

Original Article



Association between presenteeism and mental health among logistic center workers

Hyungseob Yoo , Ji-hun Song , and Hyung-Ryoul Kim *

Department of Occupational and Environmental Medicine, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea



Received: Aug 10, 2022

Revised: Oct 4, 2022

Accepted: Oct 16, 2022

Published online: Nov 17, 2022

*Correspondence:

Hyung-Ryoul Kim

Department of Occupational and Environmental Medicine, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, 222 Banpo-daero, Seocho-gu, Seoul 06591, Korea.
Email: cyclor@catholic.ac.kr

Copyright © 2022 Korean Society of Occupational & Environmental Medicine
This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORCID iDs

Hyungseob Yoo
<https://orcid.org/0000-0001-7865-6534>
Ji-hun Song
<https://orcid.org/0000-0002-0491-2483>
Hyung-Ryoul Kim
<https://orcid.org/0000-0001-7535-3140>

Abbreviations

CI: confidence interval; KWCS: Korean Working Conditions Survey; OR: odds ratio; PHQ-2: Patient Health Questionnaire-2; PR: prevalence ratio; RPE: Rating of Perceived Exertion; SD: standard deviation.

ABSTRACT

Background: Workers in logistics centers are always pressed for time to collect and pack products. They also participate in high-intensity manual labor in which various musculoskeletal hazards exist. In the case of logistic center labor, it is estimated that there is a high risk of presenteeism due to the above characteristics which can cause deterioration of workers' mental health. However, there is insufficient research on this topic.

Methods: Workers in a logistic center were surveyed using an Internet questionnaire. The survey items included demographic characteristics, labor intensity and work-related factors, and mental health aspects such as depression and anxiety. The survey was conducted for about a month from July 26, 2021 and a total of 353 people were analyzed. Through the χ^2 test and t-test, the characteristics of workers who experienced presenteeism were examined and the prevalence ratios (PRs) of depression and anxiety experiences were calculated by multivariable Poisson regression. Afterwards, stratification analysis considering gender, the type of contract, and labor intensity was implemented.

Results: In the group that experienced presenteeism, the number of working days per week was higher and fixed-term workers, high labor intensity, and sleep deprivation were more common. In the multi-Poisson regression analysis conducted by adjusting the demographic characteristics, working hours, and work-related factors, the PRs of depression and anxiety were 1.98 (95% confidence interval: 1.24–3.18) and 1.81 (1.22–2.68), respectively. In particular, the *p*-value for interactions was significant when stratified with the type of contract.

Conclusions: As a result of the study, presenteeism and mental health were associated in logistic center workers. To prevent mental health issues of logistic center workers, management of presenteeism is necessary and a prospective study is needed.

Keywords: Presenteeism; Mental health; Depression; Anxiety

BACKGROUND

Recently, the overall demand for the logistics industry has begun to increase especially after the coronavirus disease 2019 pandemic.¹ The logistics industry occupies a large proportion of the world's economy and can be largely divided into transportation, storage of goods, and packaging materials. The industry controls the overall process of delivering products

Competing interests

The authors declare that they have no competing interests.

Author contributions

Conceptualization: Kim HR; Data curation: Yoo H, Song JH; Formal analysis: Yoo H, Song JH, Kim HR; Validation: Kim HR; Visualization: Yoo H; Writing - original draft: Yoo H; Writing - review & editing: Song JH, Kim HR.

to consumers at distribution centers and warehouses.² Labor in logistics center is always pressed for time to collect and pack products ordered. In addition, it is a high-intensity manual labor environment in which various musculoskeletal hazards exist. Due to the nature of the industry, repetitive movements, lifting, moving things, and fast-paced work environments are observed, and it is estimated that there is a high risk of occupational injury.³ Because of the high job demands and low job control, logistic center workers are considered to be at risk of occupational stress and mental health risks are also expected to be high. While there have been studies about mental health in drivers in transport and logistics industries, research on logistic center workers is insufficient.⁴⁻⁶

Presenteeism has been actively studied in recent years and definitions are being used in various ways. There are 2 largely used definitions of presenteeism.⁷ One definition is “people, despite complaints and ill health that should prompt rest and absence from work, still turning up at their jobs,” which is referred to as ‘sickness presenteeism’ and is mainly used in the European literature.^{8,10} The second one is a decrease in the productivity of employees while they are on the job, which is also known as ‘health-related productivity loss’ mainly used in the American literature.^{11,12} Presenteeism is a risk factor for future sickness absences and decreased self-rated health.¹³ There have been various studies which have shown that mental health conditions such as depression and anxiety precede presenteeism. Those studies mainly focused on the second definition dealing with productivity loss, not the first definition of showing up at their jobs while ill.¹⁴⁻¹⁷

