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Prevalence and influencing factors of occupational burnout among healthcare workers in the Chinese mainland during the late 2022 Omicron COVID-19 outbreak: a multicenter cross-sectional study

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Abstract

China witnessed an Omicron COVID-19 outbreak at the end of 2022. During this period, medical crowding and enormous pressure on the healthcare systems occurred, which might result in the occurrence of occupational burnout among healthcare workers (HCWs). This study aims to investigate the prevalence of occupational burnout and associated mental conditions, such as depressive symptoms, anxiety, PTSD symptoms, perceived social support, resilience, and mindfulness among HCWs of the Chinese mainland during the Omicron COVID-19 outbreak, and to explore the potential risk and protective factors influencing occupational burnout of HCWs. A multicenter cross-sectional study was conducted among HCWs working in the Chinese mainland from January 5 to February 9, 2023. A total of 6552 participants were recruited by convenience sampling. Data were collected on demographic characteristics, occupational burnout, depressive symptoms, anxiety, PTSD, perceived social support, resilience, and mindfulness by online questionnaires. Descriptive analyses were performed to describe the participants' demographic characteristics. Univariate-Multivariate analyses were used to determine the influencing factors of occupational burnout. The results showed that the prevalence of occupational burnout and associated mental disorders, such as depressive symptoms, anxiety, and PTSD in HCWs were 44.56%, and 70.75%, 47.87%, and 37.49%, respectively. Older age, female gender, higher income, more doses of COVID-19 vaccine, a higher level of mindfulness, resilience, and perceived social support were protective factors of occupational burnout. Working as nurses, in a department currently taking charge of the treatment of COVID-19 patients, perceived high risk of

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contracting COVID-19 due to work, perceived high work intensity, and a higher level of anxiety and depressive symptoms were risk factors of occupational burnout. Tailored interventions on perceived social support, resilience, and mindfulness should be implemented to alleviate occupational burnout and associated mental disorders among HCWs.

Keywords Occupational burnout, Healthcare worker, COVID-19, China

Introduction

The COVID-19 pandemic made a profound impact on the mental health and well-being of healthcare workers (HCWs) worldwide. In China, HCWs were overwhelmed by huge patient demand for hospital care during the pandemic [1]. The COVID-19 pandemic has seen multiple waves of infection in China, each with distinct characteristics and challenges. The initial wave in early 2020, centered in Wuhan, was characterized by a high incidence of respiratory symptoms and severe cases, requiring strict lockdowns and extensive testing to control the spread [2]. Subsequent waves in 2020 and 2021 demonstrated variations in symptomatology, including gastrointestinal and neurological manifestations. Public health measures, such as mass testing and quarantine, were crucial in managing these waves. With the widespread availability of COVID-19 vaccines and the decreasing virulence of the virus, the impact gradually reduced [3]. However, The Omicron wave in late 2022 was particularly notable for its high transmissibility, leading to a substantial increase in severe cases among patients with comorbidities. This wave also coincided with the end of the Zero-COVID policy, resulting in a rapid surge of infections, medical crowding, and enormous pressure on the healthcare system [4]. The Omicron variant has been shown to have unique effects on humans, including increased transmissibility and a preference for upper respiratory tract infection. These characteristics have led to new challenges and stressors for HCWs, who have had to adapt to rapidly changing infection control measures and increased patient loads [5]. Therefore, HCWs faced greater challenges and pressures compared to the general population, such as higher workloads, increased staff shortages, and deeper psychological distress, which could have resulted in occupational burnout [6–9]. Understanding these unique effects of the Omicron COVID-19 outbreak on HCWs is crucial for developing targeted interventions to support their mental health and well-being future potential pandemics.

Several studies have reported a high prevalence of occupational burnout among HCWs in China during the COVID-19 pandemic. A multicenter cross-sectional study conducted in Wuhan, Harbin, and Shenzhen reported a prevalence rate of 48.6% for occupational burnout among HCWs with 21.8% of them reporting severe burnout [10]. Another study from Liaoning, China showed that 72.9% of HCWs reported at least one

symptom of occupational burnout [11]. A nationwide survey also showed that the prevalence rates of occupational burnout, depression, and anxiety among Chinese nurses were 34.0%, 55.5%, and 41.8%, respectively, during the COVID-19 pandemic. Moreover, a study conducted during the Omicron wave in Taizhou, China showed that 71.2% of HCWs experienced occupational burnout, of which 54.8% were mild to moderate and 16.4% severe, higher than those in other countries such as 49% in the U.S. and 43.1% in Japan in average [12–15]. These data emphasized the heightened vulnerability of Chinese HCWs to occupational burnout, highlighting the urgent need for targeted interventions to mitigate this issue in China. A high prevalence of occupational burnout in HCWs may lead to decreased job satisfaction, compromised quality of care, and increased turnover rates, ultimately affecting the overall functioning of the healthcare system [16, 17]. Therefore, it is crucial to implement targeted interventions and support to alleviate the burden of occupational burnout among HCWs in China.

The risk factors of occupational burnout among HCWs during the COVID-19 pandemic in China were multifaceted, including high workload and long working hours, inadequate distribution of personal protective equipment (PPE), fear of infection, and psychological disorders [18–26]. Additionally, the rapidly changing and unpredictable nature of the virus also contributed to the higher risk of occupational burnout among HCWs in China [27]. Among these influencing factors, some mental health conditions are considered critical risk factors for occupational burnout. A cross-sectional study in Turkey revealed that HCWs with depressive symptoms were 3 times more likely to develop occupational burnout compared to those without depressive symptoms; similarly, HCWs with anxiety symptoms had a 7-time higher risk of developing occupational burnout compared to those without anxiety symptoms during the COVID-19 pandemic [28]. Another cross-sectional study in Iran and a comprehensive review showed that post-traumatic stress disorder (PTSD) caused by COVID-19 was associated with occupational burnout among HCWs [29, 30].

Some other conditions are considered protective. A cross-sectional study in Turkey indicated that a higher level of perceived social support among HCWs could reduce their occupational burnout during the COVID-19 pandemic [31]. A cross-sectional study in Italy suggested that resilience was negatively associated with

HCWs' occupational burnout during the COVID-19 pandemic [32]. A systematic review and meta-analysis demonstrated that mindfulness-based interventions could reduce occupational burnout among HCWs [33].

