Psychological Stress and Job Burnout of Frontline Nurses in Wuhan in the Context of Normalized Pandemic Prevention and Control for COVID-19----A Cross-sectional Study

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Abstract

Background: Nurses in the designated hospitals for COVID-19 in Wuhan (China) during the early period of COVID-19 outbreak may have suffered great occupational stress in the context of normalized pandemic prevention and control. The aim of this study was to make a survey on the occupational stress of nurses working in a designated hospital for COVID-19, explore their demographic data and the impact of job burnout, insomnia and psychological resilience on nurses' occupational stress.

Methods: 552 nurses who had been working in the designated hospital for COVID-19 by January 2021 were selected to conduct the cross-sectional survey. We used self-made demographic data questionnaire, stress perception questionnaire, job burnout scale, insomnia severity index questionnaire and psychological resilience scale.

Results: Generally the average score of the stress perception of nurses working in the designated hospital for COVID-19 was 14.00 (0.00,36.00), a moderate stress level. 273 of the participants presented a mild stress level, accounting for 49.46% and 46 with severe stress，accounting for 8.33%; "no sense of job accomplishment" scored 34.00 (0.00, 48.00), an index of severe job burnout. The participants got a mean score of 5.00 (1.00,8.00), of which 115 (20.83%) presented mild insomnia, 34 (6.16%) and 4 (0.72%)severe insomnia. The results by correlation analysis revealed that stress perception was positively correlated with emotional fatigue and work indifference (p <0.05), and stress perception was negatively correlated with sense of accomplishment, strength, optimism, and tenacity (p <0.05).

Conclusions: In the context of normalized COVID-19 prevention and control, nurses in the designated hospital for COVID-19 in Wuhan presented mild work stress and little sense of accomplishment. The psychological stress and job burnout of nurses as a group can be preliminarily predicted from the dimensions of insomnia, sense of work accomplishment, psychological resilience, etc.

Yunyan Xian Yu et al.
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Introduction

The sudden outbreak of COVID-19 at the end of 2019 brought great psychological stress to the people worldwide, resulting in many people's psychological problems[1-4]. The medical staff during COVID-19 outbreak in Wuhan also mostly presented various psychological stress and negative emotions[5-6].

Due to the outbreak of COVID-19 at the end of 2019, many hospitals for non-infectious disease in Wuhan were designated as the hospitals for COVID-19. A large number of medical staff went to the clinical front-line to battle against the pandemic after a simple training of COVID-19 protection and treatment[7]. In the battle against COVID-19, nurses were praised as "most beautiful counter-marching people", quietly dedicated at the forefront in teams. Front-line nurses were the longest in time in close contact with COVID-19 patients, not only undertook the mission of treating patients and saving life, but also the task of the patient's daily basic requirements, witnessing the clinical adverse reactions and the dying state of a large number of COVID-19 patients in critical condition. The frequent occurrence of traumatic emergencies presented a great challenge for front-line nurses. Meanwhile, heavy workload, risk of COVID-19 infection and the unpredictable situation increased the incidence of psychological traumatic stress of those front-line nurses[8].

The studies revealed that the medical staff at the frontline of public health emergencies were prone to stress reactions, both physical and psychological problems, due to the hard working environment, heavy workload, many unprecedented difficulties and high risks of infection. Even after a period of adjustment after they went back from the frontline, the medical staff may still have certain psychological problems. For example, medical staff involved in MERS treatment were still at the risk of post-traumatic stress disorder (PTSD) even after a period of time[9]; while nearly 18% of medical staff still had relevant psychological problems even 6 months after the end of SARS[10].

