Research paper

# Association between sickness presenteeism and depressive symptoms in Korean workers during the COVID-19 pandemic: A cross-sectional study

Kyung-Shin Lee [a,1], Dong-Wook Lee [b,1], JooYong Park [c], Ho-Yeon Kim [d], Je-Yeon Yun [e,f], Yun-Chul Hong [b,c,g], Nami Lee [e,h,*]

[a] Public Health Research Institute, National Medical Center, Republic of Korea
[b] Public Healthcare Center, Seoul National University Hospital, Seoul, Republic of Korea
[c] Institute of Environmental Medicine, Seoul National University Medical Research Center, Seoul, Republic of Korea
[d] Department of Preventive Medicine, Seoul National University College of Medicine, Seoul, Republic of Korea
[e] Department of Psychiatry, Seoul National University Hospital, Seoul, Republic of Korea
[f] Yeongeon Student Support Center, Seoul National University College of Medicine, Seoul, Republic of Korea
[g] Department of Human Systems Medicine, Seoul National University College of Medicine, Seoul, Republic of Korea
[h] Human Rights Center, Seoul National University Hospital, Seoul, Republic of Korea

## A R T I C L E   I N F O

*Keywords:*
COVID-19
Depressive symptoms
Sick leave
Sickness presenteeism
Worker

## A B S T R A C T

*Background:* During the COVID-19 pandemic, Korean workers have reported various types of sickness presenteeism (SP: continuing to attend work during illness). Understanding SP through mental health perspectives will help to make practical strategy for better working conditions. We examined the association between SP and depression among Korean workers during the COVID-19 pandemic in relation with the socioeconomic and lifestyle factors.
*Methods:* Data from the 2020 Korean Community Health Survey were used as a representative nationwide sample dataset. We surveyed the experience of depression in the last two weeks from individuals who worked more than a week recently. We investigated the associations between SP and depressive symptoms. Depressive symptoms were scored using the Patient Health Questionnaire-9 (PHQ-9). Logistic regression analysis was performed to examine the significance of the associations.
*Results:* Analysis of the data obtained from 84,514 participants revealed that 1700 (2.2 %) participants reported experiencing depressive symptoms in 2020. Employees with SP showed higher association with depressive symptoms than employers or self-employed individuals (OR = 2.18, 95 % CI: 1.85, 2.56 among employees vs. OR = 1.76, 95 % CI: 1.29, 2.40 among employers or self-employed individuals).
*Conclusion:* SP has become more prominent during the COVID-19 pandemic. A protective strategy against SP among vulnerable workers is necessary for a healthier and safer society.

## 1. Introduction

Sickness presenteeism (SP) is defined as continuing to work despite functioning beneath the total capacity in the workplace due to sickness (Aronsson et al., 2000; Kinman, 2019). The concept was introduced in the mid-1990s and has attracted attention in the field of occupational health (Jung et al., 2020). The average prevalence of SP was reported to be 35 % in European countries, with Montenegro, Slovenia, Turkey, and United Kingdom reporting the highest prevalence and Italy, Bulgaria, Poland, and Portugal reporting a lower prevalence (d'Errico et al.,

2016). In South Korea, the prevalence of SP was reported to be 22–23 % (Cho et al., 2016; Kim et al., 2019). During the pandemic, the association between SP and various psychosocial outcomes, such as depression, anxiety, and stress, among hospital- and medical facility-workers were highlighted (Gun et al., 2011; Jung et al., 2007; Lee and Jung, 2008; Ryu et al., 2012; Suzuki et al., 2015).

Psychological stress factors related to SP were investigated with the focus on helping health professions amid Coronavirus Disease 2019 (COVID-19) (Kinman and Grant, 2021; Masuda et al., 2022; Okawara et al., 2022). Individuals with lower socioeconomic status could be more

vulnerable to mental disorders during the COVID-19 pandemic(Jaspal and Breakwell, 2022) . However, there has been little research on the human right to take rest or sick leave during COVID-19 regarding depression (Burstyn and Holt, 2022; Deguchi et al., 2022; Finstad et al., 2021; Ortiz and Bluyssen, 2022). COVID-19 infection has affected poorer and less educated people more than richer and more educated (Prats-Uribe et al., 2020). Most low-paid essential workers cannot use sick leave even when they are ill. Similarly, employers and self-employed individuals cannot have paid sick leave. Manifestation and etiology of the association SP and mental disorders have not been fully interrogated. Regarding the association between depressive symptoms and presenteeism, cognitive function mediates the relationship between them. Significant relationship between depression severity and presenteeism was reported (Johnston et al., 2019) and the association between depressive symptoms and presenteeism-induced productivity change was discussed in relation with information processing speed, especially in their medium and high levels (Lopes et al., 2018). In a study using the community sample, subjective cognitive function impairments and depressive symptoms were considered to be related to SP (Toyoshima et al., 2020). Korean workers have reported various types of SP depending on their job categories during the COVID-19 pandemic. Understanding the phenomena and the origin of SP will help to build up safe working environment in order to protect vulnerable workers from serious medical and industrial adversity. This study aimed to examine the association between SP and depressive symptoms among Korean workers during the COVID-19 pandemic in order to make practical strategies for sick workers who are forced to work.

## 2. Methods

### 2.1. Study population and data

Data from the Community Health Survey (CHS) 2020 were used after receiving approval from the Korean Centers for Disease Control (https://www.kdca.go.kr). Details of the study protocol have been described elsewhere (Kang et al., 2015; Lee et al., 2022). CHS presents the health statistics for cities, counties, and districts in Korea since 2008. The average sample size of each community health center (total 235 centers) was 900 people were extracted from adults aged 19 years or older from all cities, counties, and districts using multilevel probability sampling (Kang et al., 2015). Trained surveyors visited sample households to conduct computer-assisted personal interviews.

### 2.2. Study measures: depressive symptoms

The Korean version of the Patient Health Questionnaire-9 (PHQ-9) is a nine-item self-assessment questionnaire for measuring symptoms of depression, verified for validity and reliability in a prior study, was used (Han et al., 2008). The PHQ-9 score can range from 0 to 27, since each item is scored on a 3-point Likert scale (0 = not at all to 3 = nearly every day). Higher scores indicates greater symptom severity(0–4 = minimal depression, 5–9 = mild depression, 10–14 = moderate depression, 15–19 = moderately severe depression, and ≥ 20 = severe depression) (Kroenke et al., 2001) . In this study, we defined a PHQ-9 score ≥ 10 as the presence of depressive symptoms.

