Neuropsychiatric Disease and Treatment

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

A Cross-Sectional Survey on Psychological Health and Influencing Factors Among 2628 Asymptomatic and Mild COVID-19 Patients in Fangcang Shelter Hospital

Min Zhao[1], Fei-xiang Liu[1,*], Xiao-lin Wang[2,*], Ya-hui Gao[2], Xiang Li[3,4]

[1]The First Affiliated Hospital of Henan University of Chinese Medicine, Zhengzhou, Henan Province, People's Republic of China; [2]The First Clinical Medical School, Henan University of Chinese Medicine, Zhengzhou, Henan Province, People's Republic of China; [3]State Key Laboratory for Diagnosis and Treatment of Infectious Diseases, National Clinical Research Center for Infectious Diseases, Collaborative Innovation Center for Diagnosis and Treatment of Infectious Diseases, The First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, People's Republic of China; [4]Research Units of Infectious Disease and Microecology, Chinese Academy of Medical Sciences, Hangzhou, People's Republic of China

*These authors contributed equally to this work

Correspondence: Fei-xiang Liu, No. 19 Renmin Road, Zhengzhou, 450008, People's Republic of China, Email spiritofwestlfx@126.com

Purpose: The Coronavirus disease 2019 (COVID-19) remains a global public health concern. Many people have been forced to change their lifestyles, which has led to psychological and sleep problem. This study aims to investigate the psychological health problems and factors among patients in the Fangcang Shelter Hospital (FSH) during the COVID-19 pandemic.

Patients and Methods: A Cross-Sectional survey was conducted to investigate the sleep, anxiety, depression and stress disorders of 2628 asymptomatic and mild patients treated in FSH of Zhengzhou, Henan Province, from 30 October to 6 December 2022, by scanning a WeChat two-dimensional code. Sociodemographic data and influencing factors in FSH were collected, Insomnia Severity Index (ISI), 9-item Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), and Impact of Event Scale-Revised (IES-R) were administered. Descriptive statistics, *t*-tests or analysis of variance, Spearman or Pearson correlation analysis, and multivariate regression analysis were used to explore the relationships between different variables and their impact on psychological health indicators.

Results: The proportions of patients with insomnia, depressive disorder, anxiety, and stress disorders were 33.49%, 35.80%, 31.74%, and 43.57%, respectively. Spearman correlation analysis demonstrated that factors such as gender, higher education level, positive nucleic acid test results, longer illness duration, underlying diseases, and extended electronic device use were associated with elevated psychological distress scores. Notably, within FSH, extended exposure to light, a noisy environment, and sleep schedule management significantly impacted the prevalence of insomnia, depression, anxiety, and stress disorders ($p<0.01$). Multivariable binary logistic regression analysis identified higher education level, light exposure, noisy environment, sleep management, and electronic device usage as the primary risk factors for psychological distress.

Conclusion: Patients in FSH face psychological distress influenced by sociodemographic factors, environment, and lifestyle, highlighting the need for integrated psychological support in healthcare, particularly in temporary medical facilities during crises.

Keywords: anxiety, COVID-19, depressive disorder, insomnia, stress disorders

Introduction

Coronavirus disease 2019 (COVID-19), caused by the novel coronavirus SARS-CoV-2, is marked by rapid transmission, multiple routes of spread, high infectivity, and susceptibility among the population.[1,2] The global response to the COVID-19 pandemic has underscored not only its widespread impact, but has also exposed a significant surge in psychological strain among individuals.[3,4] A survey conducted during the pandemic revealed increased levels of mild

Received: 15 November 2023
Accepted: 10 January 2024
Published: 16 January 2024

depression, generalized anxiety, sleep problems, and psychological stress disorders among pregnant women, significantly higher than pre-pandemic levels.[5] Moreover, residents in epidemic hotspots, especially women and young people, have reported severe insomnia.[6]

Reflecting on previous respiratory outbreaks and the psychological aftermath of viral epidemics, it is crucial for governments to establish robust mental health services to mitigate mental disorder risks. Early in the pandemic, various countries, including China, implemented measures such as mandatory quarantine and social distancing.[7] China, facing challenges like limited medical resources and high population density, established Fangcang Shelter Hospitals (FSH) in cities to manage asymptomatic and mild COVID-19 patients.[8,9] Currently, only three cross-sectional studies focused on patients in FSH have indicated a notable prevalence of anxiety, depressive disorders, insomnia, and stress disorders among them, with higher occurrence rates in comparison to patients undergoing home isolation.[10–12] These studies shed light on the psychological challenges within FSH during the early stages of the COVID-19 outbreak, spanning from January 2020 to 2021. However, there remains a dearth of research examining the psychological status and associated influencing factors among patients undergoing isolation treatment in FSH in China, occurring just prior to the government's relaxation of COVID-19 control measures, after October 2022.

This study specifically aims to investigate the prevalence of insomnia, depression, anxiety, and stress disorders among patients in FSH in Zhengzhou during the COVID-19 epidemic, with a particular focus on the psychological health risks among women and individuals with higher education. And identify potential factors influencing these psychological conditions, exploring whether and how these factors exacerbate or alleviate the mental health of the patients. Additionally, we examine the impact of electronic device usage on mental health. The findings of this study are intended to provide critical insights into psychological impacts during major disease outbreaks and offer valuable guidance for implementing effective psychological interventions in such contexts.

Materials and Methods

Study Sample and Data

A total of 13,640 patients with COVID-19 over 14 years old who were treated in FSH of Zhengzhou City, Henan Province, China, were included in the investigation scope from 30 October to 6 December 2022. It should be noted that to ensure the safety of elderly individuals (>65 years old), pregnant women, infants, postpartum women, lactating women, patients with severe underlying diseases, severe COVID-19 patients, and other patients requiring immediate medical attention were arranged for treatment and observation at designated hospitals by the health authorities. Therefore, these special populations were not included in our study scope.

A cross-sectional survey was conducted using an online questionnaire survey by scanning a WeChat two-dimensional code, and participants had the right to withdraw from the study at any time. We meticulously adhered to the Chinese version of the STROBE cross-sectional reporting guidelines, referencing and implementing them to ensure a systematic and transparent presentation of our research methods, thereby contributing to the overall rigor and reliability of our study.[13] Convenience sampling was adopted as our preferred method to minimize direct contact with patients, demonstrating notable advantages in terms of time efficiency, cost-effectiveness, and logistical feasibility within the specific constraints of our research context. While we acknowledge potential limitations, we firmly believe that convenience sampling represents the most pragmatic choice in this particular scenario.

