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ORIGINAL ARTICLE

Observational Study

Health care worker occupational experiences during the COVID-19 outbreak: A cross-sectional study

Xiao-Fang Li, Xuan-Lin Zhou, Sheng-Xiu Zhao, Yue-Mei Li, Shi-Qin Pan

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Abstract

BACKGROUND

Health care workers treating coronavirus disease 2019 (COVID-19) patients experience burnout and stress due to overwork and poor working conditions.

AIM

To investigate the work experiences of frontline health care workers in Wuhan city and Qinghai province, China, during the COVID-19 outbreak.

METHODS

In this cross-sectional descriptive study, a self-reported questionnaire was designed to evaluate work experiences of medical staff throughout the course of the COVID-19 pandemic. A total of 178 health care workers responded to the questionnaire between February 19 and 29, 2020. Higher questionnaire dimensional score confirmed dimensional advantage.

RESULTS

Of all dimensions evaluated by this questionnaire, the occupational value dimension had the highest mean score of 2.61 (0.59), followed by the support/security dimension score of 2.30 (0.74). Occupational protection scored lowest at 1.44 (0.75), followed by work environment at 1.97 (0.81). The social relationships dimension had an intermediate score of 2.06 (0.80). Significant differences in working conditions were observed across hospital departments, with the fever ward scoring lowest. Total scores also differed significantly across workplaces; the fever outpatient department scored lowest ($P < 0.01$). This phenomenon was likely due to the fact that work in the fever outpatient department, where many patients present to hospital, necessitates constant contact with a large number of individuals with insufficient provision of resources (such as

protective equipment and social support). Medical workers in the fever outpatient department were burdened with a fear of COVID-19 infection and a lower sense of professional value as compared to workers in other hospital departments. Medical staff in Wuhan worked longer hours ($P < 0.01$) as compared to elsewhere. The mean support/security dimension score was higher for tertiary hospital as compared to secondary hospital medical staff as well as for Wuhan area as compared to Qinghai region staff ($P < 0.01$). Staff in Wuhan had a lower mean work environment score as compared to staff in Qinghai ($P < 0.05$).

CONCLUSION

Medical staff treating COVID-19 patients in China report poor occupational experiences strongly affected by work environment, occupational protection and social relationships. Health care managers must address the occupational needs of medical staff by ensuring a supportive and safe work environment.

Key Words: Novel coronavirus; COVID-19; Health care worker; Occupational exposure; Personal protective equipment

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Core Tip: Several studies have reported on mental health care and infection prevention for health care workers, but there has been no research on the experiences of health care workers during the early stage of the coronavirus disease 2019 (COVID-19) pandemic, when little was known about the disease. We developed a questionnaire to evaluate health care workers' work experiences consisting of five domains: Support/security, work environment, occupational protection, and social relationships, and occupational value. Health care workers treating COVID-19 patients in China had poor work experiences overall. Health care managers should address the problems faced by health care workers by providing high-quality personal protective equipment and adequate training and ensuring a supportive and safe work environment.

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INTRODUCTION

The outbreak of a novel coronavirus tentatively named 2019 novel coronavirus (2019-nCoV) was reported by the World Health Organization (WHO) on January 12, 2020 in Wuhan, Hubei Province, China. The virus spread rapidly to all Chinese provinces and the majority of other countries[1]. The WHO declared the 2019-nCoV pandemic a public health emergency of international concern on January 30, 2020, and on February 11, 2020, the disease was officially named coronavirus disease 2019 (COVID-19)[2].

This virus is transmitted by contact with respiratory droplets from an infected individual[3]. The incubation period usually lasts 3-7 d and does not exceed 14 d[4]. The main symptoms are fever, dry cough and fatigue[5]. Because of its strong infectivity, COVID-19 has been listed as a Category B infectious disease by the National Center for Disease Control and Prevention, although prevention and control measures used for Category A infectious diseases are currently recommended[6,7]. Since February, health care workers from Qinghai have voluntarily traveled to Hubei to help treat the rising number of infected patients. In order to slow the spread of COVID-19 and care for patients confirmed or suspected to be infected with the virus, additional services such as fever clinics and infectious isolation units have been established at many hospitals[6]. Frontline health care workers have faced enormous challenges including an overwhelming workload, shortage of personal protective equipment (PPE) and an uncertain course of the pandemic. Multiple studies have shown that frontline medical staff treating COVID-19 patients have a high risk of developing mental health conditions including anxiety, stress and feeling that they are inadequately prepared for their duties[8-11]. Occupational experiences of staff working in different hospital departments during the COVID-19 outbreak have not been evaluated in detail. Poor occupational experience is not only detrimental to the physical and mental state of medical staff but also affects the quality of services provided to patients[12]. Here, we developed a questionnaire according to the Delphi method to evaluate work experiences of frontline health care staff treating