### 2.3. Study measures: assessment of SP

We evaluated the questions representing SP using the following two questions, which were appropriately modified for the COVID-19 situation from previous studies (Cho et al., 2016; Kim et al., 2016b; Park et al., 2020). "Are you able to rest at home when you have fever or respiratory symptoms such as coughing?" and "What is the main reason of not staying at home when you are sick? The responses included: a) cannot take sick leave from work, b) to buy necessities of life, c) to take care of other family and acquaintances who live separately, and d) other

reason." The participants who responded "no" to the former question and responded "a) unable to take sick leave from work" to the latter question were regarded as workers who cannot have paid sick leave.

### 2.4. Study measures: covariates

The internet questionnaire included the following variables: age (revised to 20–29, 30–39, 40–49, and 50–59), sex (male/ female), educational status (revised to <college education and ≥ college graduate), occupation (revised to white collar for managers or professionals, pink collar for service or sales workers, and blue collars for machine operators, craft workers, or assemblers (Seok et al., 2017), marital status (married, widowed/divorced, and unmarried), current smoking status (yes/no), current drinking status (yes/no), moderate physical activity (yes/no), diagnosis of diabetes mellitus (yes/no), and diagnosis of hypertension (yes/no).

### 2.5. Statistical analysis

To show the distribution of all studied variables in the study population, we examined the frequencies with all categorical variables and further stratified the employment type into employees, employers or independent enterprise owners, so-called self-employed workers. A univariate logistic regression analysis was performed to estimate the odds ratios (ORs) and 95 % confidential intervals (CI) for the association between demographic variables and the presence of depressive symptoms. We used multivariate logistic regression analysis to determine the association between SP and the presence of depressive symptoms after adjusting for all covariates. In the subgroup analysis, we also plotted the results of the associations by stratifying the socio-demographic variables, including sex, age group, education, occupation, and marital status, using the 'plotrix' function in R package (Duursma et al., 2009). In addition, we examined the associations after changing the definition of depressive symptoms, such as dividing the total score of PHQ-9 into normal (0 ≤ total score of PHQ-9 ≤ 4) and mild to severe depressive symptom (5 ≤ total score of PHQ-9) categories (Kroenke et al., 2001).

Statistical significance was set at $p < 0.05$. All percentages of frequency for variables were weighted and analyzed using PROC SURVEYFREQ and PROC SURVEYLOGISTIC statements in SAS as they were sampled using stratified systematic sampling methods. The weighting processes have been described elsewhere (Kang et al., 2015). Analyses for frequency were conducted using SAS (version 9.4; SAS Institute Inc., Cary, NC, USA).

## 3. Results

### 3.1. Demographics in the study population

Among the 229,269 individuals who completed the 2020 CHS, 125,375 women and 103,894 men who refused to answer questions or had missing answers were excluded. In addition, 137,967 respondents were excluded as they were under 20 years old, unemployed, unpaid family workers, and 60 years old and above. Lastly, 6788 respondents determined to have provided invalid or erroneous responses were excluded. The remaining 84,514 subjects were included in the study (Fig. 1) and divided into two groups: the employee group (n = 64,666) and the employers or self-employed workers group (n = 19,848). In the employee group, 5926 (9.1 %) individuals reported experiencing an inability to take sick leave, whereas 1838 (9.2 %) individuals in the employers or self-employed group reported being unable to take sick leave (Table 1). The employees group comprised 42.5 % females, 62.0 % college graduates and above, and 54.4 % white collar workers. The participants in the employees group who were under college graduates (40.3 % vs. 37.7 %), blue collar workers (30.3 % vs. 27.6 %), smokers (44.7 % vs. 41.4 %), and those diagnosed with diabetes mellitus (4.5 % vs. 3.7 %), and hypertension (11.4 % vs. 10.1 %) were at a higher risk of
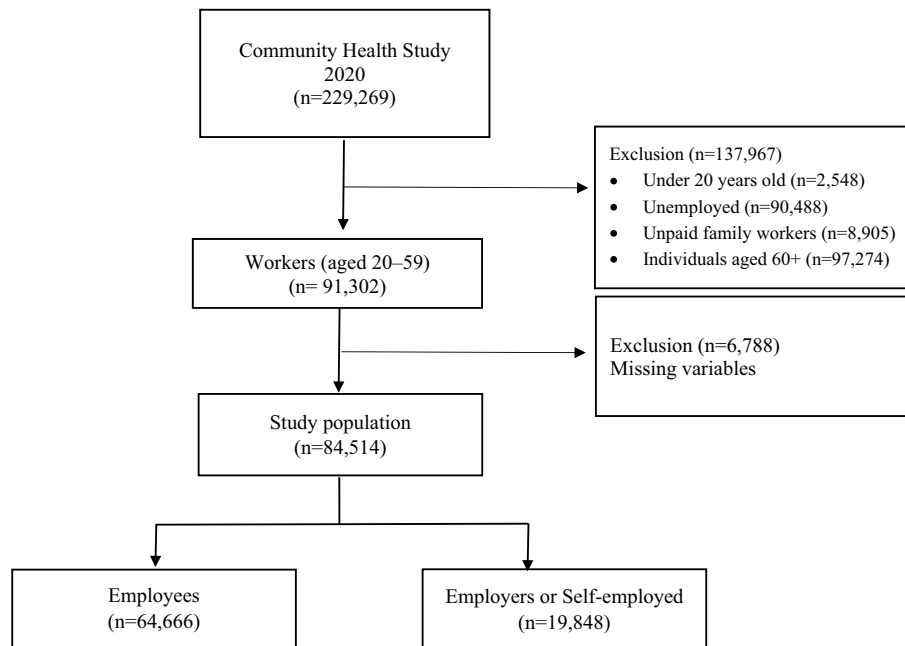
```
                    ┌─────────────────────────┐
                    │  Community Health Study  │
                    │          2020            │
                    │      (n=229,269)         │
                    └─────────────────────────┘
                                │
                                │              ┌────────────────────────────────────────┐
                                │─────────────▶│ Exclusion (n=137,967)                  │
                                │              │  • Under 20 years old (n=2,548)        │
                                │              │  • Unemployed (n=90,488)               │
                                ▼              │  • Unpaid family workers (n=8,905)     │
                    ┌─────────────────────────┐│  • Individuals aged 60+ (n=97,274)     │
                    │   Workers (aged 20–59)  │└────────────────────────────────────────┘
                    │      (n= 91,302)        │
                    └─────────────────────────┘
                                │              ┌────────────────────────────────────────┐
                                │─────────────▶│ Exclusion (n=6,788)                    │
                                │              │ Missing variables                      │
                                ▼              └────────────────────────────────────────┘
                    ┌─────────────────────────┐
                    │    Study population     │
                    │      (n=84,514)         │
                    └─────────────────────────┘
                                │
                   ┌────────────┴────────────┐
                   ▼                         ▼
        ┌─────────────────────┐   ┌─────────────────────────┐
        │     Employees       │   │  Employers or Self-employed │
        │    (n=64,666)       │   │      (n=19,848)         │
        └─────────────────────┘   └─────────────────────────┘
```

**Fig. 1.** Flow chart for the selection of the study population from the Korea Community Health Study 2020.

being unable to take sick leave.