Inclusion and Exclusion Criteria Inclusion Criteria

All COVID-19 patients participating in this study were diagnosed based on the Diagnosis and Treatment Plan for Novel Coronavirus Infection in China.[14]

Inclusion criteria: (1) Positive results in consecutive nucleic acid tests. (2) Presence of respiratory tract infection as the main clinical manifestation, such as fever, cough, sore throat, runny nose, etc. (3) Asymptomatic with only positive nucleic acid test results; (4) 65>Age>14 years old.

Exclusion Criteria: (1) Participants who did not have a smartphone or were unable to use a smartphone to complete the survey. (2) Participants who were unwilling to cooperate with the survey. (3) Participants with persistent high fever (>3

days), or cough and dyspnea, respiratory rate < 30 breaths/minute, resting state, oxygen saturation > 93% while breathing ambient air. (4) Participants with severe pneumonia or shock, respiratory rate ≥ 30 breaths/minute, resting state, oxygen saturation ≤ 93% while breathing ambient air, arterial partial pressure of oxygen/oxygen concentration ≤ 300 mmHg, progressive worsening of clinical symptoms, and CT scan showing severe lung infection with > 50% lesion progression within 24–48 h.

Theoretical Framework

This study meticulously adhered to ethical standards, including strict data confidentiality and ensuring that all participants were fully informed about the research's purpose and provided their informed consent prior to participation. For participants under the age of 18, informed consent was obtained from their parents or legal guardians, safeguarding the rights and welfare of these minor participants. Conducted in strict compliance with the ethical principles outlined in the 1964 Declaration of Helsinki and its subsequent amendments, the study also received ethical clearance from the Medical Ethics Committee of the First Affiliated Hospital of Henan University of Chinese Medicine (Ethics number: 2022HL-458-01).

Survey Method

The self-designed questionnaire was finalized after expert consultation (involving personal basic information) and pre-survey, and was conducted by trained qualified investigators. The questionnaire consisted of five sections: socio-demographic characteristics, the Chinese versions of Insomnia Severity Index (ISI),[15] 9-item Patient Health Questionnaire (PHQ-9),[16] Generalized Anxiety Disorder-7 (GAD-7),[17] and Impact of Event Scale-Revised (IES-R).[18] Investigators personally assisted patients in completing the questionnaires by scanning a QR code using participants smartphones, providing individual guidance throughout the process, with each questionnaire requiring approximately 5 to 15 minutes for completion. Investigators diligently verify on-site that patients have personally completed the survey questionnaire by meticulously cross-referencing essential details such as the patient's name, gender, and age. For participants who were unable to self-administer the questionnaire due to physiological or educational reasons, the investigators conducted a face-to-face interview and recorded their responses item by item.

To ensure a sample size sufficient to detect effects on psychological health issues, we conducted a detailed sample size calculation based on previous study data. Using PASS software and considering the highest prevalence rate of depression (54.4%), we calculated that a minimum of 1565 participants was needed. Taking into account a potential dropout rate, we increased the total sample size to more than 1957. The final sample size obtained in this study markedly exceeded the initially calculated minimum requirement, thereby substantially reinforcing the reliability and validity of our research findings.

Demographic and Clinical Characteristics

The final confirmed basic data were self-designed and compiled by the researchers, including gender, age, marital status, occupation, education level, presence of underlying diseases (such as hypertension, diabetes, etc.), duration of illness, nucleic acid test results, total daily sleep duration, total daily electronic device usage duration, and other relevant information. The flowchart as shown in Figure 1 illustrated the process of enrolling respondents and outlines the study procedures. It provided a visual representation of the sequential steps involved in participant recruitment, screening, and the progression through various stages of the research.

Research Instruments

ISI was used to assess the participants' sleep quality over the past two weeks. Higher scores indicate more severe insomnia. The scoring range is from 0 to 28, with scores of 0–7 indicating no insomnia, 8–14 indicating mild insomnia, 15–21 indicating moderate insomnia, and 22–28 indicating severe insomnia.

PHQ-9 was used to assess depressive symptoms over the past two weeks. It is one of the recommended depression screening tools by the World Health Organization, based on the diagnostic criteria for major depressive episodes in the DSM-IV. The questionnaire consists of nine items, each scored from 0 to 3, with a total score range of 0–27. Scores of 0–

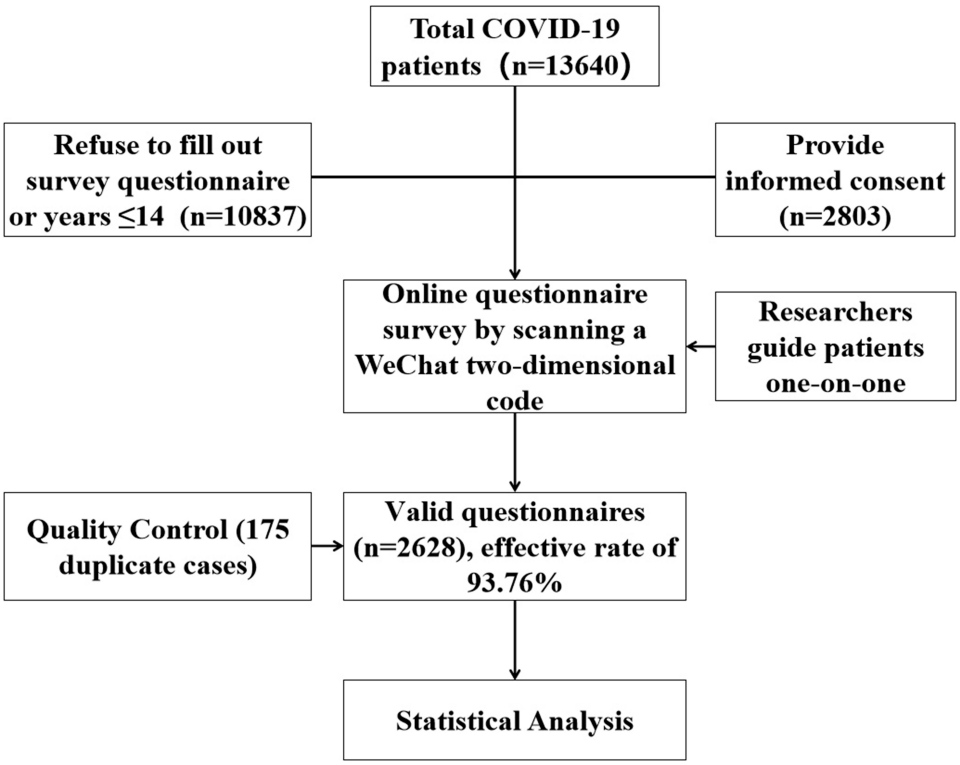

Figure 1 The flowchart of the enrollment of respondents and study procedures.