COVID-19 inpatients in the city of Wuhan and province of Qinghai. Our analysis of factors affecting medical staff work experience provides guidance concerning the establishment of services and policies that ensure safe and productive clinical work environments. This cross-sectional survey details both environmental and human resources hazards faced by medical staff in this unprecedented emergency that has tested health systems worldwide. It is critical for medical staff, especially trainees, to receive appropriate guidance regarding emergency response practices in order to enhance public health capabilities and preparedness. As grassroots medical workers face challenges of increasing severity with the outbreak of COVID-19, many previously neglected issues have been brought into the spotlight including those concerning basic medical care, preventive medicine and psychological counseling for both patients and medical staff. Even with ample manpower, not all hospitals take sufficient precautions in dealing with emergency situations. This study aims to detail a certain theoretical basis for structuring future approaches to mass medical emergencies and at the same time call on health care staff to actively take care of their mental health for better service of the public good.

MATERIALS AND METHODS

Study design

This study is a descriptive study. Throughout the COVID-19 outbreak, occupational experiences of frontline medical staff in Wuhan city and Qinghai province, China, was evaluated. Study subjects were selected with the aid of random numbers. The research team included staff from Wuhan Xizhou Hospital, Qinghai Provincial People's Hospital and Qinghai Provincial Fourth People's Hospital. Before the start of formal surveying, 20 research subjects were selected for pre-experimental preparation; response scales were defined at the same time. Data were collected using Questionnaire Star (an online survey tool). If response time was less than 30 s or the same score was provided more than five times in a row, the questionnaire was regarded as invalid. Questionnaire recovery rate was 100%. The mean total work experience score (\pm SD) of these 20 front-line medical staff was 50.34 (12.51); their mean occupational protection, occupational value, work environment, support/safety and social relationships scores were 1.98 (0.54), 2.61 (0.59), 1.32 (0.64), 2.03 (0.49) and 1.56 (0.71), respectively.

Sample size estimation

According to values in reference literature and our pre-experimental sample size estimation, the required sample size was found required to be 5-10 times the number of questionnaire items[13]. Considering a sample loss rate of 10%, target sample size was determined to be 176-352; a total of 178 questionnaires were finally distributed.

Participants

A total of 178 frontline health care workers from hospitals in the city of Wuhan and two designated hospitals in Qinghai province who worked in fever, observation and isolation wards were enrolled. Frontline medical personnel involved in the diagnosis, treatment, and care of patients with confirmed or suspected COVID-19 who provided informed consent and volunteered to participate in this study met our inclusion criteria. Health care workers who had been involved in such medical work for less than one week were excluded from analysis[14].

Study instruments

General information questionnaire: This part of the questionnaire evaluated for hospital level, work area, workplace, sex, occupation, age, education level, and years of work experience (Table 1).

Work experience questionnaire: This part of the questionnaire was developed based on relevant prior literature as well as expert opinion[15-20]. The questionnaire comprised five dimensions and a total of 36 items; questionnaire data were evaluated by nine experts including an intensive care unit medical specialist (chief physician), a hospital infection specialist (deputy chief nurse) and seven nursing experts (five deputy chief nurses and two chief nurses). The Delphi technique consisted of two rounds. In the first round, experts were asked to rank the importance of features for work experiences using a five-point Likert-type scale (essential; important but not essential; regular; not important; not required). The experts were also encouraged to provide further information regarding the proposed list of features via free text responses. In the second round, the drafted set of criteria was evaluated along with analysis of round one data. Experts indicated their agreement with each aspect of the criteria as well as overall questionnaire structure using a four-point Likert-type scale (strongly disagree; disagree; agree; strongly agree). The expert positive coefficient of the two rounds was 100%. In the first round, six experts put forth suggestions for revision and two items were deleted. In the second round, there was general agreement among experts regarding questionnaire items. First and second round scores were as follows: Expert consultation, 0.870 and 0.890; maturity coefficients, 0.779 and 0.842; authority coefficients, 0.810 and 0.862; coefficients of variation among experts, 0.287 and 0.254; and number of co-adjustment systems, 0.303 and 0.154. Kendall's W test indicated that the difference between the latter two coeffi-

Table 1 General characteristics and work experiences of medical staff treating coronavirus disease 2019 cases in Wuhan city and Qinghai province (n = 173)

