

The Mental Health of Healthcare Staff Working During the COVID-19 Crisis: Their Working Hours as a Boundary Condition

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Purpose: Healthcare staff operate at the forefront of the fight against COVID-19 and hence face enormous physical and mental pressures. We aim to investigate healthcare staff's mental health issues and the associated predictors during the COVID-19 pandemic. Specifically, this paper aims to identify some unique predictors of healthcare staff's mental health issues in Iran, the second country after China to experience a major COVID-19 crisis.

Methods: An online survey of 280 healthcare staff in all 31 provinces of Iran assessed staff's mental distress (K6), depression, and anxiety (PHQ-4) during April 5–20, 2020 during the COVID-19 crisis.

Results: Nearly a third of healthcare staff surpassed the cutoff for distress, depression, and anxiety symptoms. Females or more educated healthcare staff were more likely to experience distress. Those who were unsure whether they had COVID-19 were more likely to experience distress and depression symptoms. The number of COVID-19 cases among a healthcare worker's colleagues or friends positively predicted the worker's anxiety symptoms. Amongst healthcare staff, doctors were less likely than radiology technologists to experience distress and anxiety symptoms. Technicians and obstetrics staff experienced fewer anxiety symptoms. The age and the weekly working days of healthcare staff interacted such that age is a significant predictor of mental health issues among younger but not older healthcare staff.

Conclusion: The identification of the predictors of mental health issues can guide healthcare organizations to screen healthcare workers who are more likely to be mentally vulnerable in the ongoing COVID-19 pandemic.

Keywords: healthcare staff, mental health, working time, age, COVID-19, epidemic, Iran

Introduction

Healthcare staff have been under enormous physical and mental pressures during the COVID-19 pandemic.^{1–6} Working under the COVID-19 pandemic exposes many healthcare staff to the risk of being infected with the virus, difficult work environment, tremendous workloads, shortage of equipment such as PPE, and “moral injury”, which refers to the distressing awareness that healthcare workers face when they cannot meet all the needs of their patients.⁷ Many healthcare workers also experience stress from either the risk of infecting their family members by bringing the virus home or from the isolation by staying away from their families.^{8,9} All of these work and health-related issues can harm workers' mental health.^{10,11} Indeed, some healthcare workers have suffered mentally and even committed suicide due to the enormous stress of the COVID-19 pandemic.¹²

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Such issues have been documented in several countries.^{1,13} This paper aims to investigate healthcare staff's mental health issues and their associated predictors in Iran, which was the second country after China to experience a major COVID-19 outbreak in early 2020.^{3,5,14,15}

We identify the predictors of mental issues using relatively assessable variables, especially the socio-demographic^{16,17} clinical, and work-related characteristics of healthcare staff.^{18,19} Specifically, our study represents one of the first attempts to use the clinical and the working characteristics²⁰ of healthcare staff,^{6,21} such as their job functions and their number of working days per week, to identify mental issues. We also examine the interaction between healthcare workers' weekly working days and age above and beyond the prior literature on the risk factors of mental disorders among healthcare staff.^{13–15} Our approach of identifying risk factors based on work-related characteristics can help healthcare organizations to better identify healthcare staff who are more likely to suffer mentally and may need mental health services during the ongoing COVID-19 pandemic and contribute new predictors to the burgeoning research on mental health of healthcare workers under COVID-19.^{3,5,6}

Methods

Our study surveyed healthcare staff in Iran during April 5–20, 2020 when Iran was experiencing a crisis of COVID-19. On April 5, the date the survey started, a total of 58,226 cumulative COVID-19 cases had been diagnosed in Iran and 2483 new cases were diagnosed. Of the diagnosed cases, 3,603 total deaths were reported in a day, 43 of whom were healthcare staff.¹⁷ On April 20, the date the survey ended, a total of 83,505 cumulative COVID-19 cases had been reported in Iran with 1,294 daily new cases and 5,209 total deaths. These counts were among the highest across all countries in April 2020, and the COVID-19 crisis in Iran caused extreme strain on medical resources and great psychological pressures on Iranian healthcare staff.¹³

Study Design

This study followed the American Association for Public Opinion Research (AAPOR) reporting guideline. All the participants consented to the survey before their enrolment. The survey followed Declaration of Helsinki and was approved by the ethics committee at Tsinghua University (#20200304). The cover letter of the survey briefed the participants about the objectives of the study,

the procedure, and the anonymous and voluntary nature of the survey. All the participants completed the survey voluntarily and anonymously, and were free to leave the survey at any time. To access more participants under the severe constraints of the COVID-19 pandemic, we shared the links to the survey on social media channels (Instagram, WhatsApp, and Telegram)²² and requested that healthcare staff share the survey with their colleagues. The final sample comprised 280 healthcare staff across all 31 provinces of Iran.

