






The changing dynamics of work from home and its association with sleep disturbance through work–family conflict during the COVID-19 pandemic

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Abstract

Objectives: Work from home (WFH) can increase sleep disturbances. However, only few studies have examined the connection between WFH and sleep disturbance while considering work–family conflict (WFC) and the changes brought about by the COVID-19 pandemic. This study aimed to examine the association between WFH and sleep disturbance, considering WFC, and assess how this association changed during the COVID-19 pandemic.

Methods: We used data from the fifth and sixth Korean Working Conditions Survey. WFH workers and a control group were selected using propensity score matching. Conditional logistic regression analysis was used to estimate the odds ratios (ORs) with 95% CIs for sleep disturbance in the WFH and control groups.

Results: The workers working from home showed significantly higher ORs for sleep disturbance before (4.26; 95% CI, 3.59–5.05) and during (1.52; 95% CI, 1.26–1.83) the COVID-19 pandemic. When stratified by WFC, the association was significant only in the workers with WFC before COVID-19. However, the association was not significant during COVID-19 among the workers with WFC.

Conclusions: WFH was significantly associated with sleep disturbance among workers before COVID-19, but this association was not observed during the COVID-19 pandemic. Considering the significant role that WFC plays in this association, companies should provide a family-friendly WFH environment when adopting WFH practices.

Key points

- Traditionally, work from home (WFH) has been positively associated with work–family conflict (WFC). However, there have also been studies showing that it increases sleep disturbance. The changes brought about by the COVID-19 pandemic have necessitated a reevaluation of this relationship.
- There was an association between sleep disturbance and WFH, but this association was not significant in workers without WFC, and even in those with WFC, the association was not significant during the COVID-19 pandemic.
- This research alleviates concerns about the mental health of workers that may arise when organizations proactively create WFH environments, especially considering the changing association between WFH and sleep disturbance since the COVID-19 pandemic.

Keywords: work from home; work–family conflict; sleep disturbance; Korean Working Conditions Survey; COVID-19.

Introduction

The COVID-19 pandemic drastically changed lives. To prevent its spread, countries implemented policies such as closed borders, regional lockdowns, and social distancing. Many companies shifted their mode of work from traditional workplaces to work from home (WFH). During lockdowns in Australia, France, and the United Kingdom in 2020, approximately half of all workers were engaged in WFH—1.5 times to more than twice the rate compared with the previous year.¹ The percentage of workers who worked

from home rose from 10% to 28% in Japan, 5% to 20% in Italy, and 8% to 34% in Korea between 2019 and 2020.^{1,2}

Several studies examined WFH even before the COVID-19 pandemic. WFH can lower stress and fatigue by reducing commute time and increase job satisfaction by providing work flexibility.³ Studies have also reported its positive relationship with organizational performance, including increased productivity and retention.^{4,5} However, other studies have highlighted negative effects, such as loneliness due to working alone, a weakening of the

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work–family boundary, disruption of work–life balance through assignments outside of working hours, and interruptions from family and children.^{3,6} These factors are associated with an increase in work–family conflict (WFC),⁷ which can significantly impact physical, perceived, mental, and psychological health.⁸ WFC is also associated with lower life satisfaction and more fatigue, depression, and anxiety⁹ as well as increased sleep disturbance, which is a major health issue worldwide.¹⁰

Epidemiological studies have revealed that >30% of the general population experiences sleep disorders (eg, insomnia).¹¹ The prevalence of insomnia has increased over the past years and it is now one of the most common health problems after pain.¹² Factors related to insomnia include gender, age, and socioeconomic status, as well as significant life events and stress in daily life.¹³ Therefore, during the COVID-19 lockdown, rapid changes and stress factors, including home isolation, social isolation, and reduced outdoor activity, contributed to an increase in the number of people experiencing sleep disorders.¹⁴ Among these individuals, sleep disturbances among workers is noteworthy because it increases occupational injuries and absenteeism and reduces productivity.^{15,16} Workers with sleep disorders are 1.6 times more likely to experience an injury compared with those without sleep disorders; sleep-related problems contribute to about 13% of workplace injuries.¹⁷