Characteristic	n (%)	Item						
		Support/security	Work environment	Protection experience	Social relationships	Sense of worth	Total score	Working (d)
Hospital grade								
Tertiary	101 (58.4)	17.38 (4.55) ^b	16.37 (6.77)	8.73 (4.78)	16.57 (6.54)	7.96 (1.96)	66.34 (16.37)	22.99 (9.01) ^a
Secondary	72 (41.6)	14.29 (5.42)	14.79 (6.05)	8.44 (4.03)	16.31 (6.18)	7.61 (1.45)	63.43 (12.08)	25.82 (7.93)
Geographic location of work								
Wuhan city	108 (62.4)	15.12 (5.27) ^b	14.74 (6.13) ^a	8.19 (4.19)	16.76 (6.31)	7.81 (1.61)	65.05 (13.45)	26.41 (7.83) ^b
Qinghai province	65 (37.6)	17.71 (4.53)	17.32 (6.86)	9.32 (4.86)	15.97 (6.50)	7.83 (2.02)	65.26 (16.83)	20.45 (8.77)
Work department								
Fever clinic	15 (8.7)	13.87 (5.18)	15.40 (5.74)	9.87 (5.88)	5.95 (1.47) ^a	6.00 (3.05) ^b	50.00 (25.39) ^b	22.93 (8.99)
Observation ward	15 (8.7)	14.20 (7.38)	15.07 (7.45)	7.93 (5.79)	7.50 (1.51)	7.87 (2.20)	65.56 (18.33)	26.87 (6.12)
General isolation ward	67 (38.7)	15.87 (6.45)	15.28 (6.48)	7.90 (4.31)	6.43 (1.81)	7.73 (1.54)	64.43 (12.86)	25.36 (8.60)
Critical isolation unit	53 (30.6)	17.51 (6.49)	16.26 (6.98)	9.23 (4.15)	5.88 (1.86)	8.13 (1.36)	67.77 (11.33)	23.62 (9.71)
Mobile (temporary field) hospital	19 (11)	19.95 (4.52)	16.42 (5.52)	9.00 (3.73)	6.07 (1.66)	8.47 (1.12)	70.61 (9.37)	19.95 (4.99)
Other	4 (2.3)	14.25 (3.50)	15.75 (7.41)	8.50 (3.11)	6.34 (1.65)	8.50 (0.58)	70.84 (4.81)	26.00 (12.19)
Profession								
Doctor	24 (13.9)	14.38 (5.18)	15.29 (5.55)	7.38 (3.79)	15.2 (4.66)	7.38 (1.74)	61.46 (14.50)	27.88 (7.57)
Nurse	142 (82.1)	16.46 (5.06)	15.73 (6.72)	8.74 (4.51)	16.52 (6.65)	7.92 (1.75)	66.02 (14.59)	23.62 (8.65)
Infection control staff ¹	5 (2.9)	14.40 (7.37)	17.80 (6.42)	11.00 (6.20)	19.60 (5.55)	7.00 (2.45)	58.33 (20.41)	23.60 (9.63)
Other ²	2 (1.2)	14.50 (0.71)	14.00 (4.24)	8.50 (4.95)	18.50 (6.36)	7.50 (2.12)	62.50 (17.68)	20.00 (16.97)
Work experience (yr)								
< 2	10 (5.8)	18.30 (2.91)	16.80 (4.34)	9.50 (2.22)	15.00 (5.73)	7.70 (2.16)	64.17 (18.02)	16.50 (8.55) ^a
≥ 2 - < 5	27 (15.6)	15.63 (5.85)	15.56 (7.11)	9.93 (4.35)	16.22 (6.68)	7.74 (1.87)	64.51 (15.61)	20.67 (8.87)
≥ 5 - < 10	67 (38.7)	16.09 (5.37)	15.70 (7.06)	8.78 (4.26)	17.25 (6.46)	7.69 (1.92)	64.05 (16.04)	24.67 (8.61)
≥ 10 - < 20	50 (28.9)	16.72 (4.27)	16.22 (6.00)	7.90 (4.79)	16.26 (5.95)	8.10 (1.50)	67.50 (12.51)	25.56 (7.65)
≥ 20 - < 30	15 (8.7)	13.73 (5.75)	14.27 (5.73)	7.53 (4.96)	15.87 (6.96)	7.67 (1.72)	63.89 (14.32)	29.60 (6.24)
≥ 30	4 (2.3)	14.75 (7.41)	13.25 (8.42)	7.75 (6.80)	13.25 (9.18)	7.75 (1.26)	64.59 (10.49)	20.75 (11.47)
Sex								
Male	31 (17.9)	16.19 (5.08)	14.90 (6.38)	8.90 (4.62)	15.97 (5.95)	7.71 (1.99)	64.25 (16.55)	24.48 (9.26)