After COVID-19 was almost under control in Wuhan, China, in April 2020, those frontline nurses went back to their normal hospital work [11-15]. However, COVID-19 as the global public health emergency with the widest coverage and the largest number of deaths in history has not been effectively controlled worldwide, and the normalization of the epidemic prevention and control measures in China is still very tough [16-18]. The previous nursing procedures changed a lot with the normalization of COVID-19 prevention and control measures, and most nurses reported that they were overwhelmed with work stress and kept struggling to cope with it. Work stress would affect the working efficiency and accuracy in a negative way, which may lead to empathy fatigue, decreased sense of identity and satisfaction. Excessive stress can lead to mental health problems such as fatigue, anxiety, depression, etc.[19-24]. Therefore, this study focused on the mental state of those frontline nurses and its factors of their mental problems after they successfully fought against COVID-19 in the three months of pandemic outbreak in Wuhan and now returned to their normal hospital jobs under the current strict normalized prevention and control measures.

Material and Methods

Design and Procedure

Nurses in a designated hospital for COVID-19 in Wuhan were selected as the object of study. Selection criteria: ① registered nurses; ② already working in the designated hospital until January 2020; ③ no mental or consciousness disorder. Exclcriteria: ① intern nurses; ② nurses having left their jobs. In January 2021, All questionnaires required for the survey were made digital to form the QR code; we trained the surveyors to make sure their understanding of the scale was consistent with each other; the trained surveyors went to each clinical

department to collect data; the respondents scanned the QR code to complete the anonymous questionnaires with the principle of informed consent; the surveyors there were responsible for the explanation and details on how to complete those questionnaires; all questions were required to be answered and the questionnaire should be done only once on the spot by each single ID account. There were totally 674 participants involved in this survey. Based on the principle of informed consent, 555 questionnaires were returned, of which 552 were valid, the questionnaire-reclaiming efficiency being 99.5% .

Measures
We designed the general data survey scale in accordance with the study objective, with categories covering gender, age(≤25 or 25~30 or 30~40 or ≥ 40), department, literacy, marital status, working years(≤ 4 or 4~10 or 10~20 or ≥ 20), living alone or not, education degree, job title, average monthly income after COVID-19 outbreak(≤3000RMB or 3000-5000 RMB or 5000-10000 RMB or 10000-15000 RMB or ≥ 15000 RMB), working hours per week in the latest month(≤ 20 hours or 20~40 hours or 41~60 hours or ≥ 60 hours), working efficiency, any sense of psychological traumas during COVID-19 or not, how many infected with COVID-19 in 2020 and how many days they worked during the outbreak.

Perceived stress scale was used to assess the daily life stress level of the participants over the latest month, with good reliability and validity[25-26]. Out of 10 items in the scale 6 were negative questions and 4 positive. Each item scored with 5-point Likert scale (never =0, occasionally =1, sometimes = 2, often =3, always =4) , the final score being 0~40. The higher score indicates the greater stress, 0~13 for low stress, 14~19 for medium stress and over 19 for high stress.

Maslach Burnout Inventory (MBI) was jointly developed by American social psychologists Christina Maslach and Susan E. Jackson Jaskson[27-28]. The content of the questionnaire involves three dimensions: emotional exhaustion, depersonalization, and lack of personal accomplishment. This scale has been widely used abroad, with high reliability and validity. The scale reliability coefficient Cronbach's α was 0.93, and emotional exhaustion α was 0.91, cynicism α 0.81 and low sense of personal accomplishment α 0.84.

This study used Connor Davidson Resilience Scale (CD-RISC), revised and translated by the Chinese scholar Yu and his associates[29]. The scale had a total of 25 items, 3 dimensions (tenacity, strength, optimism), with the score (0~4), answering "never" scored 0 point, "rarely" scored 1 point, "sometimes" scored 2 points, "always" scored 3 points, and "almost always" scored 4 points. The points scored ranged from 0 to 100 points. Of the above 3 dimensions tenacity was of questions from 11 to 23 , a total of 13 items, and the score range was from 0 to 52 points; the strength dimension was of questions 1, 5, 7, 8, 9, 10, 24, 25, a total of 8 items, and the score range was from 0 to 32 points; the optimism dimension was of questions 2, 3, 4, and 6 , a total of 4 items, and the score range was from 0 to 16 points. The higher score meant the better psychological resilience. Cronbach's α coefficient was 0.91 in the Chinese version CD-RISC scale.

