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COVID-19 Infection Experience and Depressive Symptoms Among Chinese Medical Staff: The Mediating Role of Professional Burnout

Bingqian Wang[1,2], Xiaohan Liu[2], Bing Han[3], Xiaoguang Li[4], Jiawei Zhang[2], Yaqun Fu[2], Zheng Zhu[2], Zhijie Nie[2], Yiyang Tan[2], Jing Guo[2], Li Yang[2] and Rongmeng Jiang[3]

[1]Peking University Sixth Hospital, Peking University Institute of Mental Health, NHC Key Laboratory of Mental Health (Peking University), National Clinical Research Center for Mental Disorders (Peking University Sixth Hospital), Beijing, P. R. China; [2]Department of Health Policy and Management, School of Public Health, Peking University Health Science Center, Beijing, P.R. China; [3]Clinical and Research Center of Infectious Diseases, Beijing Ditan Hospital, Capital Medical University, Beijing, China and [4]Department of Infectious Diseases, Peking University Third Hospital, Beijing, P.R. China

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Corresponding authors:
Jing Guo, Li Yang and Rongmeng Jiang;
Emails: jing624218@163.com;
lyang@bjmu.edu.cn;
13911900791@163.com

Abstract

Objectives: This study aimed to assess the relationship between COVID-19 infection-related conditions and depressive symptoms among medical staff after easing the zero-COVID policy in China, and to further examine the mediating role of professional burnout.

Methods: A total of 1716 medical staff from all levels of health care institutions in 16 administrative districts of Beijing, China, were recruited to participate at the end of 2022 in this cross-sectional study. Several multiple linear regressions and mediating effects tests were performed to analyze the data.

Results: At the beginning of the end of the zero-COVID policy in China, 91.84% of respondents reported infection with COVID-19. After adjusting for potential confounding variables, the severity of infection symptoms was significantly positively associated with high levels of depressive symptoms ($\beta = 0.06$, $P < 0.001$), and this association was partially mediated by professional burnout. Specifically, emotional exhaustion (95% CI, 0.131, 0.251) and depersonalization (95% CI, 0.009, 0.043) significantly mediated the association between the severity of infection symptoms and depressive symptoms.

Conclusions: The mental health of medical staff with more severe symptoms of COVID-19 infection should be closely monitored. Also, interventions aimed at reducing emotional exhaustion and depersonalization may effectively reduce their risk of developing depressive symptoms.

During the COVID-19 pandemic, medical staff were the main actors directly involved in the diagnosis, treatment, and care of patients with COVID-19 infection. Evidence from this period has shown that health care workers face elevated psychological stress and increased risk of mental illness due to excessive workload, changing clinical roles, limited personal protective equipment, and high risk of infection.[1,2] A meta-analysis assessing the psychological impact of outbreaks including COVID-19 on health care workers showed that the reporting rates of post-traumatic stress symptoms, depressive symptoms, insomnia, and general psychiatric symptoms among health care workers ranged from 11 to 73.4%, 27.5 to 50.7%, 34 to 36.1%, and 17.3 to 75.3%, respectively.[3] Notably, the biggest challenge to move away from the zero-COVID-19 policy in China is the rapid surge in infection cases, which could overwhelm the health care system. Medical staff are at the forefront of this storm, exposed to prolonged physical and psychological stress that may lead to severe mental health consequences.[4] Negative psychological impacts not only harm the well-being of medical staff but also decrease their ability to effectively handle health emergencies. One study showed that physicians with positive screening for depression were three times more likely to make medical errors compared to those with negative screening.[5] Given the high prevalence and pernicious effects of psychological problems among medical personnel, we are justified in urging for more attention and the need to identify risk factors for psychological problems.

According to the biopsychosocial model, infection with COVID-19 may have physical, psychological, and social effects on people, which in turn may lead to an increase in depressive symptoms.[6] Furthermore, the more severe and longer duration of infection symptoms may worsen depressive symptoms.[7] Some studies have been conducted to confirm these findings. For example, one study from the United Kingdom revealed that participants infected with

COVID-19 were 1.08 times more likely to experience anxiety and depressive symptoms than those not infected.[8] In addition, one research covering a cohort of 62 354 American patients infected with COVID-19 showed that the severity of infection symptoms was associated with an increased rate of subsequent psychiatric diagnosis.[9] A similar trend was observed in a survey of hospital discharged COVID-19 patients in Wuhan, China.[10] However, studies on the relationship between COVID-19 infection status and depressive symptoms are very limited, particularly among health professionals. Although these prior studies have provided preliminary evidence that COVID-19 infection may be a significant predisposing factor for depressive symptoms, few studies have focused on mediators of the aforementioned relationship. Therefore, in the context of discontinuing the zero-COVID policy, further exploration of potential mediating variables between COVID-19 infection-related conditions and depressive symptoms is urgently required.

