the model was sufficient to explain suicidal ideation. Examining the model's practical applicability in terms of classification accuracy, 15 variables in Model 4 significantly improved its explanation accuracy for the dependent variable's group membership, bringing it to 85.6%. The significance of the link between each variable and suicidal ideation was assessed using Wald statistics.

All age groups, single marital status, PSS score, K-CD-RISC score, CES-D score, and working hours were significantly linked with suicidal ideation in the examination of all our models. However, none of our models' analyses revealed a statistically significant relationship between suicidal ideation and an executive's degree of education, length of employment, or job grade. Statistically, only Model 1 showed a relationship between suicidal ideation and the job grades of managers, employees, and others. The marital status of married and others (separated, divorced, or widowed) became statistically non-significant in Models 2 and 3, respectively. After accounting for the influence of other variables, the odds ratio of 1.012 in working hours means that longer working hours increase the probability of suicidal ideation by 1.012 times for men ( $P=0.003$ ).

### Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for women

Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for women ( $n=3,674$ ) with sociodemographic factors, perceived daily stress, resilience, depressive symptoms, and working hours are summarized in Table 4. The findings of all four hierarchical logistic regression models demonstrated a significant overall model fit. Both the  $\chi^2$  (549.021,  $P<0.001$ ) and the Nagelkerke  $R^2$  values (0.207, explaining about 20.7% of the variance in the dependent variable) in the analysis of Model 4 show that the model was sufficient to explain suicidal ideation. Fifteen variables in Model 4 significantly improved its explanation accuracy for the dependent variable's group membership, raising it to 78.3% when the practical utility of the model was evaluated according to classification accuracy.

Table 2. Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for all participants (n=9,326)

Independent variable	Model 1			Model 2			Model 3			Model 4		
	B	Wald	OR	P-value	B	Wald	OR	P-value	B	Wald	OR	P-value
Sociodemographic factors												
Age (yr)												
≤34	0.227	20.620	1.255 <sup>d)</sup>	0.000	0.268	11.838	1.307 <sup>d)</sup>	0.003	0.307	14.871	1.359 <sup>e)</sup>	0.001
35-44 (Ref: ≤34)	-0.091	8.758	0.913	0.003	0.159	10.773	1.172	0.001	0.170	13.235	1.185	0.000
>44 (Ref: ≤34)	0.459	63.087	1.583 <sup>e)</sup>	0.000	0.253	16.301	1.287 <sup>e)</sup>	0.000	0.241	13.985	1.273 <sup>e)</sup>	0.000
Gender (women)												
Marital status												
Single	-0.253	28.732	0.777 <sup>e)</sup>	0.000	-0.126	13.178	0.882	0.001	-0.042	5.649	0.959	0.059
Married (Ref: single)	0.405	12.611	1.500 <sup>d)</sup>	0.010	0.421	2.756	1.523 <sup>d)</sup>	0.013	0.351	0.289	1.420 <sup>d)</sup>	0.046
Other (Ref: single) <sup>a)</sup>	-0.012	6.561	0.988	0.843	0.039	6.110	1.039	0.551	0.083	3.993	1.086	0.216
Educational level (high) <sup>b)</sup>	0.008	0.039	1.008	0.112	0.004	0.356	1.004	0.480	0.003	1.529	1.003	0.549
Job duration	0.008	2.525	1.008	0.112	0.004	0.500	1.004	0.480	0.003	0.360	1.003	0.549
Job grade												
Executives	0.520	7.409	1.682 <sup>d)</sup>	0.025	0.412	3.864	1.509	0.091	0.333	2.695	1.395	0.177
Manager group (Ref: executives)	0.534	5.018	1.707 <sup>d)</sup>	0.021	0.369	2.302	1.446	0.129	0.330	1.787	1.391	0.181
Staff group (Ref: executives)	0.703	7.387	2.020 <sup>d)</sup>	0.007	0.502	3.400	1.652	0.065	0.452	2.660	1.572	0.103
Other (Ref: executives)	0.134	7.387	2.020 <sup>d)</sup>	0.007	0.134	431.554	1.144 <sup>e)</sup>	0.000	0.059	57.796	1.060 <sup>e)</sup>	0.000
Perceived daily stress (PSS)	-0.021	92.949	0.979 <sup>e)</sup>	0.000	-0.021	92.949	0.979 <sup>e)</sup>	0.000	-0.018	65.302	0.982 <sup>e)</sup>	0.000
Resilience (K-CD-RISC)	0.065	307.081	1.067 <sup>e)</sup>	0.000	0.065	307.081	1.067 <sup>e)</sup>	0.000	0.065	305.011	1.067 <sup>e)</sup>	0.000
Depressive symptoms (CES-D)	0.004	1.625	1.004	0.202	0.004	1.625	1.004	0.202	0.004	1.625	1.004	0.202
Working hours												
Statistics of the model-2LL	8,792.59				7,757.68				7,443.02			
Model $\chi^2$	155.312 (df=9)			0.000	1,185.170 (df=11)			0.000	1,504.222 (df=12)			0.000
Step $\chi^2$	152.670 (df=8)			0.000	1,180.553 (df=7)			0.000	1,500.194 (df=8)			0.000
Nagelkerke R <sup>2</sup>	0.027			0.193	0.241			0.242	0.242			0.242
Classification accuracy	81.5			82.1	82.8			82.8	82.8			82.8