Therefore, it is necessary to explore how WFH situations owing to the COVID-19 pandemic relate to workers' sleep disturbance. Conventional WFH reduces WFC associated with sleep disturbance,^{18,19} but this relationship could have been altered owing to the COVID-19 pandemic. COVID-19 made WFH mandatory and enabled increased WFC as workers spent more time at home with their families, which may have adversely affected their sleep.²⁰ Given that the characteristics of present-day WFH workers differ from those of the past,²¹ it is crucial to conduct an appropriate assessment of WFH arrangements, WFC, and their association with sleep disturbance pre- and post-COVID-19. Existing studies on WFH and sleep disturbance that consider these factors are inadequate, with an even greater lack of studies focusing on workers in Korea.²² Therefore, we hypothesized that as the association of WFH on WFC changed during the COVID-19 pandemic, its relationship with sleep disturbance would also change. This study aimed to determine whether there was an association between WFH and sleep disturbance, whether this association changed before and after COVID-19, and whether the relationship between WFH and sleep disturbance varied based on WFC.

Methods

We used data from the fifth (July–November 2017) and sixth (October 2020 to April 2021) Korean Working Conditions Survey (KWCS) conducted by the Occupational Safety and Health Research Institute. The KWCS comprehends and illuminates the total work environment, encompassing work and employment types, occupations, industries, and exposure to risk factors by benchmarking it against the European Working Conditions Survey and Labour Force Survey in the United Kingdom. The target population for the KWCS includes individuals aged 15 years and above who are employed and residing in households across South Korea at the time of the survey. The sample size is 50 000, determined through multistage systematic cluster sampling and weighted values are calculated. The primary method is to conduct one-on-one interviews using tablets in workers' homes. However, due to the COVID-19 pandemic, the data for the sixth survey was collected through a combination of paper and online sur-

veys. A previous study confirmed the KWCS's reliability and validity.²³

There were 50 205 participants in 2017 and 50 538 in 2020–2021. We excluded workers aged <20 years (257 in 2017 and 153 in 2020–2021) and self-employed persons/business owners with or without employees, unpaid family workers, other workers (20 089 in 2017 and 17 469 in 2020–2021), and individuals with missing data (2611 in 2017 and 4771 in 2020–2021). Finally, 27 248 and 28 145 workers were selected from the fifth and sixth KWCS, respectively. Among them, we extracted WFH workers and considered them as the study group, whereas non-WFH workers were designated as the control group, respectively.

Main variables

WFH

Participants responded to the question, “During the last 12 months (or since you started your job), how often have you worked in any of the following locations?” Those who answered “always,” “most of the time,” “sometimes,” and “rarely” to the “your own home” option were classified under the “WFH” category, whereas those who responded “never” were classified under the “non-WFH” category.

Sleep disturbance

Sleep disturbance was evaluated using the Minimal Insomnia Symptom Scale (MISS) comprising items related to “difficulty initiating sleep,” “difficulty maintaining sleep,” and “non-restorative sleep.” Participant responses to each question were calculated numerically: “every day” (4 points), “few times a week” (3 points), “few times a month” (2 points), “rarely” (1 point), and “not at all” (no point). The total scores ranged from 0 to 12. A score of 0–5 suggested no sleep disturbance, whereas a score of ≥ 6 suggested the presence of sleep disturbance.²⁴

WFC

WFC was considered a bidirectional variable between work and family: work interference with family (WIF) and family interference with work (FIW).²⁵ The presence of WIF was determined by response to the question, “How often in the last 12 months (or since you started your job) have you found that your job prevented you from giving the time you wanted to your family?” (“always,” “most of the time,” and “sometimes” = yes; “rarely” and “never” = no). The presence of FIW was determined by the response to the question, “How often in the last 12 months (or since you started your job) have you found that your family responsibilities prevented you from giving the time you should to your job?” (“always,” “most of the time,” and “sometimes” = yes; “rarely” and “never” = no).