Additionally, professional burnout may mediate the association between infectious conditions and depressive symptoms. Professional burnout is a common professional phenomenon caused by the accumulation of long-term professional stress[11] and is characterized by three aspects of emotional exhaustion, depersonalization, and reduced personal accomplishment.[12] COVID-19 may cause activation of the neuroimmune system in infected individuals, thus triggering neuroinflammation.[13] Specifically, symptoms such as mood changes, mental and physical fatigue, "brain fog," and social withdrawal may occur.[14] A survey including physicians of various specialties from different institutions in the Jordanian health sector found that a positive test for SARS-CoV-2 was positively associated with burnout.[15] Notably, patients who suffered from long-COVID-19 were more likely to experience burnout.[16] Furthermore, professional burnout was believed to be significantly associated with depressive symptoms in the medical staff population,[17,18] based on the Job Demand-Resources (JD-R) model and the Conservation of Resources (COR) theory. Consequently, it is reasonable to infer theoretically and empirically that professional burnout mediates the relationship between COVID-19 infection-related conditions and depressive symptoms. However, to our knowledge, no previous studies to date have explored this relationship, let alone the mediating role of different dimensions of professional burnout.

In summary, this study aimed to assess the relationship between COVID-19 infection-related conditions (presence of infection, severity of infection symptoms, and duration of infection symptoms) and depressive symptoms, and to further determine whether and how the three dimensions of professional burnout (emotional exhaustion, depersonalization, and reduced personal accomplishment) mediate the aforementioned relationship among Chinese medical staff. Drawing on previous studies and theories, the following hypotheses were proposed in this study. The first hypothesis postulated that COVID-19 infection-related conditions directly influenced depressive symptoms. Specifically, medical staff infected with COVID-19 had higher levels of depressive symptoms compared to medical staff not infected with COVID-19; among medical staff infected with COVID-19, the more severe infection symptoms and the longer the duration of symptoms, the higher levels of depressive symptoms. The second hypothesis concerned the mediating role of professional burnout on the relationship between COVID-19 infection-related conditions and depressive symptoms, with the exploratory hypothesis being that different dimensions of professional burnout would be mediated differently in the above association.

Methods

Study Design

Data for this study were obtained from a cross-sectional survey conducted in December 2022 in Beijing, China, to assess the infection and symptomatology and psychological status of various types of medical staff (including doctors, nurses, pharmacists, medical technicians, etc.) working in in-hospital fever outpatient clinics in primary, secondary, and tertiary hospitals during the initial period after easing the zero-COVID policy in China. To ensure the representativeness of the survey sample, we adopted a stratified sampling method across different levels of medical institutions and diverse geographic areas in Beijing to capture a wide range of experiences and perspectives from health care providers at various levels of the health care system. First, a total of 293 community health service centers (CHSCs) were selected. The selection process consisted of randomly selecting 8 to 42 CHSCs from each of the 16 administrative districts in Beijing. The number of selected CHSCs in each district was proportional to the total number of CHSCs in that district to ensure balanced representation. Then, 3-5 primary medical staff were randomly selected as respondents from each selected CHSC, for a total of 1202 respondents. Second, a total of 48 hospitals participated in the survey; that is, 3 hospitals were selected from the official list of medical institutions providing fever clinics in each of the 16 administrative districts in Beijing. These hospitals were selected to represent a variety of characteristics, including different levels (secondary/tertiary hospitals), different ownership types (public/private), and different specialties (general/specialist hospitals). Then, 10-20 medical staff were randomly selected as respondents from each selected hospital, bringing the total number of respondents to 545. The study used an electronic questionnaire hosted on the Wenjuanxing platform, a widely used online survey tool in China. The questionnaire was disseminated among medical staff through hospital internal communication channels, including email and WeChat groups. The research team received prior training on the principles of standardization and precautions to ensure the accuracy and validity of the data. If medical staff encountered any problems in the process of completing the questionnaire, they could raise them with the research team and the researcher would give prompt online answers. At the same time, intelligent logic checks were set up in the computer back-end system to identify and reject invalid questionnaires.

All participants gave consent after being informed about the purpose of the survey and volunteered to join the study. The study was approved by Peking University Third Hospital Medical Science Research Ethics Committee (IRB00006761-M2023018).

Measurements

Conditions related to COVID-19 infection were assessed via a self-designed questionnaire. Several previous studies have shown that the presence of infection, severity, and duration of symptoms are associated with psychological problems,[19,20] so this study measured these three aspects. Participants were first asked if they were infected ("Have you ever been infected with COVID-19 (tested positive for nucleic acids/antigens or had significant symptoms of COVID-19)"). If infected, the severity of symptoms was self-rated ("Which of the following was the severity of symptoms at the time of infection") on a 2-point scale ranging from 1 (mild symptoms) to 2 (severe symptoms). Subsequently, the duration of symptoms after infection was self-rated ("How long did it take for physical recovery

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and symptoms disappearance after infection") on a 2-point scale ranging from 1 (within two weeks) to 2 (two weeks and above).