4 represent "no depression" 5–9 represent "mild depression" 10–14 represent "moderate depression" and scores above 15 represent "severe depression".

GAD-7 scale was used to assess anxiety levels. It is a concise and effective self-rated anxiety scale consisting of seven items, with scoring and rating criteria similar to PHQ-9.

IES-R was used to assess stress disorders related to COVID-19 infection. This scale consists of 11 items, with a total score range of 0–88. The scoring criteria are as follows: 0–8 indicates no post-traumatic stress disorder (PTSD), 9–25 indicates mild PTSD, 26–43 indicates moderate PTSD, and 44–88 indicates severe PTSD.

The Chinese versions of ISI, PHQ-9, GAD-7, and IES-R have been validated and demonstrated good psychometric properties. The validation process involved comprehensive assessments of reliability and validity, affirming the dependability and effectiveness of these scales in measuring pertinent psychological constructs. During the COVID-19 pandemic, our study within FSH faced significant constraints, limiting extensive psychometric testing of environmental factors. Prioritizing rapid data collection, we utilized descriptive analysis to provide valuable insights, albeit less detailed than full psychometric testing. Recognizing this as a study limitation, future research should aim for more in-depth testing. Expert consensus in psychometrics confirms the practical challenges of conducting comprehensive testing in emergency scenarios, validating our methodology under these circumstances.

Quality Control of the Study

To ensure the transparency of our analysis process, we implemented the following measures to avoid duplications or fraud in the online survey. Firstly, technical measures were employed to ensure that each participant could submit only one questionnaire. Logical consistency checks were incorporated into the questionnaire design to identify and eliminate inconsistent or anomalous responses. Additionally, we monitored participant IP addresses to prevent multiple submissions by the same user. Secondly, we analyzed participants who did not complete the questionnaire to identify potential non-response biases. By comparing the characteristics of participants who completed the questionnaire with those who did not, we checked for significant differences that might affect the interpretation of our research findings. Thirdly, to

assess time-related biases, we compared responses from early participants to those from later participants. This helped to reveal any trends or changes that might have occurred during the survey period, which could impact the quality and content of the responses. Lastly, to evaluate potential biases arising from the measurement method, we used diverse formats and scales in our questionnaire design. Furthermore, we assessed common method bias in our data using statistical methods like the Harman's single-factor test.

During the data collection process, it was identified that 175 responses were duplicates, as determined by cross-referencing the hospital numbers of the respondents. To ensure the integrity and accuracy of our data, these duplicate entries were excluded from the analysis. This decision was made to maintain the validity of the dataset, as each entry is intended to represent an individual patient's response. In this context, applying methods such as mean or median imputation to handle these duplicates was deemed inappropriate, as they were not cases of missing data but rather instances of repetition. Our approach aligns with the objective to provide a clear and accurate representation of the surveyed population, thereby ensuring that the results and conclusions drawn from this study are based on reliable and singular patient responses.

Statistical Analysis

In conducting our statistical analysis, we chose methods best suited to the nature of our data and our research objectives. We imported the raw data into SPSS Statistics 27.0 (IBM, USA) for comprehensive analysis. Given the categorical nature of our data, we presented it as frequencies and percentages. To determine correlations between variables such as insomnia, depression, anxiety, and stress disorders severity, we employed Spearman correlation analysis, a non-parametric method ideal for ordinal data. For assessing differences in psychological impacts within FSH, *t*-tests and Dunnett's multiple comparison analysis were utilized, which are robust methods for comparing means across groups. Finally, a multiple logistic regression analysis was employed to identify independent risk factors for psychological conditions, providing odds ratios with 95% confidence intervals. This method is particularly effective in studies like ours where the outcome is binary. Each statistical procedure was carefully chosen to ensure the most accurate and reliable analysis of our data, adhering to the highest standards of research rigor.

Results

General Information

There were 2803 COVID-19 patients completed an electronic survey questionnaire, which accounting for 20.55% of the total number of people. After excluding unqualified questionnaires, a total of 2628 valid questionnaires were obtained, resulting in an effective rate of 93.76%. Among the valid questionnaires, there were 1593 male participants (60.62%) and 1035 female participants (39.38%). The average age was 32.37±13.83 years (Table 1).

Insomnia, Depression, Anxiety, and Stress Disorders Levels of COVID-19 Patients

Among the 2628 cases of COVID-19 infection, 880 cases (33.49%) experienced varying degrees of insomnia, Among them, 40.07% and 33.06% of individuals reported insomnia due to continuous positive nucleic acid testing, inability to leave the centralized isolation facility in a timely manner, and concerns about COVID-19 infection. Additionally, 24.09%, 44.25%, and 11.19% of individuals attributed their insomnia to excessive lighting in the isolation area, noisy environment, and regulations regarding sleep schedules, respectively. A total of 941 patients (35.80%) experienced varying degrees of depressive disorder, Among the patients, 834 cases (31.74%) experienced varying degrees of anxiety, Furthermore, 1145 patients (43.57%) exhibited varying degrees of psychological stress disorders (Table 1).

Analysis of Different Variables with Scores on the ISI, PHQ-9, GAD-7, and IES-R

Those patients of female, higher education levels, underlying medical conditions, shorter daily sleep duration, and longer total usage of electronic devices, had relatively higher scores on the ISI (OR values of 0.069, 0.202, 0.121, −0.385, and 0.100, respectively), PHQ-9 (OR values of 0.070, 0.240, 0.117, −0.205, 0.163, respectively), IES-R (OR values of 0.123, 0.203, 0.120, −0.202, and 0.081, respectively), and GAD-7 (OR values of 0.123, 0.203, 0.120, −0.202, and 0.081, respectively), with