Covariates

Participants' general and occupational characteristics were designated as covariates. General characteristics included sex, age, educational level, physical activity, and self-rated health. Age was classified as 20–29, 30–39, 40–49, 50–59, and ≥ 60 years. Educational level was classified as “high school or lower” and “college or higher.” Physical activity was categorized into Yes (“every day,” “a few times a week,” “a few times a month”) and No (“rarely,” “never”) responses when participants were asked the question, “How often do you participate in sports and leisure activities outside of work?” To determine self-rated health, participants were asked, “How is your health overall?” (“very good” and “good” = good self-rated health; “fair” = normal self-rated health; “bad” and “very bad” = bad self-rated health).

Occupational characteristics included weekly working hours, monthly income, number of employees, occupation, employment status, shift work, and job stress. In Korea, working 40 h per week is considered standard, and up to 12 h of overtime per week is permitted by law. Therefore, weekly working hours were categorized as “<40 h,” “40-51 h,” and “≥52 h.” Monthly income was classified as “<2 million won,” “2-2.99 million won,” “3-3.99 million won,” and “≥4 million.” The number of current employees in the participant’s workplace were categorized as “<10,” “10-299,” and “≥300.” Occupations were categorized based on the Korean Standard Classification of Occupations (white-collar: managers, professionals/related workers, and clerks; pink-collar: service and sales workers; blue-collar: skilled workers in agriculture, forestry, and fishery, craftsmen/related technical workers, equipment/machine operation and assembly workers, and elementary workers). Employment status was classified into “regular workers” and “temporary or daily workers.” Shift work status divided participants into groups of “yes” and “no.” Job stress was determined using a subjective question about experiencing stress at work (“always,” “mostly,” and “sometimes” = “yes”; “rarely” and “never” = “no”).

Statistical analyses

Propensity score matching (PSM) was conducted to reduce selection bias using sex, age, educational level, working hours, income, number of employees, occupation, employment status, shift work, physical activity, self-rated health, and job stress. The nearest neighbor method was used, and the matching ratio was set to 1:3 between the WFH and non-WFH groups.

Subsequently, we conducted a χ^2 analysis to examine the statistical differences in general and occupational characteristics, job stress, WIF, FIW, and sleep disturbance between the WFH and non-WFH (reference) groups. A conditional logistic regression analysis, considering strata, was performed to calculate the odds ratios (ORs) and 95% CIs for the association between WFH and sleep disturbance. Meanwhile, when analyzing data stratified by sex, we initially segregated men and women. Subsequently, we calculated propensity scores based on variables other than gender, matched them, and proceeded with the analysis. This process was repeated in the fifth and sixth KWCS. A *P* value < .05 was regarded as statistically significant. All statistical analyses were performed using R version 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

The baseline characteristics of the participants in the fifth (before COVID-19) and sixth (during COVID-19) KWCS are presented in Table 1. No significant differences were observed in general and occupational characteristics between the WFH and non-WFH groups after PSM. Comparing the participants before and during COVID-19 showed an increase in the proportion of men, participants in their 30s and 40s, highly educated individuals, those who worked 40-51 h per week, high-income earners, white-collar workers, and regular employees during the COVID period. There was also an increase in participation in physical activity and a slight decrease in the number of workers reporting job stress.

The WFH group exhibited higher levels of WFC (WIF and FIW) and sleep disturbance than the non-WFH group before and during COVID-19 (Table 2). However, during COVID-19, the difference in the magnitude of WFC (WIF and FIW), and sleep disturbance between the WFH and non-WFH groups decreased. After dividing by gender, the results comparing the basic characteristics

between the WFH group and non-WFH group, as well as WFC and sleep disturbance, are presented in Tables S1-S4.

