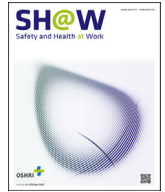




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Association Between Unpredictable Work Schedules and Depressive Symptoms in Korea

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ABSTRACT

Backgrounds: Irregular and unpredictable work schedules have become more common in most societies. The purpose of this study was to investigate the association between unpredictable work schedules and depressive symptoms in Korea.

Methods: Data from 34,486 workers who participated in the Korean Working Condition Survey in 2017 were used. Unpredictable work schedules were measured by questions about the frequency of changes in work schedule and limited advanced notice. Depressive symptoms were assessed by a single item asking if the participants had depressive symptoms over the last 12 months. Multivariable-adjusted logistic regression analysis was used to calculate odds ratios (ORs) for high depressive symptoms.

Results: The OR for depressive symptoms was significantly higher in the workers with unpredictable work schedules compared to those with predictable work schedules after controlling for age, sex, education, salary, marital status, occupation, contract period, full-time versus part-time, shift work, weekly working hours, and having a child under the age of 18 years (OR = 2.43, 95% confidence interval 1.93–3.07).

Conclusion: Unpredictable work schedules were associated with depressive symptoms controlling for the other dimensions of precarious employment in a representative working population in Korea.

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1. Introduction

Considerable evidence has pointed to the adverse health consequences of long working hours, which is usually defined as working time longer than around 40 hours per week or 8 hours per day [1]. In addition to the work hours, there is a growing interest in understanding the health consequences of unpredictable work schedules [2]. In the globalized economy of most societies, so-called “normal” or “standard” working hours no longer apply to the majority of work schedules for employees [3]. Unpredictability in work schedule is one characteristic of nonstandard or precarious work, which represents up to 25–40% of the workforce in many developed countries [4–7]. Recently, a new type of nonstandard workers, “app-based” or “gig” workers, have been growing, and their working hours are highly likely to be irregular and unpredictable [8].

Although there is no single or standard definition of unpredictable working hours, short advance notices about schedules and

last-minute changes to posted work schedules are considered to be the main aspects of unpredictable working hours [5,9]. These unpredictable scheduling practices were introduced by employers to minimize labor costs by closely matching workers' working hours to fluctuations in supply and demand conditions, based on just-in-time principles, a philosophy toward the elimination of all non-value-added activities [5,10].

For example, according to a national survey of 30,000 workers in the service sector in the United States, two-thirds of workers said they received less than 2 weeks' notice of their schedules [11]. According to the 2015 European Working Condition Survey (EWCS), 26% of workers in 28 European countries experienced change of work schedule several days or less in advance [12]. The Korean Working Condition Survey (KWCS) in 2014 reported that 21.5% of Korean workers received notice about schedule changes only “several days or less” in advance [13].

Exposure to unpredictable work schedules varies across the working population. A US representative sample of early-career

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adults aged 26 to 32 years reported that 38% of them received advance notices about their work schedule less than a week in advance and that this arrangement was more prevalent among hourly paid workers (41%), part-time workers (48%), as well as workers of color (45%) [14]. Furthermore, the higher prevalence of unpredictable schedules among men (45%) than women (31%) suggested that the problem is by no means concentrated among women (because of their higher representation in the service sector, and part-time work) [14]. The EWCS 2015 also reported that requests to come to work at short notice at least several times a month was more common among men (14%) than women (10%), and more common among service and sales workers (17%) and agricultural workers (17%), but less common for clerks (5%) [12,15].

Unpredictable schedules are a problem not just for precarious workers. A previous Korean study of work schedules among Korean workers showed that highly educated, male, regular employees were over-represented in the cluster of workers reporting frequent overtime and unpredictable schedules [16].

A number of studies have reported adverse impacts of precarious work on workers' health in South Korea [17,18]. Uncertainty of working hours is one characteristic of precarious employment; however, there have been few studies that investigate the unique contributions of unpredictable working hours to workers' health and well-being in Korea.

Although a limited number of previous studies have investigated the relationship between unpredictable schedules and health, there are strong theoretical reasons to hypothesize negative health consequences. First, unpredictable work schedules cause household economic insecurity by increasing income volatility [19]. For example, many young workers in part-time jobs experienced forced early breaks from work when there were fewer customers, resulting in reduced pay [20]. Second, work-life conflict—that is, difficulty in balancing the demands of employment and personal or family life—can be a mediator in the pathway between unpredictable work schedules and health outcomes [19]. In addition, workers having nonstandard work schedules have a higher prevalence of unhealthy behaviors including nonoptimal sleep, greater recreational screen time, and worse dietary practices [6].

Therefore, this study aimed to investigate the association of unpredictable working hours with depressive symptoms controlling for the other dimension of precarious work in the representative working population in Korea. In addition, we hypothesized that the effect of unpredictable work schedules would be worse for women, who have more family responsibilities compared with men, and especially for low-income women with fewer resources to obtain external help.

2. Materials and methods

2.1. Study population

The study sample was derived from participants in the 5th KWCS in 2017. The KWCS is a cross-sectional national survey regularly performed by the Korea Occupational Safety and Health Agency, modeled after the EWCS [21]. The target population represented by KWCS is the economically active population in Korea. A stratified cluster sampling design was used based on the National Census Registry. Hence, all analyses in the present study used sample weights provided by the KWCS. In the KWCS, all information including working conditions and health status were collected from a face-to-face interview implemented by a professional interviewer.