Table 1 Analysis of General Condition of Patients

Variables	Total	Variables	Total
Gender		6~10 d (n=850)	32.34%
Male (n=1593)	60.62%	11~15 d (n=407)	15.49%
Female (n=1035)	39.38%	16~20 d (n=34)	1.29%
Age (years)		>20 d (n=22)	0.84%
14~20 (n=661)	25.15%	Chronic diseases	
21~30 (n=609)	23.17%	No (n=2179)	82.91%
31~40 (n=667)	25.38%	Yes (n=449)	17.09%
41~50 (n=353)	13.43%	Factors in FSH	
65~51 (n=338)	12.86%	A positive of nucleic acid test (n=1053)	40.07%
Marriage		Light (n=633)	24.09%
Unmarried (n=1152)	43.84%	Worry about COVID-19 infection (n=869)	33.07%
Married (n=1304)	49.62%	Noisy environment (n=1163)	44.25%
Divorce (n=82)	3.12%	Sleep management regulations (n=294)	11.19%
Widowed (n=15)	0.57%	No (n=663)	25.23%
Others (n=75)	2.85%	Continuous negative nucleic acid	
Occupation		Yes (n=358)	13.62%
Civil servant (n=19)	0.72%	No (n=2270)	86.38%
Professional technical personnel (n=161)	6.13%	Daily sleep duration	
Staff (n=215)	8.18	<5 h (n=146)	5.56%
Enterprise management personnel (n=84)	3.20%	5~6 h (n=430)	16.36%
Workers and peasants (n=404)	15.37%	6~7 h (n=725)	27.59%
Student (n=724)	27.55%	>7 h (n=1327)	50.49%
Freelancer (n=438)	16.67%	Daily usage time of electronic products	
Retired personnel (n=64)	2.44%	0~2 h (n=250)	9.51%
Others (n=529)	20.13%	2~4 h (n=612)	23.29%
Education		4~6 h (n=750)	28.54%
Primary school and below (n=175)	6.66%	>6 h (n=1016)	38.66%
Junior high school (n=646)	24.58%	After turning off light, continue to use electronic product	
High school or technical secondary school (n=709)	26.98%	0~0.5 h (n=790)	30.06%
College and undergraduate (n=1040)	39.57%	0.5~1 h (n=839)	31.93%
Master degree or above (n=58)	2.21%	1~1.5 h (n=408)	15.53%
Days		1.5~2 h (n=287)	10.92%
0~5 d (n=1315)	50.04%	>2 h (n=304)	11.57%

statistically significant differences ($p<0.01$) (Table 2). On the other hand, younger patients had higher scores on the PHQ-9 and IES-R (OR values of −0.041 and 0.080, respectively), with statistically significant differences ($p<0.01$) (Table 2). Moreover, patients with continuous positive nucleic acid testing results were more likely to experience insomnia (OR values of 0.056), with statistically significant differences ($p<0.01$) (Table 2).

Results of the Analysis Between Different Factors in FSH with ISI, PHQ-9, GAD-7, and IES-R

The Dunnett multiple comparison analysis of the different influencing factors in FSH showed the following results. The sleep schedule management regulations had the greatest impact for ISI and IES-R Scores ($p<0.01$), while noise had a relatively smaller impact compared to other factors ($p<0.01$). The impact of lighting exposure was the greatest impact for GAD-7 and IES-R Scores ($p<0.01$), while environmental factors had a relatively smaller impact compared to other factors ($p<0.01$) (Table 3).

Table 2 Comparison and Correlation Analysis of ISI, PHQ-9, GAD-7, and IES-R Scores Under Different Variables

	Variables	ISI	*r*	*p*	PHQ-9	*r*	*p*	GAD-7	*r*	*p*	IES-R	*r*	*p*
Gender	Male	5.83±5.11	0.069	0.000	3.83±4.90	0.070	0.000	2.82±4.12	0.123	0.000	11.11±14.38	0.123	0.000
	Female	6.61±5.54			4.45±5.17			3.89±4.77			14.95±17.16		
Age	14~20	5.46±4.47	0.005	0.787	3.83±4.52	−0.041	0.035	2.67±3.81	0.025	0.201	9.51±13.02	0.080	0.000
	21~30	6.43±5.28			4.38±5.04			3.44±4.45			13.29±15.57		
	31~40	6.84±5.75			4.33±5.31			3.67±4.80			13.96±16.39		
	41~50	6.14±5.29			3.90±5.00			3.56±4.50			15.44±17.48		
	65~51	5.23±5.64			3.21±4.72			2.32±3.70			12.34±14.50		
Marriage	Unmarried	5.97±4.84	0.008	0.692	4.22±4.74	0.062	0.002	2.98±4.03	−0.019	0.335	11.36±14.25	−0.068	0.000
	Married	6.24±5.72			3.90±5.15			3.45±4.68			13.91±16.75		
	Divorce	6.83±4.78			4.26±5.23			2.88±3.75			11.62±13.68		
	Widowed	7.40±7.22			4.80±6.86			4.87±7.26			10.87±13.49		
	Others	5.89±4.37			4.41±5.94			3.77±5.07			11.09±16.94		
Occupation	Civil servant	6.42±4.82	−0.015	0.448	3.58±4.55	−0.031	0.115	2.84±3.66	−0.028	0.155	12.47±13.41	−0.026	0.188
	Professional technical personnel	5.73±5.24			3.78±5.13			3.23±4.18			14.80±17.10		
	Staff	6.79±5.46			4.48±5.01			3.53±4.66			13.66±16.20		
	Enterprise management personnel	7.30±6.23			4.19±5.51			3.77±5.13			15.51±17.89		
	Workers and peasants	6.13±5.56			4.13±5.42			3.55±4.78			13.28±16.60		
	Student	5.83±4.69			3.94±4.77			2.80±3.98			10.07±13.38		
	Freelancer	6.24±5.41			3.98±4.82			3.29±4.33			13.50±16.06		
	Retired personnel	5.02±5.16			3.27±4.43			2.52±3.78			10.59±14.01		
	Others	6.28±5.54			4.31±5.13			3.49±4.65			13.61±16.24		
Education	Primary school and below	5.98±5.53	0.202	0.000	2.90±3.65	0.240	0.000	2.37±3.89	0.203	0.000	10.87±15.08	0.191	0.000
	Junior high school	6.07±5.44			4.23±5.26			3.37±4.69			13.01±15.74		
	High school or technical secondary school	5.84±5.28			3.72±4.67			3.05±4.30			11.46±15.10		
	College and undergraduate	6.35±5.11			4.34±5.04			3.28±4.26			13.08±15.61		
	Master degree or above	6.34±5.57			3.75±4.93			3.23±4.43			12.70±16.11		
Days	0~5 d	6.29±5.18	−0.028	0.155	3.92±4.72	0.026	0.186	3.14±4.24	0.039	0.044	12.67±15.06	−0.013	0.520
	6~10 d	5.82±5.40			4.11±5.24			3.20±4.41			12.28±15.94		
	11~15 d	6.17±5.30			4.34±5.31			3.36±4.68			12.50±16.32		
	16~20 d	5.91±4.55			4.27±5.12			4.88±5.12			18.49±19.61		
	>20 d	8.58±7.95			6.46±6.30			6.33±6.26			16.13±16.62		

(*Continued*)

https://doi.org/10.2147/NDT.S446223

Table 2 (Continued).

