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Perceived Vulnerability, Resilience, and Sleep Duration as Predictors of Post-Traumatic Stress in COVID-19 Survivors

Kunal Raghuraj Raut, Dr. Shafiq Khan Yusuf Khan Pathan

Department of Psychology,
Government Vidarbha Institute of Science and Humanities, Sant Gadge Baba Amravati University, Amravati, Maharashtra, India.

Corresponding Author: Kunal Raghuraj Raut

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ABSTRACT

Background: The COVID-19 virus presented a risk of physical sickness and increased psychological discomfort, with survivors frequently experiencing post-traumatic stress. This study examined predictors: perceived vulnerability, resilience, and sleep length, to assess their impact on trauma outcomes.

Methods: A quantitative study plan was utilised, taking a survey of 400 COVID-19 survivors from Aurangabad district. Standardized instruments, such as the Perceived Vulnerability to Disease Questionnaire, the Brief Resilience Scale, the Insomnia Severity Index, and the Short Post-Traumatic Stress Disorder Rating Interview (SPRINT) post-traumatic stress disorder (PTSD) interview, were utilized. Data were subjected to regression models to observe association and prediction power.

Key Findings: The findings demonstrated that increased perceived vulnerability and reduced sleep duration significantly exacerbated PTSD symptoms, whereas resilience was a major predictor of low stress levels. Sleep disruptions were both correlations and predictors of post-traumatic symptoms. These findings underscore the mixed roles of risk and protective factors in post-traumatic adjustment.

Implications: The study emphasizes the importance of integrating post-pandemic treatment with resilience training and sleep-oriented therapy. Indicators of vulnerability perceptions seem promising for the early identification of at-risk groups to facilitate timely intervention. Policymakers and clinicians must adopt trauma-informed approaches that reconcile mental vulnerabilities with protective assets to enhance long-term mental health outcomes for survivors.

Keywords: Post-Traumatic Stress, Perceived Vulnerability, Resilience, Sleep Duration, Psychological Predictors, Trauma-Informed Care

INTRODUCTION

The COVID-19 pandemic has created a substantial impact on mental health besides its somatic morbidity, with the repeated observation of post-traumatic stress (PTS) symptoms among human beings who survived infection and hospitalization [1]. According to Tortella-Feliu et al., (2019), Systematic reviews and meta-analyses have shown probable post-traumatic stress disorder (PTSD) is to be common amongst the discharged patients and other community survivors, with a high risk among those who endured the severe

disease, were treated in intensive care, or experienced various other stressors during the pandemic, such as bereavement, economic loss, and social isolation, the study shows that COVID-19 is a complicated source of trauma, and its effects extend beyond the viral infection.[12]

Despite this stress, three psychological and behavioural predictors stand out: perceived vulnerability, resilience, and sleep duration. Perceived vulnerability, largely shaped by the Vulnerability to Disease approach, involves individuals' beliefs about their risk of infection and contagion. A higher perceived vulnerability has been associated with increased distress and harmful responses to threats during COVID-19, which makes it a potential risk factor for PTSD among survivors. [19] Resilience is the ability to maintain or regain mental balance during stress. The protective factor that prevents PTSD still continues to perform its role even when different types of traumatic incidents occur. The latest research has established a strong connection between resilience and reduced symptoms of PTSD than was previously known. The study also indicates the importance of skill-based programs that assist individuals in developing resilience through their usage. The body requires proper sleep duration changes, as it plays a crucial role in stress management and fear reduction. Recent studies have shown that people suffering from asymptomatic COVID-19 and early long COVID experience insomnia, short sleep durations, and daytime drowsiness. These effects result in increased symptoms of PTSD, which individuals experience. These two factors combine to form different categories of PTSD risks, which occur after COVID-19, and they have specific requirements.[5]

Based on the complex association between "post-traumatic stress" symptoms, perceived vulnerability, resilience, and sleep duration, the current study seeks to explore the association between feelings of vulnerability, resilience, and sleep duration and the co-occurrence of post-traumatic stress (PTS) symptoms in COVID-19 survivors. The expected findings suggest that acknowledging these overlapping experiences could enrich trauma-informed care in the wake of COVID-19. Such insights may also aid in pinpointing high-risk groups, particularly those who view themselves as highly vulnerable and grapple with ongoing sleep disturbances. The study also points out protective resources, like resilience, that can be applied in a stepped-care approach. On a larger scale, this evidence can guide screening procedures in post-COVID clinics and community programs. It can also support brief resilience-building and sleep hygiene efforts, along with the addition of mental health services in long-COVID care. Consistent with previous research, higher perceived vulnerability and short sleep duration are expected to relate more to PTSD symptoms, while resilience is predicted to act as a protective factor.