In the employers or self-employed workers group, white, pink, and blue collar workers comprised 32.1 %, 38.9 %, and 29.0 %, respectively, according to the type of occupation. Among them, 14,806 (74.1 %) were married, and 7.1 % and 15.5 % were diagnosed with diabetes mellitus and hypertension, respectively. The participants in the employers or self-employed workers group who were males (73.3 % vs. 65.9 %), under college graduates (49.9 % vs. 45.8 %), pink collars workers (43.0 % vs. 38.4 %), married (78.7 % vs. 73.6 %), smokers (61.5 % vs. 53.0 %), and diagnosed with diabetes mellitus (92.1 % vs. 88.6 %) were at a higher risk of being unable to take sick leave.

### 3.2. Univariate model of the covariates and depressive symptoms

Table 2 presents the results of the univariate logistic regression models regarding the association between the covariates and the presence of depressive symptoms by stratifying the type of employment.

In the employees or self-employed workers group, the ORs for depressive symptoms of the 30–39, 40–49, and 50–59 years age groups were lower than that of the 20–29 years age group (odds ratio, OR = 0.71, 95 % CI: 0.61–0.84, OR = 0.39, 95 % CI: 0.33–0.47, and OR = 0.30, 95 % CI: 0.25–0.37, respectively). The OR of females was 1.91 times higher than that of males (95 % CI: 1.67–2.17). The OR of pink collar workers was 1.50 times higher than that of white collar (95 % CI: 1.29–1.75). The OR of unmarried or widowed/divorced individuals for the presence of depressive symptoms was higher than that of married individuals (OR = 2.20, 95 % CI: 1.91–2.53, and OR = 1.89, 95 % CI: 1.54–2.32, respectively). Additionally, the ORs of individuals who were smokers, drinkers, and diagnosed with diabetes mellitus were higher for depressive symptoms than that of the reference group (OR = 1.25, 95 % CI: 1.10–1.42, OR = 1.86, 95 % CI: 1.45–2.38, and OR = 1.35, 95 % CI: 1.01–1.79, respectively).

In the employer or self-employed workers group, higher OR for depressive symptoms was observed in females (OR = 2.12, 95 % CI: 1.70–2.66 compared with that of males), pink collars workers (OR = 1.34, 95 % CI:1.02–1.77 compared with that of white collar workers), unmarried or widowed/divorced individuals (OR = 1.96, 95 % CI: 1.47–2.60, and OR = 2.17, 95 % CI: 1.59–2.97 compared with that of married individuals), and drinkers (OR = 1.68, 95 % CI: 1.10–2.57).

### 3.3. Association between SP and depressive symptoms

Table 3 presents the results of the multivariate logistic regression models for the association between SP and the presence of depressive symptoms. After adjusting for age group, sex, education, occupation, marital status, smoking status, drinking status, moderate physical activity, diagnosis of diabetes mellitus, and diagnosis of hypertension, the individuals who were unable to take sick leave showed higher OR for depressive symptoms (OR = 2.07, 95 % CI: 1.79, 2.39 in the total population). After stratifying the type of employment, the adjusted OR for the employees was higher for depressive symptoms than that of the employers or self-employed workers (OR = 2.18, 95 % CI: 1.85–2.56 among employees vs. OR = 1.76, 95 % CI: 1.29–2.40 among employers or self-employed).

### 3.4. Sensitivity analysis

In the subgroup analysis, we plotted the result of the association between SP and the presence of depressive symptoms by stratifying the socio-demographic variables, including sex, age group, education, occupation, and marital status, using multivariable logistic regression analysis (Fig. 2). Notably, we found that after stratifying the variables, the associations between SP and depressive symptoms were significant among employees in all groups. In the employers and self-employed group, a significant association was observed only among individuals with white collar jobs who were married, highly educated (college graduates and above), and 30–39 and 50–59 years old. We also examined the associations between SP and depressive symptoms after dividing the total score of PHQ-9 into normal and mild to severe depression (Table S1). Table 3 shows the significantly consistent associations.

## 4. Discussion

To our knowledge, this is the first study to report the association between SP and depressive symptoms during the COVID-19 era. In our study, SP was significantly associated with depressive symptoms. ORs for depressive symptoms of the employers or self-employed workers who do not use sick leave were 1.75 times higher (95 % CI: 1.29–2.40) than