OR, odds ratio; PSS, Perceived Stress Scale; K-CD-RISC, Korean version of the Connor-Davidson Resilience Scale; CES-D, Center for Epidemiologic Studies Depression scale.

<sup>a)</sup>Separated, divorced, or widowed; <sup>b)</sup>Educational level (high) includes university degree, master's, and doctorate degrees; <sup>c)</sup>p<0.05; <sup>d)</sup>p<0.01; <sup>e)</sup>p<0.001.

Table 3. Results of the hierarchical logistic regression analysis using suicidal ideation as the dependent variable for men (n=5,652)

Independent variable	Model 1			Model 2			Model 3			Model 4		
	B	Wald	OR	P-value	B	Wald	OR	P-value	B	Wald	OR	P-value
Sociodemographic factors												
Age (yr)												
≤34		26.797		0.000		13.819		0.001		14.848		0.001
35-44 (Ref: ≤34)	0.540	18.979	1.716 <sup>a)</sup>	0.000	0.473	13.250	1.605 <sup>a)</sup>	0.000	0.512	14.526	1.669 <sup>a)</sup>	0.000
>44 (Ref: ≤34)	0.201	1.379	1.223	0.240	0.365	4.094	1.441 <sup>c)</sup>	0.043	0.425	5.261	1.529 <sup>c)</sup>	0.022
Marital status												
Single		31.39		0.000		14.009		0.001		7.182		0.028
Married (Ref: single)	-0.304	6.954	0.738 <sup>b)</sup>	0.008	-0.190	2.490	0.827	0.115	-0.139	1.247	0.870	0.264
Other (Ref: single) <sup>a)</sup>	0.751	10.864	2.120 <sup>b)</sup>	0.001	0.609	5.944	1.838 <sup>c)</sup>	0.015	0.465	3.141	1.592	0.076
Educational level (high) <sup>b)</sup>	-0.126	2.076	0.881	0.150	-0.020	0.045	0.980	0.832	0.017	0.031	1.017	0.859
Job duration	0.006	0.892	1.006	0.345	0.004	0.254	1.004	0.614	0.001	0.020	1.001	0.887
Job grade												
Executives		6.927		0.074		3.618				3.027		0.388
Manager group (Ref: executives)	0.636	6.177	1.889 <sup>b)</sup>	0.013	0.416	2.395	1.515	0.416	0.350	1.679	1.419	0.195
Staff group (Ref: executives)	0.564	4.731	1.757 <sup>c)</sup>	0.030	0.303	1.241	1.354	0.303	0.262	0.914	1.300	0.339
Other (Ref: executives)	0.706	5.380	2.026 <sup>c)</sup>	0.020	0.439	1.870	1.552	0.439	0.466	2.053	1.593	0.152
Perceived daily stress (PSS)					0.146	255.091	1.157 <sup>b)</sup>	0.000	0.069	42.568	1.072 <sup>b)</sup>	0.000
Resilience (K-CD-RISC)					-0.024	64.221	0.977 <sup>b)</sup>	0.000	-0.020	41.576	0.980 <sup>b)</sup>	0.000
Depressive symptoms (CES-D)									0.069	185.292	1.072 <sup>b)</sup>	0.000
Working hours												
Statistics of the model-2LL		4,763.58				4,142.02				3,949.08		
Model $\chi^2$		65.600 (df=9)		0.000		689.417 (df=10)		0.000		881.397 (df=11)		0.000
Step $\chi^2$		64.704 (df=6)		0.000		685.271 (df=6)		0.000		878.209 (df=7)		0.000
Nagelkerke R <sup>2</sup>		0.020				0.199				0.251		
Classification accuracy		84.8				85.0				85.6		
										889.778 (df=12)		0.000
										886.119 (df=8)		0.000
										0.253		
										85.6		