Female	142 (82.1)	16.07 (5.18)	15.89 (6.55)	8.55 (4.45)	16.57 (6.48)	7.84 (1.73)	65.32 (14.40)	24.10 (8.57)
Marital status								
Unmarried	50 (28.9)	17.00 (5.47)	17.06 (6.20)	9.88 (4.49)	17.48 (5.99)	7.70 (2.21)	64.17 (18.39)	22.10 (8.47)
Married	114 (65.9)	15.47 (5.05)	15.05 (6.54)	8.00 (4.38)	15.77 (6.35)	7.81 (1.58)	65.06 (13.16)	24.84 (8.85)
Divorced	7 (4)	20.14 (0.90)	16.57 (7.85)	9.71 (4.68)	19.57 (8.81)	9.00 (0.00)	75.00 (0.00)	28.43 (5.19)
Widowed	2 (1.2)	14.50 (0.71)	16.50 (7.78)	8.00 (4.24)	19.50 (4.95)	7.00 (2.83)	58.34 (23.57)	22.50 (2.12)
Level of education								
College degree or below	42 (24.3)	16.02 (5.24)	16.19 (6.07)	9.21 (4.51)	16.52 (5.58)	7.79 (1.79)	64.88 (14.90)	21.05 (8.75) ^a
Undergraduate	126 (72.8)	16.22 (5.15)	15.66 (6.66)	8.41 (4.55)	16.50 (6.69)	7.85 (1.78)	65.41 (14.84)	25.16 (8.35)
Graduate student	5 (2.9)	13.40 (4.56)	13.00 (6.78)	8.60 (1.14)	15.00 (5.10)	7.20 (1.64)	60.00 (13.69)	25.40 (11.41)
Professional title								
Primary	100 (57.8)	16.28 (5.24)	15.86 (6.70)	9.15 (4.21)	16.76 (6.49)	7.78 (1.95)	64.83 (16.22)	22.65 (8.91) ^a
Intermediate	57 (32.9)	16.51 (4.63)	16.00 (6.64)	7.72 (4.64)	16.05 (6.72)	7.95 (1.48)	66.23 (12.34)	26.11 (7.63)
Advanced	16 (9.2)	13.44 (5.85)	13.75 (4.52)	8.44 (5.19)	16.06 (4.20)	7.56 (1.63)	63.02 (13.60)	26.75 (9.13)
Age (yr)								
< 25	19 (11.0)	17.67 (5.53)	16.94 (6.00)	9.83 (4.46)	17.11 (6.26)	7.17 (2.50)	59.72 (20.86)	19.28 (8.97) ^a
25-29	52 (30.1)	15.31 (6.01)	15.48 (6.84)	9.35 (4.18)	16.77 (6.09)	7.81 (1.97)	65.06 (16.42)	22.73 (9.03)
30-34	53 (30.6)	16.58 (4.05)	15.96 (6.78)	7.94 (4.33)	15.94 (7.05)	7.94 (1.47)	66.20 (12.28)	24.40 (8.58)
35-39	22 (12.7)	17.73 (4.13)	16.64 (6.87)	8.36 (5.21)	17.55 (5.89)	8.41 (1.05)	70.08 (8.78)	27.45 (6.23)
40-44	20 (11.6)	14.45 (5.13)	15.30 (4.77)	8.35 (4.59)	16.55 (5.78)	7.55 (1.88)	62.92 (15.64)	28.05 (7.62)
≥ 45	7 (4.0)	13.86 (6.39)	11.71 (6.58)	6.71 (5.15)	14.43 (6.75)	7.57 (1.51)	63.10 (12.60)	24.86 (9.60)

^a $P \leq 0.05$.^b $P \leq 0.01$.¹Hospital infection control workers.²Logistics support personnel and health administrator.

Values in the table are shown as mean ± SD unless otherwise indicated.

clients was statistically significant ($P < 0.001$). The questionnaire was subjected to exploratory factor analysis and the principal component of the characteristic root > 1 was extracted (Table 2); this leads to the deletion of two items. The Kaiser-Meyer-Olkin value was determined to be 0.899, which explained 69.60% of the total variance. Coefficients of Cronbach's α for different dimensions were 0.929 for support/security, 0.913 for working conditions, 0.823 for occupational protection, 0.897 for social relationships, and 0.732 for occupational value. The Cronbach's α coefficient for the entire questionnaire was 0.925, indicating good reliability and validity. The final version of the questionnaire included five dimensions (support/security; working conditions; occupational protection; social relationships; and occupational value) and a total of 32 items. The support/safety dimension was assessed by evaluating whether pre-job training, guaranteed rest periods and support of human resources were reasonable; the working condition dimension was assessed by evaluating whether a reasonable management process was effected and materials complete; the occupational safety dimension was assessed by evaluating