However, from the perspective of going to work while sick, a few studies have reported that the presenteeism itself would be a risk factor for mental illness.¹⁸⁻²¹ In terms of workers, attending work while ill is a more important issue than the reduced productivity and if presenteeism acts as a risk factor in mental health, it is very important to evaluate the prevalence of presenteeism and set the policy to decrease presenteeism. But most of the studies have measured indicators including burnout or self-rated health rather than mental symptoms such as depression or anxiety.¹⁸⁻²⁰ Also, most studies have been conducted on general workers, so research on high-risk groups like logistic center workers is needed.¹⁹⁻²¹

Most workers in logistic centers have high labor intensity, high time pressure during work, and low work autonomy.^{3,22} High job demand and low control over the pace of work are associated with presenteeism,^{18,23,24} which means that workers in logistic centers are at a high risk of presenteeism. Therefore, it is important to understand how presenteeism actually occurs in logistic center workers, what their mental health status is, and to investigate the association between presenteeism and mental health. In this study, we conducted a cross-sectional study to investigate the association between presenteeism and mental health of workers of one logistic center in Korea.

METHODS

Participants

The total number of workers at the logistic center was estimated to be about 20,000. We planned to investigate 1,000 people or 5%. Our study recruited workers in a logistic center together with the labor union of the logistic center for 4 weeks starting from July 26, 2021. The participation URL of the internet survey was distributed through the company bulletin board and social networking services. Using a self-questionnaire, the participants’

demographic data, employment status, job contents, working hours, labor intensity, and health problems were obtained. The total number of responses was 367 and after excluding duplicates and incomplete data, a total of 353 workers were included in the study.

Definition of presenteeism

The definition of presenteeism was given by the Korean Working Conditions Survey (KWCS). The KWCS is a cross-sectional, nationally representative survey conducted periodically by the Korea Occupational Safety and Health Research Institute. In KWCS, presenteeism was evaluated by the following question. "Have you been out and working even though you are sick in the past 12 months?" This current study used the same question to measure presenteeism of the logistic center workers. When participants answered "yes," it is considered that the participants have presenteeism.

Assessment of mental health

For measuring the depression level of the participants, Patient Health Questionnaire-2 (PHQ-2) was used. PHQ-2 was developed for screening depression.²⁵ The Korean version of PHQ-2 was previously assessed and showed high reliability and validity.²⁶ In PHQ-2, depression is scaled by asking how often you suffered from depressed mood and anhedonia in the last 2 weeks. Answers of "never," "few days," "over one week," and "always" are scored 0, 1, 2, and 3, respectively. When the sum of the scores is over 3, the participants are deemed to be at risk of depression.

In order to measure the anxiety level, the following question referenced by KWCS was used. "Have you had health problems (anxiety) in the past 12 months?" Among those who responded with anxiety symptoms, those who answered that they were related to work were defined as the group with anxiety symptoms.

Other variables

Data regarding the demographic characteristics such as gender and age, health behaviors including smoking and drinking alcohol, and work-related factors were obtained by using a questionnaire. Age was divided into 4 groups: 20–29 years, 30–39 years, 40–49 years, and more than 50 years. Drinking status was classified into normal and heavy drinking, which was defined as drinking more than twice a week and drinking at an average of 7 or more units of alcohol for men and 5 or more units of alcohol for women. Smoking status was classified among never-smoker/ex-smoker and current smoker.

Employment status was categorized as follows based on the participants' position at the workplace: daily worker and fixed-term worker. In the current study, a daily worker was defined as someone who signed contracts with logistic centers every working day. Fixed-term worker refers to those who were contracted with the company for a fixed period of time such as 3, 9, and 12 months. There were no regular workers in the participants. There are 3 shift schedules for the participants: daytime (8:00–17:00), afternoon (17:00–02:00), and night (21:00–06:00). Those who are scheduled to work in the daytime were classified as day workers, while all others were classified as shift workers. The numbers of daily working hours and weekly working days were part of the questionnaire. Weekly working hours were calculated by daily working hours and weekly working days and classified as "< 35 hours," "35–52 hours," and "> 52 hours."

