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Interpersonal Factors and Resilience Mediate the Association Between Work-Related Stress in Response to a Viral Epidemic and Depression Among Healthcare Workers in the COVID-19 Pandemic

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Objective This study aims to explore the association between work-related stress of healthcare workers in response to the coronavirus disease-2019 (COVID-19) pandemic and their depressive symptoms. Additionally, it focuses on the impact of insomnia symptoms, interpersonal factors, and resilience on depressive symptoms.

Methods The results of an anonymous survey of 329 healthcare workers were analyzed, including the Stress and Anxiety to Viral Epidemics-3 items, Insomnia Severity Index, Interpersonal Needs Questionnaire, Connor−Davidson Resilience Scale-2 items, and Patient Health Questionnaire-9 items. Mediation analysis assessed whether insomnia symptoms, resilience, and interpersonal factors mediate the association between work-related stress and depressive symptoms.

Results Work-related stress directly influenced depressive symptoms (standardized estimator=0.11, p=0.010, 95% confidence interval [CI] 0.03−0.19). The association between the former and latter was positively mediated by insomnia symptoms (standardized estimator=0.10, p<0.001, 95% CI 0.05−0.14), thwarted belongingness (standardized estimator=0.04, p=0.006, 95% CI 0.01−0.07), and perceived burdensomeness (standardized estimator=0.05, p=0.002, 95% CI 0.02−0.08) and was negatively mediated by resilience (standardized estimator=0.02, p=0.041, 95% CI 0.0001−0.04).

Conclusion This study highlights the connection between heightened work-related stress experienced by healthcare workers amid the COVID-19 pandemic and the subsequent development of depressive symptoms mediated by insomnia, interpersonal factors, and resilience. Interventions that focus on building resilience could be pivotal in mitigating the detrimental mental health consequences of workplace stress among healthcare workers in a viral epidemic.
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Keywords COVID-19; Healthcare workers; Anxiety; Stress.

INTRODUCTION

During the first 2 years after the initial identification of the coronavirus disease-2019 (COVID-19), the severe acute respiratory syndrome coronavirus 2 spread rapidly across the globe. Although primary emphasis is typically placed on the physical health consequences of an outbreak of an infectious disease, incidents of mental health disorders including depression, anxiety, and post-traumatic stress disorder also increase during global health emergencies.[1] A systematic review revealed a concerning prevalence of stress (29.6%), anxiety (31.9%), and depression (33.7%) in the community amid the COVID-19 pandemic.[2]

Specifically, healthcare workers have been highly impacted by the COVID-19 pandemic during which they dedicated extended hours on the frontlines of the pandemic, diagnosing and providing care to patients who were infected or at high risk of being infected while consistently facing the pain and suffering experienced by their patients. They also had to sustain abnormally intense and demanding work schedules,[3] and many reported work-related stress specific to the pandemic, such as concerns about contracting and spreading the virus.[4] Furthermore, they experienced reluctance to engage in work, a sense of being stigmatized, coping by avoiding crowds and

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colleagues, and feelings of being under scrutiny.[5] This unparalleled situation led to serious psychological issues, including depression, anxiety, and insomnia.[6] In a systematic review addressing the psychiatric problems faced by healthcare professionals (such as doctors, nurses, and allied health workers) amid the COVID-19 pandemic, it was found that the estimated rates of depression, anxiety, and post-traumatic stress disorder among these workers surpassed those observed in the general population.[4] However, when a non-specific rating scale for work-related stress is applied, an individual's work-related stress specific to a viral epidemic cannot be measured. Thus, we developed a rating scale that can measure the work-related stress experienced by healthcare workers in response to a viral epidemic, namely the Stress and Anxiety to Viral Epidemics-3 items (SAVE-3).[7]