Among 50,205 participants in the 2017 KWCS, we restricted the study population to employed workers. Then we added individuals who responded that they were employed on nonstandard

contracts, working as a sub-contractor, doing freelance work, or paid a salary by a temp agency, even though they did not answer that they were employed workers. We excluded soldiers or those with a missing occupation, as well as participants missing data on unpredictable work hours, depressive symptoms, or covariates used in the analysis. Thus, data from 34,486 participants were used in the current analysis. Fig. 1 presents the selection process of the analytic sample.

2.2. Depressive symptoms and unpredictable work schedules

Depressive symptoms were assessed by a single question “Over the last 12 months, did you have depressive symptoms?” The response options were “yes” or “no.”

Unpredictable working hours were defined by two questions. These questions are translated versions of the questions of EWCS. In the EWCS, they have been used for calculating the working time quality index reflecting working time arrangements [12].

Participants were asked, (1) “Over the last 12 months, how often have you been asked to come into work at short notice?” and (2) “If changes to your working time arrangements occur regularly, how much advance notice do you receive about these changes?” Unpredictable work schedules were defined by participants who responded “daily,” “several times a week,” or “several times a month” to the first question; or individuals who answered “the same day,” “the day before,” or “several days in advance” to the second question. If the participants responded “less often,” “never,” or “not applicable” to the first question, and “several weeks in advance” or “no change to working time arrangement” to the second question, they were defined as not having unpredictable work schedules.

2.3. Covariates

Age, sex, education, marital status, occupation, industry, salary, shift-work, weekly working hours, contract period, part-time work,

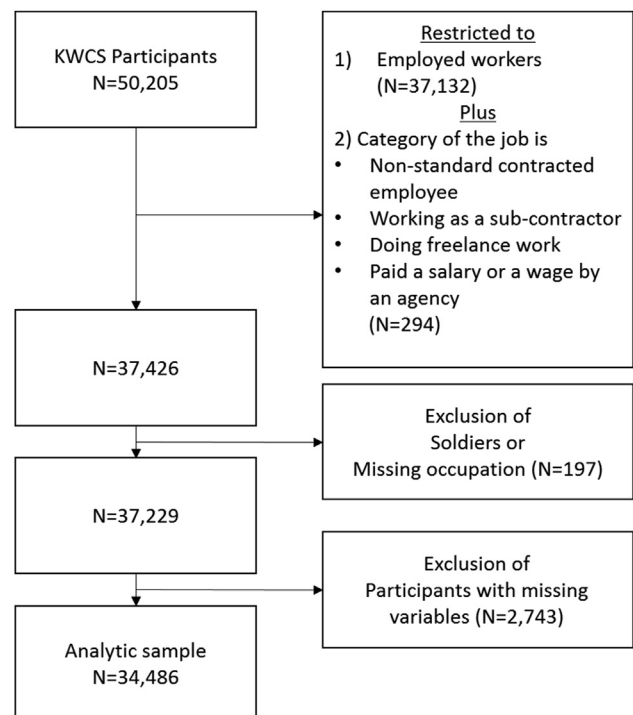


Fig. 1. A Flow chart illustrating the process of creating the analytic sample. KWCS, Korean Working Condition Survey; N, weighted frequency.

and having a child under the age of 18 years were included in our regression models as covariates, and we performed subgroup analysis by these variables.

The occupation and industry were coded according to the Korean Standard Classification of Occupation and Industry. We collapsed the nine occupational categories into four groups: professionals and managers, office workers, service and sales workers, and blue-collar workers. Working hours were assessed by the question "How many hours do you usually work per week in your main paid job?" and classified into three groups: (1) <40 hours, (2) 40–52 hours, (3) >52 hours per week. In the Labor Standard Act in Korea, 40 hours per week is defined as standard working hours, and 52 hours is the maximum weekly working hours. The contract period was classified into three groups: less than 1 month, 1 month–1 year, and more than 1 year. Platform labor was defined if the participants answered "Yes" to the question "On your job, do you personally serve customers providing goods or services, and earn income for the amount of you work you do (i.e., piece rate as opposed to hourly rate)? For example, insurance planner, work-book tutor, courier, express delivery driver, golf caddies, ready-mixed concrete truck driver, fit this category."

2.4. Statistical analysis

We applied sampling weights from the KWCS in all analyses to reflect the stratified cluster sampling design. The prevalence of unpredictable working hours was examined according to sample characteristics. Depressive symptoms were compared across the respondent groups according to unpredictable work hours as well as other sociodemographic and occupational factors. Multiple logistic regression analysis was conducted to examine the relationship between unpredictable working hours and depressive

symptoms controlling for age, sex, education, salary, marital status (Model 1), and additionally controlling for occupation, shift-work, weekly working hours, contract period, part-time work, and parental status (Model 2). To test interactions between gender or weekly working hours and unpredictable work schedules, the interaction terms were added to Model 2. Subgroup analyses were performed by these variables separately for men and women. Two-tailed *p* values <0.05 were regarded as statistically significant. SAS version 9.4 (SAS Institute, Cary, NC, USA) was used for statistical analysis.

