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Emotional Responses of Hospital Staff to the DASS-21 Survey During Mass COVID-19 Testing After the Relaxation of Prevention and Control Measures in Zhejiang, China, and Their Change Trajectory

Lifen Lu[1], Di Sheng[1], Xiaowei Xia[2], Guanghui Chen[3], Jiali Liang[4], Xiulan Shen[1], Gui Zheng[1]

[1]Department of Nursing, the First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, Zhejiang, People's Republic of China; [2]Ministry of Health, the Third Hospital of Ninghai County, Ningbo, Zhejiang, People's Republic of China; [3]Ministry of Health, the Liangzhu Street Community Health Service Center, Yuhang District, Hangzhou, Zhejiang, People's Republic of China; [4]Department of Nursing, the First People's Hospital of Yuhang District, Hangzhou, Zhejiang, People's Republic of China

Correspondence: Xiulan Shen; Gui Zheng, Department of Nursing, the First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, Zhejiang, People's Republic of China, Email shenxl@zju.edu.cn; zhenggui1119@zju.edu.cn

Aim: To investigate the emotional response of hospital staff to the Depression Anxiety Stress Scale-21 (DASS-21) over the COVID-19 pandemic and after the relaxation of prevention and control measures in Zhejiang Province, China, and identify influencing factors.

Design: Multicenter online cross-sectional design.

Methods: From January 10, 2023, to January 20, 2023, 1054 hospital employees in Zhejiang, China, were recruited using WeChat. Data was gathered via online, self-administered surveys. *T*-tests and one-way analyses of variance, Pearson's correlation analysis, and multiple linear stepwise regression analyses were used to examine the data.

Results: More than 90% of hospital employees were infected with COVID-19. Through regression analysis, the following variables were found to be independent predictors of emotional response to DASS-21: resilience (−13.346, $P < 0.0001$), sleep (14.689, $P < 0.0001$), friend support (−4.278, $P < 0.0001$), education level (2.699, $P = 0.007$), and marriage (−2.214, $P = 0.027$). The emotional responses were not as severe as predicted, but they were still well above the Chinese norm. A longitudinal comparison of DASS-21 emotional responses with similar studies showed a parabolic downward trend over time.

Conclusion: Our results identified education level, marriage, friend support, resilience, and sleep as independent predictors of emotional responses to the DASS-21 among hospital workers in this outbreak. Improving the mental resilience and sleep status of staff is a key target. Unmarried medical personnel with higher education should be given greater attention and support by management. In addition, there is still room for further improvement in the government and societal responses to similar outbreaks. The study also found a parabolic downward trend in DASS-21 emotional responses among hospital workers during the COVID-19 outbreak over time.

Keywords: COVID-19, hospital staff, DASS-21 emotional response, influencing factors, trajectory of change

Introduction

Coronavirus disease 2019 (COVID-19) is a highly infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] As is well known, the Chinese government issued a notice on November 11, 2022 (www.gov.cn), aiming to further optimize the COVID-19 prevention and control measures and ensure their accuracy and scientific effectiveness. On December 4, Zhejiang Province also issued a notice on optimizing and adjusting relevant measures for epidemic prevention and control (zhihu.com). Three years of strict prevention and control measures such as "regular nucleic acid testing, social restrictions and isolation" were ended. It was 48 days before the Chinese New Year. With the gradual relaxation of epidemic prevention and

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control measures in major cities, a large number of people in society were showing symptoms of COVID-19 infection, such as high fever, cough, and fatigue. In response, the government was forced to take emergency measures, closing factories and schools. At the same time, a panic phenomenon emerged among the population, reflecting the difficulty of seeing a doctor, and the short supply of antipyretic drugs and other related drugs. While hospitals could not be closed, a large number of healthcare staff were similarly showing symptoms of COVID-19 infection. The number of hospital outpatient visits for fever had exponentially increased, exceeding the daily average by more than 20 times. This surge led to a strain on emergency and intensive care unit (ICU) care due to the influx of severe patients, who had endured the arduous process of obtaining medicine, seeing a doctor, and being admitted to the hospital. To cope with this unprecedented pandemic shock, hospitals were forced to take emergency measures, including the integrated management of hospital beds and medical staff, the establishment of simple ICUs in ordinary wards, and the temporary allocation of medical staff irrespective of their specialty. Amidst this situation, the psychological well-being and performance of healthcare professionals have become more critical than ever.[2] To support this, the government prepared further response measures, such as emphasizing the issuance of "anti-epidemic subsidies" and the establishment of temporary pharmacies in communities.

Background

Numerous articles have highlighted the adverse effects of the COVID-19 pandemic on mental health, specifically through depression, anxiety, and stress. Depression, a common mental disorder worldwide,[3] is characterized by low mood, loss of interest, feelings of guilt and worthlessness, sleep and appetite disorders, decreased energy, and impaired concentration. Anxiety is often associated with fear and restlessness, accompanied by symptoms such as fatigue, restlessness, and palpitations.[4] Stress refers to the physical or psychological tension experienced by individuals in the face of a threatening situation, leading to decreased self-confidence and increased workplace difficulty;[4] stress exacerbates depression and anxiety and results in unstable neuropsychiatric conditions over time.[3] Research has demonstrated that perceived support from family, friends, and others during the COVID-19 pandemic reduced worry and created a sense of belonging, factors that are crucial in effectively handling and coping with various stressors in the workplace.[5–7] Werneburg[8] posits that resilience is a protective factor for psychological sequelae, including a person's ability to cope with and recover from adversity and setbacks.[9] Furthermore, sleep activity is closely related to physical and mental health and is an important indicator of overall well-being.[10,11]

Several cross-sectional surveys have shown demographic characteristics that influenced the mental health of health-care workers during the pandemic,[12–15] such as female gender, youth, marriage, work experience, education, and comorbidities. Two systematic reviews also showed that being a woman and direct care of COVID-19 patients were factors affecting the mental health of healthcare workers during the pandemic.[16,17] Several studies have also looked at the mental health of healthcare workers during lockdowns.[18–21] However, it is unclear how their mental health, demographic variables, social support, resilience, and sleep status will change as a result of drastic policy changes from lockdown to liberalization.