**Table 1**
General characteristics of the subjects.

| Category | Employees | | | P-value [c] | Employers or Self-employed workers | | | P-value [c] |
|---|---|---|---|---|---|---|---|---|
| | Total | Able to take sick leave | Unable to take sick leave(SP) | | Total | Able to take sick leave | Unable to take sick leave(SP) | |
| | n(%[a]) | n(%[b]) | n(%[b]) | | n(%[a]) | n(%[b]) | n(%[b]) | |
| Total | 64,666 (100.0) | 58,740(90.8) | 5926(9.1) | | 19,848 (100.0) | 18,010(90.7) | 1838(9.2) | |
| Age | | | | 0.0209 | | | | <0.0001 |
| 20–29 | 11,865 (20.9) | 10,783(20.9) | 1082(20.6) | | 716(4.9) | 657(5.1) | 59(3.5) | |
| 30–39 | 14,938 (26.2) | 13,434(26.1) | 1504(27.0) | | 2746(17.8) | 2432(17.4) | 314(21.0) | |
| 40–49 | 19,696 (29.0) | 17,827(28.9) | 1869(30.2) | | 6653(34.8) | 5957(34.5) | 696(37.3) | |
| 50–59 | 18,167 (24.0) | 16,696(24.2) | 1471(22.2) | | 9733(42.5) | 8964(43.0) | 769(38.2) | |
| Gender | | | | 0.0229 | | | | <0.0001 |
| Male | 34,193 (57.5) | 31,163(57.7) | 3030(55.9) | | 12,782 (66.6) | 11,511(65.9) | 1271(73.3) | |
| Female | 30,473 (42.5) | 27,577(42.3) | 2896(44.1) | | 7066(33.4) | 6499(34.1) | 567(26.7) | |
| Education | | | | 0.0007 | | | | 0.0030 |
| <College | 27,257 (38.0) | 24,654(37.7) | 2603(40.3) | | 10,624 (46.2) | 9633(45.8) | 991(49.9) | |
| ≥College | 37,409 (62.0) | 34,086(62.3) | 3323(59.7) | | 9224(53.8) | 8377(54.2) | 847(50.1) | |
| Occupation | | | | 0.0007 | | | | <0.0001 |
| White collar | 33,222 (54.4) | 30,213(54.6) | 3009(52.6) | | 5064(32.1) | 4649(32.9) | 415(25.4) | |
| Pink collar | 12,105 (17.7) | 11,047(17.8) | 1058(17.1) | | 7384(38.9) | 6569(38.4) | 815(43.0) | |
| Blue collar | 19,339 (27.9) | 17,480(27.6) | 1859(30.3) | | 7400(29.0) | 6792(28.6) | 608(31.6) | |
| Marital status | | | | 0.0247 | | | | <0.0001 |
| Married | 38,571 (58.3) | 35,136(58.4) | 3435(57.9) | | 14,806 (74.1) | 13,352(73.6) | 1454(78.7) | |
| Widowed/ divorced | 6152(7.8) | 5521(7.7) | 631(8.8) | | 2415(10.2) | 2232(10.4) | 183(8.9) | |
| Unmarried | 19,943 (33.9) | 18,083(33.9) | 1860(33.3) | | 2627(15.7) | 2426(16.1) | 201(12.4) | |
| Smoking status | | | | <0.0001 | | | | <0.0001 |
| No | 39,248 (58.3) | 35,788(58.6) | 3460(55.3) | | 9368(46.1) | 8601(47.0) | 767(38.5) | |
| Yes | 25,418 (41.7) | 22,952(41.4) | 2466(44.7) | | 10,480 (53.9) | 9409(53.0) | 1071(61.5) | |
| Drinking status | | | | 0.2335 | | | | <0.0001 |
| No | 7534(9.8) | 6925(9.8) | 609(9.3) | | 2552(11.1) | 2383(11.4) | 169(7.9) | |
| Yes | 57,132 (90.2) | 51,815(90.2) | 5317(90.7) | | 17,296 (88.9) | 15,627(88.6) | 1669(92.1) | |
| Physical activity | | | | 0.8875 | | | | 0.0638 |
| No | 40,286 (62.2) | 36,645(62.2) | 3641(62.1) | | 12,031 (62.1) | 10,960(62.4) | 1071(59.9) | |
| Yes | 24,380 (37.8) | 22,095(37.8) | 2285(37.9) | | 7817(37.9) | 7050(37.6) | 767(40.1) | |
| Diabetes mellitus | | | | 0.0095 | | | | 0.1650 |
| No | 61,970 (96.2) | 56,318(96.3) | 5652(95.5) | | 18,364 (92.9) | 16,653(92.8) | 1711(93.7) | |
| Yes | 2696(3.8) | 2422(3.7) | 274(4.5) | | 1484(7.1) | 1357(7.2) | 127(6.3) | |
| Hypertension | | | | 0.0104 | | | | 0.7592 |
| No | 57,512 (89.8) | 52,289(89.9) | 5223(88.6) | | 16,655 (84.5) | 15,122(84.5) | 1533(84.2) | |
| Yes | 7154(10.2) | 6451(10.1) | 703(11.4) | | 3193(15.5) | 2888(15.5) | 305(15.8) | |
| Depressive symptom | | | | <0.0001 | | | | 0.0008 |
| No | 63,355 (97.8) | 57,674(98.0) | 5681(95.5) | | 19,459 (97.8) | 17,683(98.0) | 1776(96.7) | |
| Yes | 1311(2.2) | 1066(2.0) | 245(4.5) | | 389(2.2) | 327(2.0) | 62(3.3) | |

[a] Weighted percent in a column.
[b] Weighted percent in a row among each group.
[c] Rao–Scott Chi-Square Test.

**Table 2**

Results of the univariate logistic regression analysis of the association between the variables and depressive symptoms.

| Variable | Category | Employees | | Employers or Self-employed workers | |
|---|---|---|---|---|---|
| | | OR(95 % CI) | *P*-value | OR(95 % CI) | *P*-value |
| Age group | 20–29 | 1(Reference) | | 1(Reference) | |
| | 30–39 | **0.71(0.61, 0.84)** | **<0.0001** | **0.61(0.40, 0.92)** | **0.017** |
| | 40–49 | **0.39(0.33, 0.47)** | **<0.0001** | **0.36(0.24, 0.54)** | **<0.0001** |
| | 50–59 | **0.30(0.25, 0.37)** | **<0.0001** | **0.32(0.22, 0.47)** | **<0.0001** |
| Sex | Male | 1(Reference) | | 1(Reference) | |
| | Female | **1.91(1.67, 2.17)** | **<0.0001** | **2.12(1.70, 2.66)** | **<0.0001** |
| Education | < College | 1(Reference) | | 1(Reference) | |
| | ≥ College | **0.83(0.73, 0.95)** | **0.005** | 0.93(0.74, 1.18) | 0.566 |
| Occupation | White collar | 1(Reference) | | 1(Reference) | |
| | Pink collar | **1.50(1.29, 1.75)** | **<0.0001** | **1.34(1.02, 1.77)** | **0.034** |
| | Blue collar | 0.88(0.75, 1.03) | 0.099 | 0.75(0.54, 1.06) | 0.099 |
| Marital status | Married | 1(Reference) | | 1(Reference) | |
| | Unmarried | **2.20(1.91, 2.53)** | **<0.0001** | **1.96(1.47, 2.60)** | **<0.0001** |
| | Widowed/divorced | **1.89(1.54, 2.32)** | **<0.0001** | **2.17(1.59, 2.97)** | **<0.0001** |
| Smoking status | No | 1(Reference) | | 1(Reference) | |
| | Yes | **1.25(1.10, 1.42)** | **0.001** | 1.05(0.84, 1.32) | 0.661 |
| Drinking status | No | 1(Reference) | | 1(Reference) | |
| | Yes | **1.86(1.45, 2.38)** | **<0.0001** | **1.68(1.10, 2.57)** | **0.018** |
| Physical activity | No | 1(Reference) | | 1(Reference) | |
| | Yes | 0.9(0.79, 1.03) | 0.119 | **1.28(1.02, 1.61)** | **0.035** |
| Diabetes mellitus | No | 1(Reference) | | 1(Reference) | |
| | Yes | **1.35(1.01, 1.79)** | **0.040** | 1.07(0.67, 1.68) | 0.787 |
| Hypertension | No | 1(Reference) | | 1(Reference) | |
| | Yes | 0.84(0.68, 1.03) | 0.094 | 1.07(0.78, 1.47) | 0.678 |

Bold represents p-value <0.05.

**Table 3**

The results of generalized additive model and logistic regression model for the association between SP and depressive symptoms.

| Type of employment | Crude | Adjusted model[a] |
|---|---|---|
| Total | | |
|   Able to take sick leave | 1 (Reference) | 1 (Reference) |
|   Unable to take sick leave | **2.19(1.90, 2.52)**[*] | **2.07(1.79, 2.39)**[*] |
| Employees | | |
|   Able to take sick leave | 1 (Reference) | 1 (Reference) |
|   Unable to take sick leave | **2.33 (1.99, 2.73)**[*] | **2.18 (1.85, 2.56)**[*] |
| Employers or Self -employed | | |
|   Able to take sick leave | 1 (Reference) | 1 (Reference) |
|   Unable to take sick leave | **1.67 (1.23, 2.27)**[*] | **1.76 (1.29, 2.40)**[*] |

[a] The model adjusted for age group, sex, education, occupation, marital status, smoking status, drinking status, moderate physical activity, diagnosis of diabetes mellitus, and diagnosis of hypertension.