3. Results

The prevalence of unpredictable work schedules by the characteristics of the study sample is presented in Table 1. There were 8,021 individuals (25.3%) who reported unpredictable work schedules. Men (25.5%) had more unpredictable work schedules than women (20.3%). Unpredictable work schedules were more prevalent among service and sales workers (27.7%) and blue-collar workers (25.2%), workers with long working hours (>52 h/wk) (30.9%), <1 month contract period (31.4%), and shift workers (38.6%).

The prevalence of depressive symptoms over the last 1 year by the characteristics of participants are shown in Table 2. The overall prevalence of depressive symptoms was 2.0% in the total sample, and they were higher in those who had unpredictable work schedules (3.6%) than in those who did not (1.5%).

Depressive symptoms were more prevalent among older participants aged ≥60 years (2.8%), lower than high school education (3.2%), another marital status than married/live together (2.4%), blue-collar workers (2.4%), lowest salary group (2.5%), long working

Table 1
Prevalence of unpredictable work schedule by characteristics of participants, *N* (%)

		Total <i>N</i> = 34,486	Men <i>N</i> = 19,705	Women <i>N</i> = 14,781
Total		8,021 (23.3)	5,025 (25.5)	2,996 (20.3)
Age (y)	<30	1,432 (25.2)	714 (26.9)	718 (23.8)
	30–39	1,823 (21.9)	1,209 (23.5)	614 (19.2)
	40–49	2,064 (23.0)	1,367 (25.5)	697 (19.4)
	50–59	1,765 (24.7)	1,101 (26.7)	664 (22.0)
	>60	938 (21.4)	634 (26.2)	303 (15.5)
Education	<High school	580 (19.5)	349 (25.7)	232 (14.4)
	High school	2,810 (26.1)	1,668 (27.9)	1,142 (24.0)
	College	4,631 (22.3)	3,008 (24.3)	1,622 (19.3)
Marital status	Married/live together	2,494 (23.5)	1,371 (25.5)	1,123 (21.5)
	Others	5,527 (23.1)	3,654 (25.5)	1,873 (19.6)
Occupation	Professional and manager	1,499 (22.5)	882 (23.3)	617 (21.3)
	Office worker	1,743 (18.1)	1,126 (20.6)	617 (14.8)
	Service and sales	2,211 (27.7)	922 (30.0)	1,289 (26.3)
	Blue-collar worker	2,568 (25.2)	2,095 (28.4)	473 (16.9)
Salary (10,000 KRW/mo)	<200	2,496 (21.8)	856 (24.9)	1,640 (20.4)
	200–299	2,226 (22.6)	1,364 (25.3)	862 (19.4)
	300–399	1,765 (24.4)	1,462 (25.1)	304 (21.5)
	>400	1,534 (25.8)	1,343 (26.5)	191 (21.5)
Weekly working hour	<40	986 (24.3)	326 (26.8)	660 (23.2)
	40–52	5,646 (21.8)	3,647 (23.8)	2,000 (18.8)
	>52	1,388 (30.9)	1,052 (33.0)	336 (26.0)
Contract period	>1 y	6,413 (22.8)	4,205 (25.0)	2,209 (19.6)
	1 mo–1 y	1,063 (22.7)	447 (24.9)	616 (21.4)
	<1 m	544 (31.4)	373 (33.6)	171 (27.5)
Part-time	Full-time	6,999 (22.8)	4,652 (25.1)	2,347 (19.2)
	Part-time	1,022 (27.3)	373 (31.8)	649 (25.2)
Shift work	No	6,461 (21.2)	4,087 (23.7)	2,375 (18.0)
	Yes	1,560 (38.6)	938 (38.5)	622 (38.7)
Platform labor	No	7,425 (22.7)	4,683 (24.9)	2,742 (19.6)
	Yes	596 (34.8)	342 (38.4)	254 (30.8)
Having a child (≤18 y)	No	4,883 (23.6)	2,903 (26.2)	1,980 (20.6)
	Yes	3,138 (22.8)	2,122 (24.6)	1,016 (19.7)

Table 2
Prevalence of depressive symptoms of the study population, N (%)