It is well-established that depression, anxiety, and stress are closely related, with individuals rarely experiencing only one of these emotions in daily life, often experiencing two or more simultaneously.[22] We found that there are few reports on Depression Anxiety Stress Scale-21 (DASS-21) scores after the relaxation of anti-pandemic policies.[19] While several reports on the DASS-21 emotional responses of healthcare workers exist,[18,19,23] they lack longitudinal comparisons of mental health. There is also a lack of mental health reports for the large numbers of hospital workers who continue to work after being infected.

These conditions create a unique background for this study. Firstly, during the three-year pandemic, we have rich experience in the prevention and control of COVID-19, but a lack of experience in its treatment. After liberalization, most hospital workers contracted COVID-19 for the first time within a short period; most hospital staff were also engaged in more work tasks during this time. Finally, the liberalization of prevention and control measures was chosen in the special period before the Spring Festival. Therefore, we need to re-understand the mental health status of hospital staff. First, did the demographic characteristics of the DASS-21 emotional responses of the hospital staff in this study change? Second, how did social support, resilience, and sleep status affect DASS-21 emotional responses in this study? Finally, did the DASS-21 emotional reactions of hospital staff in Zhejiang, China, deteriorate further during the current

outbreak? Is there a trajectory of change in DASS-21 emotional responses during the 3-year epidemic? Through this study, we aim to develop a comprehensive understanding of the mechanisms of the changing emotional well-being of hospital staff in response to major changes during the pandemic. This will be helpful for government and management departments to formulate psychological intervention strategies for similar events and provide more effective measures to support healthcare workers.

Methods

Study Design and Hospital Staff

The management of four hospitals in Zhejiang, China recruited staff using a convenient sampling method to conduct a multi-center online cross-sectional study. A total of 1118 hospital staff were recruited, with 561 participants from tertiary hospitals and 557 from community hospitals. The inclusion criteria were: age ≥18 years, length of service ≥6 months, and the ability to understand the questionnaire and express responses clearly. The exclusion criteria were: the presence of mental disorders or major traumatic events occurring in the past 6 months. According to the calculation method of sample size for the analysis of influencing factors,[24] the sample size was set as at least 5 to 10 times the total number of independent variables. A total of 45 independent variables were included in the study, so the required sample size was 270 to 540 participants considering a 20% loss of follow-up rate. Data with a response time of ≤120 seconds were rejected, resulting in the collection of 1054 valid responses, with a qualification rate of 94.28%.

Measurements

The demographic characteristics of the hospital staff were assessed and included variables such as gender, age, body mass index (BMI), education level, marriage, children, address, department, occupation, length of service, income, Covid-19 infection, smoking, drinking, religious beliefs, comorbidities, and hospital grade.

The Chinese version of the Simplified Depression-Anxiety-Stress Self-Rating Scale[25] was used in this study. This 21-item scale measures three negative emotional states: depression, anxiety, and stress. Gong et al[26] introduced the simplified Chinese version of the scale and tested it on a group of domestic college students, obtaining good reliability, validity, and structural stability. The depression subscale includes seven items (3, 5, 10, 13, 16, 17, 21) related to pathologic dysthymia, inferiority, and low levels of positive emotion. The anxiety subscale includes seven items (2, 4, 7, 9, 15, 19, 20) related to the physical and subjective experience of anxious arousal. The stress subscale includes seven items (1, 6, 8, 11, 12, 14, 18) related to tension, worry, conflict, and other negative emotions.[27] A four-point scoring system is used (0 = not at all applicable; 1 = somewhat applicable; 2 = mostly applicable; 3 = completely applicable). The score for each subscale is calculated by multiplying the sum of the seven-item scores by two. Scores range from 0 to 42 points, with higher scores indicating more severe levels of depression, anxiety, or stress.[28] This scale has been widely used in China.[29–31] In this study, the psychological status of hospital staff over the past month was assessed. The Cronbach's α coefficients for the depression, anxiety, and stress subscales and the total scale were found to be 0.862, 0.836, 0.874, and 0.945, respectively.

The Chinese version of the Perceived Social Support Scale (PSSS),[32] translated and revised by Jiang et al,[33] was used in this study. The scale consists of 12 items divided into three dimensions: family support (four items: 3, 4, 8, 11), friend support (four items: 6, 7, 9, 12), and support from others (four items: 1, 2, 5, 10). A seven-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = slightly disagree; 4 = neutral; 5 = slightly agree; 6 = agree; 7 = strongly agree) was used to assess the strength of perceived social support. Higher scores indicate higher levels of social support. This scale has been widely used in China.[34,35] In this study, Cronbach's α coefficients for the subscales for family support, friend support, and support from others and the total scale were found to be 0.908, 0.753, 0.876, and 0.950, respectively.

The Chinese version of the Brief Resilience Scale (BRS),[36] synthesized and validated by Chen et al,[37] was also used in this study. This six-item scale is a single-dimensional assessment tool composed of three positively and negatively worded items. A five-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = uncertain; 4 = agree; 5 = strongly agree) was used to score responses. The BRS is the only scale that measures resilience itself, assessing an individual's ability to

return to health or well-being when coping with stress, particularly health-related stress or stressful events. The scale has been widely used in China.[38,39] In this study, the Cronbach's α coefficient for the BRS was found to be 0.783.

The Chinese version of the Self-Rating Scale of Sleep (SRSS)[40] was used to assess sleep status over the past month. This 10-item scale is scored on a five-point scale (1–5) with total scores ranging from 10 to 50 points. Higher scores indicate more severe sleep problems. A score of 22 or lower is considered indicative of normal sleep while a score of 23 or higher is considered indicative of a sleep problem.[40] This scale is a single-dimensional measure and has been widely used in China.[41,42] In this study, the Cronbach's α coefficient for the SRSS was found to be 0.840.