[*] *P*-value <0.05.

that of those who use. ORs for depressive symptoms of the employees who could not have paid sick leave were 2.18 times higher (95 % CI: 1.85–2.56) than that of those who could.

This result is consistent with previous studies: 1) Kivimaki et al. investigated 5071 participants in the Whitehall II study and reported that SP could be a risk factor for coronary heart diseases among unhealthy men whose self-rated health was poor. No sick days during 3 years of the follow-up period among unhealthy workers was significantly associated with a two-fold higher risk for the incidence of coronary heart diseases compared with that of unhealthy workers who reported 0–14 days of absence during the same period (Kivimäki et al., 2005). 2) Conway et al. reported the association between self-reported SP, the number of days worked despite illness in the last year, and increased risk of depression using 2–year longitudinal data of 1271 Danish employees (Conway et al., 2014). 3) Cary Cooper first used presenteeism in the 1990s to describe the growing propensity of workers to spend more time at work due to their fear of losing employment (Cooper, 1994). As a predictor of SP, attendance pressure factors can be defined as variables that compel individuals to work despite their health condition: (i) personal/family and situational circumstances, (ii) dispositional and attitudinal factors, and (iii) work-related factors (Biron and Saksvik, 2009). Salasvik summarized four types of attendance pressure factors: importance pressure (responsibility at work and difficulties in obtaining temporary staff), censure pressure (concern regarding manager or colleagues), moral pressure (conscientiousness and work ethic), and security pressure (fear of losing employment) (Saksvik, 1996) . All of these symptoms may lead to depression among the workers.

Working with illness may decrease work efficiency (Johns, 2010). Sick employees usually need extra efforts to deal with the demands of their jobs, which may lead to worsening of their sickness (Demerouti et al., 2009). In addition, SP could lead to insufficient recovery and endangers safety of both workers and organizations.

In South Korea, 9.6 % of employees and 10.6 % of employers or self-employed individuals were unable to have sick leave during the COVID-19 because of no legal restriction against SP and shortage of health care workers. "Stay home when sick" is against the traditional work ethic in South Korea (Kim, 2021). One of the main reasons for SPs is workers' concern about the burden of their colleagues or peer pressure (Kaldjian et al., 2019; Mitchell and Coatsworth, 2021). A study conducted on a representative sample of 100,000 individuals working in Portugal between 2005 and 2011 reported that self-employed workers had an 85 % lower likelihood of using sick leave than that of wage workers(Gonçalves and Martins, 2018). SP among self-employed individuals and employers could be related to the indispensability of their roles and responsibility for the livelihood of their staffs and organizations. In a study that surveyed 2533 workers in Norway and Sweden, self-employed workers reported the reason for SP as the absence of any other individual who could manage their responsibilities for work and peers (Johansen et al., 2014). In our study, employers, self-employed workers, and pink collar workers who cannot have sick leave may struggle with their responsibility which cannot be replaced, which is similar with the result of studies above mentioned.

As reported by several previous studies, SP and depression are mutually associated. There could be some explanations for the association between SP and depression. SP could be a marker of weak organizational support for employees. A review on SP with respiratory disease concluded that in addition to occupation, age, gender, health behavior/perception, and vaccination, peer pressure and organizational culture (including organizational or peer pressure) are significant factors that
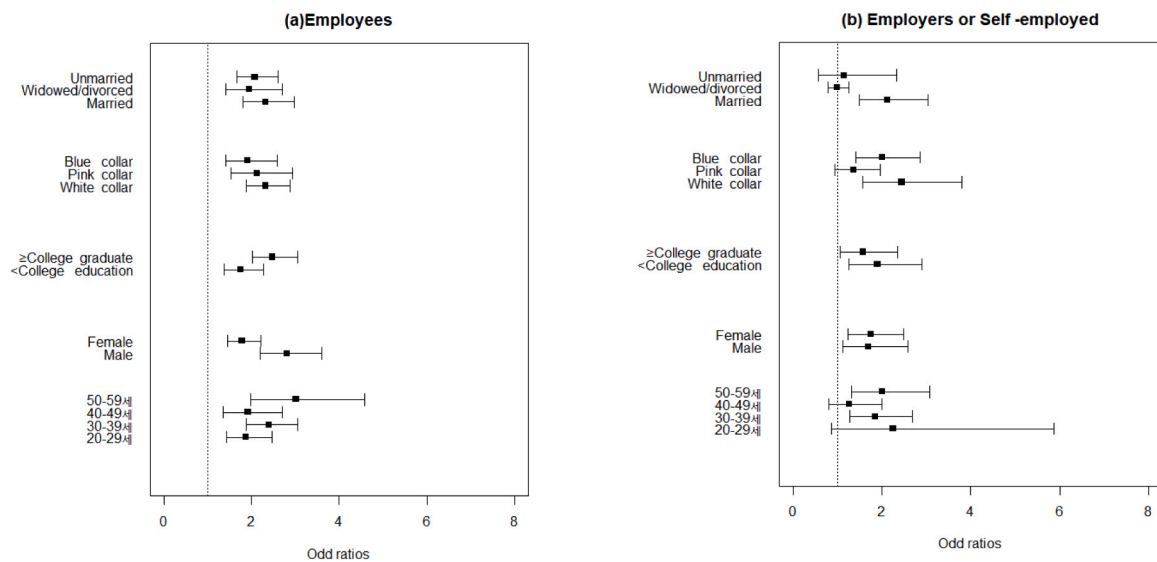
**Fig. 2.** Results of the subgroup analysis of the multivariable logistic regression analysis of the association between SP and depressive symptoms by stratifying socio-demographic variables such as sex, age group, education, occupation, and marital status.
The models adjusted for age group, sex, education, job category, marital status, smoking status, drinking status, moderate physical activity, diagnosis of diabetes mellitus, and diagnosis of hypertension, after stratifying variables; *P-value <0.05.

contribute to SP (Daniels et al., 2021). SP during the COVID-19 era can be an indicator of poor socioeconomic conditions. In a study conducted in Japan, low socioeconomic status enforced SP among workers during the COVID-19 epidemic (Masuda et al., 2022). In a study conducted in Sweden and Norway, SP was significantly associated with low income and low education of workers (Johansen et al., 2014). In our study, the participants in the employees group who were under college graduates and blue collar workers, the association between SP and depression was higher than more educated and white collar workers. Interestingly, in the employers and self-employed group, a significant association was noticed only among individuals with white collar jobs who were married, highly educated (college graduates and above), and 30–39 and 50–59 years old. Without in-depth personal interview, we cannot explain the psychological reason why the association between SP and depression is more prominent among these groups of the employers and self-employed group and in certain age groups. We conjecture that self-esteem of highly educated may be damaged by their obligation to work or masked depression of highly educated or married people may make them work despite their sickness.