Professional burnout was measured by the Maslach Burnout Inventory Human Services Survey (MBI-HSS), a reliable tool that measures burnout symptoms among people working in the human services and health care industries.[21] Respondents were asked to indicate how often they experienced certain feelings or attitudes on a 7-point Likert scale ranging from 0 (never) to 6 (every day). The MBI-HSS measures three aspects of burnout syndrome: emotional exhaustion (9 items), depersonalization (5 items), and reduced personal accomplishment (8 items). Scores per dimension are based on the sum of item scores for each dimension. Higher scores for emotional exhaustion and depersonalization indicate greater burnout, whereas lower scores for reduced personal accomplishment represent greater powerlessness toward work. The scores for each subscale are not combined into a global score. For the three subscales, Cronbach's alpha was 0.93 for emotional exhaustion, 0.89 for depersonalization, and 0.89 for reduced personal accomplishment.

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9), a convenient and effective scale for detecting the severity of depressive symptoms.[22] The PHQ-9 consists of 9 items that ask subjects to rate the occurrence frequency of each symptomatology. Each item is scored on a 4-point Likert scale ranging from "not at all" to "nearly every day," coded with values from 0 to 3. Total scores range from 0 (absence of depressive symptoms) to 27 (most severe depressive symptoms) and higher scores imply more severe depressive symptoms. In this study, Cronbach's alpha of PHQ-9 was 0.94.

Covariates included demographic and socioeconomic characteristics such as gender (male, female), age, marital status (married, else), education level (junior college or below, college, master or above), type of working institution (tertiary hospital, secondary hospital, primary hospital), type of occupation (doctor, nurse, other), working years (≤ 5, 6-10, 11-19, ≥ 20), professional title (elementary or less, intermediate, senior), average monthly income (≤ 5000 Yuan, 5001-10 000 Yuan, 10 001-20 000 Yuan, ≥ 20 001 Yuan), and chronic disease (yes, no). Previous studies have demonstrated that these variables were related to the depressive symptoms of medical staff.[23,24]

Statistical Analyses

Descriptive analyses were conducted to describe infection with COVID-19, professional burnout, medical staff's depressive symptoms, and other covariates. Frequencies and percentages were performed for categorical variables, whereas means and standard deviations were computed for continuous variables. Then, three multiple linear regressions were employed to explore the relationships among sociodemographic characteristics, COVID-19 infection-related factors, professional burnout, and depressive symptoms. Finally, model 4 of the PROCESS macro for SPSS (version 3.3)[25] was used to examine the mediating effect of three dimensions of professional burnout (including emotional exhaustion, depersonalization, and reduced personal accomplishment) on the relationship between severity of infection symptoms and depressive symptoms. The bootstrapping method (5000 bootstrapping samples) with 95% confidence intervals (CIs) was conducted to determine the significance of the effects.[26] As stated by Hayes and Preacher, dummy coding is required. For the severity of infection symptoms, 2 dummy variables were constructed (mild symptoms and severe symptoms) with a reference category of mild symptoms. Direct effects, indirect effects, and total effects were examined. All models were adjusted for gender, age, marital status, education level, type of working institution, type of occupation, working years, professional title, average monthly income, and chronic disease.

Furthermore, we conducted sensitivity analyses to check the robustness of the results, including subgroup analysis based on hospital level, excluding outliers, and changing combinations of control variables.

Results

Table 1 demonstrates the descriptive characteristics of the sample and the bivariate linear regression results of the relationship of sociodemographic characteristics and related factors with depressive symptoms. After excluding 31 subjects who answered the questionnaire too quickly (time < 5 minutes) or illogically, 1716 eligible subjects were enrolled in the study. Among them, 69.41%,

Table 1. Descriptive characteristics of study population and bivariate relationship of sociodemographic characteristics, and related factors, with depressive symptoms (N = 1716)

Variables	n/Mean	Percentage/SD	B	Std error	β	(95% CI)
Gender						
Male	459	26.75	0.24	0.33	0.02	(–0.394,0.882)
Female	1257	73.25				
Age (mean, SD)	38.74	8.91	–0.01	0.02	–0.02	(–0.045,0.018)
Marital status						
Married	1377	80.24	–0.18	0.36	–0.01	(–0.89,0.529)
Else	339	19.76				
Education level						
Junior college or below	359	20.92				
College	1061	61.83	0.86	0.36	0.07*	(0.147,1.573)
Master or above	296	17.25	–0.09	0.47	–0.01	(–1.008,0.825)
Type of working institution						