Insomnia Severity Index (ISI) was developed by Morin in 1993 [30], used to assess the participants' subjective sleep in the latest 2 weeks, including 7 self-assessment questions, each question with 5 choices from 0 to 4. The aggregate score was 0-28, the higher the score, the more serious the insomnia and the greater the stress. The aggregate score of 0~7 meant no insomnia, 8~14 mild insomnia, 15~21 moderate insomnia, and 22~28 severe insomnia. The Cronbach's α coefficient of the scale at baseline was 0.76, and the Cronbach's α coefficient was 0.78 during the three months of follow-up, an index of good sensitivity to treatment.

Statistical Analysis

R statistical software(R, 4.0.3 version) was utilized to analyze data. The measurement data were tested through Shapiro-Wilk normal test and the Levene's test, which met the normal distribution and homoscedasticity selecting parametric test, and did not meet normally distributed nonparametric test. The data did not meet normal distribution were described with median (M) and 0~100 percentile (P0~P100) or 25th, 75th percentile (P25, P75),

inter-group differences using Kruskal-Wallis H test, Mann-Whitney U test, test level α =0.05, bilateral test. The counting data were described with frequency and composition ratio; Pearson linear correlation was used to make an analysis between the two variables that met normal distribution. For the one that did not meet normal distribution, we used Spearman level correlation to make an analysis between the two variables. The P value less than 0.05 was considered significant.

Results
Demographic Characteristic

The average working years of nurses were 6.10±4.65 years; the average age was 28.61±4.71 years; 252 (45.65%) were single (including 1 divorced) and 300 were married (54.35%); 14 were males (2.54%) and 538 females (97.46%) (Table 1).

Table 1　Socio-demographic characteristics of respondents (n = 552)

Items	n(%)
Departments	
Outpatient and emergency	44 (7.97)
Buffer ward	12 (2.17)
Internal Medicine.	128 (23.19)
Surgery	158 (28.62)
Gynaecology and obstetrics	44 (7.97)
Paediatrics	36 (6.52)
ICU	48 (8.70)
Mental health center	59 (10.69)
Fever clinics	14 (2.54)
Nucleic Acid Test	9 (1.63)
Work Experience	
4 years and less	202 (36.59)
5-10 years	280 (50.72)
11-20 years	58 (10.51)
20 years and more	12 (2.17)
Gender	
Male	14 (2.54)
Female	538 (97.46)
Age	
25 and 25+	122 (22.10)
26-30	301 (54.53)
31-40	112 (20.29)
40 and 40+	17 (3.08)
Marriage	
Single	252 (45.65)
Married	300 (54.35)

Living state	
Living alone	123 (22.28)
Living with family	123 (22.28)
Living with others	123 (22.28)
Education	
College and below	27 (4.89)
BA	508 (92.03)
MA and above	17 (3.08)
Title	
Nurse	123 (22.28)
Senior nurse	337 (61.05)
Supervisor nurse	89 (16.12)
Co-chief nurse and above	3 (0.54)
Post-epidemic average monthly income (yuan/month)	
≤3000	37 (6.70)
3000-5000	240 (43.48)
5000-10000	233 (42.21)
10000-15000	37 (6.70)
≥15000	5 (0.91)
Average working hours per week	
≤20 hours	16 (2.90)
20-40 hours	268 (48.55)
41-60 hours	256 (46.38)
≥60 hours	12 (2.17)
Covid-19 psychological trauma	
Yes	114 (20.65)
No	438 (79.35)
Coronavirus infection	
No	454 (82.25)
Diagnosed	15 (2.72)
Quarantine of close contact	83 (15.04)