Among the various psychiatric consequences experienced because of COVID-19-related work stress, depression deserves critical attention because suicidal ideation and attempts are some of its symptoms. However, given that not all healthcare workers develop depression after experiencing work-related stress in response to a viral epidemic, there may be mediating factors that connect these two conditions. According to the interpersonal theory of suicide (ITS),[8] the desire for suicide is influenced by interpersonal factors, such as perceived burdensomeness (perception or feeling of not belonging or not being connected to others in a meaningful way) and thwarted belongingness (the belief that one is a burden to others and that their existence and actions impose a heavy burden on friends, family, or society). Although the theory was originally developed to explain the contributing factors for suicidal desire, previous studies revealed that the experience of thwarted belongingness and perceived burdensomeness is associated with both past and future depression.[9,10] A study on the relationship between minority stress and depressive symptoms revealed that the former was indirectly associated with the latter via perceived burdensomeness.[11] However, interpersonal factors were not studied in the context of work-related stress in response to a viral pandemic.

In contrast, resilience can be considered a protective factor against depression. Resilience pertains to an individual's capacity to effectively cope with or adapt to stressful circumstances.[12] This encompasses multiple aspects such as personality, interpersonal connections, and temporal attributes of the stressor.[13] It also involves the capacity to perceive stress as an opportunity, acknowledge personal limits in controlling stress reactions,[14] enhance self-efficacy, bolster resistance to stress, adapt, and cultivate a sense of humor.[15] Employing resilience as an adaptive coping strategy could be advantageous in diminishing work-related stress in response to a pandemic and psychiatric symptoms, including depression, among healthcare workers. A study revealed that the association between COVID-19-related work stress and depressive and anxiety symptoms of primary healthcare workers is influenced by resilience.[16]

We aim to explore whether the work-related stress experienced by healthcare workers in response to the viral epidemic may be associated with depressive symptoms. Furthermore, we tried to investigate whether insomnia symptoms, interpersonal factors, or resilience influence depressive symptoms. We posited that 1) work-related stress may be positively associated with depressive symptoms, 2) insomnia may be positively associated with depressive symptoms, 3) interpersonal factors may be positively associated with depressive symptoms, 4) resilience may be negatively associated with depressive symptoms, and 5) insomnia, resilience, and interpersonal factors may mediate the association between the work-related stress and depressive symptoms experienced by healthcare workers.

METHODS

Participants and procedure

An anonymous online survey was conducted on November 29, 2021, among healthcare workers in Asan Medical Center, Korea. This survey was part of a previous study that explored the comparisons of the psychometric properties of the viral epidemic-related rating scales among healthcare workers.[17] Participants voluntarily participated in this survey and were given a gift coupon valued at approximately USD 5.00 for their participation. At the beginning of the survey, we included the question, "Do you agree to participate in this study?" Only those who answered "Yes" proceeded with the survey. The study protocol was approved by the institutional review board of Asan Medical Center (2021-1682), and written informed consent for participation was waived. The survey forms included questions on the participant's demographic information (age, sex, job, years of employment, and marital status), COVID-19 history (experience of being quarantined, infected, or vaccinated), past psychiatric history, and current psychiatric distress.

Measures

Patient Health Questionnaire-9

The Patient Health Questionnaire-9 items (PHQ-9) is a rating scale that assesses the severity of depression.[18] It includes 9 items that can be scored from 0 to 3. The total score can range from 0 to 27, with a higher total score denoting a higher severity of depression. The optimal cutoff score for clinical depression was ≥10.[19] The validated Korean version was used in the current study,[20] and a Cronbach's alpha score of 0.883 was computed for this sample.

SAVE-3

The SAVE-3 scale is a rating scale that assesses work-related stress in response to viral epidemics.[7] It was derived from the original SAVE-9 scale, which was developed to measure the anxiety and work-related stress experienced by healthcare workers in response to viral epidemics.[21] The SAVE-3 scale includes 3 items, and each item can be scored from 0 (never) to 4 (always). The total score can range from 0 to 12, and a higher score reflects a higher degree of work-related stress related to the viral epidemic. We used the original Korean version of the scale, and Cronbach's alpha among this sample was computed to be 0.592.