(*Continued*)

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Table 1. (*Continued*)

Variables	n/Mean	Percentage/SD	B	Std error	β	(95% CI)
Tertiary hospital	402	23.43				
Secondary hospital	123	7.17	0.48	0.61	0.02	(–0.722,1.688)
Primary hospital	1191	69.41	–0.46	0.34	–0.04	(–1.136,0.213)
Type of occupation						
Doctor	1087	63.34				
Nurse	403	23.48	0.46	0.35	0.03	(–0.226,1.138)
Other	226	13.17	–0.26	0.44	–0.02	(–1.112,0.599)
Working years						
≤5	340	19.81				
6–10	297	17.31	0.37	0.47	0.02	(–0.56,1.297)
11–19	572	33.33	0.96	0.41	0.08*	(0.163,1.763)
≥20	507	29.55	0.39	0.42	0.03	(–0.434,1.204)
Professional title						
Elementary or less	667	38.87				
Intermediate	709	41.32	0.48	0.32	0.04	(–0.153,1.107)
Senior	340	19.81	–0.71	0.40	–0.05	(–1.488,0.068)
Average monthly income (Yuan)						
≤5000	156	9.09				
5001–10000	863	50.29	0.38	0.52	0.03	(–0.639,1.397)
10001–20000	635	37.00	0.18	0.53	0.02	(–0.865,1.226)
≥20001	62	3.61	–0.88	0.90	–0.03	(–2.637,0.876)
Chronic disease						
Yes	409	23.83	1.39	0.34	0.10***	(0.727,2.046)
No	1307	76.17				
Infected with COVID–19						
Yes	1576	91.84	0.92	0.53	0.04	(–0.116,1.946)
No	140	8.16				
Professional burnout (mean, SD)						
Emotional exhaustion	23.21	13.47	0.26	0.01	0.58***	(0.237,0.279)
Depersonalization	7.01	6.70	0.14	0.02	0.15***	(0.094,0.176)
Reduced personal accomplishment	18.38	11.25	0.08	0.01	0.15***	(0.059,0.096)
Depressive scores (mean, SD)	7.72	5.96				

Notes: SD, Standard deviation; B, coefficient; β, standardized coefficient; Std error, standard error;
*P < 0.05
***P < 0.001.

7.17%, and 23.43% of the subjects were from primary, secondary, and tertiary hospitals, respectively. Of the 1716 participants, the majority were female (73.25%), were married (80.24%), had obtained a bachelor's degree (61.83%), and earned a medium-income (87.29%). When it came to the health status of the participants, 23.83% of them had chronic diseases. Following the relaxation of the zero-COVID policy, 1576 (91.84%) participants reported being infected with COVID-19. In addition, regarding professional burnout, the mean score was 23.21 (SD = 13.47) for emotional exhaustion, 7.01 (SD = 6.70) for depersonalization, and 18.38 (SD = 11.25) for reduced personal accomplishment. The average score of depressive symptoms measured by the PHQ-9 scale was 7.72 (SD = 5.96).

The outcomes of the multiple linear regressions on the relationships between sociodemographic traits, COVID-19 infection-related variables, professional burnout, and depressive symptoms are summarized in Table 2. After adjusting for confounding variables, only the severity of infection symptoms was found to be significantly positively associated with depressive symptoms (β = 0.06, $P < 0.001$), whereas the presence or absence of COVID-19 infection and the duration of symptoms after infection were not significantly associated with depressive symptoms. In terms of

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Table 2. Multiple linear regressions of depressive scores on COVID-19 infection-related factors, professional burnout, and sociodemographic characteristics