Measures

Predictors

Our predictors include several relevant socio-demographic, clinical, and work-related characteristics. Socio-demographic characteristics include healthcare workers' age (in years), gender (male or female), education level (categorical variable: 1 = below a diploma or 12 years of education, 2 = a diploma with 12 years of education, 3 = a student or a graduate of a 2-year college degree, 4 = a student or a graduate of a 4-year college degree, 5 = a student or a graduate of a master degree, and 6 = a student or a graduate of a doctoral degree).

The clinical variables include the healthcare workers' chronic health issues (no, unsure, yes), COVID-19 infection status (no, unsure, yes), and the number of colleagues or friends positive with COVID-19. Drawing on previous research finding that people who have comorbidity may experience more mental health disorders in the COVID-19 pandemic,²³ we asked the participants in this survey whether they had any chronic health issues. The participants were also asked whether they had been infected with COVID-19 within the past two weeks. Lastly, the participants reported how many of their colleagues or friends had tested positive with COVID-19 within the past two weeks.

The work-related variables consist of healthcare staff's job functions, whether their work institution is private or public, and the number of working days a week. Because healthcare staff are exposed to COVID-19 to a different extent depending on their job functions,¹⁹ we asked the healthcare staff to indicate their job functions (categorical variable: 1 = doctors, 2 = nurses, 3 = technicians, 4 = radiology technologists, 5 = medical students/interns, 6 = healthcare administrators, 7 = supporting/facility/cleaning staff, 8 = volunteers, 9 = obstetricians). We also asked the participants whether their healthcare institutes are private or public and how many days they had worked in the prior week. All the measures were developed in English and then we either found existing Farsi version of the

instruments when available or translated them into Farsi, the official language of Iran.

Outcome Variables

The three mental health variables comprise distress, depression, and anxiety. We assessed distress by the Kessler Psychological Distress Scale (K6) with Cronbach's alpha of 0.79.²⁰ We measured depression and anxiety by the 4-item Patient Health Questionnaire (PHQ-4, with a score of 0–12), which is an ultra-brief scale of a 2-item depression scale (PHQ-2) and a 2-item anxiety scale (GAD-2). Given these scales had been translated and validated in previous studies conducted in Iran, we used the Farsi versions of the measures.²⁴ The cutoff scores for detecting symptoms of distress, depression, and anxiety were 13, 3, and 3, respectively. Participants who scored higher than the cutoff thresholds were characterized as having symptoms of mental health issues.

Statistical Analysis

Our empirical analysis was performed using Stata 16.1 software. The statistical significance level was assessed by $p < 0.05$, 2-tailed. Multivariable logistic regression was used to determine the potential risk factors of distress, depression, and anxiety. The statistical regression results showed the associations between the risk predictors and the outcome variables with odds ratios (ORs) and their 95% confidence intervals (CIs). We also presented a margin analysis to further investigate the interaction effect between the healthcare workers' age and number of working days.

Results

Descriptive Statistics

Table 1 displays the descriptive characteristics of the 280 healthcare staff. Among them, 21.4% (60), 30.0% (84), and 32.9% (92) surpassed the cutoff for distress, depression, and anxiety. The majority of the healthcare workers (60.0%, 168) were female. Most of the participants (70.5%, 196) were under 40 years old, and 79.4% (239) of the participants had university degrees or 2-year diplomas. Most of the healthcare workers (80.3%, 226) did not have chronic health issues, 2.5% (7) reported they were COVID-19 positive, while 27.1% (76) reported they were unsure whether they had COVID-19. A little more than half of the healthcare workers (53.0%, 161) reported they had colleagues or friends who were COVID-19 positive with a mean of 3.9 (min: 0; max: 150). Given the number

of COVID-19 positive colleagues or friends is a count variable, we transformed it by taking its logarithm.