Labor intensity was measured by the Borg Rating of Perceived Exertion (RPE). RPE is a way of measuring physical activity intensity level.²⁷ Labor intensity is rated from 6 corresponding to

“no exertion at all” to 20 representing “maximal exertion” of effort. Examples of the scores were presented in the survey as follows: “6–7: very light like lying down and resting, 9–10: light like daily activities such as folding clothes, 11–12: intermediate like walking normally, 13–14: somewhat difficult walking fast, 15–16: very hard like 100 m running, and over 17: very, very hard like marathon.” If the RPE was 15 points or higher, the workers’ labor intensity was high. The average hours of sleep was considered in the following question. “How many hours do you sleep on average (on working days at the logistic center)?” If the hours of sleep was less than 7 hours, it was defined as sleep deprivation.²⁸

Statistical analysis

The general characteristics of the study participants were evaluated. Continuous variables were expressed as means and standard deviations (SDs), while categorical variables were expressed as frequencies and percentages (%). A χ^2 test and t-test were performed to examine the ratio and the differences of demographic and occupational factors according to presenteeism. Age, gender, type of contract, shift work, weekly working hours, and labor intensity were considered potential confounders. When the outcome is common, usually with a prevalence greater than 10%, the prevalence ratio (PR) can be overestimated by the odds ratio (OR) if the PR is greater than 1 or underestimated if the PR is less than 1.^{29–32} Since the incidence of depression and anxiety is usually high, multiple Poisson regression was performed to evaluate the relationship between presenteeism and mental health (depression and anxiety). To reduce the confounding bias, model I was adjusted for age and gender, while model II was further adjusted for weekly working days, type of contract, shift work, and labor intensity. The analysis determined the PR and 95% confidence interval (CI). In addition, a stratification analysis by gender, type of contract, and labor intensity was conducted to examine modifying factors in the PR between presenteeism and mental health.

If the prevalence of the outcome is not significantly high, there is a literature that the estimated value of the ORs using logistic regression shows a less biased value than PRs.³³ Sensitivity analyses were also performed by multivariable logistic regression to evaluate the relationship between presenteeism and mental health. All statistical analyses were performed using SAS (version 9.4; SAS Institute, Cary, NC, USA). Statistical significance was defined as a *p*-value of < 0.05.

Ethics statement

The present study protocol was approved from review by the Institutional Review Board of The Catholic University College of Medicine (approval No. KC21QISI0562). Informed consent was obtained from all participants of the study.

RESULTS

The general and occupational characteristics of the participants are listed in **Table 1**. There were slightly more women workers (54.4%) than men (45.6%). The average working period of the participants was 17.2 months (SD 16.3), the average 21.1 months (SD 17.2) for fixed-term workers, and the average 14.3 months (SD 15.1) for daily workers. Presenteeism was present in 174 (49.3%) of the total 353 participants. The average Borg RPE level was 13.66 and workers in high labor intensity (RPE \geq 15) represented 28.3% of the total. The proportions of depressed and anxious workers were 25.8% and 37.8%, respectively. Fixed-term workers had more presenteeism than daily workers (*p* < 0.05). In the presenteeism group, they worked

Table 1. General and occupational characteristics of the participants by presenteeism

Variables	Total (n = 353)	Presenteeism		p-value
		No (n = 179)	Yes (n = 174)	
Gender				0.351
Men	161 (45.6)	86 (53.4)	75 (46.6)	
Women	192 (54.4)	93 (48.4)	99 (51.6)	
Age (years)				0.142
20–29	127 (36.0)	71 (55.9)	56 (44.1)	
30–39	101 (28.6)	55 (54.5)	46 (45.5)	
40–49	70 (19.8)	29 (41.4)	41 (58.6)	
≥ 50	55 (15.6)	24 (43.6)	31 (56.4)	
Smoking				0.744
Never/Ex-smoker	261 (73.9)	131 (50.2)	130 (49.8)	
Current smoker	92 (26.1)	48 (52.2)	44 (47.8)	
Drinking				0.281
Normal	326 (92.3)	168 (51.5)	158 (48.5)	
Binge drinker	27 (7.7)	11 (40.7)	16 (59.3)	
Sleeping time (hours)				< 0.001
≥ 7	52 (14.7)	43 (82.7)	9 (17.3)	
< 7	301 (85.3)	136 (45.2)	165 (54.8)	
Type of contract				0.005
Fixed-term worker	150 (42.5)	63 (42.0)	87 (58.0)	
Daily worker	203 (57.5)	116 (57.1)	87 (42.9)	
Shift work				0.059
No	131 (37.1)	75 (57.3)	56 (42.7)	
Yes	222 (62.9)	104 (46.8)	118 (53.2)	
Daily working hours	8.66 ± 1.32	8.60 ± 1.37	8.72 ± 1.27	0.377 ^a
Weekly working days	4.02 ± 1.39	3.85 ± 1.48	4.19 ± 1.27	0.023^a
Weekly working hours (hours)				0.852
< 35	147 (41.6)	77 (52.4)	70 (47.6)	
35–52	187 (53.0)	93 (49.7)	94 (50.3)	
> 52	19 (5.4)	9 (47.4)	10 (52.6)	
Labor intensity (Borg RPE)				< 0.001
RPE < 15	253 (71.7)	146 (57.7)	107 (42.3)	
RPE ≥ 15	100 (28.3)	33 (33.0)	67 (67.0)	
Depression (PHQ-2)				< 0.001
< 3	262 (74.2)	151 (57.6)	111 (42.4)	
≥ 3	91 (25.8)	28 (30.8)	63 (69.2)	
Anxiety				< 0.001
No	209 (62.2)	128 (61.2)	81 (38.8)	
Yes	127 (37.8)	42 (33.1)	85 (66.9)	

Values are presented as number (%) or mean ± standard deviation. *p*-values with statistical significance were presented in bold (< 0.05).