Most studies examining occupational burnout among Chinese HCWs during the COVID-19 pandemic were conducted before the Omicron COVID-19 outbreak at the end of 2022. Additionally, the association between psychological factors and occupational burnout among HCWs in the Chinese mainland has not been adequately examined. To fill these gaps, the current large sample, multicenter, cross-sectional study is aimed at investigating the prevalence of occupational burnout and associated mental conditions, such as depressive symptoms, anxiety, PTSD symptoms, perceived social support, resilience, and mindfulness among HCWs of the Chinese mainland during the Omicron COVID-19 outbreak at the end of 2022, exploring how psychological factors influence occupational burnout, and providing valuable insights for further policy-making and interventions.

Methods

Sampling and participants

This multicenter cross-sectional study was conducted among HCWs working in hospitals in the Chinese mainland from January 5 to February 9, 2023, covering seven geographical regions of China (Northeast China, North China, East China, South China, Central China, Northwest China, and Southwest China), which could ensure the representativeness of our research sample. All participants were recruited by convenience sampling based on the distribution of medical resources, and were required to fill in an anonymous, structured, self-administered questionnaire via an online survey platform "SoJump" powered by "www.wjx.cn". The questionnaire was designed by an expert team of epidemiologists and mental health professionals through several rounds of literature reviews and group discussions. Afterward, our team conducted interviews and piloted the questionnaire on healthcare workers eligible for the inclusion criteria. Finally, the questionnaire was finalized based on healthcare workers' scientific advice and experience. Digital informed consent was obtained from all participants to ensure their voluntary participation. The eligibility criteria were: (1) over 18 years old; (2) HCWs working in hospitals in the Chinese mainland (In this study, HCWs refer to individuals who provide care and services to the sick and ailing, either directly as doctors and nurses, or indirectly as aides, helpers, laboratory technicians, and other related professionals); (3) proficiency in Chinese; (4) able to complete the questionnaire independently; (5) had mobile communication equipment such as a mobile phone; (6) agreed to participate in this study. In total, 6996 healthcare workers completed the questionnaires,

and 6558 of them met the eligibility criteria. After excluding samples with obvious patterns in questionnaire responses (e.g., all items having the same choice), 6552 samples were retained for further analyses, with an effective recovery rate of 99.91%. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines, and was approved by the Ethics Committee of the Chinese Academy of Medical Science on December 29th, 2022 (CAMS&PUMC-IEC-2022-83).

Measurement

Demographic characteristics

Demographic characteristics include age, gender, job, educational background, marriage status, workplace, years of working, income, drinking and smoking frequency, whether the current department taking charge of the treatment of COVID-19 patients, whether having supported other departments to treat COVID-19 patients, perceived risk of contracting COVID-19 due to work, perceived work intensity, COVID-19 infection condition during the Omicron COVID-19 outbreak at the end of 2022, and the number of doses of COVID-19 vaccine.

Occupational burnout

Occupational burnout is a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed. It is usually characterized by three key dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment. The Chinese version of the Maslach Burnout Inventory-General Survey (MBI-GS) was used to evaluate participants' occupational burnout. MBI-GS was developed by Maslach, et al. in 2001, and was adapted in the Chinese population by Li, et al. in 2003 [34, 35]. This instrument contains 15 items which are 7-point Likert scaled from 0 to 6. The total scores will be converted to standard scores to evaluate occupational burnout, where a standard score below 50 represents no occupational burnout, 50~74 represents mild occupational burnout, 75~99 represents moderate occupational burnout, and equal or above 100 represents severe occupational burnout. The Cronbach's α of this instrument in this study was 0.875.

Depressive symptoms

Depressive symptoms are characterized by persistent feelings of sadness, hopelessness, irritability, loss of interest in activities, and cognitive difficulties [36]. The 9-item Patient Health Questionnaire (PHQ-9) was used to assess participants' depressive symptoms in the past two weeks. PHQ-9 was introduced by Kroenke, et al. in 2001 and was revised and validated in the Chinese elderly by Xu, et al. in 2007 [37, 38]. This instrument contains 9 items which

are 4-point Likert scaled ranging from 0 to 3. The total score is utilized to assess the degree of depressive symptoms, with scores of ≥ 5 indicating depressive symptoms, and scores of 5–9 mild depressive symptoms; 10–14 moderate depressive symptoms; 15–19 moderately severe depressive symptoms; and scores of ≥ 20 severe depressive symptoms. The Cronbach's α of this instrument in this study was 0.922.

Anxiety

Anxiety disorders are characterized by features that include excessive fear and anxiety or avoidance of perceived threats that are persistent and impairing [39]. The 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) was used to assess participants' anxiety in the past two weeks. This instrument was developed and validated by Spitzer, et al. in 2006 and was validated among pregnant women and people with epilepsy in China [40–42]. This instrument contains 7 items which are 4-point Likert scaled ranging from 0 to 3. The scores of the instrument range from 0 to 21. A cutoff score of ≥ 5 is recommended for considering significant anxiety symptoms, and scores between 5 and 9, 10 and 14, and 15 and higher represent mild, moderate, and severe anxiety symptoms, respectively.

PTSD

PTSD is a mental disorder that may develop in some people who have been exposed to exceptionally threatening or horrifying events [43]. The 6-item Impact of Event Scale (IES-6) was used to evaluate the participants' experience of PTSD in the past 7 days. This instrument was developed by Thoresen, et al. in 2010, and was validated among ARDS survivors in China [44, 45]. IES-6 contains 6 items which are 4-point Likert scaled ranging from 0 to 3. A total score of equal to or above 10 indicates PTSD is positive. The Cronbach's α of the instrument in this study was 0.941.

Resilience

Resilience is the ability to successfully adapt to difficult or challenging life experiences [46]. The 10-item Connor-Davidson Resilience Scale (CD-RISC-10) was used to measure participants' psychological resilience. This instrument was developed by Connor, et al. in 2003 with 25 items and was reduced to 10 items by Campbell-Sills, et al. in 2007 [47, 48]. This instrument contains 10 items which are 4-point Likert scaled ranging from 1 to 4 and has been validated among parents of children with cancer diagnosis and earthquake victims in China [49, 50]. A higher total score of CD-RISC-10 indicates a higher level of psychological resilience. The Cronbach's α of the instrument in this study was 0.971.