In terms of job function of the healthcare staff, 15.0% (42) were doctors, 20.4% (57) were nurses, 9.0% (25) were technicians, 22.1% (62) were radiology technologists, 3.6% (10) were medical students and interns, 13.2% (37) were healthcare administrators or interns, 3.6% (10) were supporting staff (ie, facility or cleaning staff), 10.3% (29) were obstetrics staff, and 2.8% (8) were volunteers. About three-quarters of the healthcare staff worked in a public healthcare organization (74.7%, 223), and the majority of them worked at least three days a week (72.2%, 202).

Logistic Regression Results

Table 1 presents the multivariate logistic regression results. Firstly, our analysis revealed that female healthcare staff were 2.23 times more likely to have distress symptoms (OR=2.23; 95% CI: 1.02 to 4.86; $p=0.043$) than their male counterparts. Highly educated healthcare staff experienced a higher level of distress (OR=1.63; 95% CI: 1.05 to 2.44; $p=0.017$) than less-educated staff. Compared to healthcare staff who were not infected by COVID-19, those who were unsure if they were infected by the virus had a higher level of distress (OR=3.23; 95% CI: 1.59 to 6.60; $p=0.001$) and depression (OR=2.42; 95% CI: 1.33 to 4.37; $p=0.004$). The number of COVID-19 positive cases among healthcare workers' colleagues or friends also positively predicted anxiety symptoms (OR=2.11; 95% CI: 1.11 to 4.01; $p=0.023$). Compared to radiology technologists—the most common job function category in this study, medical doctors were less likely to experience distress (OR=0.09; 95% CI: 0.02 to 0.53; $p=0.007$) and anxiety symptoms (OR=0.12; 95% CI: 0.03 to 0.48; $p=0.003$) while technicians (OR=0.27; 95% CI: 0.08 to 0.89; $p=0.031$) and obstetrics staff (OR=0.21, 95% CI: 0.06 to 0.81; $p=0.023$) were less likely to experience anxiety symptoms. Our analysis also showed that healthcare staff's existing chronic health issues and the type of healthcare organization they worked in (private or public) did not have a significant relationship with distress, depression, and anxiety symptoms. The significant results are illustrated in Figure 1.

Secondly, the results demonstrated significant interaction terms between the healthcare workers' age and their number of working days on distress (OR=1.03; 95% CI: 1.00 to 1.06; $p=0.047$) and depression symptoms (OR=1.03, 95% CI: 1.00 to 1.06; $p=0.026$). Figure 1

Table 1 Descriptive Findings and Risk Factors of Healthcare Staff's Mental Issues by Logistic Regression (N=280)

Variables	Description	Distress		Depression		Anxiety	
		OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Socio-Demographic Variables							
Age							
20–29 years old	101 (36.3%)	0.87 (0.80 to 0.96)	0.004	0.87 (0.79 to 0.96)	0.004	0.91 (0.83 to 1.00)	0.052
30–39 years old	95 (34.2%)						
40–49 years old	63 (22.7%)						
50–60 years old	19 (6.8%)						
Gender							
Male	112 (40.0%)	Reference group		Reference group		Reference group	
Female	168 (60.0%)	2.23 (1.02 to 4.86)	0.043	1.41 (0.75 to 2.66)	0.283	1.70 (0.91 to 3.17)	0.095
Education							
Under 12 years of education	4 (1.4%)	1.63 (1.05 to 2.44)	0.017	1.14 (0.83 to 1.56)	0.433	1.40 (0.99 to 1.97)	0.055
Diploma (with 12 years of education)	19 (6.8%)						
Student or graduate with 2 academic years	34 (12.1%)						
Student or graduate from university	135 (48.2%)						
Student or graduated with a master degree	40 (14.3%)						
Student or graduated with a doctoral degree	48 (17.2%)						
Clinical Variables							
Chronic Health Issue							
No	226 (80.7%)	Reference group		Reference group		Reference group	
Unsure	36 (12.9%)	0.48 (0.15 to 1.56)	0.224	0.98 (0.39 to 2.44)	0.958	0.64 (0.26 to 1.61)	0.346
Yes	18 (6.4%)	0.83 (0.21 to 3.30)	0.791	0.67 (0.22 to 2.04)	0.486	1.20 (0.39 to 3.66)	0.750
COVID-19 Infection Status							
No	197 (79.4%)	Reference group		Reference group		Reference group	
Unsure	76 (27.1%)	3.23 (1.59 to 6.60)	0.001	2.42 (1.33 to 4.37)	0.004	1.72 (0.93 to 3.18)	0.084
Yes	7 (2.5%)	6.19 (0.82 to 46.64)	0.077	1.36 (0.18 to 9.98)	0.765	1.83 (0.28 to 11.96)	0.527
Number of COVID-19 cases among colleagues or friends	Mean=3.86	0.98 (0.40 to 2.37)	0.930	1.26 (0.62 to 2.58)	0.523	2.11 (1.11 to 4.01)	0.023