REVIEW OF LITERATURE

1. Review Related to Perceived Vulnerability

Bok et al., [3] explored the relationship between perceived disease vulnerability, COVID-19 fear, and vaccine hesitancy, which was identified as the three core variables in the original problem. The study aimed to clarify the interaction between these variables and vaccine conspiracy beliefs in influencing vaccination decisions. Using path analysis on a large U.S. sample, the study revealed that higher perceived disease vulnerability was associated with lower vaccine hesitancy and higher COVID-19 fear, this fear also reduces vaccine hesitancy. The study demonstrated that when people feel more vulnerable and fearful, even those who hold conspiratorial beliefs might be more willing to get vaccinated. It also stressed the need to adapt public health messages to focus on personal disease risk. This approach could help counter vaccine resistance driven by misinformation.

Martins et al.,[13] examined the factor structure of the Portuguese version of the Perceived Vulnerability to Disease Scale (PVD) to investigated differences in chronic concerns about the transmission of infectious diseases. The data were collected from a Portuguese convenience sample of 1,203 participants collected during the first COVID-19 lockdown, applying exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The results showed that a three-factor model superior fil compared to the two-factor model usually used for the original 15-item PVD and the 10-item Portuguese version. This additional factor highlighted a more detailed understanding of perceived resistance to infectious diseases. This change may reflect the increased awareness during the pandemic. As a result, the PVD was able to assess more dimensions of perceived vulnerability and resistance in pandemic situations.

2. Review Related to Resilience as a Protective Factor

Scoglio et al., [18] investigated the role of pre-pandemic psychological resilience about coping styles during the COVID-19 pandemic for healthcare professionals with prior trauma. The longitudinal data from 13,143 women of the Nurses' Health Study II were used. Resilience was assessed between 2018 to 2019, while coping strategies were measured from May to August 2020. Using multiple linear regressions, it was shown that persons with higher resilience in the pre-COVID-19 period were more likely to engage in approach coping ($\beta = 0.06$). However, less likely to utilize avoidant coping ($\beta = -0.39$). Resilience was linked with adaptive coping mechanisms, while negatively linked with maladaptive coping mechanisms such as self-blame, behavioral disengagement, substance use, and distraction. these findings suggested that increasing the psychological resilience of an individual after a traumatic event might increase the usage of adaptive coping mechanisms in response to larger stress events in the future, promoting opportunities for targeted interventions in vulnerable populations.

Godara et al.,[8] examined the contemporary models of resilience and vulnerability during the first two years of COVID-19. The study recognized the pandemic as a collective stressor that recurred repeatedly at different times, the study proposed the Wither or Thrive Model of Resilience. This framework expands on existing psychological resilience theories (1) shifting from narrow single-scale approaches to a broader view of resilience and vulnerability that includes markers of non-clinical mental health like well-being, (2) identifying different paths of resilience and vulnerability in response to ongoing and repeated stressors, and (3) considering various influencing factors, such as social cohesion and how individuals process information. The model facilitates detailed analysis of pandemic mental health data. From this model, a clear method can replace current research and policy efforts. This can lead to practical public health strategies and interventions designed to protect vulnerable groups during ongoing and future pandemic situations.

3. Review Related to Sleep Duration and Trauma

Mei et al.,[14] aimed to explore the sleeping and neuropsychological features shown by patients with post-traumatic stress disorder (PTSD) due to COVID-19 in Wuhan, two years post-pandemic inception. Through PSG monitoring and neuropsychological testing conducted on 42 insomnia patients seen between December 2021 and May 2022 at a Sleep Medicine Centre, three categories of participants were divided: PTSD group (post-COVID-19 PTSD insomnia), non-PTSD insomnia, and healthy controls. The PTSD group suffered from more severe sleep disturbances, neuropsychological symptoms, and abnormal PSG changes than the non-PTSD group. Divergencies were found across subtypes of COVID-19 regarding the disease course, sleep disturbances, symptoms of mental health, and PSG data.