Mindfulness

Mindfulness can be defined as an open and conscious observation of one's present experience, which is characterized by non-judgmental awareness of the present experience, including awareness of individual's feelings, thoughts, physical state, consciousness, and environment, while encouraging openness, curiosity, and acceptance [51]. The 5-item Mindful Awareness Attention Scale (MAAS-5) was used to evaluate the mindfulness level of participants. This instrument was developed by Brown, et al. in 2003 and was simplified to 5 items by Tomás Caycho-Rodríguez, et al. in 2021 [52, 53]. This instrument was translated into Chinese through a rigorous process and adapted in Chinese diabetic patients [54]. MAAS-5 contains 5 items which are 6-point Likert scaled ranging from 1 to 6. Since a higher total score of MAAS-5 indicated a lower level of mindfulness, we reversely scored the items to make the explanations more intuitive. The Cronbach's α of the instrument in this study was 0.933.

Perceived social support

Perceived social support refers to the perceived comfort, caring, esteem, or instrumental help a person receives from others [55]. The 2-item Perceived Social Support Scale (PSSS-2) was used to assess participants' perceived social support. This instrument was developed by Li, et al. in 2017 and has been used among men who have sex with men and COVID-19 survivors in China [56, 57]. It contains two items, and each item is 11-point Likert scaled from 0 to 10. Higher total scores indicated a higher level of perceived support. The Cronbach's α of the instrument in this study was 0.858.

Statistical analysis

Descriptive analyses were performed to describe the participants' demographic characteristics, the COVID-19-related factors, and the conditions of mental health and occupational burnout. The Chi-square and one-way ANOVA were used for univariate analysis of the association between occupational burnout and potential influencing factors. However, Chi-square requires a relatively large sample size and/or a relatively even split of the subjects among the levels. In this case, the expected counts in 80% of the cells should be greater than five, otherwise the Fisher's exact test should be reported. Statistically significant variables in univariate analysis ($p \leq 0.10$) were further included in the stepwise multinomial logistic regression, with the category of "no occupational burnout" as the reference. Adjusted odds ratio (AOR) and the corresponding 95% confidence intervals (95% CI) in the regression model were calculated to determine the influencing factors of occupational burnout. All statistical

analyses were completed with SAS 9.4. with the level of significance determined at $\alpha = 0.05$.

Results

Demographic characteristics

Among the 6522 healthcare workers in this study, the average age was 37.58; 76.65% were female; 90.37% were of the Han nationality; 47.72% were nurses; 65.81% were of bachelor degrees; 76.57% were married; 77.58% worked in tertiary hospitals; 36.02% had worked for 10–20 years; 48.99% had a monthly income of 5000–10,000 CNY; 92.72% did not smoke in the past 6 months; 78.47% did not drink in the past 6 months; 68.49% took charge of the treatment of COVID-19 patients; 47.07% supported other departments that treated COVID-19 patients; 90.43% perceived high COVID-19 risk of contracting COVID-19 due to work; 88.01% perceived high work intensity; 76.62% were infected with COVID-19 once, and 80.47% received three doses of COVID-19 vaccine. The results are displayed in Table 1.

Prevalence of occupational burnout and associated mental disorders of participants

In this study, the scores of CD-RISC-10 were 28.54 ± 7.164 ; MAAS-5 was 21.95 ± 5.633 ; PSSS-2 was 15.13 ± 4.703 . The prevalence of occupational burnout and associated mental disorders such as depressive symptoms, anxiety, PTSD, and occupational burnout were 44.56% and 70.75%, 47.87%, and 37.49%, respectively. The detailed information is summarized in Table 2; Fig. 1.

Influencing factors of occupational burnout

Due to the low proportion of the “severe occupational burnout” group (0.80%) in this study, we combined this group with “moderate occupational burnout” as the “moderate to severe burnout” group for further analyses. The results of the univariate analyses are shown in Table 3. The statistically significant variables were further included in multivariate analysis as independent variables.

The result of multivariate analysis showed that older age (AOR=0.968, $P < 0.001$), female (AOR=0.689, $P < 0.001$), having an income of 5000~10,000 CNY per month (AOR=0.836, $P = 0.011$), 2~4 doses of COVID-19 vaccine (AOR=0.401/0.425/0.445, $P = 0.006/0.006/0.012$), a higher level of mindfulness (AOR=0.874, $P < 0.001$), a higher level of resilience (AOR=0.942, $P < 0.001$), and a higher level of perceived social support (AOR=0.926, $P < 0.001$) were protective factors of mild occupational burnout; working as nurses (AOR=1.337, $P < 0.001$), current department taking charge of the treatment of COVID-19 patients (AOR=1.1390, $P < 0.001$), a higher level of anxiety (AOR=1.069, $P < 0.001$), and a higher level of depressive symptoms (AOR=1.073, $P < 0.001$)

were risk factors of mild occupational burnout. Older age (AOR=0.933, $P < 0.001$), having been infected with COVID-19 without a positive PCR/antigen test result or infected once (AOR=0.536/0.597, $P = 0.020/0.015$), a higher level of mindfulness (AOR=0.863, $P < 0.001$), a higher level of resilience (AOR=0.870, $P < 0.001$), and a higher level of perceived social support (AOR=0.880, $P < 0.001$) were protective factors of moderate to severe occupational burnout. Current department taking charge of the treatment of COVID-19 patients (AOR=1.380, $P = 0.025$), perceived risk of contracting COVID-19 due to work (AOR=2.191, $P = 0.013$), Perceived work intensity (AOR=3.023, $P < 0.001$), a higher level of anxiety (AOR=1.140, $P < 0.001$), and a higher level of depressive symptoms (AOR=1.117, $P < 0.001$) were risk factors of moderate to severe occupational burnout. The results are illustrated in Table 4; Fig. 2, and Fig. 3.

Discussion

The primary aim of the current multicenter cross-sectional study is to provide insights into the prevalence and influencing factors of occupational burnout among HCWs of the Chinese mainland during the Omicron COVID-19 outbreak at the end of 2022, highlighting the impact of psychological factors on their occupational burnout, such as depressive symptoms, anxiety, perceived social support, resilience, and mindfulness. These findings could have implications for the evaluation of the burden of occupational burnout on HCWs in China and may inform further public health policies.