Table 2 Exploratory factor analysis of the work experiences questionnaire

	Common elements				
	1	2	3	4	5
Support guarantee					
Adequate knowledge and skill training before taking up the post	-0.059	0.916	0.137	0.068	0.008
Prepared for an outbreak	-0.082	0.928	0.157	0.084	0.021
Adequate nursing staff	-0.119	0.918	0.102	0.034	0.027
Hospital layout conforming to requirements of nosocomial infection control	-0.058	0.869	0.119	0.06	0.035
Presence of logistic support (e.g., catering, oxygen, provision of appropriate equipment)	-0.053	0.898	0.124	0.108	-0.017
Good quality sleeping environment	-0.152	0.878	0.07	0.008	-0.063
Adequate nutritional support	-0.05	0.93	0.091	0.047	-0.004
Occupational environment					
Lack of personal protective equipment use and infection prevention measures	0.616	-0.041	0.23	-0.145	0.025
Fear of infection, uncertainty regarding adequate protection (e.g., fear that masks are not suitable and allow for leakage around the edges)	0.577	0.006	0.358	-0.18	-0.102
Wearing protective equipment makes it difficult to communicate with patients and blocks sound	0.477	-0.111	0.553	-0.196	0.037
Wearing protective equipment makes it difficult to communicate with patients and blocks sound	0.364	-0.071	0.657	-0.362	0.03
The difficulty of conducting nursing procedures increased while wearing protective equipment	0.368	-0.12	0.617	-0.274	0.023
Various types of protective equipment models are not known to meet protection requirements	0.619	-0.007	0.415	-0.271	-0.063
The most authoritative scientific practice guidance cannot be obtained in a timely manner	0.829	0.119	-0.155	0.065	-0.297
Inconsistent work guidelines and recommendations from different channels cause confusion	0.813	0.118	0.043	0.086	-0.348
The hospital does not have sound working systems and processes	0.807	0.043	-0.134	0.086	-0.259
I do not know how to implement my duties and carry out procedures	0.819	0.05	-0.109	0.063	-0.313
Occupational protection					
Lack of materials: Protective equipment, safety I.V. cannulae, blood syringes, etc	0.617	-0.058	-0.113	0.127	-0.31
Exhaustion regarding dealing with media, publicity and interviews	0.703	0.055	-0.096	0.109	-0.098
Lack of effective communication between nurses and patients that impairs provision of high-quality care	0.786	0.025	-0.081	0.031	-0.121
Unfamiliar work environment	0.72	0.017	-0.065	0.102	-0.103
Social relationships					
Family and friends did not support my work and even criticized me	0.728	0.022	-0.297	0.198	0.203
Felt discriminated against because people nearby were afraid of infection; I felt unwelcome	0.724	0.099	-0.105	0.121	0.318
Working in the isolation ward left me feeling lonely and helpless	0.793	0.048	-0.221	0.154	0.115
I became a scapegoat for patients to vent their dissatisfaction and even societal complaints	0.763	0.036	-0.231	0.143	0.385
I blame myself for coming into contact with patients who were isolated and unable to care for their families	0.611	0.107	0.215	-0.152	0.315
Managed, argued with and received complaints from visiting family members	0.669	0.024	-0.095	0.028	0.34
Exhaustion due to repeated collection of tedious medical histories from patients	0.774	0.061	-0.077	-0.11	0.194
I answering many telephone calls results in exhaustion (involving family, friends, colleagues)	0.807	0.036	-0.011	0.015	0.179
Social relationships					
Sense of accomplishment when patients recover and are discharged from hospital	-0.072	-0.313	0.623	0.568	0.028
Appreciated by leaders and colleagues; colleagues support one other	-0.084	-0.237	0.386	0.564	0.117
Social responsibility makes me proud	-0.02	-0.331	0.602	0.542	-0.058

whether protective equipment provided at work met protection requirements; the social relationships dimension was assessed by evaluating the attitude of family and friends regarding staff in a unique

Table 3 Scores for each item and dimension of medical staff work experience (*n* = 173)