		Total N = 34,486	Men N = 19,705	Women N = 14,781
Total		684 (2.0)	364 (1.8)	319 (2.2)
Unpredictable work schedule	No	397 (1.5)	177 (1.2)	220 (1.9)
	Yes	287 (3.6)	187 (3.7)	100 (3.3)
Age (y)	<30	101 (1.8)	50 (1.9)	51 (1.7)
	30–39	118 (1.4)	66 (1.3)	52 (1.6)
	40–49	194 (2.2)	110 (2.0)	85 (2.4)
	50–59	147 (2.1)	79 (1.9)	68 (2.3)
	>60	124 (2.8)	60 (2.5)	64 (3.3)
Education	<High school	95 (3.2)	44 (3.2)	52 (3.2)
	High school	216 (2.0)	100 (1.7)	116 (2.4)
	College	372 (1.8)	221 (1.8)	151 (1.8)
Marital status	Married/live together	253 (2.4)	109 (2.0)	144 (2.8)
	Others	431 (1.8)	256 (1.8)	175 (1.8)
Occupation	Professional and manager	125 (1.9)	73 (1.9)	52 (1.8)
	Office worker	155 (1.6)	84 (1.5)	71 (1.7)
	Service and sales	163 (2.0)	48 (1.6)	115 (2.3)
	Blue-collar worker	240 (2.4)	159 (2.2)	81 (2.9)
Salary (10,000 KRW/mo)	<200	283 (2.5)	88 (2.6)	195 (2.4)
	200–299	177 (1.8)	101 (1.9)	76 (1.7)
	300–399	102 (1.4)	74 (1.3)	28 (1.9)
	>400	122 (2.1)	100 (2.0)	22 (2.4)
Weekly working hour	<40	96 (2.4)	31 (2.5)	65 (2.3)
	40–52	471 (1.8)	258 (1.7)	213 (2.0)
	>52	117 (2.6)	75 (2.4)	42 (3.2)
Contract period	>1 y	504 (1.8)	271 (1.6)	233 (2.1)
	1 mo–1 y	119 (2.5)	52 (2.9)	67 (2.3)
	<1 mo	61 (3.5)	42 (3.7)	20 (3.2)
Part-time	Full-time	584 (1.9)	328 (1.8)	256 (2.1)
	Part-time	100 (2.7)	36 (3.1)	63 (2.5)
Shift work	No	587 (1.9)	307 (1.8)	280 (2.1)
	Yes	97 (2.4)	57 (2.4)	39 (2.4)
Platform labor	No	629 (1.9)	338 (1.8)	292 (2.1)
	Yes	55 (3.2)	27 (3.0)	28 (3.4)
Having a child (≤18 y)	No	444 (2.1)	222 (2.0)	222 (2.3)
	Yes	240 (1.7)	143 (1.7)	97 (1.9)

hours (>52 h/wk) (2.6%), <1 month contract period (3.5%), and part-time workers (2.7%).

The associations between unpredictable work schedules and depressive symptoms obtained from multiple logistic regression analyses stratified by gender are shown in Table 3. The odds ratio (OR) for depressive symptoms was significantly higher in the workers with unpredictable work schedules than those without it in Model 1 (OR = 2.51, 95% confidence interval [CI] 2.02–3.13) controlling for age, sex, education, salary, marital status, and Model 2 (OR = 2.43, 95% CI 1.93–3.07) additionally adjusted for occupation, contract period, full-time versus part-time, shift work, weekly working hours, and parental status. Besides unpredictable work schedules, not being married (OR = 1.72, 95% CI 1.31–2.25) and contract period (<1 month; OR = 1.58, 95% CI 1.02–2.44) showed statistically significant associations with depressive symptoms. In women, having a child under the age of 18 years showed a marginally significant increased risk for depressive symptoms (OR = 1.36, 95% CI 0.97–1.93).

A significant interaction was present for gender and unpredictable work schedules in both Model 1 ($p = 0.018$) and Model 2 ($p = 0.021$); therefore, gender stratified analyses were performed. In Model 2 analysis stratified by gender, both men and women showed a significant association between unpredictable schedules and depressive symptoms, and men showed a greater increase in OR (3.04, 95% CI 2.18–4.24) than women (OR = 1.82, 95% CI 1.32–2.51).

Regarding the interaction between weekly working hours and unpredictable schedule, Model 2 added interaction terms for unpredictable schedule * weekly working hour groups in male workers. The results showed a significant interaction for the short

working hour group (<40 h/wk; $p = 0.006$) in the direction of lowering the risk of depressive symptoms, whereas long working hours (>52 h/wk) * unpredictable work schedule showed marginally significant interaction ($p = 0.06$) in the direction of elevating the risk. However, there was no significant interaction between working hours and unpredictable work schedules in women.

Table 4 shows the results of multiple logistic regression analysis among selected subgroups. It showed a significant association between unpredictable work schedules and depressive symptoms across almost all subgroups. The intensity of associations between unpredictable work schedule and depressive symptoms was stronger among male office workers (OR = 7.76, 95% CI 3.62–16.65) and workers with a long working hour (>52 h/wk; men: OR = 3.35, 95% CI 1.65–6.78; women: OR = 3.30, 95% CI 1.34–8.08). Among men, the highest income group showed higher OR (7.64, 95% CI 3.66–15.96), whereas the lowest income group showed higher OR (1.87, 95% CI 0.95–3.70) in women. Men showed similar ORs regardless of the presence of children, but women with children showed higher OR (2.54, 95% CI 1.52–4.23) compared to women without children (OR = 1.58, 95% CI 1.05–2.38). When the analysis was restricted to platform workers, the risk of depressive symptoms was higher among workers with unpredictable work schedules, but the results were not statistically significant.

4. Discussion

We found that workers engaged in unpredictable work schedules have a higher risk of depressive symptoms compared to those with predictable work schedules in Korea. The association

Table 3

The ORs and 95% CIs of unpredictable work schedules on depressive symptoms.