Data Collection

Data was collected using an electronic questionnaire created with the Chinese mainland's online questionnaire software (URL: https://www.wjx.cn) and distributed by hospital management to staff via WeChat, one of the most widely used social media platforms in China. The data collection period was from January 10th to January 20th, 2023. Each phone's IP address could only be used once to access and complete the survey. Before participating in the survey, hospital staff logged in to the page by scanning the code on WeChat. Participants were informed of the purpose and significance of the survey, that the survey was anonymous and had no incentive, and that participation was entirely voluntary and would not affect their work. Participants affirmed their consent in order to take the survey.

Data Analysis

(Tables 1– 5) SPSS 26.0 version (IBM Corp., Armonk, NY, USA) was used for data analysis. Descriptive statistics were used to analyze hospital staff demographic characteristics and responses to the DASS-21, PSSS, BRS, and SRSS. Quantitative variables are presented as mean ± standard deviation and categorical variables as frequencies. *T*-tests or one-way ANOVAs were used to compare groups. Pearson correlation coefficients were used to analyze the relationships between DASS-21, PSSS, BRS, and SRSS responses. Multiple linear stepwise regression analyses were used to identify factors affecting DASS-21 emotional response. Figure 1A–C was created using a single-sample *T*-test in GraphPad Prism (version 8.0.2 for Windows, GraphPad Software, San Diego, California USA). Figure 1D Mapping using the software. A p-value of less than 0.05 was considered statistically significant.

Ethics

This study was approved by the Ethics Committee of the First Affiliated Hospital of Zhejiang University School of Medicine (IIT20220551B).

Table 1 Descriptive Statistics of Participants on Each Scale

Questionnaires	Dimensions	Average Score		Total Score	
		Mean	SD	Mean	SD
DASS-21	Depression	0.80	0.93	5.62	6.51
	Anxiety	0.87	0.93	6.10	6.52
	Stress	1.15	1.07	8.07	7.52
	Total	0.94	0.92	19.79	19.28
PSSS	Family support	5.29	1.21	21.17	4.83
	Friend support	5.11	1.19	20.43	4.75
	Additional support	4.94	1.16	19.76	4.63
	Total	5.11	1.08	61.36	12.93
BRS	/	3.35	0.64	20.11	3.82
SRSS	/	2.34	0.65	23.37	6.48

Abbreviations: DASS-21, Depression, Anxiety and Stress Scale; PSSS, Perceived Social Support Scale; BRS, Brief Resilience Scale; SRSS, Self-Rating Scale of Sleep; SD, Standard Deviation.

Table 2 Demographic Comparison of DASS-21 Emotional Responses (N =1054)

Variable	N (%)	Depression			Anxiety			Stress			Total		
		Mean (SD)	t/F	p	Mean (SD)	t/F	p	Mean (SD)	t/F	p	Mean (SD)	t/F	p
Gender			1.232	0.219		−0.492	0.623		1.501	0.134		0.855	0.393
Males	240 (22.8)	6.13 (7.46)			5.92 (6.95)			8.76 (8.37)			20.80 (21.52)		
Females	814 (77.2)	5.47 (6.20)			6.15 (6.39)			7.86 (7.24)			19.49 (18.58)		
Ages			1.384	0.246		4.414	0.004		1.152	0.327		2.154	0.092
20–29	297 (28.2)	6.13 (7.12)			7.12 (6.91)			8.62 (8.24)			21.87 (21.00)		
30–39	437 (41.5)	5.44 (6.20)			5.98 (6.25)			7.79 (6.91)			19.21 (18.07)		
40–49	253 (24.0)	5.63 (6.00)			5.52 (6.72)			8.16 (7.92)			19.30 (20.06)		
50+	67 (6.4)	4.51 (4.98)			4.57 (5.00)			7.04 (6.27)			16.12 (15.00)		
BMI			0.385	0.764		2.505	0.058		0.097	0.962		0.613	0.607
<18.5	104 (9.9)	5.96 (6.11)			7.58 (7.27)			8.23 (7.26)			21.77 (19.25)		
18.5–23.9	688 (65.3)	5.66 (6.49)			6.10 (6.50)			8.12 (7.51)			19.87 (19.28)		
24.0–27.9	206 (19.5)	5.24 (6.29)			5.57 (6.02)			7.89 (7.30)			18.71 (18.36)		
≥28	56 (5.3)	5.96 (8.16)			5.32 (6.79)			7.75 (8.92)			19.04 (22.67)		
Education level			3.986	0.008		4.464	0.004		3.94	0.008		4.427	0.004
Junior high school and below	64 (6.1)	3.31 (4.44)			3.63 (5.40)			5.63 (7.03)			12.56 (15.60)		
High school/Technical Secondary School	67 (6.4)	5.10 (7.52)			4.84 (6.85)			7.10 (7.73)			17.04 (21.10)		
College	170 (16.1)	5.11 (6.46)			6.28 (6.67)			7.41 (7.73)			18.80 (19.53)		
Bachelor degree above	753 (71.4)	5.98 (6.53)			6.38 (6.50)			8.51 (7.45)			20.87 (19.21)		
Marriage			2.788	0.006		3.388	0.001		1.791	0.074		2.773	0.006
Unmarried	248 (23.5)	6.73 (7.40)			7.38 (6.94)			8.87 (8.34)			22.98 (21.34)		
Married	806 (76.5)	5.28 (6.17)			5.70 (6.34)			7.82 (7.24)			18.81 (18.51)		
Children			2.033	0.043		2.841	0.005		0.964	0.335		1.996	0.046
NO	311 (29.5)	6.28 (7.05)			6.98 (6.70)			8.42 (8.00)			21.68 (20.46)		
Yes	743 (70.5)	5.35 (6.25)			5.73 (6.41)			7.92 (7.31)			18.99 (18.73)		
Address			1.629	0.104		1.925	0.055		1.818	0.069		1.909	0.056
City	832 (78.9)	5.79 (6.68)			6.30 (6.68)			8.28 (7.60)			20.37 (19.68)		
Rural	222 (21.1)	4.99 (5.78)			5.35 (5.84)			7.25 (7.18)			17.59 (17.58)		
Department			3.385	0.009		5.19	0.000		3.703	0.005		4.414	0.002
Emergency	140 (13.3)	7.33 (7.78)			7.60 (7.29)			6.11 (8.44)			24.76 (22.21)		
Fever clinic	76 (7.2)	5.45 (5.76)			6.32 (6.89)			6.12 (7.37)			20.26 (18.53)		
Outpatient	219 (20.8)	5.30 (6.27)			5.39 (5.60)			6.13 (6.87)			18.21 (17.55)		
Ward	206 (19.5)	5.93 (6.62)			7.17 (6.98)			6.14 (7.89)			21.84 (20.36)		
Other	413 (39.2)	5.09 (6.15)			5.39 (6.26)			6.15 (7.26)			17.83 (18.34)		