RPE: Rating of Perceived Exertion; PHQ-2: Patient Health Questionnaire-2.

^aThe *p*-value determined by the *t*-test.

more days and harder than the non-presenteeism group ($p < 0.05$). Also, differences of the hours of sleep were observed depending on presenteeism ($p < 0.05$).

Table 2 indicates the association between presenteeism and mental health evaluated by multiple Poisson regression. For depression, the PR of presenteeism was 2.31 (95% CI: 1.48–3.61) compared with those of the non-presenteeism group. After adjusting for age and gender, the PR of presenteeism was similarly high at 2.34 (1.49–3.66). Significant results were obtained with a PR of 1.98 (1.24–3.18), even after further adjusting for weekly working hours, type of contract, shift work, and labor intensity. Likewise, the crude PRs, model I, and model II between presenteeism and anxiety were evaluated and were statistically significant with values of 2.07 (1.43–3.00), 2.08 (1.43–3.02), and 1.81 (1.22–2.68), respectively.

Table 3 shows the association between presenteeism and mental health stratified by gender, type of contract, and labor intensity. The *p*-values for the interactions between gender and presenteeism were not significant. Association between presenteeism and mental health was significant for daily workers. There were significant interactions between presenteeism and the type of contract on depression ($p = 0.044$), but not on anxiety ($p = 0.148$). On the other hand, the interactions between labor intensity and presenteeism were not significant.

Table 2. Crude and adjusted PR between presenteeism and mental health

Variables	Depression						Anxiety					
	Crude		Model I		Model II		Crude		Model I		Model II	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Presenteeism												
No	1.00		1.00		1.00		1.00		1.00		1.00	
Yes	2.31	1.48–3.61	2.34	1.49–3.66	1.98	1.24–3.18	2.07	1.43–3.00	2.08	1.43–3.02	1.81	1.22–2.68
Demographic characteristic												
Gender												
Men			1.00		1.00				1.00		1.00	
Women			0.82	0.54–1.25	0.77	0.50–1.20			0.98	0.68–1.40	0.90	0.62–1.30
Age (years)												
20–29			1.00		1.00				1.00		1.00	
30–39			1.40	0.83–2.34	1.14	0.67–1.96			1.26	0.81–1.95	1.24	0.79–1.95
40–49			1.34	0.76–2.35	0.91	0.48–1.71			1.18	0.73–1.91	1.18	0.68–2.04
≥ 50			0.88	0.44–1.79	0.59	0.27–1.25			0.93	0.53–1.63	0.90	0.49–1.66
Occupation related factors												
Type of contract												
Fixed-term worker					1.00						1.00	
Daily worker					0.85	0.48–1.51					1.17	0.71–1.91
Shift work												
No					1.00						1.00	
Yes					1.25	0.80–1.96					0.97	0.67–1.40
Labor intensity (Borg RPE)												
RPE < 15					1.00						1.00	
RPE ≥ 15					2.08	1.36–3.18					2.10	1.46–3.01
Weekly working hours (hours)												
< 35					0.53	0.29–0.99					0.83	0.50–1.36
35–52					1.00						1.00	
> 52					0.72	0.29–1.82					0.70	0.30–1.64

p-values with statistical significance were presented in bold (< 0.05).

PR: prevalence ratio; CI: confidence interval; RPE: Rating of Perceived Exertion.

Table 3. Crude and adjusted PR between presenteeism and mental health stratified by gender, type of contract, and labor intensity