	Model 1 (N=1716)				Model 2 (N=1576)				Model 3 (N=1576)			
	B	Std error	β	(95% CI)	B	Std error	β	(95% CI)	B	Std error	β	(95% CI)
Gender (Ref: female)												
Male	0.65	0.25	0.05**	(0.157,1.15)	0.68	0.26	0.05**	(0.164,1.192)	0.64	0.26	0.05*	(0.123,1.158)
Age	0.03	0.03	0.04	(–0.021,0.076)	0.05	0.03	0.07	(–0.002,0.099)	0.05	0.03	0.07	(–0.006,0.095)
Marital status (Ref: else)												
Married	–0.32	0.31	–0.02	(–0.916,0.286)	–0.48	0.32	–0.03	(–1.103,0.149)	–0.43	0.32	–0.03	(–1.054,0.202)
Education level (Ref: junior college or below)												
College	0.71	0.29	0.06*	(0.132,1.286)	0.68	0.31	0.06*	(0.083,1.284)	0.69	0.31	0.06*	(0.086,1.293)
Master or above	–0.13	0.42	–0.01	(–0.961,0.699)	–0.32	0.44	–0.02	(–1.175,0.542)	–0.27	0.44	–0.02	(–1.133,0.591)
Type of working institution (Ref: tertiary hospital)												
Secondary hospital	0.49	0.46	0.02	(–0.406,1.377)	0.48	0.48	0.02	(–0.456,1.415)	0.55	0.48	0.02	(–0.393,1.482)
Primary hospital	–0.69	0.31	–0.05*	(–1.292,–0.097)	–0.70	0.31	–0.05*	(–1.313,–0.08)	–0.68	0.32	–0.05*	(–1.299,–0.062)
Type of occupation (Ref: doctor)												
Nurse	0.27	0.34	0.02	(–0.391,0.923)	0.22	0.35	0.02	(–0.455,0.901)	0.26	0.35	0.02	(–0.422,0.938)
Other	0.18	0.34	0.01	(–0.479,0.843)	0.18	0.35	0.01	(–0.504,0.859)	0.16	0.35	0.01	(–0.522,0.847)
Working years (Ref: ≤5)												
6–10	–0.21	0.38	–0.01	(–0.959,0.535)	–0.23	0.39	–0.01	(–0.995,0.544)	–0.25	0.39	–0.02	(–1.016,0.527)
11–19	0.05	0.43	0.00	(–0.787,0.88)	0.00	0.44	0.00	(–0.85,0.856)	–0.05	0.44	0.00	(–0.901,0.81)
≥ 20	–0.18	0.60	–0.01	(–1.356,0.995)	–0.41	0.62	–0.03	(–1.625,0.8)	–0.42	0.62	–0.03	(–1.637,0.796)
Professional title (Ref: elementary or less)												
Intermediate	–0.32	0.29	–0.03	(–0.894,0.259)	–0.38	0.30	–0.03	(–0.97,0.213)	–0.39	0.30	–0.03	(–0.981,0.206)
Senior	–0.97	0.41	–0.07*	(–1.773,–0.164)	–1.07	0.42	–0.07*	(–1.894,–0.24)	–1.12	0.42	–0.08**	(–1.953,–0.294)
Average monthly income (Yuan) (Ref: ≤5000)												
5001–10000	0.07	0.40	0.01	(–0.711,0.857)	0.16	0.42	0.01	(–0.658,0.979)	0.16	0.42	0.01	(–0.657,0.985)
10001–20000	0.05	0.44	0.00	(–0.817,0.916)	0.23	0.46	0.02	(–0.675,1.13)	0.22	0.46	0.02	(–0.681,1.129)
≥ 20001	–0.77	0.72	–0.02	(–2.169,0.639)	–0.52	0.74	–0.02	(–1.977,0.942)	–0.56	0.75	–0.02	(–2.022,0.911)
Chronic disease (Ref: no)												
Yes	0.38	0.26	0.03	(–0.135,0.897)	0.14	0.27	0.01	(–0.397,0.671)	0.17	0.27	0.01	(–0.366,0.706)
COVID–19 infection (Ref: no)												
Yes	0.44	0.38	0.02	(–0.312,1.194)								
Severity of infection symptoms (Ref: mild symptoms)												
Severe symptoms					0.74	0.22	0.06***	(0.302,1.175)				
Duration of physical recovery and symptoms disappearance (Ref: within two weeks)												
Two weeks and above									0.13	0.23	0.01	(–0.31,0.574)
Professional burnout												
Emotional exhaustion	0.26	0.01	0.59***	(0.238,0.28)	0.26	0.01	0.58***	(0.233,0.277)	0.26	0.01	0.59***	(0.238,0.282)
Depersonalization	0.13	0.02	0.15***	(0.088,0.171)	0.13	0.02	0.14***	(0.084,0.17)	0.13	0.02	0.14***	(0.082,0.169)
Reduced personal accomplishment	0.08	0.01	0.14***	(0.055,0.094)	0.08	0.01	0.16***	(0.063,0.102)	0.08	0.01	0.16***	(0.062,0.102)
R-squared			0.475				0.480				0.477	

Notes: B, nonstandardized coefficient; β, standardized coefficient; Std error, standard error; CI, coefficient interval;
*P < 0.05
**P < 0.01
***P < 0.001; R-squared, determination coefficient.
Model 1 focused on whether infected with COVID-19, Model 2 focused on severity of infection symptoms, and Model 3 focused on duration of physical recovery and symptoms disappearance.

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professional burnout, we observed that all three dimensions of burnout were strongly associated with higher levels of depressive symptoms. Of these, the variable with the largest absolute standardized coefficient was emotional exhaustion, followed by depersonalization and reduced personal accomplishment. In general, concerning socioeconomic characteristics, males and those with medium educational levels often reported greater severity of depressive symptoms. However, individuals employed in primary hospitals and those with senior professional titles discovered lower levels of depressive symptoms.