Scores of Nurses' Psychoometric Indicators

The participants' stress score M (p0~p100) was 14.00 (0.00,036.00) points, generally the stress level being moderate. 273 of the participants presented low stress perception and scored from 14 to 19 points, accounting for 42.21%; 46 of them presented high stress perception and scored over 19 points, accounting for 8.33%. The scores M(p0~p100)in dimensions of job burnout of the participants were: the average in the dimension of emotional exhaustion was 8.00 (0.00, 46.00)；the average in the dimension of work indifference was 2.00 (0.00, 25.00)；the dimension of no sense of work accomplishments 34.00 (0.00, 48.00); emotional exhaustion and work indifference were of low burnout levels and no sense of work accomplishments was in a high burnout level. Each

dimension score M(p0~p100) was: strength dimension: 22.00 (0.00,32.00); optimism dimension: 12.00 (0.00,16.00); tenacity dimension: 34.00 (0.00,52.00); the aggregate score from the psychological resilience scale was 68.00 (0,100)points.The participants in the survey got an average score of 5.00 (1.00, 8.00) in the insomnia severity index scale(ISI), 115 of them(20.83%) presented mild insomnia, 34 (6.16%) moderate insomnia, and 4（0.72%）severe insomnia.

Monofactor Analysis of Nurses' stress and Their Job Burnout

According to statistics, the average monthly income and COVID-19 psychological trauma are the affecting factors upon nurses' stress perception, with significant difference in the scores (p <0.05). In terms of the affecting factors on psychological resilience, COVID-19 psychological trauma would affect the strength dimension of nurses' psychological resilience, the scores with significant difference (p<0.05); the post-epidemic average monthly income and the COVID-19 trauma would affect the dimension of optimism in nurses' psychological resilience, the scores with significant difference (p <0.05); working in different departments and COVID-19 psychological trauma would affect the dimension of nurses'tenacity, the scores with significant difference (p <0.05). In terms of the severity of nurses' insomnia, working in different departments, gender, post-epidemic average monthly income, average weekly working hours, COVID-19 psychological trauma and some others were the factors that affected the severity of insomnia of nurses, with significant difference in the statistical scores (p <0.05)(Table 2).

TABLE 2   Monofactor Analysis of Nurses' Stress and Job Burnout from the Perspective of Demographic Characteristics (n = 552)

	Items	Number	Stress perception	Psychological resiliance	Insomalia	Emotional exhaustion	Dehumanization	Sense of accomplishment
						Burnout		
Departments	Outpatient and emergency	44	14.00 (7.00, 16.00)	71.00 (54.75, 84.25)	3.00 (2.00, 5.25)	5.50 (0.75, 9.25)	1.50 (0.00, 5.00)	33.50 (23.00, 42.00)
	Buffer ward	12	16.00 (12.25, 16.00)	58.50 (50.00, 70.50)	5.00 (2.00, 8.00)	6.50 (3.75, 14.50)	2.50 (0.75, 4.75)	25.00 (9.00, 34.00)
	Internal Medicine.	128	13.50 (7.00, 16.00)	69.00 (50.00, 81.25)	4.00 (1.00, 7.00)	9.00 (4.75, 18.00)	3.00 (0.00, 6.00)	37.50 (23.75, 43.00)
	Surgery	158	13.00 (8.00, 16.00)	67.50 (55.00, 78.75)	5.50 (1.00, 8.00)	8.50 (3.00, 16.00)	2.00 (0.00, 6.00)	37.00 (26.00, 42.00)
	Gynaecology and obstetrics	44	13.00 (8.75, 16.00)	71.00 (53.50, 80.00)	5.50 (3.75, 11.00)	10.00 (3.75, 17.25)	2.50 (0.00, 7.00)	35.00 (18.00, 42.75)
	Paediatrics	36	16.00 (10.75, 17.00)	54.50 (48.00, 75.00)	6.50 (3.00, 10.00)	13.00 (4.00, 16.00)	2.00 (0.00, 5.50)	24.50 (16.75, 34.00)
	ICU	48	16.00 (10.75, 18.00)	58.00 (50.00, 74.25)	4.00 (2.00, 7.00)	9.50 (6.00, 17.00)	3.00 (1.00, 5.25)	32.00 (24.00, 40.00)
	Mental health center	59	13.00 (5.00, 16.00)	69.00 (55.00, 82.00)	6.00 (4.25, 10.50)	7.00 (3.00, 9.50)	2.00 (0.00, 5.00)	31.00 (17.00, 41.00)
	Fever clinics	14	13.50 (8.50, 16.00)	75.00 (61.00, 89.75)	1.00 (1.00, 3.00)	9.50 (5.25, 24.25)	2.00 (1.00, 5.50)	36.00 (29.75, 44.50)
	Nucleic Acid Test	9	11.00 (9.00, 12.00)	60.00 (55.00, 67.00)	4.50 (2.50, 10.00)	11.00 (7.00, 13.00)	7.00 (7.00, 8.00)	34.00 (33.00, 40.00)
	Z		13.455	16.648	20.374	19.863	11.514	21.356
	P		0.143	0.055	0.016*	0.019*	0.242	0.011*