Anxiety and depression felt emotionally were reported by PTSD patients without self-relief over time, especially in severe or critical COVID-19. The study stressed prolonged monitoring and focused interventions for sleep and mental health among post-COVID-19 PTSD sufferers.

Ahmed et al.,[2] investigated the long-term effects of COVID-19 on sleep and mental health, specifically focusing on how psychiatric outcomes are related to the severity of the initial disease. The study evaluated 182 studies within six months after COVID-19 infection. Participant were categorized into three severity groups based on WHO criteria: non-severe (n=101), severe (n=60), and critical (n=20). The study employed the Pittsburgh Sleep Quality Index (PSQI), PTSD Checklist for DSM-5, and Symptom Checklist-90 to evaluate the variables. The findings indicated that 91.2% of the participants had psychiatric symptoms. Reported conditions included poor sleep (64.8%), PTSD (28.6%), somatization (41.8%), anxiety (28%), phobic anxiety (24.2%), OCD (19.8%), depression (11.5%), and psychoticism (17.6%). Sleep disturbance appeared to be associated with diabetes, oxygen therapy, and the use of mechanical ventilation. Additionally, a high neutrophil/lymphocyte ratio was matched with PTSD. There were a greater number of critical cases linked to PTSD, anxiety, and psychosis. According to the findings, female gender, diabetes, respiratory support, and an elevated Neutrophil-to-Lymphocyte Ratio (NLR) were identified as the principal risk factors for mental illness post COVID-19.

4. Review Related to Post-Traumatic Stress during COVID-19 Pandemic

Mohammad et al.,[15] investigated peritraumatic stress symptoms in COVID-19 survivors in Iraq, considering the pandemic as a traumatic event given the risk of death, burdened hospitals, and establishment of a weak healthcare system in the country. Using the PTSD Checklist for DSM-5, the study sampled 370 survivors, including 148 females and 222 males, from different Iraqi governorates. Results showed that 31.1% scored above the cutoff of 23, indicating probable PTSD, with no major differences between females and males. One key factor predicting probable PTSD was education, having a postgraduate degree was linked to higher odds of probable PTSD compared to having primary or no education. A longer infection duration was also tied to a much higher risk of PTSD. This first-ever study in Iraq highlights serious systemic healthcare needs for improvement, including the engagement of trained social workers and psychologists who could provide psychological first aid at hospitals.

Qiu et al.,[17] conducted a systematic review and meta-analysis to estimate the pooled prevalence of post-traumatic stress symptoms in those who experienced trauma during the COVID-19 outbreak. The study searched various databases left until 14 October 2020, identified 76 studies including 106,713 participants, among whom 33,810 had reported PTSS. Using R software for statistical analysis, the pooled prevalence was set at 28.34 per cent (95% confidence interval: 23.03 to 34.32 per cent). Subgroup analysis pointed to higher prevalence in older individuals, in males, and in studies with the larger sample sizes. However, after adjusting for other factors, meta-regression analysis stated that gender and sample size were no longer significant predictors. Thus, the findings demonstrated a great burden of mental health affecting PTSS in populations affected by the COVID-19 pandemic.

Research Gap

This study aims to investigate the interconnection that may be seen to be existing between the concepts of perceived vulnerability, resilience, and sleep duration as predictors of post-traumatic stress (PTS) that may be seen to affect COVID-19 survivors. While previous studies have shown the importance of each individual concept, there is still limited knowledge regarding the interaction of all three

concepts and their combined role in the onset of PTS that may affect COVID-19 victims. Perceived vulnerability, resilience, and sleep disturbances have all been seen to be crucial in the prediction and role played in the onset of post-traumatic stress, and yet there is limited knowledge regarding their interaction and how it may be able to be utilized to assist in the recovery from trauma.

Objectives

- To identify critical predictors of "post-traumatic stress" symptoms among perceived vulnerability, resilience, and shorter sleep duration.
- To recommend psychological support strategies to reduce post-traumatic stress in COVID-19 survivors with high vulnerability and short sleep duration.

Hypothesis

H1a. The regression coefficient to predict "post-traumatic stress" based on shorter sleep duration is other than zero.

H1b. The regression coefficient to predict "post-traumatic stress" based on perceived vulnerability is other than zero.