Absenteeism, time off work due to disability or time missed from work due to health reasons, is regarded as a concept similar to presenteeism in terms of the productivity loss. There have been several studies on the relationship between absenteeism and depression. Beck et al. studied 771 workers with depression, and showed that depressive symptoms are associated with absenteeism and presenteeism measured by the Work Productivity and Activity Impairment questionnaire in a dose-reponse manner (Beck et al., 2011). Johnston et al. investigated 4953 workers in Australia and reported that sickness absence in the preceding 4 weeks are significantly associated with depressive symptoms measured by PHQ-9 (Johnston et al., 2019). A study using the Korean Working Condition Survey data, a nationally representative data, reported that absenteeism and presenteeism are associated with lower level of well-being (Jeong et al., 2020).

In South Korea, the cost due to absenteeism and presenteeism related to depression are estimated as 1149 million US$ and 1809 million US$, respectively (Chang et al., 2012). Meanwhile Cocker et al. reported that absenteeism's cost in UK is higher than presenteeism (42.573 for absenteeism and 37,791/6 years for presenteeism). He argued that Absenteeism and SP of white collars, being more acknowledged financially than blue collars, cost more economic burdens (Cocker et al.,

2014). However, differentiation between white collar and blue collar, especially among small business settings in Korea, is often blurring. Many self-employed business people play both the roles of white collar and blue collar. Also, we must consider overlapping of SP and absenteeism. In the beginning of disease process, laborers choose SP, but the exacerbation of symptoms or lengthy disease courses would let them choose absenteeism rather than SP.

There is a possibility that there was an economic loss due to SP related to depression symptoms. Although there are various meaningful studies on the economic burden of disease and injuries in Korea (Hyun et al., 2017; Oh et al., 2011), reports on SP and its economic burden have not been designed. Differentiating calculation of economic burden according to categories of SP, absenteeism, rest from home, or hospitalization may not be reliable without discrete and in-depth interviews. We instead focused on the relation between depressive symptoms and SP. We believe that elucidation of relation between depression and SP may raise social awareness of the danger of SP and rather strengthen the social safety net to prevent SP and depression.

There could be some interventions to protect workers from SP. First, establishing working environment and organizational systems to support sick employers are strongly needed. A study including 240 workers employed at a public hospital in the United States showed that social support at work was associated with a lower incidence of depression (Park et al., 2004). Another study including 228 employees in China also reported that perceived organizational support was associated with a decrease in depressive symptoms. Employees who are unable to take sick leave may harbor negative and resentful emotions towards the organization and their commitment to the organization may be weakened (Collins et al., 2018). Workers with SP may feel that they are not supported by their organization, and these feelings could lead or exacerbate depressive symptoms(Lei and Chen, 2020). Second, a sickness benefit could be a solution for the SP, which is provided by the social protection system and is paid as a fixed rate of previous earnings, or a flat-rate amount (Spasova et al., 2016). The sickness benefit compensates the loss of income caused by sickness and illness, regardless of the relationship of sickness and illness with work. The South Korean Government did not provide the sickness benefit, although most other Organization for Economic Cooperation and Development countries provided that (Jung et al., 2019). Recently, the pilot program for sickness benefit has implemented in six districts in South Korea. This policy

can help waged workers and self-employed workers to take sick leave by providing a bread-and-butter income. Third, improving the employment status of precarious workers could work to protect workers from SP. Min et al. showed subcontract worker were found to have a higher prevalence for absenteeism and work-related disease than workers who were their parent companies (Min et al., 2013). Kim et al. showed that most nonstandard worker may increase risk of presenteeism (Kim et al., 2016b). These studies imply that the employment status could be one of important factors of the unavailability of taking sick leave. Fourth, managing long working hours is necessary. As longer working hours are related to higher occurrence of SP (Kinman and Wray, 2018; Min et al., 2021), proper working hours should be legalized. As healthy communication and supervision will encourage workers' report on their medical conditions, managerial skills for open and flexible working environments should be further developed. Finally, workplace culture and social support should be guaranteed. If shortage of manpower is not corrected and unhealthy working conditions are neglected like in COVID pandemic, SP either voluntarily and involuntarily, will be continued. Especially within health industries, workers are not comfortable to take sick leave for the concerns of patients and their colleagues. In a study of 2016, Korean registered nurses reported that all of them had experiences of SP (Kim et al., 2016a). In other study in Korea, shift nurses experienced more SP than non-shift nurses did (Min et al., 2021).

Shift workers may have been influenced by their irregular schedules against normal biorhythms, which could exacerbate underlying medical problems and SP of shift-workers occur oftener than non-shift workers. *Re*-organizing workers schedules according to their own health demands rather than focusing the efficiency of organizations should be recommended for the sustainable and safe societies. Flexible hiring especially in the shortage of laborers would prevent SP. Cultures which emphasize sensitivity to the health issues of laborers will be more efficient than denying sickness of laborers in the long run, as they may get often injured or have serious illnesses by denying sickness and harmful working conditions.

This study has several limitations. First, reverse causality may be present due to the cross-sectional nature of the study. We believe that SP could lead to depressive symptoms; however, there is a possibility that depressive symptoms could be a cause of SP since some workers may not be confident or comfortable saying 'No' to employers or supervisors. They may deny their problems and hide their sickness. Second, more detailed reasons for SP through subjective or narrative information were not discussed in our study. In-depth and diverse psychological approach through phenomenal understanding should be discussed. Third, our data was collected only within South Korean; therefore, it is difficult to generalize the results to other countries. Fourth, we couldn't specify the severity of depression and the treatment history of mental illness including depression due to the lack of information. In addition, our assessment questionnaire of SP need to be revised for better validity and the reliability although we modified the previous question to fit COVID-19 situation. Further study for the assessment of modified question for SP should be needed. Nevertheless, there are some strengths in our study. First, our sample is nationally representative of the South Korean population. Second, to investigate the association between SP and depressive symptoms, we considered various covariates, including age, sex, education, occupation, marital status, smoking, drinking, physical activity, diabetes mellitus, and hypertension, for the further understanding of SP and depression.

## 5. Conclusion

During the COVID-19 pandemic, SP was significantly associated with the presence of depressive symptoms, especially among the undereducated employees. Among employers and self-hired groups, highly educated and married people presented association between SP and depression. Amid the COVID-19 pandemic, attendance pressure could lead to SP, which may endanger mental health status. Protective strategies at the organizational and government levels are needed to protect and promote the health of the workers and organizations.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2022.09.029.