	Variables	ISI	*r*	*p*	PHQ-9	*r*	*p*	GAD-7	*r*	*p*	IES-R	*r*	*p*
Chronic diseases	No	5.79±5.12	0.121	0.000	4.15±5.09	0.117	0.000	3.29±4.48	0.120	0.000	12.67±15.70	0.121	0.000
	Yes	7.62±5.77			3.77±4.65			3.05±4.13			12.43±15.44		
Factors in FSH	A positive of nucleic acid test	7.52±5.78	0.442	0.000	5.71±5.68	0.416	0.000	4.73±4.99	0.407	0.000	17.33±17.33	0.429	0.000
	Light	8.26±5.63			6.31±5.71			5.34±5.22			21.18±18.64		
	Worry about COVID-19 infection	8.20±5.45			5.45±5.30			4.24±4.67			15.84±16.74		
	Noisy environment	8.38±5.48			5.32±5.36			4.24±4.69			16.42±16.67		
	Sleep management regulations	9.73±6.15			6.57±6.20			5.53±5.52			18.49±18.77		
	No	2.67±3.32			1.49±3.03			1.08±2.63			5.09±10.05		
Continuous positive nucleic acid	Yes	5.35±4.76	0.056	0.004	3.86±4.55	0.005	0.782	2.81±3.94	0.029	0.133	11.09±14.49	0.037	0.055
	No	6.26±5.37			4.11±5.09			3.31±4.49			12.86±15.81		
Daily sleep duration	<5 h	12.95±6.98	−0.385	0.000	8.42±7.30	−0.205	0.000	6.77±6.02	−0.202	0.000	24.47±20.63	−0.216	0.000
	5~6 h	8.92±5.86			5.51±5.82			4.56±5.39			17.16±18.56		
	6~7 h	6.34±4.57			3.90±4.48			3.13±4.06			12.61±14.69		
	>7 h	4.37±4.12			3.22±4.31			2.49±3.71			9.85±13.37		
Daily usage time of electronic products	0~2 h	5.46±5.67	0.100	0.000	3.54±5.52	0.163	0.000	3.28±5.02	0.081	0.000	12.89±18.52	0.047	0.015
	2~4 h	5.59±5.25			3.27±4.60			2.90±4.21			12.60±15.61		
	4~6 h	6.28±5.17			3.82±4.59			3.03±4.04			12.01±14.35		
	>6 h	6.53±5.29			4.88±5.31			3.60±4.61			13.00±15.80		
After turning off the light, continue to use electronic product	0~0.5 h	4.66±4.64	0.238	0.000	2.60±4.15	0.280	0.000	2.26±3.74	0.185	0.000	10.02±14.30	0.445	0.000
	0.5~1 h	5.82±4.84			3.75±4.59			3.15±4.10			12.85±15.52		
	1~1.5 h	6.99±5.26			4.50±4.58			3.63±4.22			12.18±13.65		
	1.5~2 h	7.16±5.13			5.36±5.07			3.90±4.56			15.02±15.80		
	>2 h	8.74±6.76			7.02±6.78			4.94±6.04			17.08±19.78		

Notes: *r*: Refers to the correlation coefficient. *p*: Indicates whether the model is statistically significant.
Abbreviations: ISI, Insomnia Severity Index; PHQ-9, 9-item Patient Health Questionnaire; GAD-7, Generalized Anxiety Disorder-7; IES-R, Impact of Event Scale-Revised.

Table 3 Multiple Comparisons of ISI, PHQ-9, GAD-7, and IES-R Scores Under Different Influencing Factors

	Comparison	$\lvert X_i–X_0 \rvert$	S ($_{xi–x0}$)	Critical value		*P*
				Lower Limit	Upper Limit	
ISI	Group1 VS Control group	4.856	0.265	4.190	5.520	<0.001
	Group2 VS Control group	5.591	0.297	4.850	6.330	
	Group3 VS Control group	5.538	0.276	4.850	6.230	
	Group4 VS Control group	5.716	0.260	5.060	6.370	
	Group5 VS Control group	7.067	0.378	6.120	8.010	
PHQ-9		4.227	0.261	3.570	4.880	
		4.818	0.291	4.090	5.550	
		3.963	0.271	3.280	4.640	
		3.832	0.255	3.190	4.470	
		5.079	0.371	4.150	6.010	
GAD-7		3.647	0.231	3.070	4.220	
		4.453	0.258	3.810	5.100	
		3.162	0.240	2.560	3.760	
		3.157	0.226	2.590	3.720	
		4.449	0.329	3.630	5.270	
IES-R		12.235	0.822	10.180	14.300	
		16.087	0.918	13.790	18.390	
		10.749	0.855	8.610	12.890	
		11.330	0.805	9.310	13.350	
		13.395	1.170	10.460	16.330	

Notes: *p*: Indicates whether the model is statistically significant. Control group represents the population not affected. Group1 represents the group affected by "Continuous positive nucleic acid". Group2 represents the group affected by "Light". Group3 represents the group affected by "Worry about COVID-19 infection". Group4 represents the group affected by "Noisy environment". Group5 represents the group affected by 'Sleep management regulations'. X_i: The mean score of the scales in groups 1, 2, 3 or 4. X_0: The mean score of the control group. $\lvert X_i–X_0 \rvert$: The absolute value of the mean difference. S($_{xi–x0}$): Standard Error.
Abbreviations: ISI, Insomnia Severity Index; PHQ-9, 9-item Patient Health Questionnaire; GAD-7, Generalized Anxiety Disorder-7; IES-R, Impact of Event Scale-Revised.

Results of Logistic Regression Analysis on Different Variables with ISI, PHQ-9, GAD-7, and IES-R Scores

Logistic regression analysis was performed to analyze the data. The results showed that insomnia was associated with "education level" "sleep duration" "presence of underlying diseases" "duration of electronic device use until falling asleep" and "factors within FSH" (p<0.05 and Exp(B) values within the 95% confidence interval). Among them, "higher education level" "factors within FSH" and "duration of electronic device use" were risk factors. (OR values of 1.296, 8.190, and 1.279, respectively) (p<0.01), while "Longer sleep duration" and "absence of underlying diseases" were protective factors (OR values of 0.443 and 0.550, respectively) (p<0.01) (Figure 2A).

Depressive symptoms was associated with "gender" "presence of underlying diseases" "education level" "total duration of electronic device use" "sleep duration" and "factors within FSH" (p<0.05 and Exp(B) values within the 95% confidence interval). Among them, "longer duration of electronic device use" "higher education level" and "factors within the field hospital" were risk factors (OR values of 1.359, 1.463, and 5.156, respectively) (p<0.05), while "longer sleep duration" "absence of underlying diseases" and "male gender" were protective factors (OR values of 0.672, 0.434, and 0.785) (p<0.05) (Figure 2B).