Work Experience	4 years and less	202	13.00 (6.25, 16.00)	68.00 (53.00, 83.00)	4.00 (1.00, 7.00)	9.00 (4.00, 17.00)	2.00 (0.00, 5.00)	37.00 (26.75, 43.00)
	5-10years	280	15.00 (9.00, 16.00)	67.00 (51.00, 78.00)	5.00 (2.00, 8.00)	8.00 (3.00, 15.00)	3.00 (0.00, 5.25)	33.00 (20.00, 41.75)
	11-20years	58	13.00 (8.00, 16.00)	68.00 (55.00, 77.75)	5.50 (1.00, 8.75)	9.50 (4.25, 18.00)	4.50 (0.00, 7.00)	36.50 (25.00, 41.00)
	20 years and more	12	14.50 (9.00, 17.25)	61.50 (53.25, 73.50)	7.00 (4.25, 8.00)	7.50 (6.75, 13.00)	2.00 (0.00, 4.50)	34.00 (22.25, 39.50)
	Z		4.725	2.914	3.501	1.594	3.637	10.754
	P		0.193	0.405	0.321	0.661	0.303	0.013*
Gender	Male	14	15.50 (13.00, 17.00)	72.50 (55.25, 77.50)	7.50 (4.25, 11.25)	9.50 (1.25, 23.75)	4.50 (1.00, 12.25)	29.50 (24.00, 36.50)
	Female	538	13.00 (8.00, 16.00)	68.00 (52.25, 79.75)	5.00 (1.00, 8.00)	8.00 (4.00, 16.00)	2.00 (0.00, 6.00)	35.00 (23.00, 42.00)
	Z		4380.5	3965	5044.5	4026	4684	2993
	P		0.294	0.735	0.029*	0.658	0.113	0.429
Age	25 and 25+	122	13.50 (6.25, 17.00)	62.00 (50.00, 77.00)	4.00 (1.25, 7.00)	10.00 (5.00, 19.00)	2.00 (0.00, 6.00)	34.00 (22.00, 42.00)
	26-30	301	14.00 (8.00, 16.00)	68.00 (53.00, 80.00)	4.00 (1.00, 8.00)	8.00 (3.00, 15.00)	2.00 (0.00, 5.00)	34.00 (23.25, 42.00)
	31-40	112	12.00 (8.00, 16.00)	69.50 (55.00, 80.00)	5.00 (2.00, 9.00)	7.00 (3.00, 14.25)	3.00 (0.00, 6.25)	36.00 (24.00, 42.00)
	40 and 40+	17	15.00 (10.00, 18.00)	66.00 (51.00, 74.00)	7.00 (5.00, 9.00)	9.00 (7.00, 19.00)	2.00 (1.00, 8.00)	38.00 (28.50, 41.00)
	Z		2.854	3.403	6.15	7.183	1.126	0.756
	P		0.415	0.334	0.105	0.066	0.771	0.86