Table 3 and Figure 1 illustrate the mediating effect of the three dimensions of professional burnout on the association between the severity of infection symptoms and depressive symptoms. After controlling for covariates, there was a significant direct association between the severity of infection symptoms and depressive symptoms (β = 0.33, P < 0.001). Furthermore, two mediators were present in this association; however, reduced personal accomplishment did not mediate the outcome. The severity of infection symptoms had a significant effect on the mediating variables emotional exhaustion (β = 0.33, P < 0.001) and depersonalization (β = 0.17, P < 0.001), whereas the severity of infection symptoms (β = 0.12, P < 0.001) and the mediating variables emotional exhaustion (β = 0.58, P < 0.001) and depersonalization (β = 0.14, P < 0.001) all had a significant effect on depressive symptoms. The direct effect size of the severity of infection symptoms on depressive symptoms was 0.12 (95% CI, 0.302, 1.175), and the effect was significant. Indirect effects were as follows: the indirect effect size of the severity of infection symptoms mediated by emotional exhaustion on depressive symptoms was 0.19 (95% CI, 0.131, 0.251), whereas the indirect effect size of the severity of infection symptoms mediated by depersonalization on depressive symptoms was 0.02 (95% CI, 0.009, 0.043), and both results were significant. These findings suggested that relatively more severe symptoms of COVID-19 infection could lead to the emergence of emotional exhaustion and depersonalization, which in turn could exacerbate depressive symptoms.

Table 3. Effects of severity of infection symptoms and depressive symptoms: the mediating effects of three dimensions of professional burnout (N = 1576)

Effects	Paths	Standardized estimates	Bootstrap (95% CI)
Direct	Severity of infection symptoms → Depressive symptoms	0.12***	(0.302,1.175)
	Severity of infection symptoms → Emotional exhaustion	0.33***	(3.101,5.728)
	Severity of infection symptoms → Depersonalization	0.17***	(0.5,1.83)
	Severity of infection symptoms → Reduced personal accomplishment	–0.07	(–1.857,0.325)
	Emotional exhaustion → Depressive symptoms	0.58***	(0.233,0.277)
	Depersonalization → Depressive symptoms	0.14***	(0.084,0.17)
	Reduced personal accomplishment → Depressive symptoms	0.16***	(0.063,0.102)
Indirect	Severity of infection symptoms → Emotional exhaustion → Depressive symptoms	0.19*	(0.131,0.251)
	Severity of infection symptoms → Depersonalization → Depressive symptoms	0.02**	(0.009,0.043)
	Severity of infection symptoms → Reduced personal accomplishment → Depressive symptoms	–0.01**	(–0.027,0.005)
Total	Severity of infection symptoms → Depressive symptoms	0.20*	(0.136,0.27)

Notes: CI, coefficient interval;
*P < 0.05
**P < 0.01
***P < 0.001
Control variables: gender, age, marital status, education level, type of working institution, type of occupation, working years, professional title, average monthly income, and chronic disease.

Discussion

Several key findings of this study deserve in-depth discussion. Initially, our research partially confirmed the first hypothesis that only the severity of infection symptoms was significantly and positively correlated with depressive symptoms. According to the biopsychosocial model, this association can be explained in several ways. First, this association might be mediated in part by biological factors directly related to COVID-19 (e.g., viral load, dyspnea, or the nature of the immune response), which can be viewed as a dose-response relationship.[27] In other words, the more severe the infection symptoms, the more adverse biological factors are mediated, resulting in more severe depressive symptoms. Secondly, medical staff may experience psychological changes such as frustration, helplessness, and adjustment issues in the process of becoming critically ill, and these psychological changes may be associated with the emergence of depressive symptoms.[28] Finally, the strict policy shift has had an immediate impact on the medical staff, with a large number of infected medical staff still working on the front line, but those with more severe symptoms were vulnerable to discrimination by patients and their families, which in turn could lead to more depressive symptoms.

However, unlike some previous studies,[8,29] our study did not find significant associations between the presence of COVID-19 infection or the duration of symptoms after infection and depressive symptoms. This may be due to the widespread infection among medical staff in China following the cessation of the zero-COVID policy (91.84% infection rate reported by medical staff in this study), but there was a significant reduction in psychosocial stressors such as social isolation, lack of interaction, and illness stigma, which may be the overriding mechanism leading to increased levels of depressive symptoms.[30] Additionally, this study was conducted within one month of widespread infection to understand the initial phase after easing the zero-COVID policy in China. The time constraints of the survey did not allow for consideration of individuals with longer duration of symptoms (e.g., more than one month), which may have made the relationship between depressive symptoms and duration of infection symptoms insignificant.