In this study, the prevalence of occupational burnout among Chinese HCWs was 44.56%, higher than that in the previous waves [13]. Although the virulence and mortality rate of the Omicron strain of COVID-19 decreased, it remained highly contagious [58, 59]. Since the surge period, a massive number of individuals have been infected with the Omicron variant, suffering from symptoms such as fever, headache, and lung infections, etc [60]. The widespread infections and symptoms led to a sharp increase in the number of hospitalized patients in a short period, the burden on the healthcare systems, and serious psychological and work pressure on HCWs, and thereby, increased their occupational burnout [61, 62]. Additionally, the prevalence of depressive symptoms and anxiety of HCWs in this study were 70.75% and 47.87%, respectively, which were higher than those before this survey, both significantly associated with occupational burnout [63]. These findings emphasized the importance of effective management and prevention of occupational burnout as well as the associated mental disorders among HCWs, and demanded closer attention from healthcare institutions and policymakers.

In this study, depressive symptoms and anxiety were both risk factors for occupational burnout in Chinese

Table 1 Demographic characteristics of participants(*N*=6522)

Variable	Mean (SD) or <i>n</i> (%)
Age, years	37.58 (8.820)
Gender	
Male	1523 (23.35)
Female	4999 (76.65)
Occupation	
Doctor	2584 (39.62)
Nurse	3112 (47.72)
Pharmacist	127 (1.95)
Public health professional	134 (2.05)
Other	565 (8.66)
Educational attainment	
Associate degree or below	935 (14.34)
Bachelor	4292 (65.81)
Master or above	1295 (19.86)
Marital status	
Single / Unmarried	1359 (20.84)
Married	4994 (76.57)
Divorced / Widowed	169 (2.59)
Workplace	
Primary hospital	227 (3.48)
Secondary hospital	1185 (18.17)
Tertiary hospital	5060 (77.58)
Private hospital	50 (0.77)
Years of working	
years < 5	1402 (21.50)
5 ≤ years < 10	1231 (18.87)
10 ≤ years < 20	2349 (36.02)
years ≥ 20	1540 (23.61)
Income (CNY per month)	
< 5000	2666 (40.88)
5000 ~ 10,000	3195 (48.99)
10,000 ~ 30,000	630 (9.66)
≥ 30,000	31 (0.48)
Smoking Frequency (on average within the past 6 months)	
No smoking	6047 (92.72)
Less than one cigarette a day	100 (1.53)
2–9 cigarettes a day	186 (2.85)
0.5–1 pack of cigarettes a day	162 (2.48)
More than a pack a day	27 (0.41)
Drinking Frequency (on average within the past 6 months)	
No alcohol	5118 (78.47)
Less than once a week	1112 (17.05)
1–2 times a week	199 (3.05)
3–4 times a week	60 (0.92)
5 or more times a week	20 (0.31)
Almost every day	13 (0.20)
Department taking charge of the treatment of COVID-19 patients	
No	2055 (31.51)
Yes	4467 (68.49)
Having supported other departments to treat COVID-19 patients	
No	3452 (52.93)
Yes	3070 (47.07)
Perceived risk of contracting COVID-19 due to work	

Table 1 (continued)

Variable	Mean (SD) or n (%)
Not high	624 (9.57)
High	5898 (90.43)
Perceived Work Intensity	
Not high	782 (11.99)
High	5740 (88.01)
COVID-19 infection during the Omicron COVID-19 outbreak at the end of 2022*	
Not infected	630 (9.66)
Infected once	4997 (76.62)
Infected twice or more	52 (0.80)
Infected without a positive PCR/antigen test result	843 (12.93)
Doses of COVID-19 vaccine	
0	67 (1.03)
1	80 (1.23)
2	412 (6.32)
3	5248 (80.47)
4	715 (10.96)

*(Nov. 2022 to Feb. 2023)

Table 2 Conditions of mental health and occupational burnout of participants

Variable	Mean (SD) or n (%)
Resilience (CD-RISC-10)	
Total score	28.54 (7.164)
Mindfulness (MAAS-5)	
Total score	21.95 (5.633)
Perceived social support (PSSS-2)	
Total score	15.13 (4.703)
Depressive symptoms (PHQ-9)	
Total score 8.40 (6.15)	
No	1908(29.25)
Mild	2383(36.54)
Moderate	1181(18.11)
Severe	1050(16.10)
Anxiety (GAD-7)	
Total score 5.62 (5.43)	
No	3400(52.13)
Mild	1920(29.44)
Moderate	764(11.71)
Severe	438(6.72)
PTSD (IES-6)	
Total score 7.73 (6.38)	
No	4077(62.51)
Yes	2445(37.49)
Occupational Burnout (MBI-GS)	
No	3616(55.44)
Mild	2466(37.81)
Moderate	388(5.95)
Severe	52(0.80)

HCWs, which are similar to the findings of previous research [26, 64]. The influence of depressive symptoms and anxiety on occupational burnout in HCWs may have a biological basis. In individuals with depressive

symptoms and anxiety, their hypothalamic-pituitary-adrenal (HPA) axis can become dysregulated, leading to increased levels of cortisol [65, 66]. In this case, elevated cortisol levels can result in chronic stress, which is a generally recognized risk factor for occupational burnout [67]. In addition to the biological basis, according to the job demands-resources (JD-R) model, depressive symptoms and anxiety could result in increased working stress, exhaustion, and emotional depletion in HCWs, which can make it more difficult for them to handle the demands of their job, thus contributing to occupational burnout [68, 69]. Additionally, depressive symptoms and anxiety can also reduce HCWs' job resources by impairing their motivation to learn new skills, and develop positive relationships with colleagues, which could further lead to occupational burnout [70]. The findings highlighted the importance of prioritizing the management of depressive symptoms and anxiety in HCWs to mitigate their occupational burnout. Organizational strategies such as reducing workplace stressors and providing structural mental health interventions, including cognitive-behavioral therapy and acceptance and commitment therapy, have been recommended to address these issues effectively [71, 72].