	Total				Men				Women			
	Model 1*		Model 2		Model 1*		Model 2		Model 1*		Model 2	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Unpredictable work schedule												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes	2.51	2.02-3.13	2.43	1.93-3.07	3.20	2.33-4.39	3.04	2.18-4.24	1.84	1.36-2.48	1.82	1.32-2.51
Age (y)	1.02	1.01-1.03	1.02	1.01-1.03	1.01	0.99-1.02	1.00	0.99-1.02	1.02	1.01-1.04	1.03	1.01-1.04
Sex												
Men	1.00		1.00									
Women	1.12	0.88-1.42	1.21	0.94-1.57								
Education												
<High school	1.14	0.76-1.71	1.02	0.65-1.61	1.33	0.77-2.30	0.97	0.51-1.84	0.90	0.48-1.70	0.90	0.46-1.78
High school	0.93	0.72-1.21	0.86	0.65-1.15	0.80	0.56-1.15	0.67	0.45-0.99	1.11	0.76-1.64	1.07	0.69-1.65
College	1.00		1.00		1.00		1.00		1.00		1.00	
Salary (10,000 KRW)												
<200	1.04	0.72-1.50	1.03	0.71-1.51	1.26	0.79-2.02	1.16	0.72-1.90	0.85	0.45-1.60	0.86	0.46-1.62
200-299	0.85	0.58-1.25	0.82	0.55-1.22	0.97	0.61-1.54	0.94	0.57-1.54	0.70	0.36-1.37	0.68	0.34-1.34
300-399	0.70	0.47-1.05	0.69	0.46-1.03	0.67	0.42-1.06	0.66	0.41-1.06	0.84	0.39-1.81	0.82	0.38-1.76
>400	1.00		1.00		1.00		1.00		1.00		1.00	
Marital status												
Married/live together	1.00		1.00		1.00		1.00		1.00		1.00	
Single/others	1.53	1.21-1.92	1.72	1.31-2.25	1.14	0.79-1.65	1.17	0.73-1.89	1.94	1.44-2.60	2.23	1.65-3.03
Occupation												
Professional and manager			1.00				1.00				1.00	
Office worker			0.95	0.65-1.38			0.84	0.49-1.43			1.03	0.60-1.75
Service and sales			0.87	0.60-1.25			0.60	0.34-1.08			1.13	0.67-1.90
Blue-collar worker			0.99	0.67-1.47			0.85	0.51-1.43			1.21	0.66-2.23
Contract period												
>1 y			1.00				1.00				1.00	
1 mo-1 y			1.23	0.89-1.69			1.76	1.09-2.84			0.89	0.58-1.36
<1 mo			1.58	1.02-2.44			2.12	1.13-3.99			1.07	0.57-2.02
Part-time												
Full-time			1.00				1.00				1.00	
Part-time			1.13	0.76-1.68			1.30	0.66-2.57			1.02	0.64-1.63
Shift work												
No			1.00				1.00				1.00	
Yes			0.99	0.73-1.35			1.00	0.65-1.54			0.98	0.60-1.59
Weekly working hour (h)			1.02	1.01-1.03			1.02	1.01-1.03			1.01	0.99-1.02
Having a child under the age of 18 y												
No			1.00				1.00				1.00	
Yes			1.25	0.94-1.67			1.09	0.68-1.74			1.36	0.97-1.93

CI, confidence interval; OR, odds ratio.

* Adjusted for age, sex, education, salary, and marital status.

† Adjusted for age, sex, education, salary, marital status, occupation, contract period, full-time versus part-time, shift work, weekly working hours, and having a child under the age of 18 years.

remained significant after controlling possible confounders including socioeconomic status (SES) and selected work characteristics. Subgroup analysis revealed that among almost all subgroups (defined by work characteristics), the association between unpredictable work schedules and depressive symptoms was found.

Our findings are in line with previous studies on the impact of unpredictable work hours on the health and well-being of workers. In a previous study using the data from the EWCS, individuals with fixed start and finish times reported less stress, fatigue, sleeping problems, and anxiety [3]. According to a study based on a survey of police officers in the United Kingdom, unpredictability in the work schedule was associated with greater work-life conflict and perceived stress [22]. Among retail workers in the United States and Canada, the unpredictable work schedule was associated with work-life conflict [5,23]. Unpredictable working hours was also associated with less healthy eating behavior [24].

Precarious work—including involuntary part-time work, temporary work, or contract work—is known to be a major contributor

to nonstandard working hours including unpredictable work schedules [25-27]. Low SES of precarious workers might underlie the adverse impact of unpredictable work schedules on workers' depressive symptoms. In addition, SES can also be an effect modifier of the association between unpredictable work schedules and depressive symptoms. Low SES workers having fewer resources to manage unpredictable work schedules could be affected more. In our data, the association between unpredictable work schedules and depressive symptoms was stronger in *high-income* men, as well as in *low-income* women, based on the marginally significant three-way interaction between unpredictable schedule, salary, and gender ($p = 0.056$).