OR, odds ratio; PSS, Perceived Stress Scale; K-CD-RISC, Korean version of the Connor-Davidson Resilience Scale; CES-D, Center for Epidemiologic Studies Depression scale.

<sup>a)</sup>Separated, divorced, or widowed; <sup>b)</sup>Educational level (high) includes university degree, master's, and doctorate degrees; <sup>c)</sup>p<0.05; <sup>d)</sup>p<0.01; <sup>e)</sup>p<0.001.





Each indicator's significance in relation to suicidal ideation was assessed using Wald statistics.

Age 34 or younger, PSS score, K-CD-RISC score, and CES-D score were statistically linked with suicidal ideation in the analysis of all our models, whereas age >35 years, marital status of separated, divorced, or widowed, education level, job duration, job grade, and working hours were not. Only Model 1 showed a statistically significant correlation between marital status and suicidal ideation; Models 2, 3, and 4 showed no such correlation. After accounting for the influence of other variables, working hours for women were not statistically associated with suicidal ideation ( $P=0.172$ ).

## DISCUSSION

As noted in the introduction, most previous research demonstrated that long work hours are associated with increased suicidal ideation. However, research on the relationship between working hours and suicidal ideation based on gender is lacking, as only a few studies offer it as the primary outcome [11,19]. According to a study conducted among 67,471 Koreans, employees who worked more than 60 hours per week had a significantly higher rate of suicide ideation than those who worked less than 41 hours per week [19]. This result was replicated in both genders when analyzed separately [19]. In another study of the Korean general population, compared to workers who worked less than 52 hours per week, there was a statistically significant rise in suicidal ideation among those who worked 60 hours or more per week [11]. This outcome was also replicated in both genders after a separate analysis [11]. As mentioned above, the two studies differ from ours in that they only adjusted for sociodemographic factors and not for psychological factors such as daily stress, depressive symptoms, and resilience.

Some studies reached similar results, where the association between working hours and suicidal ideation was stronger in male employees than female employees [20,21]. A study using cohort data from 95,356 Koreans found no significant link between women's working hours and suicidal ideation; however, there was a link between men's long working hours and higher suicidal ideation [20]. However, unlike our study, the above study examined the relationship between each item in the Korean Occupational Stress Scale (KOSS) and suicidal ideation. Its primary outcome was analyzing occupational stress in male and female employees related to suicidal ideation [20]. Furthermore, in a study of 13,628 workers, a stronger association between longer working hours and increased suicidal ideation

was more apparent in men than in women [21]. However, the study only considered shift workers, using a different set of research subjects from the current study [21].