Insomnia Severity Index

The insomnia severity index (ISI) is a rating scale that assesses the severity of insomnia.[22] It includes 7 items, and each item can be scored from 0 to 4. The total score can range from 0 to 28, and a higher total score reflects a higher degree of insomnia. We used a validated Korean version,[23] and a Cronbach's alpha of 0.834 was computed for this sample.

Interpersonal Needs Questionnaire

The interpersonal needs questionnaire (INQ) is a rating scale that can measure thwarted belongingness and perceived burdensomeness[24] based on the ITS.[8] It includes 15 items, and each item can be scored from 1 to 7. It can be clustered into two factors: factor I can measure thwarted belongingness (items 1, 2, 3, 4, 5, and 6) (INQ-TB), and factor II can measure perceived burdensomeness (items 7, 8, 9, 10, 11, 12, 13, 14, and 15) (INQ-PB). Items 7, 8, 10, 13, 14, and 15 were scored in the reverse. A higher total score reflects a higher degree for each psychological factor. We used a validated Korean version of the scale,[25] and Cronbach's alpha values of 0.955 and 0.425 were computed for factors I and II of this sample, respectively.

Connor–Davidson Resilience Scale-2

The Connor–Davidson resilience scale-2 items (CD-RISC2) is a rating scale that assesses an individual's resilience.[26] It is a shortened version of the original 25-item CD-RISC scale.[27] The CD-RISC2 includes 2 items, and each item can be scored from 0 to 4. A total score can range from 0 to 8, and a higher total score reflects a higher level of resilience. We used the Korean version of this scale,[28] and the split-half coefficient was 0.783 for this sample.

Statistical analysis

Demographic variables and rating scale scores are presented as mean±standard deviation. First, Pearson's correlation coefficients were calculated to explore whether healthcare workers' depressive symptoms or work-related stress were correlated with other psychological factors such as insomnia, interpersonal needs, or resilience. Second, linear regression analysis with enter methods was used to explore whether the years of employment or psychological factors of the participants could be used to predict their depressive symptoms. Finally, mediation analysis was conducted to examine whether insomnia, resilience, or interpersonal factors of the participants mediate the association between the depressive symptoms and work-related stress of the healthcare workers in response to the viral epidemic. We defined statistical significance as $p<0.05$ in two-tailed tests. SPSS version 21.0, AMOS version 27 (SPSS Inc., Chicago, Illinois), and JASP version 0.14.1.0 software (JASP Team, Amsterdam, The Netherlands) were used for statistical analysis.

RESULTS

Of the 329 healthcare workers, the mean age was 35.8±14.3 years old, with a mean employment duration of 9.7±7.7 years. Among them, 194 (59.0%) were nursing professionals, 267 (81.2%) were female, and 157 (47.7%) were single (Table 1). Regarding COVID-19-related questions, 45 (13.7%) responded that they experienced being quarantined, 2 (0.6%) experienced being infected, and 327 (99.4%) were vaccinated.

Healthcare workers' depressive symptoms (PHQ-9) was significantly correlated with SAVE-3 ($r=0.31$, $p<0.01$), ISI ($r=0.56$, $p<0.01$), INQ-TB ($r=0.49$, $p<0.01$), INQ-PB ($r=0.47$, $p<0.01$), and CD-RISC2 ($r=-0.39$, $p<0.01$) (Table 2). Their work-related stress in response to the viral epidemic (SAVE-3) was significantly correlated with ISI ($r=0.26$, $p<0.01$), INQ-TB ($r=0.17$, $p<0.01$), INQ-PB ($r=0.24$, $p<0.01$), and CD-RISC2 ($r=-0.17$, $p<0.01$).

Linear regression analysis revealed that high SAVE-3 ($\beta=0.11$, $p=0.012$), high ISI ($\beta=0.39$, $p<0.001$), high INQ-TP ($\beta=0.24$, $p<0.001$), high INQ-PB ($\beta=0.20$, $p<0.001$), and low CD-RISC2 ($\beta=-0.12$, $p<0.001$) ($F=53.03$, $p<0.001$) (Table 3) were significantly associated with healthcare workers' depressive symptoms during the pandemic.