Item	Score (mean ± SD)
Presence of logistics support (e.g., catering, oxygen, equipment)	2.42 ± 0.84
Prepared for another outbreak	2.39 ± 0.83
Adequate knowledge and skills training before taking up the post	2.37 ± 0.90
Adequate nutritional support	2.36 ± 0.86
Adequate support by nursing staff	2.31 ± 0.88
Good quality sleeping environment	2.14 ± 0.95
Hospital layout conformed to nosocomial infection control requirements	2.11 ± 0.87
Support/security dimension	2.30 ± 0.74
The hospital does not have sound working systems and processes	2.05 ± 1.04
I do not know how to implement my work systems and procedures	2.02 ± 1.02
The most relevant scientific and authoritative guidance cannot be obtained in a timely manner	2.01 ± 1.03
Lack of effective communication between nurses and patients, impairing provision of high-quality care	1.98 ± 0.98
Lack of materials (i.e., protective equipment, safety I.V. cannulae, blood collection syringes)	1.95 ± 1.10
Exhaustion from dealing with media, publicity and interviews	1.93 ± 1.02
Inconsistent work guidelines and recommendations from different channels cause confusion	1.90 ± 1.02
The working environment is unfamiliar	1.88 ± 1.04
Work environment dimension	1.97 ± 0.81
Lack of personal protective equipment practice and infection prevention measures	1.81 ± 1.06
Fear of infection, uncertainty whether protection is adequate; for example, fear that masks are not tight-fitting and leak	1.69 ± 1.07
Wearing protective equipment makes it difficult to communicate with patients and blocks sound	1.42 ± 0.94
Various types of protective equipment models not known to meet protection requirements	1.40 ± 1.02
Protective equipment was uncomfortable and the work was difficult, producing difficulty breathing, sweating, poorer vision, and headache if worn for a long time	1.15 ± 1.01
The difficulty of conducting nursing procedures increased while wearing protective equipment	1.15 ± 1.05
Occupational protection dimension	1.44 ± 0.75
My family and friends did not support my work and even criticized me	2.42 ± 1.01
Working in the isolation ward left me feeling lonely and helpless	2.23 ± 0.98
I became a scapegoat for patients to vent their dissatisfaction and societal complaints	2.13 ± 1.05
Managed, argued with and received complaints from visiting family members	2.11 ± 1.04
Felt discriminated against because surrounding individuals feared infection; I felt unwelcome	2.10 ± 1.04
Exhaustion from answering telephone calls from family, friends and colleagues	1.92 ± 1.04
Collecting tedious medical history and receiving patients and visitors can be exhausting	1.92 ± 1.03
Blaming yourself for coming into contact with patients who were isolated and unable to care for their families	1.64 ± 1.17
Social relationship dimension	2.06 ± 0.80
Sense of accomplishment when patients recover and are discharged from hospital	2.79 ± 0.56
Social responsibility makes me proud	2.72 ± 0.68
Feeling appreciated by leaders and colleagues; colleagues support each other	2.31 ± 0.91
Occupational value	2.61 ± 0.59

work environment; and the professional value dimension was assessed by evaluating how staff perceived the value of their professional duties during the pandemic. A four-level Likert scale was used to score each item in the questionnaire. The support/security and occupational value dimensions had

positive scores (not true = 0; somewhat true = 1; true = 2; and very true = 3), while the work environment, occupational protection and social relationships dimensions were scored in reverse (not true = 3; somewhat true = 2; true = 1; and very true = 0). Higher scores indicated better work experiences; a total score of 128 was possible. The mean total work experience score (\pm SD) of the 20 front-line medical staff was 50.34 points (12.51); mean scores for occupational protection, professional value, work environment, support/safety and social relationships were 1.98 (0.54), 2.61 (0.59), 1.32 (0.64), 2.03 (0.49) and 1.56 (0.71), respectively.

Data collection

Data were collected using Questionnaire Star (an online survey tool). If response time was less than 30 s or the same score was given more than five times in a row, the questionnaire was considered invalid.

Ethical considerations

Ethics approval was obtained from the Institutional Review Board of Qinghai Provincial People's Hospital. Written informed consent was obtained from all participants who were also informed that study participation was voluntary and that their refusal to participate would have no negative consequences. All data were kept anonymous and confidential throughout the study.

Data analyses

Data analyses were performed using SPSS v20.0 (IBM, United States); frequency, composition ratio, and mean \pm SD were considered descriptive statistics. Either the independent samples test or analysis of variance was used to analyze differences between and across different subgroups of health care workers according to demographics and work experiences. Tests were two-tailed with a significance level of $\alpha < 0.05$.

RESULTS

General characteristics of the study population

A total of 178 participants were contacted; five dropped out and 173 completed the questionnaire (including 72 from secondary and 101 from tertiary hospitals). A total of 65 respondents worked in Qinghai while 108 worked in Wuhan; 15 worked with patients suffering fever in outpatient departments, 15 in observation wards, 67 in general isolation wards, 53 in critical isolation wards, 23 in temporary (field) hospitals, and four in other settings. The general characteristics of the study population are presented in Table 1.

Comparison of frontline health care worker work experience scores

Total work experience scores varied according to workplace. The mean score was lowest for staff working in fever outpatient departments and highest for those in field and other such hospitals. Support/security dimension mean score was higher for staff working in tertiary hospitals as compared to secondary hospitals, and for staff in the Wuhan area as compared to those in the Qinghai region ($P < 0.01$). Staff in Wuhan had a lower mean work environment dimension score than those in Qinghai ($P < 0.05$). Work experience scores varied across workplaces in regards to the social relationships dimension; fever outpatient department staff had the lowest mean score while observation ward staff had the highest ($P < 0.05$). Work experience scores similarly differed according to workplace in regards to the occupational value dimension; fever clinic staff had the lowest mean score while those in temporary hospitals and other such workplaces had the highest ($P < 0.01$). The total score also differed significantly across workplaces, being lowest for fever outpatient department staff ($P < 0.01$). Medical workers in Wuhan worked longer hours ($P < 0.01$), as did those with an undergraduate degree, who were aged 30–45 years, and had 5–20 years of work experience ($P < 0.05$; Table 1).