Working Characteristic Variables					
Job Function		Reference group		Reference group	
Radio technologist	62 (22.1%)	0.09 (0.02 to 0.53)	0.007	0.83 (0.24 to 2.90)	0.776
Doctor	42 (15.0%)	0.58 (0.23 to 1.49)	0.260	0.79 (0.35 to 1.79)	0.572
Nurse	57 (20.4%)	0.31 (0.09 to 1.11)	0.072	0.55 (0.16 to 1.85)	0.334
Technician	25 (9.0%)	0.27 (0.06 to 1.21)	0.087	0.49 (0.14 to 1.74)	0.273
Obstetrics	29 (10.3%)	0.62 (0.23 to 1.68)	0.343	0.68 (0.27 to 1.67)	0.404
Healthcare administrator	47 (15.8%)	0.44 (0.02 to 7.96)	0.575	0.58 (0.06 to 5.34)	0.634
Supporting staff	10 (3.6%)	0.32 (0.03 to 3.46)	0.345	0.24 (0.02 to 2.84)	0.258
Volunteer	8 (2.8%)				
Public or Private Healthcare Institution					
Private	71 (25.4%)	Reference group		Reference group	
Public	209 (74.6%)	1.79 (0.82 to 3.89)	0.143	0.86 (0.43 to 1.74)	0.674
Workdays a Week					
1 day	41 (14.6%)	0.38	0.075	0.37	0.030
2 days	37 (13.2%)	(0.13 to 1.10)		(0.15 to 0.91)	
3 days	81 (28.9%)				
4 days	61 (21.8%)				
5 days	60 (21.5%)				
Interaction					
Working days * Age	280 (100%)	1.03 (1.00 to 1.06)	0.047	1.03 (1.01 to 1.06)	0.018
					0.283
					0.61 (0.25 to 1.51)
					0.94 (0.48 to 1.87)
					0.870