Variables	Depression						Anxiety					
	Crude		Model I ^a		Model II ^b		Crude		Model I ^a		Model II ^b	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Gender												
Men	2.62	1.40–4.91	2.55	1.35–4.80	2.23	1.15–4.34	1.83	1.07–3.13	1.83	1.07–3.13	1.70	0.85–3.38
Women	2.08	1.10–3.91	2.04	1.08–3.87	1.70	0.86–3.38	2.39	1.41–4.04	2.39	1.41–4.04	2.05	1.17–3.59
<i>p</i> for interaction	0.611		0.514		0.448		0.544		0.596		0.794	
Type of contract												
Fixed-term worker	1.58	0.88–2.86	1.62	0.88–2.95	1.23	0.65–2.31	1.69	0.96–2.97	1.69	0.96–2.97	1.39	0.76–2.54
Daily worker	3.11	1.58–6.12	3.10	1.57–6.13	3.09	1.51–6.33	2.39	1.45–3.94	2.39	1.45–3.94	2.12	1.27–3.53
<i>p</i> for interaction	0.141		0.164		0.044		0.344		0.360		0.148	
Labor intensity (Borg RPE)												
RPE < 15	1.75	0.99–3.10	1.75	0.99–3.11	1.58	0.88–2.83	1.96	1.20–3.22	1.96	1.20–3.22	1.96	1.18–3.24
RPE ≥ 15	2.53	1.13–5.69	2.64	1.15–6.03	2.30	0.96–5.50	1.47	0.81–2.68	1.47	0.81–2.68	1.53	0.80–2.91
<i>p</i> for interaction	0.467		0.444		0.323		0.464		0.454		0.543	

p-values with statistical significance were presented in bold (< 0.05).

PR: prevalence ratio; CI: confidence interval; RPE: Rating of Perceived Exertion.

^aAdjusted for age, gender.

^bAdjusted for model I + weekly working hours, type of contract, shift work, labor intensity.

DISCUSSION

This study aimed to examine the association between presenteeism and mental health in logistic center workers. The results of the current study showed that workers who experienced presenteeism had elevated PRs of depression and anxiety even after adjusting for age, gender, weekly working hours, the type of contract, shift work, and labor intensity (Table 2). In particular, the type of contract had a mediating effect between presenteeism and depression (Table 3).

In Table 1, among the 353 workers, 49.3% of the responders attended work while ill in the past 12 months. In the fifth and sixth KWCS (2017, 2020), presenteeism was present at levels of 17.2% and 12%, respectively. In the sixth European Working Conditions Survey (2015), presenteeism was observed in 39% of responders.³⁴ This means that the participants have more presenteeism than ordinary workers and the value is similar to the nurse job group (50.1%), which is known to be at high risk for presenteeism.³⁵ This means that the workers of this study have more presenteeism than general workers, which implies that they are vulnerable group for presenteeism.

In addition, daily workers and shift workers accounted for more than half. As the amount of logistics increases, the working population in the logistic industry increase which induces the raise of the number of precarious workers. Furthermore, overall sleep and mental health conditions in these workers were poor. The most of participants had sleeping time less than 7 hours. Who are at risk of depression in current study was 25.8% which is more than the prevalence of depression (5.3%) in Korea.³⁶ Who suffered from anxiety symptoms in the participants were 37.8% which is much more than 5% in the sixth KWCS (2020). It is estimated that workers in the logistic centers are at high risk of mental health. There were significant differences in sleeping time, depression, and anxiety between presenteeism and non-presenteeism group (Table 1). Health risk would increase due to the employment instability and labor intensity, which could induce presenteeism.^{3,37-39}

Our finding regarding associations between presenteeism and mental health are consistent with previous research (Table 2). In the sensitivity analysis, the association between presenteeism and depression and anxiety was also significant when calculated by multivariable logistic regression (Supplementary Table 1). Conway et al.²¹ reported an effect between sickness presenteeism and depression in a Danish prospective cohort study. Gustafsson and Marklund¹⁹ and Taloyan et al.²⁰ studied the relationship between sickness presenteeism and low self-rated health or mental well-being in a Swedish cohort study. From all of the above studies, presenteeism appears to have a negative impact on mental health.

There were several possible mechanisms between presenteeism and mental health. First, presenteeism requires additional effort due to poor performance at work and affected workers have to exert more effort. Excessive effort will hinder the opportunity of recovery and also affect the ability to recovery after work, causing mental disorders such as depression and anxiety.⁴⁰⁻⁴² Insufficient recovery accumulates stress and prolonged stress leads to wear and tear on the body (allostatic load). Allostatic load induces the release of stress hormones, adrenalin and cortisol, and if repeated, should lead to atrophy of neurons and changes of brain structure and function, which cause major depressive illness and anxiety disorder.⁴²

A second possible mechanism is that presenteeism itself could increase the level of occupational stress which worsens mental health.⁴³ The most important model that explains occupational stress is the demand-control model.⁴⁴ In the job demand-control model,

presenteeism means workers do not have enough control not to attend the workplace even if they are sick. When they are going to work while ill, they have to exert more effort to perform the same job as before, although they have already performed a lot of labor-intensive logistic center work. High job strain and low job control can induce deterioration of mental health.^{45,46}

A third possible explanation is if workers who are sick attend work, the workers' low productivity may worsen their relationship with colleagues and supervisors. These social stressors, for example conflicts with co-workers and supervisors in addition to a negative group climate, leads to a decrease of self-esteem and increases of anxiety and depressive symptoms.⁴⁷

In the subgroup analysis, it was confirmed that daily workers are more vulnerable to mental health effects of presenteeism than fixed-term workers (p for interaction = 0.044) (Table 3). It can be explained that the daily workers have less job control than fixed-term workers, which increase occupational stress. For example, in the case of daily workers, even though they do not want to, the work in the logistic center suddenly change according to the instructions of their superiors. Also, there are experiences of different wages or actual discrimination due to the different type of contract. There are no annual leave in daily workers. When presenteeism is inevitably caused to prevent the loss of income and protect the continuous employment, mental stress is also expected to occur.