The ORs and 95% CIs for sleep disturbance according to WFH status before and during COVID-19 are shown in Table 3. Sleep disturbance risk was significantly higher among WFH workers than among non-WFH workers before (OR = 4.26; 95% CI: 3.59-5.05) and during (OR = 1.52; 95% CI: 1.26-1.83) COVID-19. Similar results were observed in the analysis stratified by sex.

Table 4 shows results further stratified by WIF and FIW. Among men and women workers without WIF or FIW, the WFH group did not exhibit a significantly higher risk of sleep disturbance compared with the non-WFH group, except for male workers without FIW during COVID-19, for whom there was a marginally significant OR of 1.44 (95% CI: 1.03-2.02). However, for men with WIF or FIW, the ORs were 6.12 (95% CI: 3.78-9.93) and 6.10 (95% CI: 3.52-10.58) before COVID-19 and 1.38 (95% CI: 0.81-2.36) and 2.79 (95% CI: 0.56-13.90) during COVID-19, respectively. The ORs in women with WIF or FIW were 5.90 (95% CI: 4.06-8.56) and 4.74 (95% CI: 3.14-7.16) before COVID-19 and 1.28 (95% CI: 0.78-2.10) and 1.75 (95% CI: 0.61-4.99) during COVID-19, respectively.

Discussion

We analyzed the association between WFH and sleep disturbance among Korean workers before and during the COVID-19 pandemic stratified by WFC. The results revealed that a significant association between WFH and sleep disturbance was identified only among workers experiencing WFC, suggesting that WFC is an important variable of the relationship between WFH and sleep disturbance. However, the association was not significant during COVID-19 even when accounting for WFC, suggesting that lifestyle changes resulting from an environment that encouraged WFH may have mitigated the disadvantages of traditional WFH, such as social isolation, and amplified the advantages, such as work flexibility and shorter commutes.^{3,26}

Comparing data before and during COVID-19 showed a change in the characteristics of WFH workers, with an increase in the proportion of highly educated, high-income, and white-collar workers. The proportion of regular working hours increased with the influx of full-time workers. This aligns with a study that found that switching to WFH after COVID-19 was much more prevalent among highly educated, high-income, white-collar workers.²¹ This suggests that, although working from home was limited to specific jobs or contractors (eg, freelancers) before COVID-19, it became more common among the general workforce during COVID-19.²⁷ Additionally, a social climate that emphasizes work-life balance, prioritizes family life, and decreases concerns about the spread of infectious diseases may have increased workers’ satisfaction with WFH.²⁶ Thus, the proportion of WFH workers with job stress, WIF, FIW, and sleep disturbance was lower than it was before COVID-19.

We adjusted for personal and occupational characteristic differences that may affect sleep disturbance between WFH and non-WFH workers using PSM. Subsequently, we recruited a control group with similar tendencies and compared them with WFH workers on sleep disturbance. The results revealed that sleep disturbance was higher in the WFH group than in the control group. This is consistent with previous studies showing that WFH has a negative impact on mental health owing to the blurring of physical and organizational boundaries between work and home.^{6,28} These blurred boundaries increase WFC as workers are forced to juggle multiple tasks at once; increased WFC consequently leads to sleep disturbance.²⁹ Other possible explanations include

Table 1. General and occupational characteristics of the study population according to work from home status.