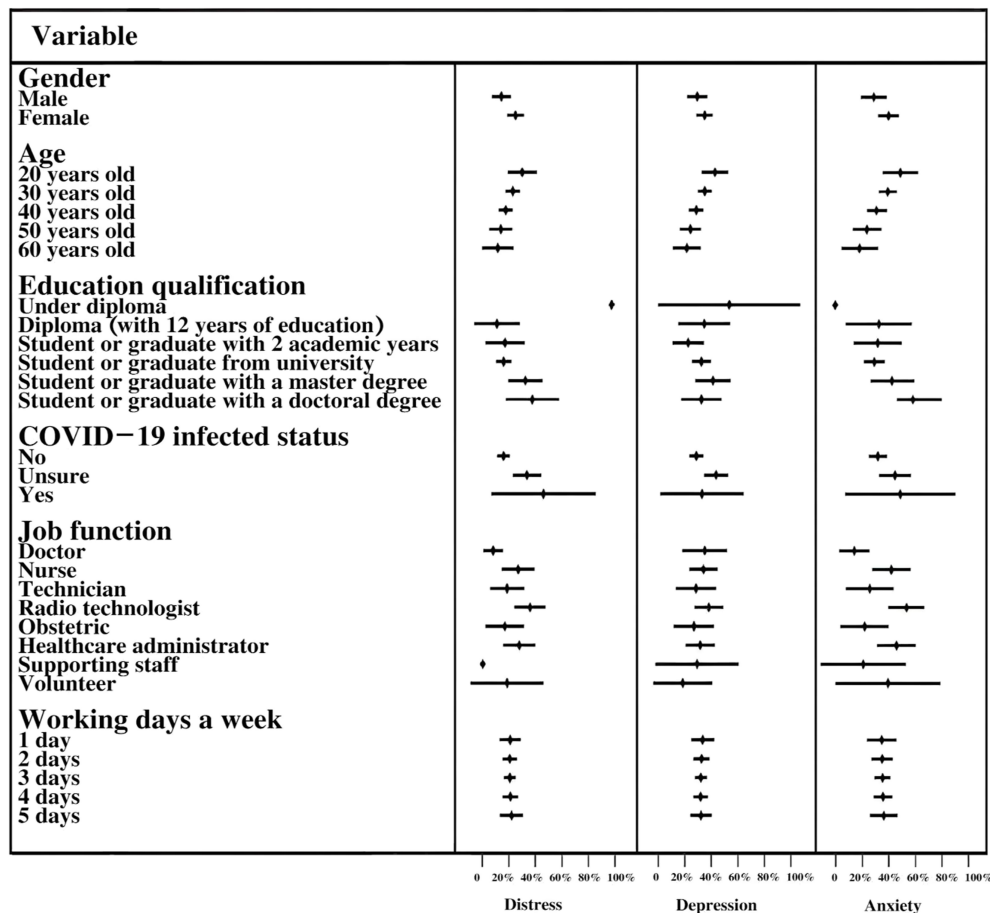


Figure 1 The predicted odds ratios and their 95% confidence intervals (CIs) of distress, depression, and anxiety by healthcare staff's socio-demographic, clinical and work-related characteristics.

illustrates the interaction effect. Further margin analysis on the interaction results revealed that the healthcare staff who were 20 years old and worked only one day per week had the highest likelihood of distress (41%; 95% CI: 23% to 65%; $p=0.000$) and depression symptoms (61%; 95% CI: 40% to 82%; $p=0.000$). In contrast, the healthcare staff who were 20 years old but worked five days a week had a much lower likelihood of having distress (19%; 95% CI: 19% to 36%; $p=0.023$) and depression symptoms (24%; 95% CI: 7% to 40%; $p=0.004$). The chance of having distress and depression symptoms varied significantly by the number of working days among younger participants but not their older counterparts. These margin analysis results are presented in Figure 2.

Discussion

The findings of our study revealed that nearly a third of the healthcare staff in Iran reported symptoms of distress, depression, and anxiety during the COVID-19 pandemic. Gender and education were significant risk factors to

predict the distress of healthcare staff. The participants who were unsure if they were infected with the COVID-19 virus reported more distress and depression. Our survey also suggested that the number of COVID-19 cases among a healthcare worker's colleagues or friends positively predicted the worker's anxiety. We also uncovered that healthcare staff's age and their number of working days per week are significantly related to distress and depression symptoms.

Some demographic risk factors found in previous research failed to predict the mental health of the healthcare staff in our study in a significant manner. While gender predicted the mental health among healthcare staff during the COVID-19 pandemic in China,^{25–27} Italy,²⁸ Brazil,²¹ and several other countries,²⁹ it was not significant in this study. Previous studies indicated those who had chronic health issues had worse mental health,^{30,31} but such a relationship was not significant in this study. These findings may indicate that the predictors of the mental health of healthcare staff during the pandemic may vary from one country to