		N						
Marital status	Single	252	14.00 (8.00, 16.00)	66.00 (50.00, 79.00)	5.00 (2.00, 8.00)	9.00 (4.00, 17.00)	3.00 (0.00, 6.00)	34.00 (23.00, 42.00)
	Married	300	13.50 (8.00, 16.00)	68.00 (54.00, 80.00)	5.00 (1.00, 8.00)	8.00 (4.00, 15.00)	2.00 (0.00, 6.00)	34.00 (24.00, 42.00)
	Z		38036.5	36145.5	39993.5	40503	39418.5	30728
	P		0.899	0.375	0.238	0.147	0.378	0.724
Living state	Living alone	123	16.00 (9.00, 17.00)	62.00 (48.50, 78.00)	5.00 (2.00, 9.00)	9.00 (4.00, 18.00)	3.00 (0.00, 7.00)	29.00 (18.00, 40.00)
	Living with family	307	13.00 (8.00, 16.00)	68.00 (54.00, 79.50)	5.00 (1.00, 8.00)	8.00 (4.00, 15.00)	2.00 (0.00, 6.00)	35.00 (24.00, 42.00)
	Living with others	122	13.00 (7.00, 16.00)	68.00 (54.00, 81.00)	4.00 (1.25, 8.00)	9.00 (4.00, 15.75)	2.00 (0.00, 6.00)	38.50 (26.75, 43.00)
	Z		2.133	2.228	1.633	1.577	1.639	8.855
	P		0.344	0.328	0.442	0.454	0.441	0.012*
Education	College and below	27	11.00 (8.50, 16.50)	55.00 (46.50, 82.00)	8.00 (2.50, 10.00)	7.00 (3.00, 15.00)	1.00 (0.00, 3.50)	31.00 (20.00, 43.00)
	BA	508	14.00 (8.00, 16.00)	68.00 (52.75, 79.00)	5.00 (1.00, 8.00)	8.00 (4.00, 16.00)	2.50 (0.00, 6.00)	35.00 (23.00, 42.00)
	MA and above	17	15.00 (9.00, 17.00)	75.00 (65.00, 80.00)	6.00 (3.00, 8.00)	9.00 (7.00, 18.00)	2.00 (0.00, 6.00)	39.00 (23.75, 44.50)
	Z		0.098	4.228	3.791	1.267	3.652	1.137
	P		0.952	0.121	0.15	0.531	0.161	0.566
Title	Nurse	123	15.00 (8.00, 16.00)	62.00 (50.00, 80.00)	5.00 (2.00, 8.00)	10.00 (4.00, 19.00)	2.00 (0.00, 5.50)	32.00 (21.50, 42.00)
	Senior nurse	337	14.00 (8.00, 16.00)	69.00 (53.00, 82.00)	4.00 (1.00, 8.00)	8.00 (3.00, 15.00)	2.00 (0.00, 6.00)	35.00 (24.00, 42.00)

	Supervisor nurse	89	13.00 (8.00, 16.00)	67.00 (54.00, 76.00)	5.00 (2.00, 8.00)	8.00 (4.00, 15.00)	3.00 (0.00, 6.00)	36.00 (20.00, 42.00)
	Co-chief nurse and above	3	17.00 (10.50, 18.00)	57.00 (57.00, 67.50)	7.00 (4.50, 7.50)	7.00 (6.50, 13.00)	6.00 (3.00, 6.50)	22.50 (22.25, 22.75)
	Z		1.508	2.349	1.207	1.306	1.436	2.891
	P		0.68	0.503	0.751	0.728	0.697	0.409
Post-epidemic average monthly income (yuan/month)	≤3000	37	16.00 (15.00, 18.00)	60.00 (46.00, 85.00)	6.00 (2.00, 11.00)	9.00 (3.00, 19.00)	2.00 (0.00, 5.00)	24.00 (9.00, 36.00)
	3000-5000	240	14.00 (8.00, 17.00)	65.00 (50.00, 78.00)	5.00 (2.00, 9.00)	9.00 (4.00, 17.00)	2.00 (0.00, 5.25)	34.00 (22.00, 42.00)
	5000-10000	233	13.00 (8.00, 16.00)	69.00 (55.00, 82.00)	4.00 (1.00, 7.00)	7.00 (2.00, 14.00)	2.00 (0.00, 6.00)	36.00 (25.25, 42.00)
	10000-15000	37	11.00 (7.00, 16.00)	68.00 (63.00, 79.00)	5.00 (2.00, 7.00)	10.00 (5.00, 14.00)	4.00 (1.00, 8.00)	40.00 (31.00, 42.50)
	≥15000	5	16.00 (15.00, 17.00)	59.00 (57.00, 72.00)	7.00 (4.00, 9.00)	7.00 (5.00, 7.00)	2.00 (0.00, 7.00)	23.00 (18.00, 28.00)
	Z		13.913	6.535	14.793	8.127	3.254	21.573
	P		0.008*	0.163	0.005*	0.087	0.516	<0.001*
Average working hours per week	≤20 hours	16	14.50 (8.00, 16.00)	70.50 (58.00, 84.25)	2.00 (1.00, 3.00)	3.50 (0.00, 9.00)	0.00 (0.00, 2.00)	31.00 (21.00, 42.25)
	20-40 hours	268	13.00 (7.00, 16.00)	69.00 (53.00, 82.00)	4.00 (1.00, 8.00)	9.00 (4.00, 16.00)	3.00 (0.00, 6.00)	37.00 (24.00, 42.00)
	41-60hours	256	15.00 (9.00, 16.00)	68.00 (51.00, 77.00)	5.00 (2.00, 8.00)	8.00 (3.00, 16.00)	2.00 (0.00, 6.00)	34.00 (21.00, 41.25)
	≥60hours	12	15.50 (8.75, 17.50)	58.50 (53.75, 65.50)	5.00 (3.75, 8.25)	13.50 (5.75, 25.50)	2.50 (0.75, 7.25)	32.00 (28.75, 36.00)
	Z		3.882	2.571	8.889	5.967	5.819	3.38