H1c. The regression coefficient to predict "post-traumatic stress" based on resilience is other than zero.

RESEARCH METHODOLOGY

The present study made use of a quantitative research methodology to assess the psychological effects of COVID-19 on survivors in Aurangabad District, Maharashtra. A sample size of 400 participants was selected, consisting of 200 males and 200 females. A similar proportion of 200 participants from metropolitan regions and 200 participants from rural regions was selected. A three-category classification was made based on age groups: 18 to 35, 35 to 60, and above 60. A purposive method was used to ensure adequate representation of all significant demographic groups, thus ensuring generalizability of results. Established data collection instruments were used. The Short Post-Traumatic Stress Disorder Rating Interview (SPRINT) measured the levels of post-traumatic stress disorder. The Perceived Vulnerability to Disease Questionnaire (PVDQ) measured subjective vulnerability. The Brief Resilience Scale (BRS) measured the levels of resilience, whereas the Insomnia Severity Index (ISI) measured the levels of sleep disturbances. A socio-demographic questionnaire was used to obtain background information from the respondents. The research utilized various statistical tools such as MS Excel and SPSS version 26. The research employed various statistical techniques such as mean, standard deviation, and regression analysis. These techniques allowed the researchers to analyze the correlation, predictor, and hypothesis to determine the reliability and validity.

RESULTS

- **Results Based on Demographics**

Table 1: The Respondents' Demographic Profile

Sr. no.	Demographic Characteristics	Category	N	%
1.	Gender	Male	200	50.0%
		Female	200	50.0%
2.	Age	18–35 years	187	46.8%
		36–60 years	122	30.5%
		Above 60 years	91	22.8%
3.	Educational Qualification	Higher Secondary	135	33.8%
		Graduate	113	28.2%
		Postgraduate	97	24.3%
		Doctoral	55	13.8%
4.	Marital Status	Married	209	52.3%

		Single	191	47.8%
5.	Inhabitant	Rural	200	50.0%
		Urban	200	50.0%
6.	Profession	Student	52	13.0%
		Daily Wage Worker	87	21.8%
		Farmer	70	17.5%
		Self-employed	49	12.3%
		Private Sector Employee	77	19.3%
		Government Employee	65	16.3%

The table shows that male and female participants in the study have equal representation. There are 200 male respondents, making up 50.0%, and 200 female respondents, also at 50.0%. The age group of 18 to 35 years showed the highest response rate with 187 participants who made up 46.8% of total respondents. Next, there are 122 respondents aged 36 to 60, accounting for 30.5%. The group of respondents includes 91 individuals who are above 60 years old which represents 22.8% of total respondents. The data shows that participants come from three different age groups which include younger individuals and middle-aged people and older adults. The sample shows educational diversity as 135 respondents (33.8%) achieved higher secondary education while 113 respondents (28.2%) completed their undergraduate degrees and 97 respondents (24.3%) earned postgraduate degrees and 55 respondents (13.8%) obtained doctoral degrees. The data regarding the marital status shows that married individuals were 209, forming 52.3%, and single individuals were 191, forming 47.8%, indicating that both categories are equally represented in the data, with a slight edge for married individuals. The number of rural and urban background individuals is equal, with 200 from each category, forming 50.0%, thereby ensuring equal representation for both. The highest number of individuals from any occupation are daily wage workers, forming 87, or 21.8%, followed by private sector workers, forming 77, or 19.3%, then farmers forming 70, or 17.5%, government employees forming 65, or 16.3%, then students forming 52, or 13.0%, and finally self-employed individuals forming 49, or 12.3%. This shows a highly diverse occupational group.

- **Results Based on hypothesis**

H1a. The regression coefficient to predict "post-traumatic stress" based on shorter sleep duration is other than zero.

Table 2: Regression Analysis

Hypothesis	Regression Weights (B)	Beta Coefficient	R	R^2	F	t-value	p-value	Result
H1a: The regression coefficient to predict "post-traumatic stress" based on shorter sleep duration is other than zero.	-0.646	-0.540	0.540	0.292	164.039	-12.808	0.000	Supported

According to Table 2, Regression analysis indicates that reduced sleep duration significantly predicts elevated levels of post-traumatic stress. A negative beta (β) coefficient of -0.540 signifies that an increase in post-traumatic stress correlates with a reduction in sleep duration. The correlation coefficient ($R = 0.540$) indicates a strong association, while the coefficient of determination ($R^2 = 0.292$) reveals that sleep

duration explains 29.2% of the variation in post-traumatic stress. The substantial F-value (164.039) and very significant t-value (-12.808) at $p < 0.001$ validate the model's stability. Consequently, hypothesis (H1a) is supported, indicating that sleep length is essential in influencing post-traumatic stress.