Contrary to previous research, the findings of the current study indicated that PTSD was not significantly associated with occupational burnout among HCWs. One explanation is that healthcare workers with PTSD symptoms may develop emotional numbness as a coping mechanism, which can reduce their emotional engagement with work and consequently weaken the association between PTSD and emotional exhaustion in occupational burnout [73, 74]. Moreover, this survey was conducted during 1 ~ 2 months after the surge period, the

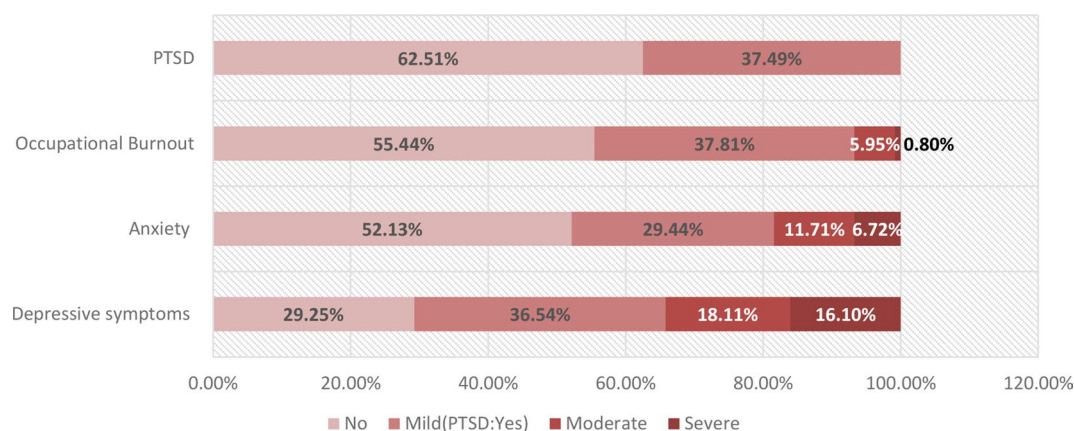


Fig. 1 Prevalence of occupational burnout, PTSD, anxiety, and depressive symptoms among healthcare workers

HCWs with PTSD had possibly developed certain coping strategies that enabled them to better manage their work- or COVID-19-related intrusion, avoidance, and hyperarousal, and buffered the association between PTSD and occupational burnout [75]. This unexpected result required further investigation into potential mechanisms that might contribute to the insignificant association between PTSD and occupational burnout.

To be noted, the results of this survey revealed that compared with doctors, nurses were almost 1.5 times more likely to develop occupational burnout. To deal with the soaring cases, nurses had to undertake an extra workload of caring for patients [13]. Additionally, nurses often had a higher risk of exposure to COVID-19 compared to doctors since they spent more time with patients, which could lead to increased anxiety and stress related to concerns about personal health and the potential risk of transmitting the virus to family and friends, thus increasing their occupational burnout [76]. Moreover, nurses might have less decision-making power than doctors in patient care, which could increase their feelings of frustration and helplessness, and hence developing occupational burnout if their contributions were not fully recognized [77]. This finding highlighted the necessity of paying more attention to nurses' occupational burnout and psychological health and suggested that more interventions and support should be provided for this population.

In addition to the risk factors, the findings of this study indicated that higher levels of perceived social support, resilience, and mindfulness could decrease occupational burnout among HCWs, which were similar to the results of previous research [78–80]. Social support could provide psychological capital for HCWs to deal with stressors caused by COVID-19, which

could further alleviate occupational burnout as well as negative emotions such as depressive symptoms and anxiety [81, 82]. A higher level of resilience could help HCWs better adapt to their working environment, thus buffering the association between negative events in their work and occupational burnout and the associated mental disorders [83, 84]. Equally important, a higher level of mindfulness could help HCWs achieve inner peace and relaxation, and further decrease their occupational burnout and mental disorders such as depressive symptoms and anxiety [85, 86]. These findings indicated that higher levels of perceived social support, resilience, and mindfulness could reduce occupational burnout of Chinese HCWs, and alleviate mental disorders of HCWs such as depressive symptoms and anxiety, the two major influencing factors of occupational burnout determined in this study. Health institutions could improve HCWs' perceived social support by creating a harmonious work environment, encouraging the development of social connections among colleagues, and rewarding positive behaviors [87–89]. Additionally, social media campaigns should appeal to the general population to provide more emotional and behavioral support for HCWs, thereby fostering a sense of community and support [90]. To enhance HCWs' resilience, the health authorities could consider providing HCWs with training and resources to develop their coping strategies with negative events, stress management skills, and self-care practices [91]. Furthermore, to improve the mindfulness level of HCWs, health authorities could consider implementing regular mindfulness-based interventions for HCWs, such as the “Mindful Living with Challenge” (MLWC) course that was specifically designed for coping with COVID-19-related mental health challenges [51, 92].

Table 3 Univariate analysis of influencing factors of occupational burnout

Variable	Classification of occupational burnout			χ^2/F	P
	No occupational burnout	Mild occupational burnout	Moderate to severe occupational burnout		
Age, years	38.66 ± 9.06	36.44 ± 8.43	35.10 ± 7.57	71.18*	< 0.001
Gender				32.367#	< 0.001
Male	875 (57.45%)	594 (39.00%)	54 (3.55%)		
Female	2741 (54.83%)	1872 (37.45%)	386 (7.72%)		
Job				60.309#	< 0.001
Doctor	1517 (58.71%)	917 (35.49%)	150 (5.80%)		
Nurse	1591 (51.12%)	1263 (40.58%)	258 (8.29%)		
Pharmacist	82 (64.57%)	42 (33.07%)	3 (2.36%)		
Public health professional	81 (60.45%)	44 (32.84%)	9 (6.72%)		
Other	345 (61.06%)	200 (35.40%)	20 (3.54%)		
Educational Background				11.59#	0.021
Junior college or below	497 (53.16%)	375 (40.11%)	63 (6.74%)		
Bachelor	2349 (54.73%)	1645 (38.33%)	298 (6.94%)		
Master or above	770 (59.46%)	446 (34.44%)	79 (6.10%)		
Marriage Status				37.961#	< 0.001
Single / Unmarried	671 (49.37%)	558 (41.06%)	130 (9.57%)		
Married	2841 (56.89%)	1851 (37.06%)	302 (6.05%)		
Divorced / Widowed	104 (61.54%)	57 (33.73%)	8 (4.73%)		
Workplace				8.884#	0.180
Primary hospital	125 (55.07%)	86 (37.89%)	16 (7.05%)		
Secondary hospital	650 (54.85%)	474 (40.00%)	61 (5.15%)		
Tertiary hospital	2815 (55.63%)	1884 (37.23%)	361 (7.13%)		
Private hospital	26 (52.00%)	22 (44.00%)	2 (4.00%)		
Years of working				105.071#	< 0.001
years < 5	718 (51.21%)	571 (40.73%)	113 (8.06%)		
5 ≤ years < 10	629 (51.10%)	506 (41.10%)	96 (7.80%)		
10 ≤ years < 20	1245 (53.00%)	937 (39.89%)	167 (7.11%)		
years ≥ 20	493 (32.01%)	567 (36.82%)	274 (17.79%)		
Income (CNY per month)				73.388#	< 0.001
< 5000	1316 (49.36%)	1135 (42.57%)	215 (8.06%)		
5000 ~ 10,000	1889 (59.12%)	1110 (34.74%)	196 (6.13%)		
10,000 ~ 30,000	394 (62.54%)	208 (33.02%)	28 (4.44%)		
≥ 30,000	17 (54.84%)	13 (41.94%)	1 (3.23%)		
Smoking Frequency (on average within the past 6 months)				16.058#	0.042
No smoking	3362 (55.60%)	2260 (37.37%)	425 (7.03%)		
Less than one cigarette a day	49 (49.00%)	48 (48.00%)	3 (3.00%)		
2–9 cigarettes a day	105 (56.45%)	75 (40.32%)	6 (3.23%)		
0.5–1 pack of cigarettes a day	86 (53.09%)	71 (43.83%)	5 (3.09%)		
More than a pack a day	14 (51.85%)	12 (44.44%)	1 (3.70%)		
Drinking Frequency (on average within the past 6 months)				&	0.031
No alcohol	2861 (55.90%)	1907 (37.26%)	350 (6.84%)		
Less than once a week	597 (53.69%)	433 (38.94%)	82 (7.37%)		
1–2 times a week	114 (57.29%)	80 (40.20%)	5 (2.51%)		
3–4 times a week	32 (53.33%)	27 (45.00%)	1 (1.67%)		
5 or more times a week	8 (40.00%)	10 (50.00%)	2 (10.00%)		
Almost every day	4 (30.77%)	9 (69.23%)	0 (0.00%)		
In a department currently taking charge of the treatment of COVID-19 patients				48.377#	< 0.001
No	1266 (61.61%)	683 (33.24%)	106 (5.16%)		
Yes	2350 (52.61%)	1783 (39.91%)	334 (7.48%)		
Having supported other departments to treat COVID-19 patients				26.415#	< 0.001
No	2016 (58.40%)	1225 (35.49%)	211 (6.11%)		