Yunyan Xian Yu et al.
Psychological Stress and Job Burnout of Frontline Nurses in Wuhan in the Context of Normalized Pandemic Prevention and Control for COVID-19----A Cross-sectional Study

	P		0.274	0.463	0.031*	0.113	0.121	0.337
Covid-19 psychological trauma	Yes	114	16.00 (11.00, 18.75)	57.50 (50.00, 71.75)	8.00 (5.00, 11.75)	16.00 (8.00, 23.75)	5.00 (2.00, 9.75)	29.50 (24.00, 40.00)
	No	438	13.00 (7.00, 16.00)	70.00 (54.25, 82.00)	4.00 (1.00, 7.00)	7.00 (3.00, 13.00)	2.00 (0.00, 5.00)	36.00 (23.00, 42.00)
	Z		33504	18079.5	36152	36117.5	33818	18971
	P		<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.128
	No	454	14.00 (8.00, 16.00)	68.00 (53.00, 79.00)	5.00 (2.00, 8.00)	8.00 (4.00, 15.00)	2.00 (0.00, 5.00)	34.00 (22.00, 42.00)
	Diagnosed	15	15.00 (6.00, 16.00)	69.00 (52.50, 85.00)	3.00 (0.00, 11.00)	7.00 (2.00, 17.00)	5.00 (1.50, 8.00)	36.00 (28.50, 38.00)
Coronavirus infection	Quarantine of close contact	83	13.00 (8.50, 16.50)	65.00 (52.50, 79.50)	5.00 (1.50, 8.00)	12.00 (5.00, 21.50)	4.00 (1.00, 7.00)	37.00 (25.00, 42.50)
	Z		0.593	0.045	0.74	5.69	13.786	1.86
	P		0.744	0.978	0.691	0.058	0.001*	0.395

Correlation Analysis of stress perception

According to Spearman correlation analysis, nurses' stress perception is positively correlated with emotional fatigue, work indifference, severe insomnia, P<0.01, a negative correlation with the total score of their sense of job achievements, strength, optimism, tenacity and psychological resilience, P <0.01. The table below is a correlation analysis of stress perception among 552 frontline nurses combating COVID-19(Table 3).