H1b. Regression coefficient to predict "post-traumatic stress" based on perceived vulnerability is other than zero.

Table 3: Regression Analysis

Hypothesis	Regression Weights	Beta Coefficient	R	R^2	F	t-value	p-value	Result
H1b: Regression coefficient to predict "post-traumatic stress" based on perceived vulnerability is other than zero.	0.156	0.448	0.448	0.201	99.905	9.995	0.000	Supported

According to Table 3, Regression analysis indicates that perceived vulnerability positively predicts post-traumatic stress disorder (PTSD). The standardized beta coefficient $\beta = 0.448$ indicates a moderate connection, suggesting that increased perceived vulnerability is associated with elevated levels of PTSD. The R-value of 0.448 indicates a substantial correlation, however $R^2 = 0.201$ reveals that merely 20.1% of the variance in PTSD can be anticipated based on a solitary predictor factor specifically, perceived vulnerability. The elevated F-statistic (99.905) and the extremely significant t-value (9.995, $p < 0.001$) validate the robustness of the model. The findings support the acceptance of Hypothesis H1b and suggest that perceived vulnerability is a significant predictor or risk factor in PTSD.

H1c. Regression coefficient to predict "post-traumatic stress" based on resilience is other than zero.

Table 4: Regression Analysis

Hypothesis	Regression Weights	Beta Coefficient	R	R^2	F	t-value	p-value	Result
H1c: Regression coefficient to predict "post-traumatic stress" based on resilience is other than zero.	-0.588	-0.556	0.556	0.309	178.192	-13.349	0.000	Supported

Regression analysis in Table 4 indicates that resilience is a strong negative predictor of post-traumatic stress disorder (PTSD). The standardized beta coefficient ($\beta = -0.556$) indicates a robust negative correlation; whereby increased resilience diminishes PTSD symptoms. The correlation coefficient of 0.556 indicates a moderate-to-strong association, while the coefficient of determination $R^2 = 0.309$ demonstrates that resilience accounts for 30.9% of the variance in PTSD scores, with the remainder attributable to other variables. The substantial F-statistic (178.192) and significant negative t-value (-13.349, $p < 0.001$) combined provide compelling evidence supporting this effect. The results validate Hypothesis H1c, so establishing resilience as an essential protective feature in trauma recovery.

DISCUSSION

The findings from the study revealed that lack of sleep was a significant predictor for

increased levels of post-traumatic stress, and this revealed that sleep is actually a restorative mechanism that helps in the recovery from trauma. The regression analysis from the results obtained from Table 2 revealed that sleep duration led to increased levels of post-traumatic stress, as indicated by the negative beta (-0.540), and this revealed a strong correlation ($R = 0.540$) and variance (29.2%) ($R^2 = 0.292$). The testing results revealed strong results, as indicated by the large F-value (164.039) and the highly significant t-value (-12.808, $p < 0.001$). The findings from the study revealed that lack of sleep acted as an indicator and as the major factor that determined the severity of stress, and this revealed the impact that sleep has on emotional control and mental strength. Previous studies have revealed the impact that sleep has on the results obtained in trauma-related situations. Germain[7] observed that sleep disturbances are characteristic of post-traumatic stress disorder, with reduced duration and insomnia exacerbating ongoing distress. In support of this, Kobayashi et al.,[10] conducted a meta-analysis that affirmed trauma-exposed individuals exhibited consistently shorter and less efficient sleep, closely associated with symptom severity. Together, these investigations identified sleep disturbance as a critical clinical marker of trauma pathophysiology. Extending this evidence, Koffel et al.,[11] established that sleep disturbances were predictive indicators of the beginning and duration of PTSD, hence providing predictive capacity for problematic sleep-in trauma trajectories. This study improved existing understanding by providing predictive potential through a thorough regression methodology, which extends beyond simple correlations. This study found sleep duration to be a clinically relevant issue, highlighting the potential of sleep interventions to reduce post-traumatic stress.