Table 3 (continued)

Variable	Classification of occupational burnout			χ^2/F	P
	No occupational burnout	Mild occupational burnout	Moderate to severe occupational burnout		
Yes	1600 (52.12%)	1241 (40.42%)	229 (7.46%)		
Perceived risk of contracting COVID-19 due to work				51.978#	< 0.001
Not high	423 (67.79%)	188 (30.13%)	13 (2.08%)		
High	3193 (54.14%)	2278 (38.62%)	427 (7.24%)		
Perceived Work Intensity				67.635#	< 0.001
Not high	528 (67.52%)	240 (30.69%)	14 (1.79%)		
High	3088 (53.80%)	2226 (38.78%)	426 (7.42%)		
COVID-19 infection during the Omicron COVID-19 outbreak at the end of 2022				18.415#	0.005
Not infected	360 (57.14%)	231 (36.67%)	39 (6.19%)		
Infected once	2736 (54.75%)	1915 (38.32%)	346 (6.92%)		
Infected twice or more	21 (40.38%)	22 (42.31%)	9 (17.31%)		
Infected without a positive PCR/antigen test result	499 (59.19%)	298 (35.35%)	46 (5.46%)		
Doses of COVID-19 vaccine				21.249#	0.007
0	27 (40.30%)	36 (53.73%)	4 (5.97%)		
1	34 (42.50%)	41 (51.25%)	5 (6.25%)		
2	217 (52.67%)	176 (42.72%)	19 (4.61%)		
3	2931 (55.85%)	1955 (37.25%)	362 (6.90%)		
4	407 (56.92%)	258 (36.08%)	50 (6.99%)		
Mindfulness (MAAS-5)	24.27 ± 4.75	19.31 ± 5.24	17.67 ± 5.45	870.57*	< 0.001
Resilience (CD-RISC-10)	30.07 ± 7.59	27.10 ± 5.96	24.06 ± 6.15	251.31*	< 0.001
Perceived social support (PSSS-2)	16.49 ± 4.00	13.77 ± 4.83	11.64 ± 5.26	386.24*	< 0.001
Anxiety (GAD-7)	3.31 ± 3.80	7.90 ± 5.45	11.81 ± 6.48	931.48*	< 0.001
Depressive symptoms (PHQ-9)	5.81 ± 4.62	11.00 ± 6.03	15.06 ± 6.57	945.94*	< 0.001
PTSD (IES-6)	5.58 ± 5.34	10.00 ± 6.38	12.72 ± 7.09	535.48*	< 0.001

Note: *: χ^2 values for the Chi-square test; #: F values for the one-way ANOVA; &: Fisher's exact test

Moreover, the findings indicated that higher income is a protective factor of occupational burnout in HCWs, which is consistent with the result of previous research [93]. Higher income is associated with less financial stress and improved job satisfaction, which could further decrease occupational burnout [94]. Under high working intensity, HCWs in China with a high income might have more resources to deal with negative events in their life, and might be more sensitive to react to their own needs for psychological counseling [95]. Hence, moderately improving the income of HCWs might be helpful in preventing the occurrence of occupational burnout, and to ensure the motivation, dedication, and well-being of the healthcare workers [96]. The health authorities could consider allocating more funding to increase salaries of HCWs, and provide hazard pay or bonuses for those working at the frontline of healthcare [97].

This study enriched our understanding of the prevalence and the influencing factors of occupational

burnout among Chinese HCWs during the Omicron COVID-19 outbreak. While previous studies have explored the relationship between psychological variables and occupational burnout, our study focuses on a specific cohort of Chinese healthcare workers during a unique period of the Omicron COVID-19 outbreak. In addition, our research adopts a comprehensive approach by integrating multiple psychological variables simultaneously, rather than studying them in isolation. This allows for a more holistic understanding of their combined impact on occupational burnout. However, it has several limitations. First, this cross-sectional study did not confirm a causal relationship between occupational burnout and potential influencing factors. Second, convenience sampling might reduce the statistical representativeness of the selection of the population; Third, the potential mediation or moderation effects of the variables were not examined in the current study. Fourth, the potential pathways and