Mediation analysis revealed that work-related stress in relation to the viral epidemic directly influenced the depressive symptoms of healthcare workers. Their insomnia, thwarted belongingness, and perceived burdensomeness positively mediated the association between work-related stress and depressive symptoms, and their resilience negatively mediated the association between work-related stress and depressive symptoms (Table 4 and Figure 1).

DISCUSSION

We observed that the work-related stress of healthcare work-

ers in response to a viral epidemic was directly associated with their depressive symptoms during the COVID-19 pandemic era. Their insomnia symptoms were significantly associated with depressive symptoms and work-related stress, and resilience was negatively associated with these factors. Their thwarted belongingness and perceived burdensomeness were also positively associated with depressive symptoms and work-related stress. Furthermore, healthcare workers' insomnia, resilience, and interpersonal factors mediated the association between work-related stress and depressive symptoms.

Table 1. Clinical characteristics of participants (N=329)

Variables	Value
Sex (female)	267 (81.2)
Age (yr)	35.8±14.3
Years of employment	9.7±7.7
Job	
Nursing professionals	194 (59.0)
Doctors	23 (7.0)
Other healthcare workers	112 (34.0)
Marital status	
Single	157 (47.7)
Married, without kids	51 (15.5)
Married, with kids	121 (36.8)
Questions on COVID-19	
Did you experience being quarantined due to infection with COVID-19? (Yes)	45 (13.7)
Did you experience being infected with COVID-19? (Yes)	2 (0.6)
Did you get vaccinated? (Yes)	327 (99.4)
Psychiatric history	
Did you have experience or treated depression, anxiety, or insomnia? (Yes)	46 (14.0)
Now, do you think you are depressed or anxious, or do you need help for your mood state? (Yes)	24 (7.3)
Rating scales	
PHQ-9	4.4±4.2 (0–25)
SAVE-3	6.8±2.3 (1–12)
ISI	6.7±4.9 (0–26)
INQ-TB	8.6±5.5 (6–42)
INQ-PB	28.1±10.4 (9–57)
CD-RISC2	5.1±1.4 (0–8)

Values are presented as number (%) or mean±standard deviation. COVID-19, coronavirus disease-2019; PHQ-9, Patient Health Questionnaire-9 items; SAVE-3, Stress and Anxiety to Viral Epidemics-3 items; ISI, Insomnia Severity Index; INQ, Interpersonal Needs Questionnaire; TB, thwarted belongingness; PB, perceived burdensomeness; CD-RISC2, Connor-Davidson Resilience Scale-2 items

Table 2. Pearson correlation coefficients of each variable among healthcare workers

Variables	Years of employment	PHQ-9	SAVE-3	ISI	INQ-TB	INQ-PB
PHQ-9	-0.01					
SAVE-3	-0.05	0.31**				
ISI	-0.02	0.56**	0.26**			
INQ-TB	-0.05	0.49**	0.17**	0.28**		
INQ-PB	0.08	0.47**	0.24**	0.24**	0.41**	
CD-RISC2	0.03	-0.39**	-0.17**	-0.25**	-0.33**	-0.39**

**p<0.01. PHQ-9, Patient Health Questionnaire-9 items; SAVE-3, Stress and Anxiety to Viral Epidemics-3 items; ISI, Insomnia Severity Index; INQ, Interpersonal Needs Questionnaire; TB, thwarted belongingness; PB, perceived burdensomeness; CD-RISC2, Connor-Davidson Resilience Scale-2 items

In this association between work-related stress and depressive symptoms, their thinking on thwarted belongingness and perceived burdensomeness had a mediation effect. According to ITS,[8] thwarted belongingness and perceived burdensomeness are important factors in the development of suicidal thoughts and behaviors. Thwarted belongingness can arise when individuals experience a sense of social isolation, loneliness, or lack of connection with others, and perceived burdensomeness can arise when an individual feels that they are unable to contribute positively to the lives of others.[8] When the "need to belong"[29] is unmet, this condition is termed as thwarted belongingness and represents an interpersonal need significantly linked to suicidal ideation,[8] which is a core symptom of major depressive disorder.[30] During the COVID-19 pandemic, healthcare workers felt isolated and alone because of the physical distancing policy enacted in hospitals to prevent viral infection and transmission from healthcare workers to patients.[31] In addition, they sometimes felt useless when they were unable to help or treat patients with COVID-19.[32] We could speculate that these feelings may have caused the depression of healthcare workers during the pandemic. As work-related stress increases in relation to viral epidemics, this burden may enhance their feelings of depression mediated by thwarted belongingness and perceived burdensomeness.