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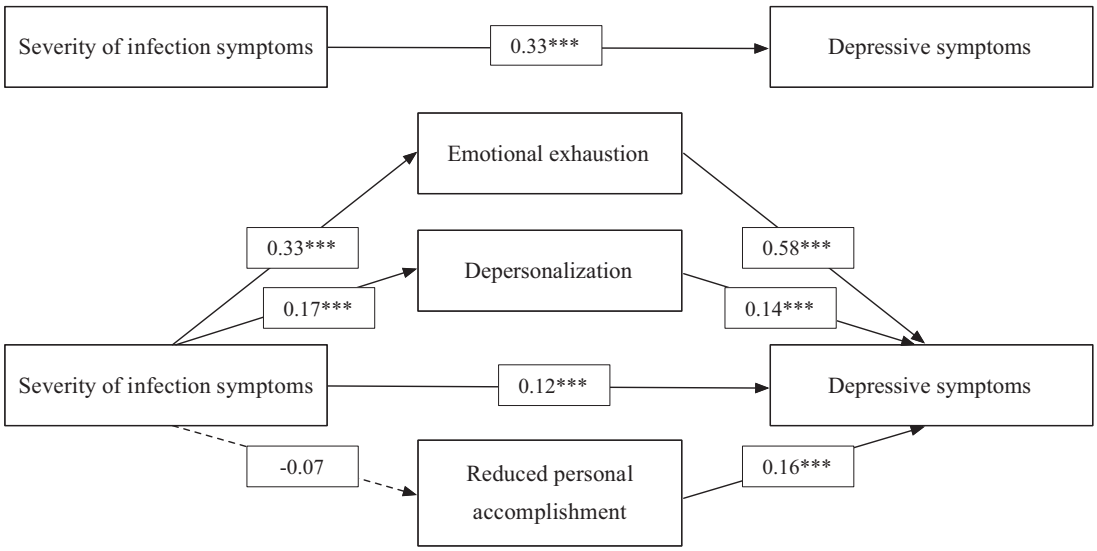

Figure 1. Multiple mediation bootstrap analysis of relationships between severity of infection symptoms and depressive symptoms as mediated by three dimensions of professional burnout.
Notes: *** P < 0.001.

Future studies could expand the survey to include individuals with longer duration of infection symptoms to better examine the relationship between these two.

Furthermore, our findings also identified that emotional exhaustion and depersonalization, as possible explanatory factors, mediated the association between the severity of infection symptoms and depressive symptoms among medical staff. To our knowledge, this is the first study to investigate the mediating role of different dimensions of professional burnout in the association between the severity of infection symptoms and depressive symptoms. Specifically, when medical staff had more severe symptoms of COVID-19 infection, there may be an impact on the physical domain of quality of life (QOL), including aspects of daily activities, vigor, tiredness, pain and discomfort, and work capacity. Also, these aspects are all assessed in the physical domain of the World Health Organization Quality of Life (WHOQOL) questionnaire. It had been noted that a decrease in each point on the physical domain of the WHOQOL scale was associated to some degree with emotional exhaustion and depersonalization among medical staff.[31] In addition, emotional exhaustion and depersonalization were positively associated with depressive symptoms, which is consistent with the role of stress in the Job Demands-Resources (JD-R) model and Conservation of Resources (COR) theory.[32] That is, when the demands of the job exceed the resources available, individuals attempt to obtain more resources to get the job done, but this leads to a depletion of energy and ultimately to personal emotional exhaustion. Subsequently, employees display defensive and self-defeating traits in their work attitudes and behaviors,[33] maintaining an apathetic attitude. To cope with professional burnout, individuals are likely to suffer from psychological problems, which can be seen as negative outcomes of the stressful process.[34] It is worth mentioning that reduced personal accomplishment did not play a mediating role, a result that is not surprising. Because this dimension measures feelings of competence and achievement at work,[12] the severity of infection symptoms in a short period does not significantly impact it. Taken together, this suggested that relatively more severe symptoms of COVID-19 infection may lead to the onset of emotional exhaustion and depersonalization, which in turn may exacerbate depressive symptoms. Therefore, in light of these findings, policy-makers should adopt any measures that can help alleviate the emotional exhaustion and depersonalization of medical staff with severe infection symptoms that may help prevent or reduce depressive symptoms.