(*Continued*)

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Table 2 (Continued).

Variable	N (%)	Depression			Anxiety			Stress			Total		
		Mean (SD)	t/F	p	Mean (SD)	t/F	p	Mean (SD)	t/F	p	Mean (SD)	t/F	p
Occupation			4.563	0.001		7.427	0.000		4.601	0.001		5.745	0.000
Doctor	179 (17.0)	5.61 (6.93)			5.25 (6.00)			7.79 (7.44)			18.65 (19.25)		
Nurse	573 (54.4)	6.12 (6.47)			6.85 (6.65)			8.53 (7.54)			21.50 (19.45)		
Engineer	95 (9.0)	5.58 (5.81)			6.82 (6.50)			9.45 (7.78)			21.85 (18.82)		
Administrative	18 (1.7)	7.89 (11.22)			7.11 (10.63)			8.78 (10.45)			23.78 (30.54)		
Outsourcing companies	189 (17.9)	3.95 (5.66)			4.16 (5.61)			6.15 (6.75)			14.25 (16.59)		
Length of service			6.066	0.000		4.841	0.002		6.331	0.000		6.438	0.000
6–12 months	111 (10.5)	3.53 (5.41)			4.09 (6.18)			5.57 (7.71)			13.19 (18.08)		
1–3 years	199 (18.9)	6.09 (7.48)			6.37 (6.79)			8.05 (7.78)			20.51 (20.58)		
3–5 years	100 (9.5)	7.14 (7.39)			7.30 (6.97)			9.94 (8.13)			24.38 (21.22)		
>5 years	644 (61.1)	5.60 (6.13)			6.17 (6.36)			8.21 (7.21)			19.99 (18.50)		
Income			2.073	0.082		1.537	0.189		0.641	0.633		1.326	0.258
<2000	25 (2.4)	7.44 (8.77)			7.44 (8.03)			8.96 (10.31)			23.84 (25.83)		
2000~	129 (12.2)	6.64 (6.92)			6.74 (6.82)			8.91 (7.64)			22.29 (20.24)		
4000~	297 (28.2)	4.97 (5.40)			5.71 (5.66)			7.87 (6.77)			18.55 (16.57)		
6000~	244 (23.1)	5.79 (6.94)			6.63 (6.97)			8.11 (8.03)			20.53 (20.75)		
>8000	359 (34.1)	5.56 (6.66)			5.73 (6.62)			7.83 (7.50)			19.12 (19.44)		
Covid-19 infection			4.332	0.000		3.514	0.001		3.359	0.001		−4.150	0.000
Yes	978 (92.8)	5.81 (6.59)			6.26 (6.59)			8.28 (7.56)			20.35 (19.45)		
No	76 (7.2)	3.26 (4.78)			4.05 (5.15)			5.29 (6.40)			12.61 (15.33)		
Smoking			−0.138	0.891		−1.407	0.160		−0.662	0.508		0.789	0.430
Yes	72 (6.8)	5.50 (7.89)			5.06 (5.84)			7.50 (7.84)			18.06 (20.20)		
No	982 (93.2)	5.63 (6.40)			6.18 (6.56)			8.11 (7.50)			19.91 (19.22)		
Drinking			0.032	0.975		−0.415	0.678		0.885	0.376		−0.215	0.830
Yes	106 (10.1)	5.64 (6.79)			5.85 (6.38)			8.68 (7.46)			20.17 (19.10)		
No	948 (89.9)	5.62 (6.48)			6.13 (6.54)			8.00 (7.53)			19.74 (19.31)		
Religious beliefs			−0.088	0.930		0.530	0.596		1.213	0.225		−0.622	0.534
Yes	97 (9.2)	5.57 (5.90)			6.43 (5.93)			8.95 (7.39)			20.95 (17.87)		
No	957 (90.8)	5.63 (6.57)			6.06 (6.58)			7.98 (7.53)			19.67 (19.43)		
Comorbidities			1.449	0.148		1.816	0.072		2.587	0.011		−2.065	0.041
Yes	107 (10.2)	6.49 (7.36)			7.35 (7.61)			10.13 (8.85)			23.96 (22.40)		
No	957 (90.8)	5.52 (6.40)			5.96 (6.37)			7.83 (7.32)			19.32 (18.86)		
Hospital grade			−1.887	0.059		−1.806	0.071		−1.944	0.052		−2.009	0.045
Community hospital	501 (47.5)	5.23 (6.10)			5.72 (6.05)			7.60 (7.04)			18.54 (17.98)		
Tertiary hospitals	553 (52.5)	5.98 (6.84)			6.44 (6.91)			8.49 (7.91)			20.92 (20.34)		

Abbreviations: DASS-21, Depression, Anxiety and Stress Scale; SD, Standard Deviation.