The limitations of this study are as follows. First, we did not inquire about the socioeconomic status of the participants such as income and educational status, which can affect presenteeism and mental health.³⁷ Second, recall bias may occur due to the limitations of the survey. Third, due to the lack of a large sample size, it cannot be assumed to be representative of the Korean entire logistic industry. We conducted the survey for a long time to include as many people as possible, but it was not easy to predict how many people would register. Also, it was difficult to access due to the nature of fixed-term and daily workers. However, it was not recruited from a specific biased group, and even if the number of respondents cannot represent the entire logistic industry, it is judged that it is not a problem in terms of association rather than prevalence. Fourth, causality is not guaranteed because this study is a cross-sectional study. In particular, there have been several studies evaluating the link between mental illness such as depression¹⁴ and anxiety¹⁶ and presenteeism, so the reverse causality cannot be excluded. However, as explained in the background of this study, presenteeism was measured as an index of loss of work productivity in the case of the above studies, which is different from this study. In order to address these limitations, more prospective studies on presenteeism and mental health with a large sample size are needed.

On the contrary, there are several strengths of this study. This is the first study which researched the association between presenteeism and mental health for logistic center workers. Stratification with gender, the type of contract, and labor intensity were also evaluated to investigate the relationship between presenteeism and mental health. Based on the results of this study, it is suggested that intervention is necessary for logistic center workers who experience presenteeism which can adversely affect mental health.

CONCLUSIONS

Logistic center workers who show presenteeism had significantly elevated PRs of depression and anxiety. The results of this study suggest that presenteeism could worsen the mental

health of logistic center workers and the type of contract mediates the relationship between presenteeism and depression. To prevent presenteeism and presenteeism related mental problems, laws and systems such as “paid sick leave” and “sickness-benefit” should be established in Korea. In addition, it is important to lower the labor intensity and resolve job insecurity in logistic centers. More prospective research is needed to discuss how presenteeism affects mental health and what factors mediate the impacts.

ACKNOWLEDGEMENTS

The authors would like to thank the labor union of the logistic center.

SUPPLEMENTARY MATERIAL

Supplementary Table 1

Crude and adjusted OR between presenteeism and mental health (using multiple logistic regression)

[Click here to view](#)

REFERENCES

1. Park H, Kim SH, Jeong SJ, Seo S. The Changes in the parcel delivery service according to the spread of COVID-19 in Korea. *J Transport Res* 2021;28(8):51-66.
[CROSSREF](#)
2. Lovas S, Nagy K, Sándor J, Ádám B. Presumed exposure to chemical pollutants and experienced health impacts among warehouse workers at logistics companies: a cross-sectional survey. *Int J Environ Res Public Health* 2021;18(13):7052.
[PUBMED](#) | [CROSSREF](#)
3. Lee JH, Jung HS, Lee HJ. The Impact on the musculoskeletal symptoms of the warehouse employees' work-related characteristics and job stress. *Korean J Occup Health Nurs* 2017;26(3):133-41.
4. Orris P, Hartman DE, Strauss P, Anderson RJ, Collins J, Knopp C, et al. Stress among package truck drivers. *Am J Ind Med* 1997;31(2):202-10.
[PUBMED](#) | [CROSSREF](#)
5. Shen S, Li Y, Zhou M, Zhang C, Jiang Y, Kang Y. Depression status and associated factors in Chinese occupational truck drivers. *Cell Biochem Biophys* 2013;67(3):1497-500.
[PUBMED](#) | [CROSSREF](#)
6. Tucker MK, Jimmieson NL, Jamieson JE. Role stressors in Australian transport and logistics workers: psychosocial implications. *Saf Sci* 2018;109:12-9.
[CROSSREF](#)
7. Ishimaru T, Mine Y, Fujino Y. Two definitions of presenteeism: sickness presenteeism and impaired work function. *Occup Med (Lond)* 2020;70(2):95-100.
[PUBMED](#) | [CROSSREF](#)
8. Aronsson G, Gustafsson K, Dallner M. Sick but yet at work. An empirical study of sickness presenteeism. *J Epidemiol Community Health* 2000;54(7):502-9.
[PUBMED](#) | [CROSSREF](#)
9. Kivimäki M, Head J, Ferrie JE, Hemingway H, Shipley MJ, Vahtera J, et al. Working while ill as a risk factor for serious coronary events: the Whitehall II study. *Am J Public Health* 2005;95(1):98-102.
[PUBMED](#) | [CROSSREF](#)
10. Dew K, Keefe V, Small K. 'Choosing' to work when sick: workplace presenteeism. *Soc Sci Med* 2005;60(10):2273-82.
[PUBMED](#) | [CROSSREF](#)