Table 4 Multivariate analysis of influencing factors of occupational burnout

Variable	Mild occupational burnout				Moderate to severe occupational burnout			
	AOR	95%CI		P	AOR	95%CI		P
		LL	UL			LL	UL	
Age, years	0.968	0.961	0.976	<0.001	0.933	0.918	0.948	<0.001
Gender								
Male	1				1			
Female	0.689	0.585	0.811	<0.001	1.427	0.999	2.040	0.051
Job								
Doctor	1				1			
Nurse	1.337	1.15	1.555	<0.001	1.259	0.955	1.659	0.103
Pharmacist	1.213	0.762	1.929	0.415	0.502	0.138	1.826	0.296
Public health professional	0.893	0.566	1.408	0.627	1.370	0.588	3.196	0.466
Other	1.006	0.788	1.285	0.962	0.629	0.362	1.093	0.100
Income (CNY per month)								
<5000	1				1			
5000~10,000	0.836	0.729	0.959	0.011	1.103	0.856	1.423	0.448
10,000~30,000	0.921	0.732	1.157	0.479	1.339	0.833	2.152	0.228
≥30,000	1.392	0.565	3.430	0.472	0.749	0.082	6.871	0.798
In a department currently taking charge of the treatment of COVID-19 patients								
No	1				1			
Yes	1.390	1.202	1.607	<0.001	1.380	1.041	1.830	0.025
Perceived risk of contracting COVID-19 due to work								
Not high	1				1			
High	1.192	0.948	1.500	0.133	2.191	1.182	4.060	0.013
Perceived Work Intensity								
Not high	1				1			
High	1.126	0.913	1.389	0.268	3.023	1.660	5.503	<0.001
COVID-19 infection during the Omicron COVID-19 outbreak at the end of 2022								
Not infected	1				1			
Infected once	0.726	0.583	0.905	0.004	0.597	0.393	0.905	0.015
Infected twice or more	0.541	0.244	1.199	0.131	0.457	0.146	1.434	0.180
Infected without a positive PCR/antigen test result	0.657	0.501	0.861	0.002	0.536	0.317	0.907	0.020
Doses of COVID-19 vaccine								
0	1				1			
1	0.539	0.236	1.231	0.143	0.606	0.124	2.963	0.536
2	0.401	0.209	0.767	0.006	0.345	0.094	1.264	0.108
3	0.425	0.232	0.777	0.006	0.734	0.222	2.419	0.611
4	0.445	0.238	0.835	0.012	0.886	0.257	3.057	0.848
Mindfulness (MAAS-5)	0.874	0.861	0.886	<0.001	0.863	0.840	0.887	<0.001
Resilience (CD-RISC-10)	0.942	0.933	0.951	<0.001	0.870	0.853	0.887	<0.001
Perceived social support (PSSS-2)	0.926	0.913	0.940	<0.001	0.880	0.859	0.901	<0.001
Anxiety (GAD-7)	1.069	1.046	1.093	<0.001	1.140	1.099	1.183	<0.001
Depressive symptoms (PHQ-9)	1.073	1.052	1.094	<0.001	1.117	1.080	1.155	<0.001

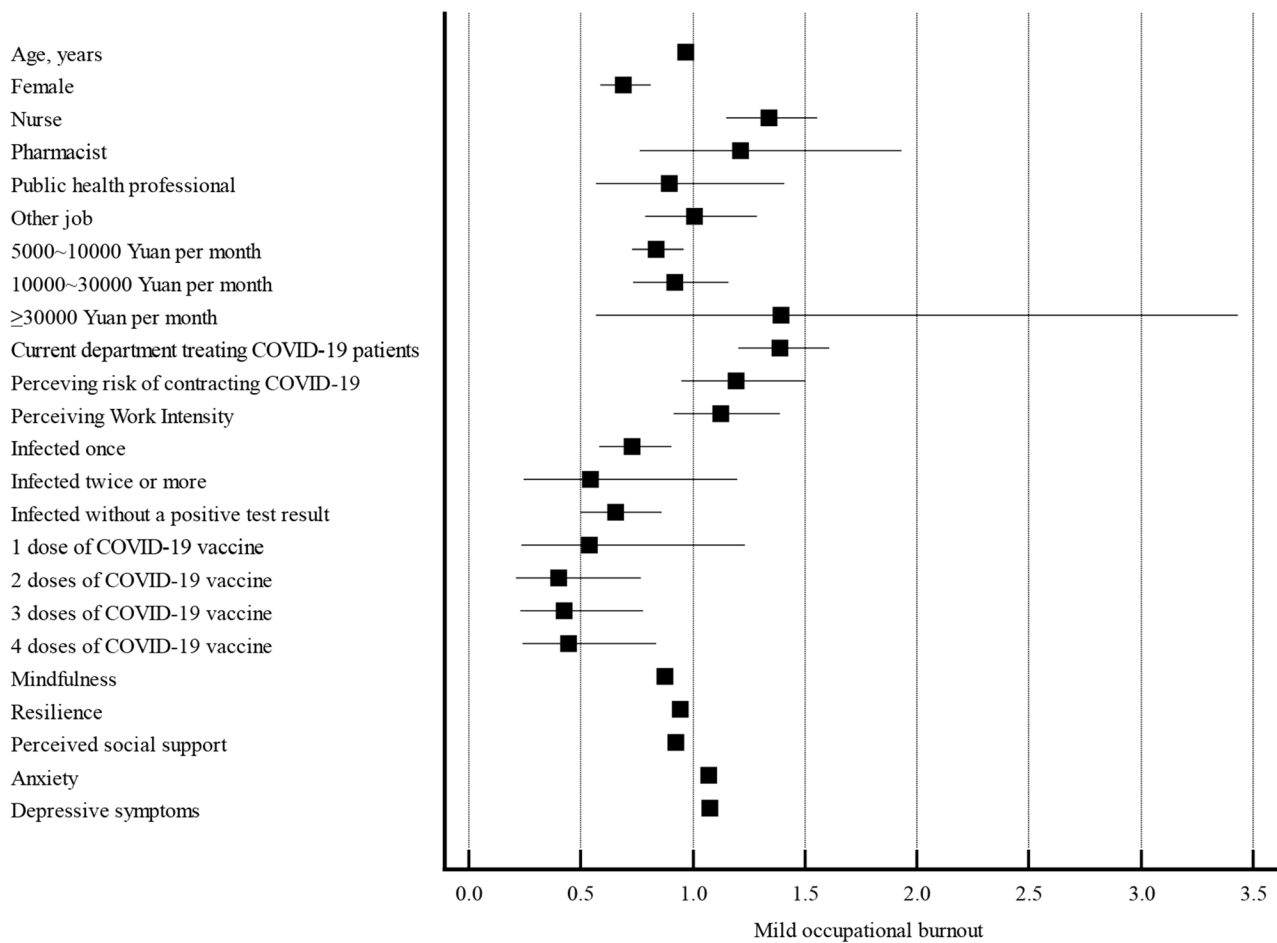


Fig. 2 Forest plot of influencing factors of mild occupational burnout. Note: The X-axis represents the value of the odds ratio

mechanisms on the association between PTSD and occupational burnout in HCWs are yet to be explored by longitudinal studies. Fifth, we did not utilize more rigorous methodologies, such as the Delphi method, in our questionnaire development. The Delphi method, known for reducing biases and achieving rapid consensus through expert input, could have further enhanced

the reliability and validity of our questionnaire. Future studies should consider incorporating such methodologies to strengthen research instruments. Sixth, this is an exploratory without any hypotheses being raised before the data was analyzed, which may lower the evidence level of the results. Further confirmatory studies could be conducted to validate the conclusion of this study.