Generally, unfavorable work hours are linked to a lack of individual control over hours and work stress [28]. These factors could mediate the association between unpredictable work schedules and depressive symptoms. In addition, short notice of changes to work schedules influenced time-based and strain-based work-life conflict [5,12]. Work-life conflict is a psychosocial factor strongly associated with various health outcomes including self-rated

Table 4
Adjusted OR and 95% CI of unpredictable work schedule for depressive symptoms in subgroups by sex

Subgroups		Men		Women	
		OR	95% CI	OR	95% CI
Occupation	Professional and manager	2.79	1.35–5.74	0.99	0.42–2.33
	Office worker	7.76	3.62–16.65	2.62	1.22–5.61
	Service and sales	3.49	1.59–7.66	2.56	1.70–3.86
	Blue-collar worker	1.80	1.17–2.77	1.29	0.64–2.59
Contract period	>1 y	3.85	2.57–5.76	2.17	1.52–3.08
	1 mo–1 y	0.80	0.34–1.86	1.06	0.47–2.39
	<1 mo	2.94	1.23–7.05	1.28	0.28–5.87
Part-time	Full-time	3.32	2.33–4.72	1.97	1.40–2.78
	Part-time	1.56	0.71–3.45	1.44	0.71–2.92
Working hour (h/wk)	<40	0.51	0.16–1.63	1.62	0.83–3.14
	40–52	3.50	2.32–5.26	1.68	1.11–2.55
	>52	3.35	1.65–6.78	3.30	1.34–8.08
Salary (10,000 KRW/mo)	<200	1.59	0.87–2.90	2.00	1.34–3.01
	200–299	2.74	1.32–5.70	1.87	0.95–3.70
	300–399	2.10	1.10–4.01	1.57	0.59–4.19
	>400	7.64	3.66–15.96	1.03	0.30–3.48
Platform labor	No	3.11	2.20–4.40	1.84	1.30–2.60
	Yes	2.36	0.77–7.22	1.43	0.59–3.43
Marital status	Married/live together	3.49	1.77–6.90	1.10	0.60–2.01
	Single/others	2.88	1.98–4.19	2.69	1.87–3.87
Having a child under the age of 18 y	No	3.04	1.98–4.67	1.58	1.05–2.38
	Yes	3.02	1.80–5.08	2.54	1.52–4.23

Adjusted for age, sex, education, salary, marital status, occupation, contract period, full-time versus part-time, shift work, weekly working hours, and having a child under the age of 18 years.

CI, confidence interval; OR, odds ratio.

health, sleep disorders, stress, and burnout [29]. Nonstandard working hours including irregular or unpredictable work schedules adversely impact on amount and quality of sleep [6,30]. Considering that insufficient sleep could be related to depression [31], sleep disruption might be in the path between unpredictable work schedules and depressive symptoms.

Working irregular and unpredictable hours is expected to be a source of stress, particularly for women because of the difficulty to manage family responsibility [32]. However, in the gender-stratified analysis, we found a stronger association between unpredictable work schedules and depressive symptoms among men than women, and the interaction between unpredictable work schedules and gender to depressive symptoms was statistically significant.

A previous EU survey reported no gender difference in the association between irregular and variable work hours and health problems [3]. Thus, contrary to our hypothesis, it is not clear whether the impact of unpredictable work schedules is stronger in women than in men. Even for long working hours which has been studied extensively, some studies reported significant associations only in men, whereas others found both groups to be affected [1]. Considering the high degree of gender segregation in the labor force, the nature of unpredictable work schedules could be different by gender, usually overtime for men and part-time for women [3]. In Korea, which has one of the highest working hours among the OECD countries, longer working hours for men could be potentiating the negative impact of unpredictable work schedules. There may also be differential selection into the workforce by gender, though our study sample represents all employed workers in Korea. A high gender employment gap has been reported in Korea, which is especially large among college-educated workers, ranking at the top among OECD countries [33]. In addition, married women were 40–60% less likely to participate in the labor force than single women in Korea [34]. This suggests that women having more family responsibilities might be more likely to leave the labor market. By contrast, women forced to take both the responsibility of being the primary income earner and caregiver (i.e., single

mothers) can be predicted to suffer the most from unpredictable work schedules. Indeed, our data indicated a much higher prevalence of depressive symptoms (9.8%) among single mothers with unpredictable work schedules compared to the other women with unpredictable schedules (3.2%) (data not shown).

Different normative role expectations by gender may also play a role. For example, in a previous study based in the United States, workers-oriented flexible working hours (compressed work weeks combined with flexitime, which are supposed to have greater workers' control) increased stress and burn-out among women but benefited men [35]. The authors argued about the possibility that men prioritize personal leisure, whereas women tend to engage in additional family-related activities when they secure extra time [35]. Similarly, less autonomy in work schedules caused by unpredictable work hours might affect men more than women.

We hypothesized unpredictable work schedule would be associated with depressive symptoms beyond precarious work. Indeed, after controlling several dimensions of precarious work (working hours, salary, duration of contract, and part-time), we still found a significant association between unpredictable work schedules and depressive symptoms. By contrast, stratified analysis revealed an even stronger association among full-time workers, workers with long-term contracts, and higher incomes. These findings suggest that the impact of unpredictable work schedules is not confined to precarious or nonstandard workers. Precarious workers, especially young workers, have lower expectations about salary and job security [36], whereas workers in more stable jobs are likely to have higher expectations, resulting in low job satisfaction when their schedules become unpredictable [37]. Thus, the subjective perception of working conditions and satisfaction might moderate the effect of unpredictable work schedules on mental health.

A strength of the present study is that the study sample was drawn from a nationwide representative sample of employed workers. To the best of our knowledge, this is the first study investigating the association between unpredictable work schedules and depressive symptoms in Korea.