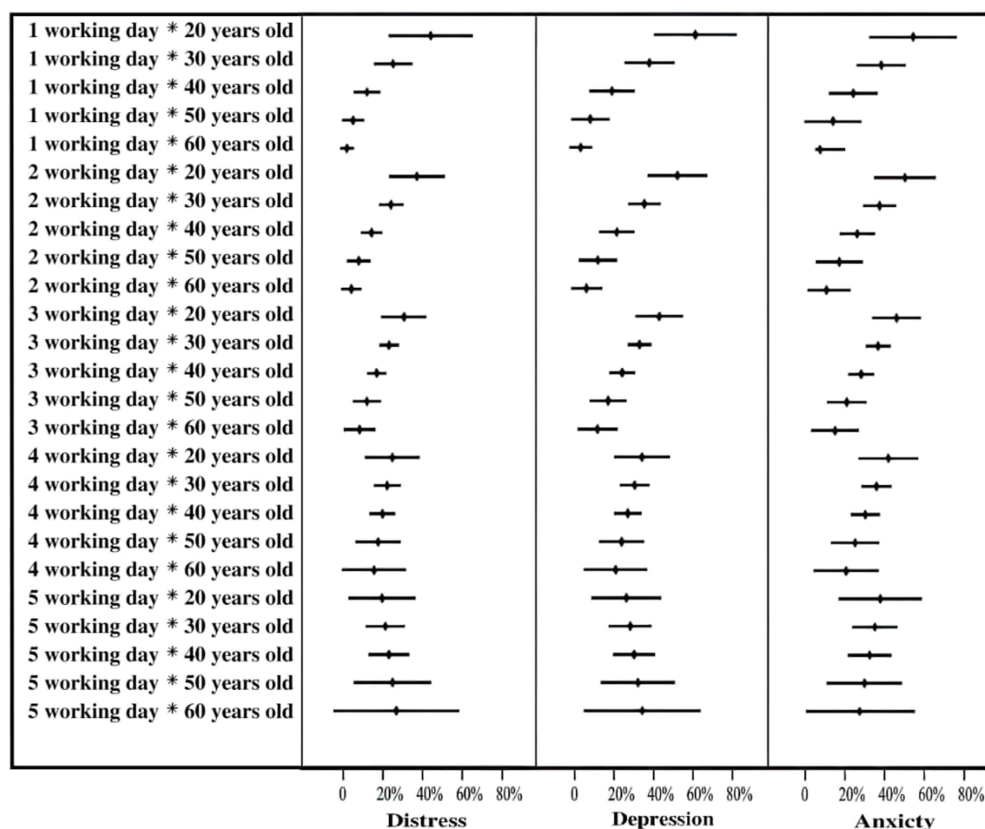


Figure 2 The predicted odds ratios and their 95% confidence intervals (CIs) of distress, depression, and anxiety by healthcare staff's age and number of workdays a week.

another.³²⁻³⁴ Our study also revealed that doctors were more likely to suffer from distress and anxiety than radiology technologists. Prior mental health research among healthcare workers has rarely examined the differences in their mental health by their job functions. Our findings that that radiologists were more likely to experience anxiety in their workplace might be specific to the Iranian context, as there is heavy shortage of radiologists in Iran.³⁵ We suggest future research on mental health under COVID-19 pandemic to investigate further the difference in mental health by healthcare workers' job functions in different contexts.

Moreover, this study, to our best knowledge, is the first to uncover the interaction effect between age and working days in the identification of mentally vulnerable healthcare workers. Previous literature has uncovered age as a predictor in a linear relationship only.² Our finding of an interaction effect suggests that the use of individual healthcare workers' age as a predictor of mental health depends on their number of working days a week. The linear relationship that older healthcare workers are less likely to have mental health issues (the previous finding) is significant only among those who had fewer working days per week. Hence, our findings suggest important boundary conditions on the use of age as a

predictor of mental health. Moreover, the obtained significant interaction effect indicates it is important to consider age, working days, and their interaction effect together in future predictive models of mental health among healthcare staff. Specifically, our findings revealed that younger healthcare staff who did not work many days and older healthcare staff who worked more days are the most mentally vulnerable groups. Unlike previous studies that have shown that younger individuals experienced greater mental issues in SARS,³⁶ we showed younger healthcare staff did not generally have worse mental health, and therefore better predictive models need to take account of their working days to jointly predict the mental health of healthcare staff during the pandemic to better identify which healthcare workers might need more help.

Limitations

Our study has several limitations that open new agendas for future investigations. While we sampled from all the provinces of Iran, our sample did not aim to capture healthcare staff by their proportions based on the provinces in Iran. Future studies may use more representative samples from more countries in the world.¹ We conducted

this study using an observational cross-sectional survey, so our findings are predictive instead of causal. Lastly, even though our sample contained adults who reported having COVID-19, the number of infected cases in our sample is too small, and we suspect they would belong to the majority of COVID-19 infected cases that have mild symptoms, as people with more severe symptoms would not have been able to answer our survey.

Conclusions

Our identification of the demographic, clinical, and work-related characteristics as risk factors of mental health issues for healthcare staff during the COVID-19 crisis enables psychological services to better identify mentally vulnerable healthcare staff. The interaction of healthcare staff's age and the number of working days a week suggests important boundary conditions and room for improvement in the identification models applied in the prior studies. Our results suggest the need to further investigate the work-related characteristics during the COVID-19 pandemic as a fruitful direction to identify mentally vulnerable healthcare staff during the COVID-19 crisis.

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Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest for this work.

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