Table 3 Correlation of DASS-21 Emotional Response with PSSS, BRS and SRSS

Questionnaires	Dimensions	DASS-21			
		DASS-21 (Depression)	DASS-21 (Anxiety)	DASS-21 (Stress)	Total
PSSS	Family support	−0.303**	−0.214**	−0.238**	−0.267**
	Friend support	−0.294**	−0.209**	−0.261**	−0.271**
	Additional support	−0.305**	−0.227**	−0.263**	−0.282**
	Total	−0.330**	−0.238**	−0.279**	−0.301**
BRS	Total	−0.526**	−0.514**	−0.546**	−0.564**
SRSS	Total	0.486**	0.540**	0.522**	0.550**

Note: **P<0.01.
Abbreviations: DASS-21, Depression, Anxiety and Stress Scale; PSSS, Perceived Social Support Scale; BRS, Brief Resilience Scale; SRSS, Self-Rating Scale of Sleep.

Table 4 Multiple Stepwise Linear Regression Analysis of Participant DASS-21 Emotional Responses (n=1054)

Variables	*B*	*SE*	*β*	t	*p*	95%CI	
						Lower	Upper
Model 1							
Constant	10.112	5.327		1.898	0.058	−0.341	20.566
Education level	2.691	0.705	0.120	3.817	0.000	1.308	4.075
COVID-19 infection	6.662	2.257	0.089	2.952	0.003	2.234	11.090
Hospital grade	2.487	1.226	0.064	2.029	0.043	0.082	4.892
Comorbidities	6.022	1.953	0.094	3.083	0.002	2.189	9.854
Department	−1.099	0.421	−0.080	−2.611	0.009	−1.924	−0.273
Marriage	−3.631	1.400	−0.080	−2.594	0.010	−6.378	−0.885
Model 2							
Constant	31.360	5.372		5.838	0.000	20.819	41.901
Additional support	−0.782	0.193	−0.188	−4.042	0.000	−1.161	−0.402
Education level	4.279	0.683	0.191	6.268	0.000	2.939	5.619
Hospital grade	3.611	1.167	0.094	3.095	0.002	1.321	5.900
Friend support	−0.663	0.190	−0.163	−3.485	0.001	−1.037	−0.290
COVID-19 infection	6.006	2.132	0.081	2.818	0.005	1.823	10.188
Comorbidities	6.025	1.845	0.094	3.265	0.001	2.404	9.646
Department	−1.188	0.397	−0.086	−2.989	0.003	−1.968	−0.408
Marriage	−2.856	1.326	−0.063	−2.154	0.031	−5.458	−0.254
Model 3							
Constant	65.805	4.591		14.334	0.000	56.797	74.813
BRS	−2.577	0.136	−0.510	−18.925	0.000	−2.844	−2.310
Department	−1.018	0.347	−0.074	−2.937	0.003	−1.698	−0.338
Friend support	−0.473	0.112	−0.117	−4.235	0.000	−0.693	−0.254
Education level	2.896	0.598	0.129	4.839	0.000	1.721	4.070
Hospital grade	3.372	0.996	0.087	3.385	0.001	1.417	5.326
Comorbidities	4.148	1.600	0.065	2.592	0.010	1.008	7.288
COVID-19 infection	3.656	1.863	0.049	1.963	0.050	0.002	7.311

(*Continued*)

Table 4 (Continued).

Variables	*B*	*SE*	*β*	*t*	*p*	95%CI	
						Lower	Upper
Model 4							
Constant	38.369	4.488		8.549	0.000	29.562	47.175
BRS	−1.821	0.136	−0.360	−13.346	0.000	−2.089	−1.553
SRSS	1.113	0.076	0.374	14.689	0.000	0.965	1.262
Friend support	−0.441	0.103	−0.108	−4.278	0.000	−0.643	−0.239
Education level	1.445	0.535	0.065	2.699	0.007	0.395	2.496
Marriage	−2.314	1.045	−0.051	−2.214	0.027	−4.365	−0.263

Note: Education level, marriage, children, department, occupation, length of service, COVID-19 infection, comorbidities, hospital grade were included as control variables in the structural equation model. Model 1: R2 = 0.048, adjusted R2 = 0.043, F = 8.804, p < 0.001. Model 2: R2 = 0.153, adjusted R2 = 0.147, F = 23.617, p < 0.001. Model 3: R2 = 0.356, adjusted R2 = 0.351, F = 82.439, p < 0.001. Model 4: R2 = 0.450, adjusted R2 = 0.448, F = 171.650, p < 0.001.

Abbreviations: CI, confidence interval; DASS-21, Depression, Anxiety and Stress Scale; PSSS, Perceived Social Support Scale; BRS, Brief Resilience Scale; SRSS, Self-Rating Scale of Sleep.

Results

A total of 1054 hospital staff completed the questionnaire, including 553 from tertiary hospitals and 501 from community hospitals. The mean age of hospital staff was 35.29 ± 8.51 years and the ratio of male to female was 23:77. During the peak of COVID-19 infection, the average DASS-21, PSSS, BRS and SRSS scores of hospital staff were: 19.79 ± 19.28, 61.36 ± 12.93, 20.11 ± 3.82, 23.37 ± 6.48, respectively (Table 1).

Education level (F = 4.427, p = 0.004), marriage (F = 2.773, p = 0.006), children (F = 1.996, p = 0.046), department (F = 4.414, p = 0.002), occupation (F = 5.745, p = 0.000), length of service (F = 6.438, p = 0.000), COVID-19 infection (t = −4.150, p = 0.000), comorbidities (t = −2.065, p = 0.041), and hospital grade (t = −2.009, p = 0.045) were influencing factors of the DASS-21 emotional response. In addition, there were statistically inconsistent results in the dimensions and total scores of DASS-21. In the stress dimension, there was no significant difference between marriage and children (p > 0.05). Hospital grade had no statistical significance in the depression, anxiety, or stress dimensions (p > 0.05). On the other hand, age showed a unique response in the anxiety dimension (F = 4.414, p = 0.004). There were no significant differences associated with gender, BMI, address, income, smoking, drinking, or religious beliefs (p > 0.05) (Table 2).