Insomnia also mediated the association between work-related stress and depressive symptoms of healthcare workers during the COVID-19 pandemic. Numerous studies reported that work-related stress was associated with insomnia or depression during the COVID-19 pandemic among healthcare workers.[7] Among workers involved in cold chain management who were exposed to extreme temperatures or hazardous materials, insomnia mediated the association between their burnout and depression.[7] Chronic exposure to work-related stressors can disrupt sleep patterns via physiological responses, such as elevated cortisol levels,[33] and contribute to cognitive and emotional factors, including persistent worry and anxiety.[16] The resulting insomnia may exacerbate symptoms of depres-

Table 3. Linear regression analysis to explore variables expecting healthcare workers' depression in COVID-19 pandemic

Variables	β	p	Adjusted R^2	F, p
PHQ-9			0.49	F=53.03,
Years of employment	0.003	0.942		p<0.001**
SAVE-3	0.11	0.012*		
ISI	0.39	<0.001**		
INQ-TB	0.24	<0.001**		
INQ-PB	0.20	<0.001**		
CD-RISC2	-0.12	<0.001**		

*p<0.05; **p<0.01. COVID-19, coronavirus disease-2019; PHQ-9, Patient Health Questionnaire-9 items; SAVE-3, Stress and Anxiety to Viral Epidemics-3 items; ISI, Insomnia Severity Index; INQ, Interpersonal Needs Questionnaire; TB, thwarted belongingness; PB, perceived burdensomeness; CD-RISC2, Connor-Davidson Resilience Scale-2 items

Table 4. The results of direct, indirect, and total effects on mediation analysis

Effect	Standardized estimator	S.E.	Z	p	95% CI
Direct effect					
SAVE-3 → PHQ-9	0.11	0.04	2.59	0.010*	0.03 to 0.19
Indirect effect					
SAVE-3 → ISI → PHQ-9	0.10	0.02	4.23	<0.001**	0.05 to 0.14
SAVE-3 → INQ-TB → PHQ-9	0.04	0.02	2.72	0.006**	0.01 to 0.07
SAVE-3 → INQ-PB → PHQ-9	0.05	0.02	3.13	0.002**	0.02 to 0.08
SAVE-3 → CD-RISC 2 → PHQ-9	0.02	0.01	2.04	0.041*	0.0001 to 0.04
Path coefficients					
SAVE-3 → ISI	0.26	0.05	4.77	<0.001**	0.15 to 0.36
ISI → PHQ-9	0.39	0.04	9.20	<0.001**	0.30 to 0.47
SAVE-3 → INQ-TB	0.17	0.06	3.16	0.002**	0.07 to 0.28
INQ-TB → PHQ-9	0.24	0.04	5.36	<0.001**	0.15 to 0.33
SAVE-3 → INQ-PB	0.24	0.05	4.41	<0.001**	0.13 to 0.34
INQ-PB → PHQ-9	0.20	0.05	4.43	<0.001**	0.11 to 0.29
SAVE-3 → CD-RISC 2	-0.17	0.05	-3.10	0.002**	-0.28 to -0.06
CD-RISC 2 → PHQ-9	-0.12	0.04	-2.72	0.007**	-0.20 to -0.03
Total effect					
SAVE-3 → PHQ-9	0.21	0.04	5.53	<0.001**	0.13 to 0.28