Finally, our findings indicated that male medical staff and medical staff with an intermediate educational level faced higher levels of depressive symptoms risk, whereas those working in primary care and those with senior professional titles reported lower levels of depressive symptoms. This is inconsistent with previous studies on gender differences[35] and educational differences[36] in the prevalence of depressive symptoms during the COVID-19 pandemic. This inconsistency may be due to the surge in fever outpatients following the end of the zero-COVID policy in China, where male medical staff faced greater emotional expression constraints and higher social expectations. In a highly stressful and pressured work environment, the inability to adequately express and process emotions may increase the risk of depressive symptoms. In addition, medical staff with college degrees may take on more challenging work and be required to handle more complex cases than those with junior college or below degrees. This work stress and professional challenge may lead to the emergence of depressive moods. Our results also showed that medical staff working in primary hospitals had lower levels of depressive symptoms. This is because infected patients were more likely to visit tertiary hospitals, and medical staff in primary hospitals had relatively less close contact with infected patients and worked under less stress, resulting in a lower incidence of depressive symptoms.[37] Lastly, medical staff with senior professional titles had lower levels of depressive symptoms. This can be explained by the fact that junior medical staff had less training and experience than senior medical staff.[38] Junior health care professionals were more likely to work outside their competence, putting them at greater risk of moral distress[39] and thus adversely affecting the mental health of junior health care professionals. Consequently, this study recommends that male medical workers, medical workers who have a secondary

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education level, employ in a tertiary hospital, and hold a junior title should receive more attention to prevent suffering from depressive symptoms.

The findings of this study have substantial practical implications for the development of interventions to promote mental health among medical staff, so as to strengthen the resilience of the health care system and improve the response and preparedness systems in future infectious disease situations. Firstly, medical staff exhibiting depressive symptoms and professional burnout should be offered tailored psychotherapy programs, such as cognitive behavioral therapy, psychodynamic therapy, and interpersonal therapy, supplemented with appropriate medication, when necessary, under professional guidance. Secondly, health care facility managers should thoroughly analyze the workload, reasonably allocate work tasks, adjust job responsibilities, and implement a work rotation system to reduce emotional fatigue and burnout caused by high-intensity work. Moreover, expert support groups and stress management workshops should be organized, and professional burnout rehabilitation programs should be provided to help medical staff regain their enthusiasm and motivation for their work. Finally, support at the family and social levels should be strengthened, such as establishing peer support groups for medical staff and providing platforms for emotional support and experience exchange, thereby enhancing the ability of medical staff to cope with stress.

Limitations

Our research has certain limitations that need to be acknowledged. First, being a cross-sectional study limited causal inference. Although the study put forward empirical evidence that professional burnout was a mediator between infection symptoms and depressive symptoms, it could not confirm the temporal relationship. For instance, individuals who suffer from depressive symptoms may report more severe infection symptoms.[40] Future studies with longitudinal follow-up should be considered to further validate the direction of the above pathway. Second, although the severity of infection symptoms and depressive symptoms based on the individual's subjective perception were important, self-report measures may not always be aligned with objective assessments such as clinical diagnosis. Therefore, future research could extend the single-source approach to combine self-reported data and objective evaluation data, such as clinical diagnosis, job performance evaluation, and physiological indicators, to obtain more objective information, thus avoiding memory or self-perception bias. Third, the study focused on medical staff working in fever clinics and was conducted in Beijing, China, so the findings may not be generalizable to the experiences of health care workers in other regions or countries with different health care systems, COVID-19 policies, and cultural contexts during the pandemic. In future studies, a wider range of health care settings and roles should be included to enhance the applicability of the findings. In addition, this study assessed the association between infection-related conditions, professional burnout, and depressive symptoms at the beginning after easing the zero-COVID policy in China (within 1 month of widespread infection) and therefore could not examine the situation in individuals whose symptoms persisted for a longer period. Future studies could be conducted for different stages after large-scale infection to assess whether these associations remain significant. Finally, the indirect effect sizes for both emotional exhaustion and depersonalization on infection symptoms and depressive symptoms were not very high, even though this indirect effect was shown to be significant. Future research should consider exploring other alternative pathways (e.g., social support, job engagement, and job satisfaction) to gain a more comprehensive understanding of the multiple factors that affect the mental health of health care workers.

Conclusions

The study confirmed a significant positive correlation between the severity of infection symptoms and higher levels of depressive symptoms. In addition, if medical staff experience more severe symptoms of COVID-19 infection, this may make them more prone to emotional exhaustion and depersonalization, which can lead to higher levels of depressive symptoms. Based on these findings, there is a need to develop and implement professional burnout interventions to reduce the risk of depressive symptoms among medical staff with more severe infection symptoms, especially to prevent the onset of emotional exhaustion and depersonalization.

Data availability statement. Data are available upon reasonable request.

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Author contribution. LY, JG, and RMJ designed this study. BQW wrote the original manuscript, prepared the analysis, and interpreted the data. XHL, BH, XGL, JWZ, YQF, ZZ, ZJN, and YYT helped with the analysis and gave essential comments on multiple versions. All authors approved the final version of the manuscript.

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Competing interest. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical standard. This study was proved by the Ethics Committee of Peking University Third Hospital. All participants gave consent after informed of the aims of the survey and had the right to refuse to participate.

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