	Before COVID-19		P value	During COVID-19		P value
	Work from home			Work from home		
	No (n = 4749)	Yes (n = 1583)		No (n = 4695)	Yes (n = 1565)	
Sex			.650			.502
Men	2052 (43.2%)	673 (42.5%)		2313 (49.3%)	755 (48.2%)	
Women	2697 (56.8%)	910 (57.5%)		2382 (50.7%)	810 (51.8%)	
Age (years)			.479			.981
20-29	476 (10.0%)	149 (9.4%)		498 (10.6%)	165 (10.5%)	
30-39	1021 (21.5%)	358 (22.6%)		1323 (28.2%)	430 (27.5%)	
40-49	1249 (26.3%)	413 (26.1%)		1413 (30.1%)	474 (30.3%)	
50-59	1242 (26.2%)	433 (27.4%)		945 (20.1%)	324 (20.7%)	
≥60	761 (16.0%)	230 (14.5%)		516 (11.0%)	172 (11.0%)	
Education level			.404			.869
High school or lower	2090 (44.0%)	677 (42.8%)		1263 (26.9%)	425 (27.2%)	
College or higher	2659 (56.0%)	906 (57.2%)		3432 (73.1%)	1140 (72.8%)	
Working hours per week			.682			.080
<40 h	963 (20.3%)	305 (19.3%)		798 (17.0%)	283 (18.1%)	
40-51 h	3362 (70.8%)	1136 (71.8%)		3675 (78.3%)	1191 (76.0%)	
≥52 h	424 (8.9%)	142 (9.0%)		222 (4.7%)	93 (5.9%)	
Monthly income (million KRW)			.244			.800
<2	1919 (40.4%)	601 (38.0%)		1055 (22.5%)	344 (22.0%)	
2-2.99	1264 (26.6%)	438 (27.7%)		1289 (27.5%)	450 (28.8%)	
3-3.99	804 (16.9%)	294 (18.6%)		1085 (23.1%)	354 (22.6%)	
≥4	762 (16.0%)	250 (15.8%)		1266 (27.0%)	417 (26.6%)	
Number of employees			.436			.808
<10	1908 (40.2%)	622 (39.3%)		1501 (32.0%)	502 (32.1%)	
10-299	2084 (43.9%)	687 (43.4%)		2580 (55.0%)	849 (54.2%)	
≥300	757 (15.9%)	274 (17.3%)		614 (13.1%)	214 (13.7%)	
Occupation			.872			.639
White collar	1970 (41.5%)	659 (41.6%)		3044 (64.8%)	1003 (64.1%)	
Pink collar	1543 (32.5%)	522 (33.0%)		903 (19.2%)	318 (20.3%)	
Blue collar	1236 (26.0%)	402 (25.4%)		748 (15.9%)	214 (15.6%)	
Employment status			.702			.236
Regular	3678 (77.4%)	1234 (78.0%)		4063 (86.5%)	1335 (85.3%)	
Temporary/part-time	1071 (22.6%)	349 (22.0%)		632 (13.5%)	230 (14.7%)	
Shift work			.857			.576
No	4341 (91.4%)	1444 (91.2%)		4485 (95.5%)	1489 (95.1%)	
Yes	408 (8.6%)	139 (8.8%)		210 (4.5%)	76 (4.9%)	
Physical activity			.735			.907
No	2791 (58.8%)	922 (58.2%)		2306 (49.1%)	772 (49.3%)	
Yes	1958 (41.2%)	661 (41.8%)		2389 (50.9%)	793 (50.7%)	
Self-rated health			.135			.793
Good	3150 (66.3%)	1083 (68.4%)		3106 (66.2%)	1029 (65.8%)	
Normal/bad	1599 (33.7%)	500 (31.6%)		1589 (33.8%)	536 (34.2%)	
Job stress			.165			.862
No	614 (12.9%)	227 (14.3%)		812 (17.3%)	267 (17.1%)	
Yes	4135 (87.1%)	1356 (85.7%)		3883 (82.7%)	1298 (82.9%)	

loneliness due to social isolation and increased work hours to compensate for time away from the company.³⁰ Additionally, WFH workers were less physically active and spent more time sitting during the workday than did non-WFH workers.³¹ This lack of physical activity has a negative impact on sleep disturbances.³² However, more WFH workers during COVID-19 reported engaging in physical activity than before COVID-19, which may explain the reduced association between WFH and sleep disturbance.