*p<0.05; **p<0.01. S.E., standard error; CI, confidence interval; SAVE-3, Stress and Anxiety to Viral Epidemics-3 items; PHQ-9, Patient Health Questionnaire-9 items; ISI, Insomnia Severity Index; INQ, Interpersonal Needs Questionnaire; TB, thwarted belongingness; PB, perceived burdensomeness; CD-RISC 2, Connor-Davidson Resilience Scale-2 items

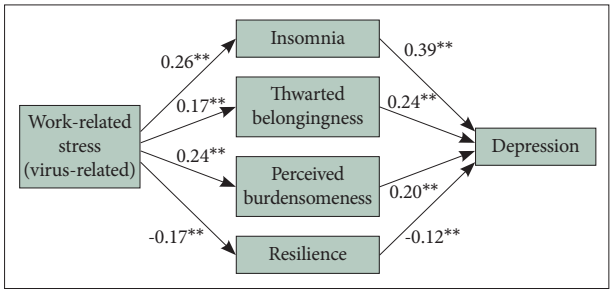

Figure 1. Mediation model delineating the pathway from the impact of work-related stress in response to a viral epidemic (independent variables) on depression (outcome) via insomnia, resilience, thwarted belongingness, and perceived burdensomeness (mediators). **p<0.01.

sion by impairing emotional regulation and reducing an individual's ability to cope with stress.[34,35]

Our observations also suggest that people with higher levels of resilience may be less susceptible to depression resulting from work-related stress. This finding is in agreement with that of a previous study on the psychological impact of COVID-19 on nurses, which showed that resilience partially mitigated the effect of perceived stress on depression.[36] This supports the conclusion that resilience had a protective effect on the emotional well-being of nurses during the pandemic. Resilience, which is defined as the ability to adapt and recover from adversity,[12] appears to serve as a protective factor in this context. Those with greater resilience may be better equipped to cope with the challenges posed by work-related stressors and may exhibit reduced vulnerability to the development or exacerbation of depressive symptoms.[16] This finding underscores the importance of fostering resilience as a potential intervention strategy to buffer against the negative mental health consequences of workplace stress. A meta-analysis examined the effectiveness of resilience-building programs in the workplace and found that one-on-one formats, such as coaching, are the most effective.[37] These are followed by group formats delivered in a classroom setting.

This study has some limitations. First, this study was conducted within a single hospital; therefore, the results cannot be generalized to other hospitals or medical centers with similar settings. Second, it was conducted via an online survey, and we were unable to confirm whether the participants provided answers. Moreover, limited access to the system and self-selection bias may have led to a non-representative sample. Third, there may be a selection bias stemming from the predominance of female participants in the sample, which could limit the generalizability of the findings to the broader population, particularly to male participants. Fourth, because of its cross-sectional design, a causal relationship could not be established. Finally, some of the rating scales within this sample showed a relatively low level of reliability in terms of internal consistency.

In conclusion, this study highlights a clear connection between the heightened work-related stress experienced by healthcare workers amid the COVID-19 pandemic and the subsequent onset of depressive symptoms. Insomnia serves as a mediator in this relationship, thus emphasizing its role in exacerbating the effect of stress on mental health. Additionally, the study introduces the mediating influence of thwarted belongingness and perceived burdensomeness. Factors such as enforced physical distancing and the emotional weight of being unable to save infected patients contribute significantly to feelings of isolation and a sense of being a burden, thus potentially leading to depression. Notably, resilience emerges as a protective factor, thus indicating that individuals with higher resilience levels are less susceptible to the depressive effects of work-related stress. This study suggests that interventions that focus on building resilience could be pivotal in mitigating the detrimental mental health consequences of workplace stress among healthcare workers in the context of a viral epidemic.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

C. Hyung Keun Park and Seockhoon Chung, a contributing editors of the *Psychiatry Investigation*, were not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

Author Contributions

Conceptualization: all authors. Data curation: C. Hyung Keun Park, Seockhoon Chung. Formal analysis: Seockhoon Chung. Investigation: Seockhoon Chung. Methodology: C. Hyung Keun Park, Seong Yoon Kim. Writing—original draft: all authors. Writing—review & editing: all authors.

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