Anxiety symptoms was associated with "gender" "presence of underlying diseases" "education level" "sleep duration" and "duration of electronic device use until falling asleep" (p<0.05 and Exp(B) values within the 95% confidence interval). Among them, "longer duration of electronic device use" and "higher education level" were risk factors (OR values of 1.204 and 1.506, respectively) (p<0.01), while "longer sleep duration" "absence of underlying diseases" and "male gender" were protective factors (OR values of 0.691, 0.535, and 0.629, respectively) (p<0.05) (Figure 2C).

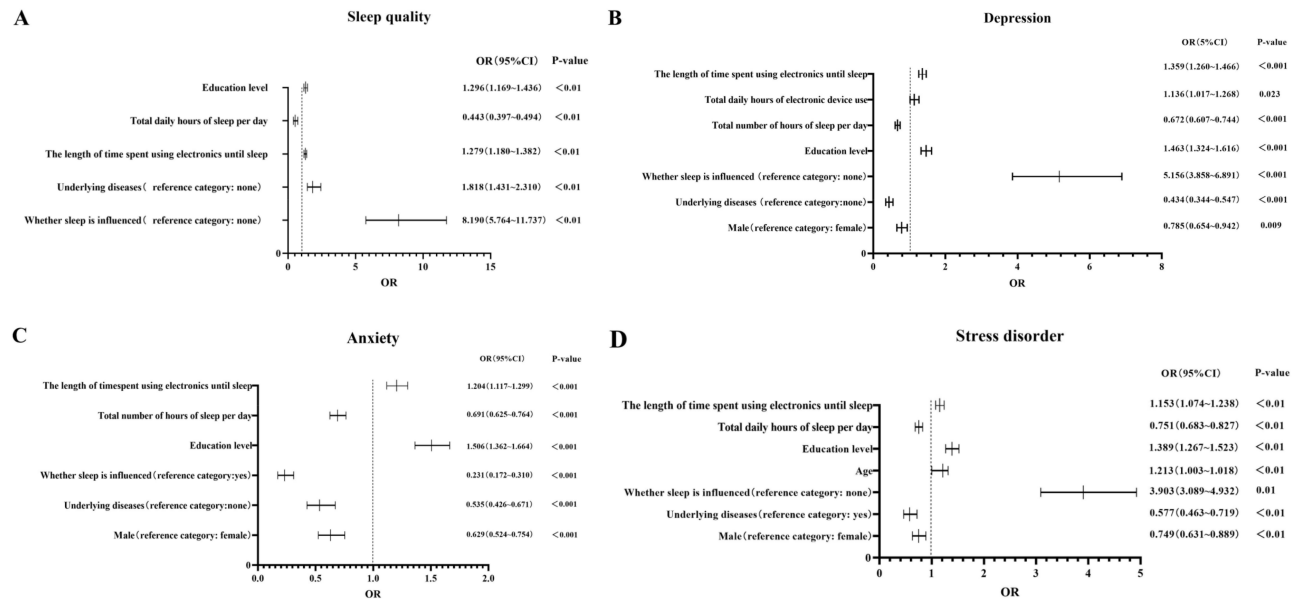

Figure 2 Logistic regression analysis of different factors and mental health.
Notes: (**A**) Logistic regression analysis of different factors and depression. (**B**) Logistic regression analysis of different factors and sleep quality. (**C**) Logistic regression analysis of different factors and anxiety. (**D**) Logistic regression analysis of different factors and stress disorder.
Abbreviations: OR, Odds ratio; 95% CI, 95% confidence interval.

Stress disorders was associated with "age" "gender" "presence of underlying diseases" "factors within the field hospital" "education level" and "sleep duration" ($p<0.05$ and Exp(B) values within the 95% confidence interval). Among them, "higher education level" "age" and "factors within the field hospital" were risk factors (OR values of 1.389, 1.213, and 3.903, respectively) ($p<0.01$), while "Sleep duration" "absence of underlying diseases" and "male gender" were protective factors (OR values of 0.751, 0.577, and 0.749, respectively) ($p<0.01$) (Figure 2D).

Discussion

The establishment of FSH is a major initiative in China's public health prevention and control measures.[19] Patients in FSH are free to move around, and the government provides all necessary living and medical supplies. By admitting asymptomatic and mild COVID-19 patients to FSH, the rapid spread of the virus in the community could be effectively slowed down, which markedly relieving the pressure on the healthcare system and ensuring the safety of vulnerable patients.[20] However, since FSH are public areas, factors such as lighting, noisy, and sleep management regulations inevitably have an impact on the sleep quality, anxiety, depressive disorder, and stress disorders of some individuals.[21] Therefore, quieter spaces should be provided for individuals experiencing severe insomnia, anxiety, and depressive symptoms in FSH.

In this study, we meticulously analyzed the psychological health status of 2803 COVID-19 patients, with a focus on the prevalence and severity of insomnia, depression, anxiety, and stress disorders. Our findings highlight the amplified mental health challenges in the specialized environment of FSH, where environmental stressors such as inadequate lighting, persistent noise, and rigid sleep management regulations significantly exacerbate mental health conditions.

Analyzing the relationship between various demographic and behavioral factors and their impact on mental health, as measured by the ISI, PHQ-9, GAD-7, and IES-R, we found that females, individuals with higher education, those with underlying medical conditions, shorter sleep durations, and extended electronic device usage exhibited higher scores across these mental health indices. This pattern aligns with existing research, highlighting the disproportionate impact of the pandemic on specific populations. In FSH, limited recreational activities lead patients to heavily rely on electronic devices for work, study, and social interaction. However, prolonged use of these devices can cause various mental health issues, including insomnia and disrupted sleep quality due to overexposure to blue light, and increased anxiety and stress disorders from excessive social media use and constant news updates.[22–24]

During the COVID-19 pandemic, women experienced higher rates of insomnia, anxiety, depression, and stress disorders, attributed to physiological and hormonal differences such as menstrual cycles, pregnancy, and menopause.[25–27] Additionally, their increased responsibilities for family health and safety added to their stress disorders and anxiety.[28,29] Individuals with higher education levels also reported higher incidences of these mental health issues, possibly due to information overload and heightened concern about the pandemic's risks.[30–32] Previous studies have shown that insomnia prevalence generally increases with age, but a study during the pandemic in France found higher rates of insomnia among young people, attributed to increased social isolation and economic difficulties.[33,34] Additionally, chronic diseases like hypertension, diabetes, and mental disorders are closely linked to poorer mental health outcomes, underscoring the importance of holistic management of both physical and mental health in these patients.[35–37] Moreover, noise and lighting issues in FSH significantly exacerbated patients' psychological health problems, consistent with the findings of Stansfeld et al in similar environments.[38] However, our study further reveals the roles of factors such as education level and electronic device usage in influencing mental health, which have been less explored in previous research.