There were several limitations in the present study. First, the cross-sectional design made us unable to determine the causal relationship between unpredictable work schedules and depressive symptoms. Reverse causation cannot be ruled out. Second, we used variables measured by self-report. The single item may underestimate the prevalence of depressive symptoms [38]. However, the 2.0% prevalence of depressive symptoms over the past year in our data was comparable to the 1.6% prevalence of major depression from the Survey of Mental Disorders in Korea using K-CIDI (Korean version of Composite International Diagnostic Interview) with nationally representative samples in 2016 [39]. In addition, according to several studies, even a single item about depressive symptoms has a strong correlation with clinically diagnostic measures of depression in various populations [40–43]. Also, we controlled for factors such as age, education, and income, which might potentially impact the sensitivity of the outcome measure.

Future studies could benefit from using objective measures of variables and longitudinal design.

We found that workers who have unpredictable work schedules have a higher risk of depressive symptoms independent of other aspects of precarious work. Regarding gender difference, we could not find a stronger impact of unpredictable work schedules among women compared to men (with the notable exception of single mothers). Policies for strengthened workplace protections against unfair work schedules should be considered as well as decreasing long working hours.

Author contribution

HEL designed the research, performed the statistical analysis, and wrote the first draft of the manuscript. IK participated in the research design and critically revised the manuscript.

Conflicts of interest

All authors have no conflicts of interest to declare.

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References

- [1] Bannai A, Tamakoshi A. The association between long working hours and health: a systematic review of epidemiological evidence. *Scand J Work, Environ Health* 2014 Jan;40(1):5–18.
- [2] Arlinghaus A, Bohle P, Iskra-Golec I, Jansen N, Jay S, Rotenberg L. Working Time Society consensus statements: evidence-based effects of shift work and non-standard working hours on workers, family and community. *Ind Health* 2019 Apr 1;57(2):184–200.
- [3] Costa G, Akerstedt T, Nachreiner F, Baltieri F, Carvalhais J, Folkard S, Dresen MF, Gadbois C, Gartner J, Sukalo HG, Härmä M, Kandolin I, Sartori S, Silvério J. Flexible working hours, health, and well-being in Europe: some considerations from a SALTSA project. *Chronobiol Int* 2004;21(6):831–44.
- [4] Van Aerden K, Moors G, Levecque K, Vanroelen C. Measuring employment arrangements in the European labour force: a typological approach. *Soc Indic Res* 2014 May;116(3):771–91.
- [5] Henly JR, Lambert SJ. Unpredictable work timing in retail jobs: implications for employee work–life conflict. *ILR Rev* 2014 Jul;67(3):986–1016.
- [6] Winkler MR, Mason S, Laska MN, Christoph MJ, Neumark-Sztainer D. Does non-standard work mean non-standard health? Exploring links between non-standard work schedules, health behavior, and well-being. *SSM Popul Health* 2018 Apr;4:135–43.
- [7] Marucci-Wellman H. Precarious employment and occupational injuries in the digital age – where should we go from here? *Scand J Work Environ Health* 2018 Jul;44(4):335–9.
- [8] Howard J. Nonstandard work arrangements and worker health and safety: nonstandard Work Arrangements. *Am J Ind Med* 2017 Jan;60(1):1–10.
- [9] Lambert SJ, Fugiel PJ, Henly JR. Schedule Unpredictability among Early Career Workers in the US Labor Market: A National Snapshot [Internet]. *Employment Instability, Family Well-being, and Social Policy Network*, the University of Chicago. 2014 [cited 2020 Jan 21]. Available from: https://www.ssa.uchicago.edu/sites/default/files/uploads/lambert.fugiel.henly_executive_summary_b.0.pdf.
- [10] Kalleberg AL. Precarious work, insecure workers: employment relations in transition. *Am Sociol Rev* 2009 Feb;74(1):1–22.
- [11] Harknett K, Schneider D. Precarious work schedules and population health [Internet]. *Health Affairs Health Policy Brief: Project HOPE*. 2020 Feb [cited 2020 May 3]. Available from: <https://www.healthaffairs.org/doi/10.1377/hpb20200206.806111/full/>.
- [12] Parent-Thirion A, Biletta I, Cabrita J, Llave Vargas O, Vermeylen G, Wilczynska A, Wilkens M. 6th European Working Conditions Survey: overview report. 2017 update. Luxembourg: Publications Office of the European Union; 2017. 160 p [EF].
- [13] Korea Occupational Safety and Health Agency. 4th Korean working condition survey [Internet]; 2014 Oct [cited 2020 May 3]. Report No.: 2014-Research Institute-840. Available from: <http://www.kosha.or.kr/kosha/data/primitiveData.do?mode=download&articleNo=328528&attachNo=172408>.
- [14] Lambert SJ, Fugiel PJ, Henly JR. Precarious work schedules among early-career employees in the US: a national snapshot; 2014. 24 p.
- [15] Eurofound. European Working Conditions Survey - Data visualisation [Internet]. Eurofound. 2020 [cited 2020 May 4]. Available from: <https://www.eurofound.europa.eu/data/european-working-conditions-survey>.
- [16] Shin Y. Study on working-time arrangements types of Korean worker and its determinants. *Q J Labor Policy* 2018;18(1):135–67.
- [17] Kim M-H, Kim C-Y, Park J-K, Kawachi I. Is precarious employment damaging to self-rated health? Results of propensity score matching methods, using longitudinal data in South Korea. *Soc Sci Med* 2008 Dec;67(12):1982–94.
- [18] Han K-M, Chang J, Won E, Lee M-S, Ham B-J. Precarious employment associated with depressive symptoms and suicidal ideation in adult wage workers. *J Affect Disord* 2017 15;218:201–9.
- [19] Schneider D, Harknett K. Consequences of routine work-schedule instability for worker health and well-being. *Am Sociol Rev* 2019 Feb;84(1):82–114.
- [20] Changmin O. Survey of young workers' rights at work [Internet]. *The community of economics and culture Deoham*. 2019 [cited 2020 Jan 23]. Available from: http://www.gj15886546.org/bbs/board.php?bo_table=b01&wr_id=27.
- [21] Kim YS, Rhee KY, Oh MJ, Park J. The validity and reliability of the second Korean working conditions survey. *Saf Health Work* 2013 Jun;4(2):111–6.
- [22] Scholarios D, Hesselgreaves H, Pratt R. Unpredictable working time, well-being and health in the police service. *Int J Hum Resource Manage* 2017 Sep 8;28(16):2275–98.
- [23] Messing K, Tissot F, Couture V, Bernstein S. Strategies for managing work/life interaction among women and men with variable and unpredictable work hours in retail sales in québec, Canada. *New Solut* 2014 Aug;24(2):171–94.
- [24] Dixon J, Woodman D, Strazdins L, Banwell C, Broom D, Burgess J. Flexible employment, flexible eating and health risks. *Crit Public Health* 2014 Oct 2;24(4):461–75.
- [25] Saloniemi A, Zeytinoglu IU. Achieving flexibility through insecurity: a comparison of work environments in fixed-term and permanent jobs in Finland and Canada. *Eur J Ind Relations* 2007 Mar;13(1):109–28.
- [26] Berg P, Bosch G, Charest J. Working-time configurations: a framework for analyzing diversity across countries. *ILR Rev* 2014 Jul;67(3):805–37.
- [27] Bohle P, Quinlan M, Kennedy D, Williamson A. Working hours, work-life conflict and health in precarious and “permanent” employment. *Rev Saude Publica* 2004 Dec;38(Suppl. 1):19–25.
- [28] Härmä M. Workhours in relation to work stress, recovery and health. *Scand J Work Environ Health* 2006 Dec;32(6):502–14.
- [29] Hämmig O, Bauer GF. Work, work-life conflict and health in an industrial work environment. *Occup Med (Lond)* 2014 Jan;64(1):34–8.
- [30] Ferguson SA, Paterson JL, Hall SJ, Jay SM, Aisbett B. On-call work: to sleep or not to sleep? It depends. *Chronobiol Int* 2016;33(6):678–84.
- [31] Zhai L, Zhang H, Zhang D. Sleep duration and depression among adults: a meta-analysis OF prospective studies. *Depress Anxiety* 2015 Sep;32(9):664–70.
- [32] Zeytinoglu I, Lillevik W, Seaton B, Moruz J. Part-time and casual work in retail trade: stress and other factors affecting the workplace. *Relations Industrielles/Industrial Relations* 2004;59(3):516–44.
- [33] OECD. Towards Better social and employment security in Korea [Internet]. OECD. 2018 [cited 2019 Dec 2]. (Connecting People with Jobs). Available from: https://www.oecd-ilibrary.org/employment/connecting-people-with-jobs-towards-better-social-and-employment-security-in-korea_9789264288256-en.
- [34] Lee BS, Jang S, Sarkar J. Women's labor force participation and marriage: the case of Korea. *J Asian Econ* 2008 Apr;19(2):138–54.