The total score and each dimension of DASS-21 were correlated with the scores from the BRS, SRSS, PSSS, and each dimension of the PSSS (p < 0.01). Among them, they were positively correlated with SRSS (p < 0.01), and the rest were negatively correlated (p < 0.01) (Table 3).

A hierarchical multiple stepwise linear regression model was used to analyze predictors of DASS-21 emotional responses while controlling for confounding factors. There was no evidence of multicollinearity in the model, with tolerance values ranging from 0.375 to 0.992 (>0.10) and variance inflation factors (VIF) ranging from 1.009 to 2.665 (<5). In Model 1, factors with demographic differences were included: education level, marriage, children, department, occupation, length of service, COVID-19 infection, comorbidities, and hospital grade. Only education level, COVID-19 infection, hospital grade, comorbidities, department, and marriage were independent predictors of emotional responses to DASS-21. This model explains 4.3% of the variance in DASS-21 scores (F = 8.804, p < 0.001). In model 2, PSSS dimensions related to the emotional responses of DASS-21 were added; the explanatory power increased by 10.4% to 14.7% compared with the first stage (F = 23.617, p < 0.001). Additional support and friend support were predictors of the DASS-21 emotional response, while family support was not different in the model. In model 3, when BRS factors related to emotional responses of DASS-21 were added, the explanatory power increased by 20.4% to 35.1% compared with the previous stage (F = 82.439, p < 0.001). There was no difference in additional support and marriage compared with model 2. Finally, SRSS factors related to emotional responses of DASS-21 were added to model 4, and the explanatory power increased by 9.7% to 44.8% compared with the previous stage (F = 171.650, p < 0.001). In the model, SRSS and

education level were positively correlated with the DASS-21 emotional response. BRS, friend support, and marriage were negatively correlated with the DASS-21 emotional response (Table 4).

DASS-21 scores ranged from 0 to 126 points. Six similar research papers were selected. They included the Wang et al[43] study, which was carried out in China in 2016 and served as a norm reference; the Elbay et al[15] study, which was carried out at the start of the first wave of the pandemic in Turkey. Details are shown in Table 5. We conducted a longitudinal comparison and trend analysis of DASS-21 emotional responses in chronological order (Figure 1).

Discussion

In this study, we investigated the status and demographic characteristics of the emotional responses of hospital staff during the first large-scale COVID-19 infection in Zhejiang, China, following the release of epidemic prevention and control measures. Emotional responses were measured by the DASS-21, and its correlation with PSSS, BRS, and SRSS scales. At the same time, a review of similar studies on DASS-21 emotional response in the 3-year epidemic was conducted to find the internal change trajectory through longitudinal comparison.

First, we found that among the demographic characteristics examined in this study, only education level and marital status were independent predictors of emotional responses to DASS-21. Hospital staff with higher education levels had greater emotional responses.[19,46–48] This may be related to negative or excessive reporting of COVID-19 by the media, online news, and short videos during the pandemic.[49,50] People's daily worries and anxieties may have driven them to spend more time on their mobile phones, seeking coping methods or stress relief.[51,52] It is also possible that the high educational levels of the healthcare workers we surveyed[19] led them to pay more attention to and think more about COVID-19. Skalski's[53] research shows that persistent thinking can increase pandemic anxiety and harm mental health. In addition, the sharp increase in workload for medical staff, changes in the work environment and routines, and working while ill may also have heightened the emotional responses. However, there is also literature showing that low educational attainment[46,54] is a factor influencing emotional responses. Unmarried hospital staff also exhibited more severe emotional responses,[42,46] which may be associated with an individual's lack of life experience, work experience, and family support.

In this study, univariate analysis showed that the presence of children,[55] length of service,[15] work sector,[17,56] occupation,[55] and the presence of comorbidities[48,57] were factors influencing emotional responses, similar to our findings. It is worth noting that after controlling for other factors, these variables—as well as COVID-19 infection status and hospital grade—were no longer significant predictors in regression Model 4. We believe that the differences in factors relating to emotional responses on the DASS-21 in each study may reflect the complexity and variability of modern human emotions and lifestyles. Although some studies have shown that demographic variables such as sex, age, BMI, and income are predisposing factors for emotional responses,[15,52,54,57,58] our study did not provide evidence to support this. This may be due to differences in the nationalities, cultural backgrounds, and social identities of hospital staff, or in the epidemic status and research methods of each study. As one review suggests,[59] people in the least developed countries may have suffered less than those in emerging and other developing countries.

Secondly, our study also found that the results of PSSS were different from the past, while the results of BRS and SRSS were basically consistent with the past. The support from family, friends, and others was significantly associated with emotional responses on the DASS-21.[5–7,60] However, to our surprise, family support and support from others were no longer significant predictors in Models 2 and 3, leaving only friend support as a significant predictor of emotional response. This may be due to the fact that during the epidemic, infections spread within groups, and hospital staff's family members, relatives, colleagues, and leaders may also have been infected. In their own difficult circumstances, these other individuals may have expected and needed more care, comfort, and support from healthcare workers themselves. For example, family members and relatives may have hoped to receive the latest news and precautions about COVID-19 infections from those working in healthcare, while leaders and colleagues may have expected staff to remain at work for as long as possible and preferably work overtime. In China, friends generally refer to close individuals who know each other's character, temperament, and hobbies very well, in both daily life and work; they are also known as "besties" or "iron buddies". As such, close friends can consistently provide comfort, care, and help in any way they can (eg, by donating fever-reducing medication or other medicines, sharing experiences, or giving advice on COVID-19

Table 5 Descriptive Statistics of DASS-21 Emotional Responses in Different Periods