WFC is a key mediator of health outcomes for WFH workers.³³ Therefore, we further stratified our analysis by WIF or FIW. The results revealed that the association between WFH and sleep disturbance was not significant or marginally significant for those who reported no WIF or FIW before and during COVID-19. By

contrast, we found a robust association between WFH and sleep disturbance among workers who reported WIF or FIW in the pre-COVID-19 survey, suggesting that WFC was an important mediator in the association between WFH and sleep disturbance. However, during COVID-19, the association between WFH and sleep disturbance was not significantly higher, even in the presence of WFC. As mentioned earlier, COVID-19 has heightened people's concerns about infection, leading them to prefer WFH with less contact with others, and the negative impact on sleep disturbance may have diminished as they began to perceive WFH as a safer option.³⁴ Moreover, South Korea has one of the most hierarchical and rigid work cultures worldwide; before COVID-19, working long hours in the office was an expression of commitment to the

Table 2. Distribution of work–family conflict and sleep disturbance according to work from home status.

	Before COVID-19		P value	During COVID-19		P value
	Work from home			Work from home		
	No (n = 4749)	Yes (n = 1583)		No (n = 4695)	Yes (n = 1565)	
Work interference with family			<.001			<.001
No	2889 (60.8%)	724 (45.7%)		3449 (73.5%)	1013 (64.7%)	
Yes	1860 (39.2%)	859 (54.3%)		1246 (26.5%)	552 (35.3%)	
Family interference with work			<.001			<.001
No	3443 (72.5%)	848 (53.6%)		4212 (89.7%)	1315 (84.0%)	
Yes	1306 (27.5%)	735 (46.4%)	483 (10.3%)	250 (16.0%)		
Sleep disturbance			<.001			<.001
No	4443 (93.6%)	1227 (77.5%)		4270 (90.9%)	1365 (87.2%)	
Yes	306 (6.4%)	356 (22.5%)	425 (9.1%)	200 (12.8%)		

Table 3. The odds ratios (ORs) and 95% CIs of sleep disturbance according to work from home status, stratified by sex.

Sleep disturbance		Before COVID-19		During COVID-19	
		OR	95% CI	OR	95% CI
Total					
Work from home	No	1.00		1.00	
	Yes	4.26	3.59–5.05	1.52	1.26–1.83
Men					
Work from home	No	1.00		1.00	
	Yes	4.72	3.56–6.26	1.58	1.19–2.09
Women					
Work from home	No	1.00		1.00	
	Yes	4.26	3.42–5.31	1.30	1.02–1.66

organization, whereas caring about family life was discouraged in the workplace.³⁵ Therefore, there was a reluctance to WFH for fear of being overlooked for promotion. However, freedom from the corporate atmosphere associated with mandatory WFH due to COVID-19 also meant that WFC was no longer a decisive stressor for WFH workers.

Because WFC and sleep disorders differ based on sex,^{36,37} we analyzed men and women separately to adjust for sex-related differences and found that the association between WFH and sleep disturbance was similar regardless of sex. This aligns with a previous study that found a similar relationship between WFC and mental health among men and women (although they may differ in how they manage their work and family responsibilities³⁸), as spending more time with family members due to WFH affected both men and women. In addition, we conducted in-depth analysis based on age and educational level (Tables S5 and S6). A noteworthy finding was the high association between WFH and sleep disturbance in individuals in their 20s, even during COVID-19. This aligns with research indicating that young adults are susceptible to mental health issues during COVID-19, primarily due to reduced employment, job uncertainty, and unemployment.³⁹ Further research is deemed necessary to delve deeper into these issues.

In the post-COVID-19 era, a contact-free society is anticipated to become the new normal, and many organizations are gearing up for this shift. As organizations weigh the advantages and disadvantages of returning to on-site work versus maintaining a WFH model, this study reveals that WFH was not significantly associated with sleep disturbance in workers during COVID-19. This finding could serve as a positive justification for organi-

zations to continue or expand WFH, emphasizing that reducing WFC can contribute to lower sleep disturbance among WFH workers, subsequently enhancing productivity. Future research should delve into how the relationship between WFH and sleep disturbance has evolved in the post-COVID-19 environment.