- [35] Grzywacz JG, Carlson DS, Shulkin S. Schedule flexibility and stress: linking formal flexible arrangements and perceived flexibility to employee health. *Community, Work and Family* 2008.
- [36] Eckelt M, Schmidt G. Learning to be precarious—The transition of young people from school into precarious work in Germany. *J Crit Educ Policy Stud (JCEPS)* 2014;12(3).
- [37] Poggi A. Job satisfaction, working conditions and job-expectations. *LABOR* 2008.
- [38] Min K-D, Chun H, Kim I-H, Cho S-I. Validating a single-question depression measure among older adults. *Int Psychogeriatr* 2018;30(1):69–76.
- [39] Jo M, Rim SJ, Lee M-G, Park S. Illuminating the treatment gap of mental disorders: a comparison of community survey-based and national registry-based prevalence rates in Korea. *J Psychiatr Res* 2020 Nov;130:381–6.
- [40] Stuart AL, Pasco JA, Jacka FN, Brennan SL, Berk M, Williams LJ. Comparison of self-report and structured clinical interview in the identification of depression. *Compr Psychiatry* 2014 May;55(4):866–9.
- [41] Reme SE, Eriksen HR. Is one question enough to screen for depression? *Scand J Public Health* 2010 Aug;38(6):618–24.
- [42] Ayalon L, Goldfracht M, Bech P. “Do you think you suffer from depression?” Reevaluating the use of a single item question for the screening of depression in older primary care patients. *Int J Geriatr Psychiatry* 2010 May;25(5):497–502.
- [43] Vahter L, Kreegipuu M, Talvik T, Gross-Paju K. One question as a screening instrument for depression in people with multiple sclerosis. *Clin Rehabil* 2007 May;21(5):460–4.