In response to these insights, we advocate for a multifaceted approach to enhance mental health care in FSH and similar healthcare settings. This includes improving environmental conditions, such as better lighting and noise control, refining sleep management policies, and providing targeted psychological support and interventions for high-risk groups, especially women and individuals with higher educational levels. Additionally, our study emphasizes the need for healthcare professionals and public health authorities to be mindful of the potential adverse effects of prolonged electronic device usage on mental health, especially during pandemics. Tailored guidelines and recommendations for healthier electronic device usage are crucial.

It is important to acknowledge the limitations inherent in our study. The concentration of our sample population in FSH may not fully represent the diverse experiences of all COVID-19 patients, especially those with severe symptoms or undergoing home isolation. The reliance on online survey methods, while reducing COVID-19 transmission risk, might introduce selection bias and limit the generalizability of our findings. Moreover, the lack of a control group limits our capacity to isolate the specific impacts attributable to FSH environment. Given these limitations, future research should aim for a more inclusive demographic and employ varied data collection methods. This would enable a more comprehensive understanding of the pandemic's extensive impact on mental health across different patient populations and settings.

Conclusion

This study reveals that the psychological health status of patients in Fangcang shelter hospitals is influenced by factors such as gender, education level, duration of illness, underlying diseases, usage of electronic devices, light exposure, noise, and sleep management regulations. These insights underscore the necessity of implementing targeted psychological support and intervention strategies within healthcare settings, particularly in temporary medical facilities. Paying attention to environmental factors and managing patients' lifestyles, alongside medical treatment, is crucial in alleviating the psychological distress experienced by COVID-19 patients. Moreover, our study serves as an essential resource for healthcare providers to understand and address the diverse psychological challenges faced by patients during such unprecedented health crises. Future research should continue to explore a broader population and the effectiveness of psychological health strategies in different medical settings, guiding the development of more effective mental health interventions.

Acknowledgments

This work was supported by the Comparative Study on Traditional Chinese Medicine Technical Intervention, Henan Province Double First Class Initiative Discipline Specialization in Traditional Chinese Medicine Scientific Research (HSRP-DFCTCM-2023-1-06, HSRP-DFCTCM-2023-6-07), Henan Provincial Science and Tech Development Joint Fund (Advantageous Discipline Category) Project (232301420022), and Management of Chronic Insomnia in Henan University of Chinese Medicine (2019JDZX2007), and Evaluation of Therapeutic Effect of Shugan Jianpi Yangxin Prescription on Insomnia Disorder Insomnia in Henan University of Chinese Medicine (2022JDZX004).

Disclosure

The authors report no conflicts of interest in this work.