This study has several limitations. First, its cross-sectional design resulted in difficulty in establishing the causal relationship between WFH and sleep disturbance. Moreover, we could not directly compare changes over time because of the heterogeneous nature of the participants before and during COVID-19. Thus, further studies using longitudinal designs are required. Second, this study did not consider all variables that could affect sleep disturbance (eg, anxiety, light exposure, underlying medical history, or lifestyle habits). Nevertheless, we made efforts to enhance the study by including variables such as physical activity and self-rated health. Third, a recall bias could have occurred owing to the limitations of self-reported data. Fourth, as this study did not use a measurement tool and identified the presence of WIF or FIW based on a single question, future studies should employ a multiquestion measure to encompass more diverse aspects of WFC. Finally, despite the frequent use of the MISS in existing research,^{40–42} there is a lack of validity studies with Korean workers. Future research should be conducted to assess the validity of the MISS with Korean workers.

Nevertheless, we obtained a relatively large sample by using nationwide survey data representative of Korean workers. This study is also, to our knowledge, the first to consider the changes in the effect of WFH on sleep disturbance before and during COVID-19. It will be interesting to determine if this effect persists by incorporating data from the post-pandemic period. Additionally,

Table 4. The odds ratios (ORs) and 95% CIs of sleep disturbance according to work from home status, stratified by work interference with family and family interference with work in men and women.

Sex	Sleep disturbance		Stratum				
			No		Yes		
			OR	95% CI	OR	95% CI	
Men	Before COVID-19 Work from home	No	1.00		1.00		
		Yes	1.01	0.48–2.13	6.12	3.78–9.93	
	During COVID-19 Work from home	No	1.00		1.00		
		Yes	1.29	0.79–2.11	1.38	0.81–2.36	
	Family interference with work						
	Before COVID-19 Work from home	No	1.00		1.00		
		Yes	1.32	0.72–2.42	6.10	3.52–10.58	
	During COVID-19 Work from home	No	1.00		1.00		
		Yes	1.44	1.03–2.02	2.79	0.56–13.90	
	Women	Before COVID-19 Work from home	No	1.00		1.00	
			Yes	1.04	0.59–1.83	5.90	4.06–8.56
		During COVID-19 Work from home	No	1.00		1.00	
Yes			1.05	0.74–1.50	1.28	0.78–2.10	
Family interference with work							
Before COVID-19 Work from home		No	1.00		1.00		
		Yes	1.35	0.81–2.25	4.74	3.14–7.16	
During COVID-19 Work from home		No	1.00		1.00		
		Yes	1.28	0.96–1.70	1.75	0.61–4.99	

we could minimize the impact of other confounding variables using PSM to increase internal validity.

Conclusions

COVID-19 has changed the way we work. Because WFH is likely to become more widespread in the future, its health effects will continue to be of interest. In this study, we found a reduced association between WFC and sleep disturbance during COVID-19 compared with that before COVID-19. Considering the significant role that WFC plays in this association, companies should provide a family-friendly WFH environment when adopting WFH practices.

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Author contributions

JJ: conceptualization, methodology, formal analysis, writing—original draft, writing—review and editing. JL: conceptualization, formal analysis. Y.H.C: writing—review and editing. J.B.P: supervision, writing—review and editing. I.J: methodology, supervision, writing—review and editing.

Supplementary data

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Conflicts of interest

None declared.

Data availability

This study used publicly accessible information from the Korea Occupational Safety & Health Research Institute (OSHRI; <https://oshri.kosha.or.kr/oshri/index.do>). All data are available from the following URL with a request form: <https://oshri.kosha.or.kr>.

kr/oshri/researchField/downWorkingEnvironmentSurvey.do. The authors do not have any special access privileges.

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