Work experiences of frontline health care workers in all dimensions and scores for specific items

The maximum possible score for each dimension was three (Table 3). The occupational value dimension had the highest mean score of 2.61 (0.59), followed by the support/security dimension score of 2.30 (0.74). The occupational protection dimension had the lowest score of 1.44 (0.75), followed by the work environment dimension score of 1.97 (0.81). The social relationships dimension had an intermediate score at 2.06 (0.80).

DISCUSSION

Here, a self-reported questionnaire was used to assess the work experiences of frontline health care workers in Wuhan and Qinghai during the COVID-19 pandemic. The discomfort of wearing PPE, fear of

infection, stress of inadequate occupational support services, medical supply shortage, guilt of not being able to adequately help patients, exhaustion from managing doctor-patient relationships and being unable to take care of family needs were major factors contributing to poor work experiences reported by frontline medical personnel. The occupational protection dimension had the lowest mean score, followed by scores of the work environment and social relationships dimensions. Medical staff were motivated by a sense of social responsibility and carried strong convictions concerning their mission to heal the sick and contribute to fighting the pandemic. Importantly, frontline health care workers were proud of being able to provide high-quality care and perform their duties during the pandemic[21,22]. This is likely why the occupational value dimension had the highest mean score. National health authorities and medical institutions have placed great importance not only on the treatment of COVID-19, but on the occupational protection of health care workers, providing various types of support including human resources services, supply of materials and occupational protection training[23]. Medical staff thus gave high scores for the support/security dimension.

Support/security dimension scores were higher for staff in tertiary as compared to secondary hospitals and for staff in Wuhan as compared to those in Qinghai. These data can be explained by the fact that tertiary hospitals have better access to various medical resources including PPE as compared to secondary facilities, which contributes to a better work environment. Training concerning COVID-19 treatment and protection was conducted over a short period of time in China; preparations for addressing the viral outbreak were urgently made. When PPE shortages arose, supply priority was given to medical personnel in Wuhan, who received considerable support from all sectors of the community including hospital leaders. Thus, support/security scores for medical staff in the Wuhan area were high.

Total scores concerning work experience and working hours differed significantly according to workplace, with the lowest mean score for staff noted to be among those working in the fever outpatient department and highest among those working in temporary and other such settings. Conditions in fever outpatient departments, which include a large number of patients requiring treatment and the need to communicate with/manage both patients and their families, imposed a heavy burden on medical personnel, who simultaneously had to contend with PPE shortages and fear of infection. Compared to other clinical workplace settings, self-perceived occupational value was relatively low among outpatient department staff[24]. Patients in the temporary hospital in Wuhan tended to exhibit mild illness; staff had adequate PPE and worked in a relatively low-pressure environment while receiving considerable social support. As such, medical staff in this group experienced a strong sense of occupational value. Health care staff in Wuhan worked long hours, a feature found to be associated with an undergraduate-level education, age of 30-45 years and 5-20 years of prior work experience. Because of geographic constraints, medical personnel from Qinghai providing medical assistance in Wuhan could not be employed for long periods of time; these individuals were selected for their strong skills and successfully complete undergraduate degrees, were aged 30-45 years and had 5-20 years of work experience[25].

Health care workers deployed to Wuhan hospitals from Qinghai were unfamiliar with the work environment and had a heavy workload that involved care of a large number of COVID-19 patients. These personnel were from various hospitals and clear standardization of clinical activities was lacking, making work more difficult and adding to pressures they had experienced by health care workers in such settings. In addition to practical problems such as PPE shortages, unsuitable medical equipment and fear of infection, frontline health care workers had to overcome significant cultural differences[26].

Experience scores characterizing the social relationships dimension varied significantly across workplaces. The fever clinic had the lowest score in this dimension while the observation ward had the highest. This may be because the fever outpatient department is a unique work environment where treatment of COVID-19 patients remains an onerous task[27]. In such conditions, medical staff are required to collect extensive clinical information, thus becoming exhausted and having to manage both patients and visitors. For example, patients and their families do not always understand the need for isolation and vent their anger on medical staff. Caring for patients in an isolation ward often feels lonely and staff members may even feel discriminated against or bullied[28]. Family members feared that frequent contact with patients suspected of being infected with COVID-19 could lead to infection and were not supportive of the medical staff[16]. As there was less patient contact in the observation ward, doctor-patient conflict was less common overall and work pressure remained relatively light; this explains the higher mean social relationships score for staff still working under such difficult circumstances.