Source	Time	N	Participant	Timing	Females (%)	Age	DASS-21 (Mean)			Total
							Depression	Anxiety	Stress	
Wang et al, 2016[43]	NA	1796	University student	Pre-epidemic	62.58	18.79	2.33 (3.05)	4.05 (3.49)	4.31 (3.72)	10.70
Elbay et al, 2020[15]	2020.3.10–2020.3.15	442	Healthcare workers	The pandemic has just begun	56.80	36.05	6.92 (4.70)	4.67 (4.21)	7.46 (4.85)	19.04
Du et al, 2020[44]	2020.3.19–2020.4.7	687	Health care and the general population	Peak of the pandemic	72.20	36.92	6.62 (7.80)	7.01 (7.00)	10.18 (8.60)	23.81
Hummel et al, 2021[45]	2020.4.1–2020.6.20	609	Health care and the general population	Peak of the pandemic	75.20	41.00	11.34 (9.90)	8.61 (9.00)	17.40 (10.71)	37.35
Aymerich et al, 2022[18]	Date starts building-2021.3.1	22561–23497	Healthcare workers	NA	NA	NA	7.42 (NA)	9.59 (NA)	9.37 (NA)	26.38
Gundogmus et al, 2022[23]	2021.3.29–2021.5.1	1571	Hospital staff	Peak of the pandemic	63.50	33.83	7.27 (4.41)	7.50 (4.04)	7.17 (4.31)	21.95
This study	2023.1.10–2023.1.20	1054	Hospital staff	Peak of the pandemic	77.20	35.29	5.62 (6.51)	6.10 (6.52)	8.07 (7.52)	19.79

Abbreviations: DASS-21, Depression, Anxiety and Stress Scale; SD, Standard Deviation.

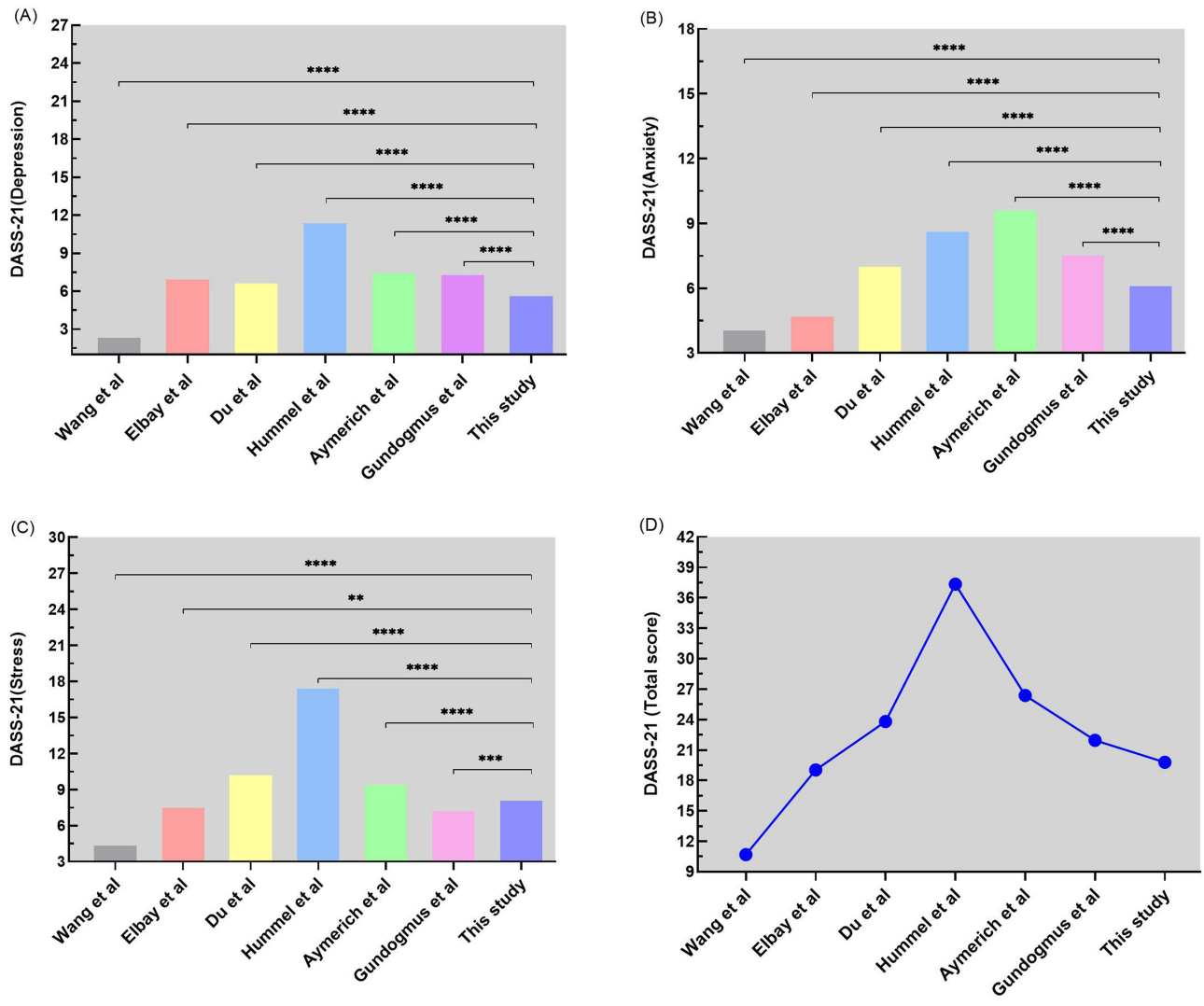

Figure 1 Longitudinal comparison and trends of emotional responses in DASS-21.
Note:*****P<0.0001*, ****P<0.001*, ***P<0.01*. (**A**) The current study's depression scores were greater than the Chinese norm[43] (p < 0.0001) and much lower than those of the post-epidemic studies (p < 0.0001). (**B**) The anxiety dimension score in this study was higher than that in the Chinese norm[43] and Elbay et al,[15] but lower than that of other studies (p < 0.0001). (**C**) Du et al,[44] Hummel et al,[45] and Aymerich et al[18] scored statistically significantly higher than this study in the stress dimension score (p<0.0001). However, the scores of other studies were lower than those of this study, and the differences were statistically significant (p< 0.0001-P <0.01). (**D**) The DASS-21 emotional response showed a parabolic trend over time.

infection). There is also literature confirming that social support declined during the second lockdown, and the correlation with the stress response gradually weakened.[55]

During infectious disease outbreaks, personal resilience is an important protective shield for healthcare professionals against psychological stress and mental breakdown. Individuals who lack adequate resilience are more vulnerable to the negative psychological impacts of the pandemic,[61–63] consistent with our findings. Resilience can be an important goal in the treatment of depression, anxiety, and stress response.[64] Therefore, it is important to actively conduct and encourage participation in training programs related to resilience in the fields of ethics, psychology, and sociology to improve resilience.