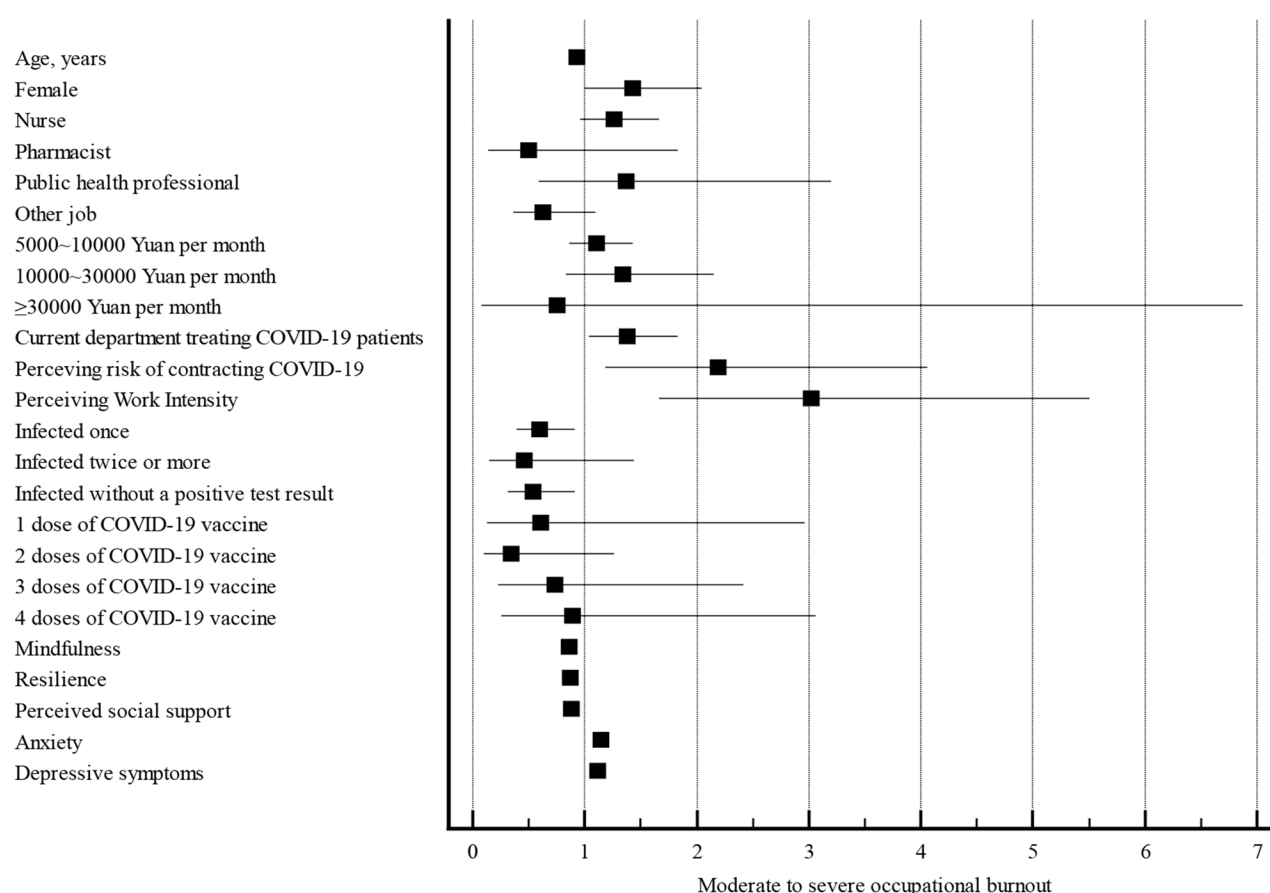


Fig. 3 Forest plot of influencing factors of moderate to severe occupational burnout. Note: The X-axis represents the value of the odds ratio

Conclusions

The prevalence of occupational burnout in Chinese HCWs during the Omicron COVID-19 outbreak was 44.56% in this study. We found that depressive symptoms and anxiety were positively associated with occupational burnout, while perceived social support, resilience, and mindfulness were negatively associated. More attention should be paid to the population of nurses. Tailored interventions on perceived social support, resilience, and mindfulness should be implemented to alleviate occupational burnout and the associated mental disorders among HCWs. Further studies could focus on randomized controlled trials and meta-analysis to confirm the results of this survey; qualitative studies could be conducted to provide insight into the experiences and perspectives of HCWs with occupational burnout and their strategies for managing their psychological health and work-related stress.

Relevance for clinical practice

This study found that depressive symptoms and anxiety were positively associated with occupational burnout, while perceived social support, resilience, and mindfulness were negatively associated. More attention should be

paid to the population of nurses. Tailored interventions on perceived social support, resilience, and mindfulness should be implemented to alleviate occupational burnout and the associated mental disorders among HCWs.

Acknowledgements

The authors thank the Editor-in-Chief, the Guest Editor, the Associate Editor, and the anonymous reviewers for their constructive comments and suggestions.

Author contributions

XS, ZD, SJ, and YW prepared the first draft. XS, ZH, and YQ provided overall guidance, managed the overall project. XL, LZ, XL, TR, JF, XC, WW, XG, LM, SZ, YY, and LL were responsible for the questionnaire survey and data analysis.

Funding

This work was supported by Discipline Development Grant for Population Medicine and Public Health (1002008-2024-4-100).

Data availability

The data that support the findings of this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate

This study has been approved by the Ethics Committee of Chinese Academy of Medical Science on December 29th, 2022 (CAMS&PUMC-IEC-2022-83).

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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Received: 13 January 2024 / Accepted: 2 December 2024

Published online: 15 January 2025

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