11. Burton WN, Conti DJ, Chen CY, Schultz AB, Edington DW. The role of health risk factors and disease on worker productivity. *J Occup Environ Med* 1999;41(10):863-77.
[PUBMED](#) | [CROSSREF](#)
12. Turpin RS, Ozminkowski RJ, Sharda CE, Collins JJ, Berger ML, Billotti GM, et al. Reliability and validity of the Stanford Presenteeism Scale. *J Occup Environ Med* 2004;46(11):1123-33.
[PUBMED](#) | [CROSSREF](#)
13. Skagen K, Collins AM. The consequences of sickness presenteeism on health and wellbeing over time: a systematic review. *Soc Sci Med* 2016;161:169-77.
[PUBMED](#) | [CROSSREF](#)
14. Johnston DA, Harvey SB, Glozier N, Calvo RA, Christensen H, Deady M. The relationship between depression symptoms, absenteeism and presenteeism. *J Affect Disord* 2019;256:536-40.
[PUBMED](#) | [CROSSREF](#)
15. Beck A, Crain AL, Solberg LI, Unützer J, Glasgow RE, Maciosek MV, et al. Severity of depression and magnitude of productivity loss. *Ann Fam Med* 2011;9(4):305-11.
[PUBMED](#) | [CROSSREF](#)
16. Esposito E, Wang JL, Williams JV, Patten SB. Mood and anxiety disorders, the association with presenteeism in employed members of a general population sample. *Epidemiol Psychiatr Soc* 2007;16(3):231-7.
[PUBMED](#) | [CROSSREF](#)
17. Laing SS, Jones SM. Anxiety and depression mediate the relationship between perceived workplace health support and presenteeism: a cross-sectional analysis. *J Occup Environ Med* 2016;58(11):1144-9.
[PUBMED](#) | [CROSSREF](#)
18. Demerouti E, Blanc PM, Schaufeli W, Hox J. Present but sick: a three-wave study on job demands, presenteeism and burnout. *Career Dev Int* 2009;14(1):50-68.
[CROSSREF](#)
19. Gustafsson K, Marklund S. Consequences of sickness presence and sickness absence on health and work ability: a Swedish prospective cohort study. *Int J Occup Med Environ Health* 2011;24(2):153-65.
[PUBMED](#) | [CROSSREF](#)
20. Taloyan M, Aronsson G, Leineweber C, Magnusson Hanson L, Alexanderson K, Westerlund H. Sickness presenteeism predicts suboptimal self-rated health and sickness absence: a nationally representative study of the Swedish working population. *PLoS One* 2012;7(9):e44721.
[PUBMED](#) | [CROSSREF](#)
21. Conway PM, Hogh A, Rugulies R, Hansen ÅM. Is sickness presenteeism a risk factor for depression? A Danish 2-year follow-up study. *J Occup Environ Med* 2014;56(6):595-603.
[PUBMED](#) | [CROSSREF](#)
22. Gutelius B, Theodore N. *The Future of Warehouse Work: Technological Change in the U.S. Logistics Industry*. Berkeley, CA: UC Berkeley Labor Center; 2019.
23. Aronsson G, Gustafsson K. Sickness presenteeism: prevalence, attendance-pressure factors, and an outline of a model for research. *J Occup Environ Med* 2005;47(9):958-66.
[PUBMED](#) | [CROSSREF](#)
24. Hansen CD, Andersen JH. Going ill to work--what personal circumstances, attitudes and work-related factors are associated with sickness presenteeism? *Soc Sci Med* 2008;67(6):956-64.
[PUBMED](#) | [CROSSREF](#)
25. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *JAMA* 1999;282(18):1737-44.
[PUBMED](#) | [CROSSREF](#)
26. Shin JH, Kim HC, Jung CH, Kim JB, Jung SW, Cho HJ, et al. The standardization of the Korean version of the Patient Health Questionnaire-2. *J Korean Neuropsychiatr Assoc* 2013;52(3):115-21.
[CROSSREF](#)
27. Borg GA. Psychophysical bases of perceived exertion. *Med Sci Sports Exerc* 1982;14(5):377-81.
[PUBMED](#) | [CROSSREF](#)
28. Watson NF, Badr MS, Belenky G, Bliwise DL, Buxton OM, Buysse D, et al. Recommended amount of sleep for a healthy adult: a joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Sleep (Basel)* 2015;38(6):843-4.
[PUBMED](#) | [CROSSREF](#)
29. Behrens T, Taeger D, Wellmann J, Keil U. Different methods to calculate effect estimates in cross-sectional studies. A comparison between prevalence odds ratio and prevalence ratio. *Methods Inf Med* 2004;43(5):505-9.
[PUBMED](#) | [CROSSREF](#)

30. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the relative risk in cohort studies and clinical trials of common outcomes. *Am J Epidemiol* 2003;157(10):940-3.
[PUBMED](#) | [CROSSREF](#)
31. Thompson ML, Myers JE, Kriebel D. Prevalence odds ratio or prevalence ratio in the analysis of cross sectional data: what is to be done? *Occup Environ Med* 1998;55(4):272-7.
[PUBMED](#) | [CROSSREF](#)
32. Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol* 2003;3(1):21.
[PUBMED](#) | [CROSSREF](#)
33. Petersen MR, Deddens JA. A comparison of two methods for estimating prevalence ratios. *BMC Med Res Methodol* 2008;8(1):9.
[PUBMED](#) | [CROSSREF](#)
34. Reuter M, Wahrendorf M, Di Tecco C, Probst TM, Ruhle S, Ghezzi V, et al. Do temporary workers more often decide to work while sick? Evidence for the link between employment contract and presenteeism in Europe. *Int J Environ Res Public Health* 2019;16(10):1868.
[PUBMED](#) | [CROSSREF](#)
35. Kim M, Choi H, Ryu E. Predictors of clinical nurses' presenteeism. *Korean J Occup Health Nurs* 2014;23(3):134-45.
[CROSSREF](#)
36. Kim GE, Jo MW, Shin YW. Increased prevalence of depression in South Korea from 2002 to 2013. *Sci Rep* 2020;10(1):16979.
[PUBMED](#) | [CROSSREF](#)
37. Cho YS, Park JB, Lee KJ, Min KB, Baek CI. The association between Korean workers' presenteeism and psychosocial factors within workplaces. *Ann Occup Environ Med* 2016;28(1):41.
[PUBMED](#) | [CROSSREF](#)
38. Vives A, Amable M, Ferrer M, Moncada S, Llorens C, Muntaner C, et al. Employment precariousness and poor mental health: evidence from Spain on a new social determinant of health. *J Environ Public Health* 2013;2013:978656.
[CROSSREF](#)
39. Sanne B, Mykletun A, Dahl AA, Moen BE, Tell GS. Testing the Job Demand-Control-Support model with anxiety and depression as outcomes: the Hordaland Health Study. *Occup Med (Lond)* 2005;55(6):463-73.
[PUBMED](#) | [CROSSREF](#)
40. Johns G. Presenteeism in the workplace: a review and research agenda. *J Organ Behav* 2010;31(4):519-42.
[CROSSREF](#)
41. Geurts SA, Sonnentag S. Recovery as an explanatory mechanism in the relation between acute stress reactions and chronic health impairment. *Scand J Work Environ Health* 2006;32(6):482-92.
[PUBMED](#) | [CROSSREF](#)
42. McEwen BS. Protection and damage from acute and chronic stress: allostasis and allostatic overload and relevance to the pathophysiology of psychiatric disorders. *Ann N Y Acad Sci* 2004;1032(1):1-17.
[PUBMED](#) | [CROSSREF](#)
43. Godin I, Kittel F, Coppieters Y, Siegrist J. A prospective study of cumulative job stress in relation to mental health. *BMC Public Health* 2005;5(1):67.
[PUBMED](#) | [CROSSREF](#)
44. Karasek RA. Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm Sci Q* 1979;24(2):285-308.
[CROSSREF](#)
45. Stansfeld SA, Fuhrer R, Shipley MJ, Marmot MG. Work characteristics predict psychiatric disorder: prospective results from the Whitehall II Study. *Occup Environ Med* 1999;56(5):302-7.
[PUBMED](#) | [CROSSREF](#)
46. Paterniti S, Niedhammer I, Lang T, Consoli SM. Psychosocial factors at work, personality traits and depressive symptoms. Longitudinal results from the GAZEL Study. *Br J Psychiatry* 2002;181:111-7.
[PUBMED](#)
47. Dormann C, Zapf D. Social stressors at work, irritation, and depressive symptoms: accounting for unmeasured third variables in a multi-wave study. *J Occup Organ Psychol* 2002;75(1):33-58.
[CROSSREF](#)