## References

Aronsson, G., Gustafsson, K., Dallner, M., 2000. Sick but yet at work. An empirical study of sickness presenteeism. J. Epidemiol. Community Health 54, 502–509.
Beck, A., Crain, A.L., Solberg, L.I., Unützer, J., Glasgow, R.E., Maciosek, M.V., Whitebird, R., 2011. Severity of depression and magnitude of productivity loss. Ann. Fam. Med. 9, 305–311.
Biron, C., Saksvik, P.Ø., 2009. Sickness presenteeism and attendance pressure factors: implications for practice. In: International Handbook of Work and Health Psychology, 3, pp. 77–96.
Burstyn, I., Holt, K., 2022. A cross-sectional survey of the workplace factors contributing to symptoms of anxiety and depression among nurses and physicians during the first wave of COVID-19 pandemic in two US healthcare systems. Ann. Work Exposures Health 66, 312–333.
Chang, S.M., Hong, J.-P., Cho, M.J., 2012. Economic burden of depression in South Korea. Soc. Psychiatry Psychiatr. Epidemiol. 47, 683–689.
Cho, Y.-S., Park, J.B., Lee, K.-J., Min, K.-B., Baek, C.-I., 2016. The association between Korean workers' presenteeism and psychosocial factors within workplaces. Ann. Occup. Environ. Med. 28, 1–11.

Cocker, F., Nicholson, J.M., Graves, N., Oldenburg, B., Palmer, A.J., Martin, A., Scott, J., Venn, A., Sanderson, K., 2014. Depression in working adults: comparing the costs and health outcomes of working when ill. PloS one 9, e105430.

Collins, A.M., Cartwright, S., Cowlishaw, S., 2018. Sickness presenteeism and sickness absence over time: a UK employee perspective. Work Stress. 32, 68–83.

Conway, P.M., Hogh, A., Rugulies, R., Hansen, Å.M., 2014. Is sickness presenteeism a risk factor for depression? J. Occup. Environ. Med. 56, 595–603.

Cooper, C.L., 1994. The Costs of Healthy Work Organizations. John Wiley & Sons.

Daniels, S., Wei, H., Han, Y., Catt, H., Denning, D.W., Hall, I., Regan, M., Verma, A., Whitfield, C.A., Van Tongeren, M., 2021. Risk factors associated with respiratory infectious disease-related presenteeism: a rapid review. BMC Public Health 21, 1–12. https://doi.org/10.1186/s12889-021-12008-9.

Deguchi, Y., Iwasaki, S., Niki, A., Kadowaki, A., Hirota, T., Shirahama, Y., Nakamichi, Y., Okawa, Y., Usuka, Y., Inoue, K., 2022. Relationships between occupational stress, change in work environment during the COVID-19 pandemic, and depressive and anxiety symptoms among non-healthcare Workers in Japan: a cross-sectional study. Int. J. Environ. Res. Public Health 19, 983.

Demerouti, E., Le Blanc, P.M., Bakker, A.B., Schaufeli, W.B., Hox, J., 2009. Present but sick: a three-wave study on job demands, presenteeism and burnout. Career Develop. Intern. https://doi.org/10.1108/13620430910933574.

d'Errico, A., Ardito, C., Leombruni, R., 2016. Work organization, exposure to workplace hazards and sickness presenteeism in the European employed population. Am. J. Ind. Med. 59, 57–72.

Duursma, E.B., Levy, O., Lemon, M.J., 2009. Package 'plotrix'.

Finstad, G.L., Giorgi, G., Lulli, L.G., Pandolfi, C., Foti, G., León-Perez, J.M., Cantero-Sánchez, F.J., Mucci, N., 2021. Resilience, coping strategies and posttraumatic growth in the workplace following COVID-19: a narrative review on the positive aspects of trauma. Int. J. Environ. Res. Public Health 18, 9453.

Gonçalves, J., Martins, P.S., 2018. The effect of self-employment on health: evidence from longitudinal social security data. https://doi.org/10.2139/ssrn.3117309.

Gun, M.-S., Choi, Y.-H., Park, K.-H., 2011. Job stress and presenteeism of clinical nurses. Korean J. Occup. Health Nurs. 20, 163–171.

Han, C., Jo, S.A., Kwak, J.-H., Pae, C.-U., Steffens, D., Jo, I., Park, M.H., 2008. Validation of the patient health Questionnaire-9 Korean version in the elderly population: the Ansan geriatric study. Compr. Psychiatry 49, 218–223.

Hyun, K., Choi, K., Lee, S., Lee, S., 2017. Analysis of Socioeconomic Cost of Major Disease for Establishing Health Policies. National Health Insurance Service, Wonju.

Jaspal, R., Breakwell, G.M., 2022. Socio-economic inequalities in social network, loneliness and mental health during the COVID-19 pandemic. Int. J. Soc. Psychiatry 68, 155–165.

Jeong, W., Kim, Y.K., Oh, S.S., Yoon, J.-H., Park, E.-C., 2020. Association between presenteeism/absenteeism and well-being among korean workers. J. Occup. Environ. Med. 62, 574–580.

Johansen, V., Aronsson, G., Marklund, S., 2014. Positive and negative reasons for sickness presenteeism in Norway and Sweden: a cross-sectional survey. BMJ Open 4, e004123. https://doi.org/10.1136/bmjopen-2013-004123.

Johns, G., 2010. Presenteeism in the workplace: A review and research agenda. J. Org. Behav. 31, 519–542. https://doi.org/10.1002/job.630.

Johnston, D., Harvey, S., Glozier, N., Calvo, R., Christensen, H., Deady, M., 2019. The relationship between depression symptoms, absenteeism and presenteeism. J. Affect. Disord. 256, 536–540.

Jung, M.H., Lee, Y.M., Arakida, M., 2007. Stress and presenteeism in workers of small and medium enterprises. Korean J. Occup. Environ. Med. 19, 47–55.

Jung, H.W., Sohn, M., Chung, H., 2019. Designing the sickness benefit scheme in South Korea: using the implication from schemes of advanced nations. Health Policy Manag. 29, 112–129.

Jung, S.W., Lee, J.-H., Lee, K.-J., 2020. Assessing the association between emotional labor and presenteeism among nurses in Korea: cross-sectional study using the 4th korean working conditions survey. Saf. Health Work 11, 103–108.

Kaldjian, L.C., Shinkunas, L.A., Reisinger, H.S., Polacco, M.A., Perencevich, E.N., 2019. Attitudes about sickness presenteeism in medical training: is there a hidden curriculum? Antimicrob. Resist. Infect. Cont. 8, 1–9. https://doi.org/10.1186/s13756-019-0602-7.