TABLE 3 Correlation analysis of stress perception

		Emotional exhaustion	Depersona-lization	Personal accomplishment	Dimension of strength	Dimension of optimism	Dimension of tenacity	CD-RISC	ISI-7	Work experience	Age
Pss-10	r	0.354**	0.382**	-0.609***	-0.497**	-0.541***	-0.473***	-0.519**	0.441	0.076	0.027
	P	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.076	0.529

Discussion

The purpose of this study was to investigate the occupational stress of nurses who had ever worked in the designated hospitals for COVID-19 in Wuhan, China, under the normalized pandemic prevention and control. The study revealed that the participants' stress was generally moderate, among them those who presented significant stress accounted for 50.54%. The factors of affecting nurses' stress were multifaceted and complex[31-32]. After the frontline anti-epidemic nurses completed the campaign against COVID-19, they immediately went back to hospital to disinfect and clean up wards, busy with the resumption of normal hospital work and production. With hospital departments resumed, nurses had to devote themselves more to learn and implement the hospital prevention and control policy in response to the new requirements for the COVID-19 prevention and control, and within the departments where they worked they must carry out those anti-epidemic measures and watch all areas of a department, equipment, facilities, patients and patients' family in the hospital,which kept those nurses who had already been nervous always in a state of nervousness. The decrease of income in the post-epidemic period was also one of the factors affecting nurses' psychological state. During the period of normalized epidemic prevention and control period, the procedures for patients to go to the hospital for treatment were more complicated than ever. During the patients' hospitalization, nucleic acid testing must be performed 15 days apart; during the hospitalization period, isolation management must be carried out, and meals must be provided by the hospital's canteen; generally patients' family members could not stay with them except for children or those can not look after themselves, and their accompanying family members also must comply with the isolation management requirements if they must stay. The normalized epidemic prevention and control measures mentioned above were almost undertaken and implemented by nurses. Consequently, the conflict between nurses and patients was prominent with patients often complaining that nurses did not let them out, food in the hospital canteen was poor, family members were not permitted to go into hospital to deliver meals for them and thus their needs for care could not be satisfied etc.. Therefore, in addition to daily nursing work, the nurses working in the wards were also struggling to cope with the epidemic prevention and control measures, which made the problem of clinical department's insufficient nursing human resources even worse.

After the outbreak of COVID-19, many frontline anti-epidemic nurses generally reported the problem of insomnia[33-34]. There were documents showing that during the pandemic, the incidence of insomnia among frontline anti-epidemic nurses in Wuhan was 52.8%[35]. Under the normalized prevention and control measures against COVD-19, some nurses still had varying degrees of insomnia, accounting for 27.72%, which possibly related to their psychological trauma suffered during COVID-19 outbreak. 20.7% of the nurses surveyed in this study believed that COVID-19 outbreak in Wuhan caused trauma to them, and those with psychological trauma

from COVID-19 presented higher degree of stress perception, their emotional exhaustion and indifference at work being more severe while their psychological resilience being lower. Among the participants in this study, 15 nurses had been infected with COVID-19, 83 nurses had been isolated as close contacts with COVID-19 patients, and the nurses who had been infected with COVID-19 had higher scores for work indifference in job burnout than that of other categories. Although most medical staff are now returning to work after recovering from being infected COVID-19, studies have shown that the special experience of being infected with COVID-19 changed the nurses' mental state, they are still suffering from psychological trauma, and job burnout at work as well.

In general, the challenging and totally new working environment made nurses suffer job burnout and occupational stress[36-37]. Nursing staff's burnout in their sense of job accomplishment was serious. Some nurses suffered psychological trauma and insomnia, with low psychological resilience.The studies above have revealed that hospital management should kept heir attention to the psychological status of nurses during the period of normalized epidemic prevention and control, especially those with psychological trauma, low income, and those once infected with COVID-19, so as to support nurses and adopt a variety of methods to improve their mental health, so as to help them improve their service for all people.

Declaration of conflicting interests: All authors disclose no actual or potential conflicts of interest including any financial, personal, or other relationships with other people or organisations that could inappropriately influence their work.

Ethics Statement

The studies involving human participants were reviewed and approved by Research Ethics Committee of Renming Hospital, Wuhan University, Wuhan, China. Patients and participants' written informed consent for participation was required for this study.

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Yunyan Xian Yu et al.
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