References

1. Pilz S, Theiler-Schwetz V, Trummer C, Krause R, Ioannidis JPA. SARS-CoV-2 reinfections: overview of efficacy and duration of natural and hybrid immunity. *Environ Res*. 2022;209:112911. doi:10.1016/j.envres.2022.112911
2. Walls AC, Park YJ, Tortorici MA, Wall A, McGuire AT, Veesler D. Structure, Function, and Antigenicity of the SARS-CoV-2 Spike Glycoprotein. *Cell*. 2020;181(2):281–292.e6. doi:10.1016/j.cell.2020.02.058
3. Lin W, Wu B, Chen B, et al. Associations of COVID-19 related experiences with maternal anxiety and depression: implications for mental health management of pregnant women in the post-pandemic era. *Psychiatry Res*. 2021;304:114115. doi:10.1016/j.psychres.2021.114115
4. Bendau A, Kunas SL, Wyka S, et al. Longitudinal changes of anxiety and depressive symptoms during the COVID-19 pandemic in Germany: the role of pre-existing anxiety, depressive, and other mental disorders. *J Anxiety Disord*. 2021;79:102377. doi:10.1016/j.janxdis.2021.102377
5. Zheng Z, Zhang R, Liu T, et al. The psychological impact of the coronavirus disease 2019 pandemic on pregnant women in China. *Front Psychiatry*. 2021;12:628835. doi:10.3389/fpsyt.2021.628835
6. Fu W, Wang C, Zou L, et al. Psychological health, sleep quality, and coping styles to stress facing the COVID-19 in Wuhan, China. *Transl Psychiatry*. 2020;10(1):225. doi:10.1038/s41398-020-00913-3
7. Chaudhuri D, Sasaki K, Karkar A, et al. Corticosteroids in COVID-19 and non-COVID-19 ARDS: a systematic review and meta-analysis. *Intensive Care Med*. 2021;47(5):521–537. doi:10.1007/s00134-021-06394-2
8. Qiu H, Cao S, Xu R. Cancer incidence, mortality, and burden in China: a time-trend analysis and comparison with the United States and United Kingdom based on the global epidemiological data released in 2020. *Cancer Commun*. 2021;41(10):1037–1048. doi:10.1002/cac2.12197
9. Jiang S, Jiang Z, Luo LH, et al. Health protection of CT radiographers during the outbreak of COVID-19: application of automatic positioning technology for relocatable CT in the Fang Cang Hospital. *Front Med*. 2021;8:659520. doi:10.3389/fmed.2021.659520
10. Lu J, Zhao M, Wu Q, et al. Mental health needs of the COVID-19 patients and staff in the Fangcang shelter hospital: a qualitative research in Wuhan, China. *Glob Ment Health*. 2021;8:e33. doi:10.1017/gmh.2021.23
11. Gu Y, Zhu Y, Xu F, Xi J, Xu G. Factors associated with mental health outcomes among patients with COVID-19 treated in the Fangcang shelter hospital in China. *Asia Pac Psychiatry*. 2021;13(2):e12443. doi:10.1111/appy.12443
12. Zhang GY, Liu Q, Lin JY, Yan L, Shen L, Si TM. Mental health outcomes among patients from Fangcang shelter hospitals exposed to coronavirus disease 2019: an observational cross-sectional study. *Chronic Dis Transl Med*. 2021;7(1):57–64. doi:10.1016/j.cdtm.2020.12.001
13. Yin T, Tu W, Zhang S, Li Y, Xu G. Standardized reporting of cross-sectional surveys. *Chin J Health Inspect*. 2017;24(03):210–216. doi:10.3969/j.issn.1007-6131.2017.03.001
14. Chen M, Mu XQ, Zhang XA, et al. Interpretation for the group standards in the handling of accidental leak coronavirus disease 2019 sample. *Zhonghua Liu Xing Bing Xue Za Zhi*. 2020;41(9):1378–1380. doi:10.3760/cma.j.cn112338-20200514-00720
15. Chung KF, Kan KK, Yeung WF. Assessing insomnia in adolescents: comparison of Insomnia Severity Index, Athens Insomnia Scale and Sleep Quality Index. *Sleep Med*. 2011;12(5):463–470. doi:10.1016/j.sleep.2010.09.019IF
16. Luo B, Xiao S. Reliability and validity for Chinese version of the 9-item Shared Decision Making Questionnaire. *Zhong Nan Da Xue Xue Bao Yi Xue Ban*. 2019;44(7):823–829. doi:10.11817/j.issn.1672-7347.2019.180316
17. Xiang Z, Luo X, Zheng R, et al. Associations of greenness surrounding schools and self-reported depressive and anxiety symptoms in Chinese adolescents. *J Affect Disord*. 2022;318:62–69. doi:10.1016/j.jad.2022.08.095
18. Wu KK, Chan KS. The development of the Chinese version of Impact of Event Scale--Revised (CIES-R). *Soc Psychiatry Psychiatr Epidemiol*. 2003;38(2):94–98. doi:10.1007/s00127-003-0611-x
19. Shen B, Chen L, Zhang L, et al. Wuchang Fangcang Shelter Hospital: practices, experiences, and lessons learned in controlling COVID-19. *SN Compr Clin Med*. 2020;2(8):1029–1034. doi:10.1007/s42399-020-00382-1
20. Chen S, Zhang Z, Yang J, et al. Fangcang shelter hospitals: a novel concept for responding to public health emergencies. *Lancet*. 2020;395(10232):1305–1314. doi:10.1016/S0140-6736(20)30744-3
21. Feng Q, Zhou H, Wang L, Kang C. A study on the effect of the pre-go-live training in anxiety and depression of medical staff based on the data of wuhan fangcang shelter hospital during COVID-19 in the era of big data. *Front Public Health*. 2022;10:909241. doi:10.3389/fpubh.2022.909241
22. Hering T. Blaues Licht — einfluss auf Schlafen und Wachen [Insomnia - blue light affects sleep and waking]. *MMW Fortschr Med*. 2020;162(2):56–58. German. doi:10.1007/s15006-020-0107-6
23. Abiddine FZE, Aljaberi MA, Gadelrab HF, Lin CY, Muhammed A. Mediated effects of insomnia in the association between problematic social media use and subjective well-being among university students during COVID-19 pandemic. *Sleep Epidemiol*. 2022;2:100030. doi:10.1016/j.sleepe.2022.100030
24. Fiol-DeRoque MA, Serrano-Ripoll MJ, Jiménez R, et al. A mobile phone-based intervention to reduce mental health problems in health care workers during the COVID-19 pandemic (PsyCovidApp): randomized controlled trial. *JMIR Mhealth Uhealth*. 2021;9(5):e27039. doi:10.2196/27039
25. Parra-Saavedra M, Villa-Villa I, Pérez-Olivo J, et al. Attitudes and collateral psychological effects of COVID-19 in pregnant women in Colombia. *Int J Gynaecol Obstet*. 2020;151(2):203–208. doi:10.1002/ijgo.13348
26. Adjorlolo S, Mensah G, Badzi CD, Spradley FT. Psychosis risk among pregnant women in Ghana. *PLoS One*. 2022;17(2):e0263011. doi:10.1371/journal.pone.0263011
27. MacKinnon AL, Madsen JW, Dhillon A, et al. Sleeping for two: study protocol for a randomized controlled trial of cognitive behavioral therapy for insomnia in pregnant women. *Trials*. 2021;22(1):532. doi:10.1186/s13063-021-05498-w
28. Ali R, Ullah H. Lived experiences of women academics during the COVID-19 pandemic in Pakistan. *Asian J Soc Sci*. 2021;49(3):145–152. doi:10.1016/j.ajss.2021.03.003
29. Kolakowsky-Hayner SA, Goldin Y, Kingsley K, et al. Psychosocial impacts of the COVID-19 quarantine: a study of gender differences in 59 countries. *Medicina*. 2021;57(8):789. doi:10.3390/medicina57080789

30. Carpio-Arias TV, Piedra-Andrade JS, Nicolalde-Cifuentes TM, Padilla-Samaniego MV, Tapia-Veloz EC, Vinueza-Veloz MF. Mobility restrictions and mental health among young adults during the COVID-19 pandemic in Ecuador. *Gac Sanit*. 2022;36(6):512–519. doi:10.1016/j.gaceta.2021.12.008
31. Hoffmann C, Schneider T, Wannous C, et al. Impact of COVID-19 on the private and professional lives of highly educated women working in global health in Europe-A qualitative study. *Front Glob Womens Health*. 2023;4:1009473. doi:10.3389/fgwh.2023.1009473
32. Gémes K, Bergström J, Papola D, et al. Symptoms of anxiety and depression during the COVID-19 pandemic in six European countries and Australia - Differences by prior mental disorders and migration status. *J Affect Disord*. 2022;311:214–223. doi:10.1016/j.jad.2022.05.082
33. Pearson NJ, Johnson LL, Nahin RL. Insomnia, trouble sleeping, and complementary and alternative medicine: analysis of the 2002 National Health Interview Survey data. *Archives of Internal Medicine*. 2006;166(16):1775–1782. doi:10.1001/archinte.166.16.1775
34. Beck F, Léger D, Fressard L, Peretti-Watel P, Verger P; Coconel Group. Covid-19 health crisis and lockdown associated with high level of sleep complaints and hypnotic uptake at the population level. *J Sleep Res*. 2021;30(1):e13119. doi:10.1111/jsr.13119
35. Nguyen HTH, Duong KL, Nguyen ST, et al. Quality of life and its associated factors among cancer patients receiving chemotherapy at oncology hospitals in vietnam after the third wave of the COVID-19 pandemic. *Cancer Manag Res*. 2022;14:2429–2444. doi:10.2147/CMAR.S370034
36. Lallana S, Fonseca E, Restrepo JL, et al. Medium-termeffects of COVID-19 pandemic on epilepsy: a follow-up study. *Acta Neurol Scand*. 2021;144(1):99–108. doi:10.1111/ane.13439
37. Zhu Z, Pan X, Zhong F, Tian J, Ong MLY. What can we learn from the Baduanjin rehabilitation as COVID-19 treatment? A narrative review. *Nurs Open*. 2023;10(5):2819–2830. doi:10.1002/nop2.1572
38. Stansfeld S, Clark C, Smuk M, Gallacher J, Babisch W. Road traffic noise, noise sensitivity, noise annoyance, psychological and physical health and mortality. *Environ Health*. 2021;20(1):32. doi:10.1186/s12940-021-00720-3