Numerous studies have analyzed men and women as a whole when examining the association between working hours and suicidal ideation. This research is significant because it was analyzed based on the hypothesis that men and women would show different characteristics of suicidal ideation due to working hours. In addition, the research participants comprised individuals working at 54 different workplaces, representing various job types. Only a few previous studies have analyzed working hours as a continuous variable instead of a categorical variable. As there was no consensus regarding psychiatric and occupational medicine for the criteria of long working hours, establishing the category of working hours differed between studies. However, this study used a reasonably large sample size to investigate working hours as a continuous variable and found a dose-response association between working hours and suicidal ideation. This enables a conclusion a more meaningful conclusion; reducing working hours lowers suicidal ideation among full-time employees. According to this study, long working hours were found to be statistically significantly associated with an increase in suicide ideation in men, but for women, the statistical significance was lost when adjusted for sociodemographic and psychological factors. Such an outcome implies that the factors contributing to suicidal ideation may differ for male and female workers. It was shown that long working hours independently triggered increased suicidal ideation in men. For women, however, it may be possible that factors other than long working hours affect suicidal ideation. Hence, additional studies investigating risk factors associated with suicidal ideation among female workers are needed, implying the necessity for considering gender characteristics when establishing suicide prevention measures for employees.

Researchers have concluded that occupational stress can influence suicidal ideation in men and women differently. In one study, of the seven items of the KOSS, men showed statistically significant associations between five items and suicidal ideation, while women displayed such associations for only two items [20]. In another study that examined suicidal risk factors of workers, insufficient job control and the organizational system as the main occupational stressor was associated with suicidality in men, while interpersonal conflict showed such an association for women [22]. Previous studies have shown that in East Asian culture, men were more likely to find self-identity in the financial arena, as they were usual-

ly responsible for earning income [23]. Therefore, given such an environment, it is argued that male workers are more vulnerable to occupational or socioeconomic stress than female workers [24].

There are also studies suggesting that spousal employment status and working hours have a significant impact on the suicidal ideation of workers, calling for the need to analyze men and women separately. According to a study conducted among 8,056 Korean house units, men showed the lowest depressive symptoms and suicidal ideation levels when their spouses did not work [25]. In contrast, women showed high levels of depressive symptoms and suicidal ideation when their spouses were not economically active [25]. When analyzing the suicidal ideation of employees, there is the possibility that spouses' working hours, in addition to those of workers' own, may significantly influence suicidal ideation, again implying the need for separate analyses of male and female workers. Unfortunately, this study did not survey spouses' employment status and economic activity.

The findings of this study should be interpreted with several limitations in mind. In compliance with the Labor Standards Act of Korea, the study's participants were employees who put in more than 40 hours each week, so the relationship between employees who worked fewer than 40 hours per week and suicidal ideation was not investigated in this study. Further studies are required to investigate the association between working hours and suicidal ideation according to workers' temporary or permanent employment status and those working less than 40 hours per week. Although the study participants worked in various occupational fields, many were white-collar workers, who may not represent all full-time workers in Korea. Since the data for this study were gathered by self-reports, there may have been some response bias. However, careless responses were excluded during data processing. Furthermore, as a cross-sectional study, this study could not suggest the causal direction of working hours and suicidal ideation.

As very few study participants actually planned or attempted suicide, these suicide plans and attempts were not examined in the study. Moreover, as the data were taken from a program designed to boost the employees' mental health, there were therapeutic interventions for those with suicidal ideation to prevent suicide plans and attempts. To this end, this study only examined suicidal ideation, excluding suicide plans or attempts. There is a positive correlation between working hours and suicide mortality, according to a prior study on this subject [4]. Future research should examine the

relationship between working hours and gender-specific suicide plans and attempts.

In conclusion, this study found that suicidal ideation was associated with long working hours among Korean male full-time workers. This study suggests that other factors may be more associated with suicidal ideation for female workers. These differences indicate that suicide prevention measures for employees should be developed by gender. Finally, future studies should concentrate on other risk factors linked to suicide ideation among employees by gender.

## CONFLICTS OF INTEREST

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

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