Kang, Y.W., Ko, Y.S., Kim, Y.J., Sung, K.M., Kim, H.J., Choi, H.Y., Sung, C., Jeong, E., 2015. Korea community health survey data profiles. Osong. Public Health Res. Perspect. 6, 211–217.

Kim, A., 2021. Too many in Korea can't afford to get sick. The Korea Herald. https://www.koreaherald.com/view.php?ud=20210210000913.

Kim, J., Suh, E.E., Ju, S., Choo, H., Bae, H., Choi, H., 2016a. Sickness experiences of Korean registered nurses at work: a qualitative study on presenteeism. Asian Nurs. Res. 10, 32–38.

Kim, J.Y., Lee, J., Muntaner, C., Kim, S.-S., 2016b. Who is working while sick? Nonstandard employment and its association with absenteeism and presenteeism in South Korea. Int. Arch. Occup. Environ. Health 89, 1095–1101.

Kim, K., Cho, S.-I., Paek, D., 2019. Association of discrimination and presenteeism with cardiovascular disease: the Fourth Korean Working Conditions Survey. Ann. Occup. Environ. Med. 31.

Kinman, G., 2019. Sickness Presenteeism at Work: Prevalence, Costs and Management.

Kinman, G., Grant, C., 2021. In: Presenteeism During the COVID-19 Pandemic: Risks and Solutions. Oxford University Press, UK, pp. 243–244.

Kinman, G., Wray, S., 2018. Presenteeism in academic employees—occupational and individual factors. Occup. Med. 68, 46–50.

Kivimäki, M., Head, J., Ferrie, J.E., Hemingway, H., Shipley, M.J., Vahtera, J., Marmot, M.G., 2005. Working while ill as a risk factor for serious coronary events: the Whitehall II study. Am. J. Public Health 95, 98–102.

Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. J. Gen. Intern. Med. 16, 606–613.

Lee, Y.-M., Jung, M.-H., 2008. Presenteeism and absenteeism according to health problems on nurses. J. Korean Acad. Community Health Nurs. 19, 459–468.

Lee, G.B., Jung, S.J., Yiyi, Y., Yang, J.W., Thang, H.M., Kim, H.C., 2022. Socioeconomic inequality in compliance with precautions and health behavior changes during the COVID-19 outbreak: an analysis of the Korean Community Health Survey 2020. Epidemiol. Health 44.

Lei, M., Chen, W., 2020. Perceived organizational support leads to less depression among hotel employees in China. J. Hum. Resour. Manag. 8, 60–68.

Lopes, S.L., Ferreira, A.I., Passos, A.M., Neves, M., Sousa, C., Sá, M.J., 2018. Depressive symptomatology, presenteeism productivity, and quality of life: a moderated mediation model. J. Occup. Environ. Med. 60, 301–308.

Masuda, M., Ishimaru, T., Hino, A., Ando, H., Tateishi, S., Nagata, T., Tsuji, M., Matsuda, S., Fujino, Y., 2022. A cross-sectional study of psychosocial factors and sickness presenteeism in japanese workers during the COVID-19 pandemic. J. Occup. Environ. Med. 64, e1–e7.

Min, K.B., Park, S.G., Song, J.S., Yi, K.H., Jang, T.W., Min, J.Y., 2013. Subcontractors and increased risk for work-related diseases and absenteeism. Am. J. Ind. Med. 56, 1296–1306.

Min, A., Kang, M., Hong, H.C., 2021. Sickness presenteeism in shift and non-shift nurses: using the fifth korean working conditions survey. Int. J. Environ. Res. Public Health 18, 3236.

Mitchell, L., Coatsworth, N., 2021. Sick leave accessibility in junior doctors at an Australian health service. Infect. Dis. Health 26, 3–10. https://doi.org/10.1016/j.idh.2020.07.005.

Oh, I.-H., Yoon, S.-J., Kim, E.-J., 2011. The burden of disease in Korea. J. Korean Med. Assoc. 54, 646–652.

Okawara, M., Ishimaru, T., Tateishi, S., Hino, A., Tsuji, M., Ogami, A., Nagata, T., Matsuda, S., Fujino, Y., Project, C., 2022. Treatment interruption is a risk factor for sickness presenteeism: a large-scale cross-sectional study during the COVID-19 pandemic. J. Occup. Health 64, e12313.

Ortiz, M.A., Bluyssen, P.M., 2022. Profiling office workers based on their self-reported preferences of indoor environmental quality and psychosocial comfort at their workplace during COVID-19. Build. Environ. 211, 1–16, 108742.

Park, K.-O., Wilson, M.G., Lee, M.S., 2004. Effects of social support at work on depression and organizational productivity. Am. J. Health Behav. 28, 444–455.

Park, J.W., Cho, S.S., Lee, J., Hwang, J., Kim, J.I., Kim, B.G., Hong, Y.S., 2020. Association between employment status and sickness presenteeism among Korean employees: a cross-sectional study. Ann. Occup. Environ. Med. 32.

Prats-Uribe, A., Paredes, R., Prieto-Alhambra, D., 2020. Ethnicity, Comorbidity, Socioeconomic Status, and Their Associations With COVID-19 Infection in England: A Cohort Analysis of UK Biobank Data. MedRxiv.

Ryu, I.-S., Jeong, D.-S., Kim, I.-A., Roh, J.-H., Won, J.-U., 2012. Association between job stress, psychosocial well-being and presenteeism, absenteeism: focusing on railroad workers. Korean J. Occup. Environ. Med. 24, 263–273.

Saksvik, P.Ø., 1996. Attendance pressure during organizational change. Int. J. Stress. Manag. 3, 47–59.

Seok, H., Choi, S.J., Yoon, J.-H., Song, G.G., Won, J.-U., Kim, J.-H., Roh, J., Jung, J.H., 2017. The association between osteoarthritis and occupational clusters in the korean population: a nationwide study. PLoS One 12, e0170229.

Spasova, S., Bouget, D., Vanhercke, B., 2016. Sick pay and sickness benefit schemes in the European Union. In: Background Report for the Social Protection Committee's In-Depth Review on Sickness Benefits.

Suzuki, T., Miyaki, K., Song, Y., Tsutsumi, A., Kawakami, N., Shimazu, A., Takahashi, M., Inoue, A., Kurioka, S., 2015. Relationship between sickness presenteeism (WHO–HPQ) with depression and sickness absence due to mental disease in a cohort of japanese workers. J. Affect. Disord. 180, 14–20.

Toyoshima, K., Inoue, T., Shimura, A., Masuya, J., Ichiki, M., Fujimura, Y., Kusumi, I., 2020. Associations between the depressive symptoms, subjective cognitive function, and presenteeism of Japanese adult workers: a cross-sectional survey study. BioPsychoSocial Med. 14, 1–7.