Health care workers in different workplaces also showed significant differences in occupational value scores. The lowest mean score was for fever clinic staff, while personnel in the temporary and other such hospitals had the highest score. As fever outpatient department health care workers treated only patients with fever, COVID-19 infection was frequently suspected. No sense of accomplishment on patient discharge or cure was apparent and little support to medical staff was provided. This undoubtedly undermined support for occupational safety[29]. A relatively large number of patients diagnosed with COVID-19 were successfully treated, and staff received greater attention from society and public leaders of all levels[20].

Occupational protection dimension scores were generally very low and no significant differences among medical staff with different characteristics were found. The vast majority of personnel lacked hands-on experience using PPE and implementing infection prevention measures; as such, these individuals encountered difficulties in properly wearing appropriate protective equipment[17]. Furthermore, medical staff were required to wear suitable PPE for long periods of time; this could result in headaches, sweating, pressure ulcer formation, eczema and other adverse reactions. The wearing of PPE also made it more difficult for staff to function as it often blocked sound, thus creating a communication barrier in doctor-patient interactions. As there are many types of PPE, it remains unclear whether the equipment used by participants of our study met protection requirements. There were concerns that masks worn were not tight-fitting, raising significant concerns whether they could suitably protect against COVID-19 infection[30].

Limitations

This study was not without limitations. Firstly, participants from Qinghai province may not have been representative of the general health care worker situation throughout China. Secondly, the self-reported questionnaire did not provide objective measures. Thirdly, questionnaire items were developed based on prior literature and expert opinions which may not have represented the actual concerns of medical staff. Finally, this study evaluated a small sample. In cross-sectional studies, evaluation of a large sample size can more accurately estimate causal relationships among variables. Similar studies with a larger sample size are thus warranted. From its design to completion of all investigation, this study adhered to the principle of randomization. Research subjects were thus selected strictly in accordance with the designed sampling plan; reasons for non-response were analyzed in a timely manner. Study protocols were standardized and investigators thoroughly trained in relevant experimental methods.

CONCLUSION

This study investigated the work experiences of frontline medical staff treating COVID-19 patients in China. Findings underscore the future necessity for hospital managers of all levels to fully address concerns and needs of health care workers by ensuring an adequate number of team members and supply of PPE. Improvements in communication strategies will ensure the provision of high-quality nursing care in future disease outbreaks. Strengthening medical personnel training regarding occupational protection and establishing a supportive and safe work environment is also critical. Public health emergencies such as the ongoing COVID-19 pandemic can be better managed by ensuring an adequate supply of emergency equipment, improving the emergency preparedness of medical personnel and providing frontline workers with appropriate psychological support.

ARTICLE HIGHLIGHTS

Research background

In December 2019, the new crown virus occurred as an emergency in Wuhan, China, and brought catastrophic difficulties to the people of Wuhan. Medical staff from all parts of the country gathered in Wuhan to fight the virus.

Research motivation

Cross-sectional survey of the working environment, professional sense of value, and psychological state of front-line medical staff during the outbreak of the new crown virus to provide effective prevention experience for emergency incidents.

Research objectives

To provide effective prevention experience for emergency incidents. Investigate the working environment and mental state of front-line staff.

Research methods

Select medical staff in Qinghai and Wuhan as the research objects, use the scale to investigate and analyze.

Research results

During the outbreak of the epidemic, front-line medical staff had a poor working environment, lack of supplies, and their sense of professional value varies from place to place.

Research conclusions

In an emergency situation, medical staff have a low sense of professional value, and work material support and psychological counseling are particularly important.

Research perspectives

Provide effective treatment outcomes for large-scale catastrophic emergencies.

FOOTNOTES

Author contributions: Zhao SX formulated research directions, guided the writing of the paper, reviewed and revised the first draft, and provided funding for the project; Li XF and Zhou XL wrote the first draft; Li XF reviewed and revised the first draft; Zhou XL and Li YM contributed to the data collection; Zhou XL and Pan SQ analyzed the data; Zhou XL submitted and revised the manuscript.

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Institutional review board statement: After review by the ethics committee of the hospital, this project complies with the Ministry of Health's "Measures for the Ethical Review of Biomedical Research Involving People (Trial)" and the relevant provisions of the Declaration of Helsinki on biological human trials, and it is agreed to conduct research.

Informed consent statement: Written informed consent was obtained from all participants who were also informed that study participation was voluntary and that their refusal to participate would have no negative consequences.

Conflict-of-interest statement: There is no conflict of interest.

Data sharing statement: The findings of this study is openly available for other studies but not commercial activities.

STROBE statement: The authors have read the STROBE Statement-checklist of items, and the manuscript was prepared and revised according to the STROBE Statement-checklist of items.

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