The results revealed that perceived vulnerability was a significant predictor of high levels of post-traumatic stress. This emphasizes the role of perceived threat in cognitive processes related to trauma. According to Table 3, the results of the regression analysis revealed that perceived vulnerability moderately predicted PTSD with a high correlation coefficient of $R = 0.448$ and an R^2 value of 20.1% while the F-statistic and t-value were 99.905 and 9.995, respectively. In their longitudinal study of adolescents, Isaksson et al.,[9] found that heightened perceived stress due to exposure to community violence forecasted increased future PTSD symptoms, highlighting the predictive power of subjective vulnerability in determining subsequent trauma outcomes. In medical care, Boyraz et al.,[4] indicated that perceived vulnerability to COVID-19 was positively correlated with traumatic stress, with health-related anxieties and isolation serving as mediating variables, implying that perceived vulnerability acted as a distress trigger independent of actual exposure. A prospective study of cases from the emergency department by Moss et al.,[16] indicated that perceived threat in medical crises was a strong and independent predictor of PTSD symptom severity at follow-up, demonstrating the importance and efficacy of vulnerability assessment. Regression analyses for this study assessed to verify that perceived vulnerability was related to and a statistically significant predictor of PTSD outcomes. The investigation contributed to the literature by developing perceived vulnerability as a risk factor that can be objectively measured and intervened upon, ahead of other concerns. It has great potential for clinical relevance: initial treatments that modify threat appraisals, for example cognitive restructuring or resilience training, can considerably reduce the prevalence and severity of PTSD in people who are exposed to trauma.

The study also discovered that resilience negatively predicted post-traumatic stress. Individuals with high resilience showed many fewer PTSD symptoms, which

supports resilience as a strong way to cope with trauma. Regression analysis in Table 4 indicates that resilience (β = -0.556) significantly decreases PTSD symptoms with a clear effect size of 30.9% of the variance explained (R^2 = 0.309). F-statistic (178.192) and t-value (-13.349, $p < 0.001$) verify the significance of this effect. According to Galatzer-Levy et al.,[6] found that resilient behaviors were most common after trauma and explained resilience as the usual path to mental stability. Building on this, Lee (2019) demonstrated that perceived social support buffered trauma exposure on PTSD symptoms for firefighters, therefore highlighting social variables in reinforcing protection from trauma. Similarly, Szabo et al.[20] demonstrated that higher resilience was connected to less severe PTSD and depression severity for survivors of natural disasters, therefore highlighting its role in protecting varied groups of people. The current regression demonstrated that resilience was a significant contributor to variance in PTSD. It suggests that interventions designed to improve resilience through formal coping skills training, strength-based therapies, or social support enhancement may reduce the incidence of PTSD and promote lasting recovery for those exposed to trauma.

CONCLUSION

This study found predictors of post-traumatic stress based on perceived vulnerability, sleep duration, and resilience among COVID-19 survivors. Short sleep duration and heightened vulnerability perception significantly increased PTSD symptoms, but resilience served as a strong mitigating factor. The conclusion suggests that the effects of trauma depend on the degree of exposure and the availability of mental resources and behavioral orientation. By examining these three variables together, the current study contributes to the growing literature establishing that treatments must target risk and protective variables to enhance trauma healing. These results have implications for applied clinical procedures from instrument construction to screening to sleep-based treatments for post-pandemic care.

The study has several limitations despite the valuable findings obtained from it. The study results relied on self-report data, and the participants showed either recall difficulties or social desirability bias. The study results are limited to the Aurangabad district, as the study was restricted to a certain geographical area, i.e., Aurangabad district. The study design used cross-sectional research, which restricted the assessment of causality as it only showed the mental conditions of the participants at a certain time rather than their entire lifetime pattern.

Longitudinal studies will be valuable to observe the adaptation processes of survivors and to determine the causative tendencies. The findings from the current study will be useful to investigate various cultural groups and geographical locations as per the need for further research. More studies focusing on therapies that emphasize building resilience, cognitive restructuring, and sleep hygiene may provide useful avenues to consider for trauma prevention and treatment. The development of these areas will be helpful to provide trauma-informed care and mental health services in the post-pandemic world.

Declaration by Authors

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