Numerous studies have shown that sleep quality deteriorated during the COVID-19 pandemic and is associated with mental health,[65,66] particularly among healthcare workers.[41,67,68] The mean SRSS score in this study was 23.37 (6.48), indicating mild sleep disturbance. It is worth noting that most of our hospital staff were healthcare workers who worked night shifts, with resultant disruption of their normal sleep patterns. Additionally, more than 90% of hospital staff in this study had been infected with COVID-19, which has been reported to affect sleep quality.[69] It is possible that after

excluding these factors, hospital staff experienced some improvement in sleep quality but this may not have significantly affected outcomes related to emotional responses.

Finally, we found no further deterioration in DASS-21 emotional responses among hospital staff in Zhejiang, China during the current outbreak. The DASS-21 emotional response showed a parabolic downward trend over time during the three-year epidemic, but remained well above normal levels in China. In this study, the DASS-21 emotional responses were not as severe as predicted. There may be several factors which account for this. First of all, the Omicron strain has become the dominant strain of COVID-19, and its severe disease rate and mortality have decreased significantly. Secondly, the liberalization policies allowed people to live, work, and study freely. It may also be related to the timing of the relaxation of prevention and control measures by the Chinese government before the important Spring Festival. In the course of fighting the epidemic for three years, many people have rarely had the chance to reunite with their families, especially during the Chinese Spring Festival; the joy of people being free to go home for the holidays may therefore have diluted the DASS-21 emotional response. Thirdly, the government has repeatedly stressed the need to issue a series of measures such as "anti-epidemic subsidies" for front-line medical staff, which have also provided a certain buffer. Finally, work processes within hospitals have been streamlined, and staff have not had to deal with some of the typical political pressures.

Previous studies have found that the mental health impact of COVID-19 on healthcare workers includes increases in depression, anxiety, and emotional responses to stress at peak moments of the pandemic.[23,70–72] However, there was no discernible variation in the mental health state between the two pandemic waves, according to Vitale's study.[73] During the outbreak of the same wave of the epidemic, Doupol et al[74] reported that the negative emotional response lessened over time, and Jin et al[75] discovered that a similar phenomenon also persisted when the outbreak period entered a stable stage. We provide a review of similar studies of emotional responses to DASS-21 in 3-year outbreaks, including the scale used, participants, age, sex, and epidemiological status (Table 5). Through longitudinal comparison, we found that the emotional responses recorded by DASS-21 showed a parabolic downward trend over time (Figure 1D). Although the COVID-19 virus cannot be eliminated, as the virus mutates, its pathogenicity, severe disease rate, and fatality rate have decreased; these changes may have helped lessen its negative emotional impact. According to our analysis, Elbay et al,[15] and Gundogmus et al[23] all reported lower scores than this study in the stress dimension. Elbay et al conducted their study during the first wave of the epidemic, while Nordin et al conducted theirs during a remission period. At the same time, our analysis also highlights the stress response portion of DASS-21 as the most prominent. This may primarily be due to a significant increase in workload forcing hospital staff to work while sick. However, it is also worth noting that the emotional response in the DASS-21 in this study was much higher than the Chinese norm.[43] This shows that there is still room for further improvement by the government and society in similar outbreaks.

Limitation

There are some limitations to the study. First, it is difficult to determine any causal relationship between variables using a cross-sectional study design, and the data sources are limited to Zhejiang Province, China, and may not be representative of China or the global population. Second, self-reported questionnaires may have influenced the reliability of responses. Finally, there was a lack of investigation on the impact of views on the Spring Festival and working while sick as potential contributing factors.

Conclusions

Our results show that education level, marriage, friend support, BSR score, and SRSS factors were independent predictors of emotional responses measured by the DASS-21 in hospital staff after the control measures were lifted in Zhejiang Province, China. Although more than 90% of hospital employees contracted COVID-19 for the first time in the short term and took on more work tasks while sick, their DASS-21 emotional responses were not as severe as we had predicted.

In addition to the greatly reduced virulence of the COVID-19 strain, the timing of the government's relaxation of prevention and control measures (preceding the Spring Festival) and the promotion of anti-epidemic subsidies are likely contributing factors. However, emotional responses to the DASS-21 were still much higher than the Chinese average. Improving the mental resilience and sleep status of healthcare workers is a key target for the future. Unmarried medical staff with higher education should receive more attention and support from their management. In addition, the government and society as a whole still have room for further

improvement in similar epidemics by providing people with a longer psychological buffer period and better psychological preparation. This could include producing videos on self-management after COVID-19 infection and disseminating them as early as possible; stockpiling more COVID-19 symptomatic drugs (fever-reducing drugs, cough medicines); providing three days of fever-reducing medication for hospital staff; and introducing a split retail mechanism of symptomatic treatment drugs for COVID-19 and an identification-based system for purchasing them. These measures could greatly reduce the phenomena of panic-buying and individual stockpiling of medications. The study also found a parabolic downward trend in DASS-21 emotional responses among hospital workers during the COVID-19 outbreak over time.

Data Sharing Statement

The corresponding author will provide any information about the data presented in the article when requested.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the First Affiliated Hospital of Zhejiang University School of Medicine (IIT20220551B). The study followed the ethical guidelines, protocol, and regulations stated in the Declaration of Helsinki. A signed consent was not required; however, completing the survey represents an informed consent which was sufficient for the purpose of the study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare that they have no conflicts of interest in this work.

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