

Nurses' core emergency competencies for COVID-19 in China: A cross-sectional study

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Abstract

Aim: To investigate nurses' core emergency competencies for handling the coronavirus disease-19 (COVID-19) and analyse the factors associated with those competencies.

Background: COVID-19 has become a major global public health event. Nursing staff have played an important role in COVID-19 prevention and control. Understanding their emergency competencies for handling COVID-19, and the potential disadvantages will help governments to develop targeted training policies and improve nurses' capacities in relation to pandemics and emergency preparedness.

Introduction: COVID-19 is a disastrous infectious disease, but the competencies of nurses in China to handle COVID-19 have not been well documented.

Methods: We conducted a cross-sectional survey on nurses from 22 provinces of China in February 2020. The scores of self-report questionnaires were used to analyse their competencies for core emergency care, and linear regression analysis was used to explore influential factors.

Results: A total of 2570 nurses participated. The study revealed that nurses had a good grasp of COVID-19 knowledge, but the majority of nurses lacked experience in isolation ward work and emergency training. We found that age, professional title, work department, major work content, total work time, disaster rescue history, emergency training and infectious disease training were associated with core emergency competencies.

Conclusions: Chinese nurses were qualified for handling COVID-19 but still need to strengthen the accumulation of practical experience.

Implications for nursing: Nurses should actively participate in emergencies to strengthen their operational capacity, whether in training or actual practice.

Implications for nursing/health policy: Managers should improve relevant policies to ensure that nurses have more opportunities to participate in the practical training of health emergencies and explore effective training methods to improve the ability of nurses to respond to these.

KEYWORDS

China, COVID-19, emergency competencies, health emergency, health policy, nurses

INTRODUCTION

In recent decades, with the unprecedented and rapid development of urbanisation and a national economy, China has suffered from frequent health emergency infectious crises such as Severe acute respiratory syndrome (SARS), H1N1 avian influenza (H1N1), H5N1 avian influenza (H5N1) and H7N9 avian influenza (H7N9) influenza viruses, Ebola virus, coronavirus disease-19 (COVID-19) and so forth. A study reported

that the annual incidence of infectious disease was 417.98 per 100 000 people from 2004 to 2013 and increased by 5.9% every year (Yang et al., 2017). The number of imported infectious diseases has increased from two to 11 from 2003 to 2016 in mainland China (Wang et al., 2018). These infectious diseases have caused the greatest economic burden and serious threats to people's health and life. It was estimated that the health care costs of SARS were approximately 17 150 RMB (or approximately US\$ 1886) per patient in Beijing (Xiao et al., 2004).

Additionally, during the SARS epidemic period, China's economic loss was estimated at 25.3 billion dollars, and 916 patients died (Wei et al., 2016; Yang et al., 2020). More than 205 countries have suffered from COVID-19 disease. According to the report from World Health Organization (WHO) and Johns Hopkins University, as of 18 November 2020, the number of confirmed cases exceeded 55 million, and the cumulative death toll reached 1 336 670 (Johns Hopkins University, 2020; World Health Organization, 2020a). When a new, emerging infectious disease occurs, medical staff, especially nurses, have often been the first to respond to patients (Liao et al., 2019). Nurses constitute the largest number of healthcare providers and play an essential role in all phases of disaster management (Veenema et al., 2019). Core emergency competencies represent nurses' ability to provide a comprehensive and rapid response to unexpected diseases with their knowledge, skills and experiences. They will significantly affect the prevention and control of emergent infectious diseases. The International Council of Nurses defined the core competencies of a nurse as discretionary judgement, personal and family safety, and clinical competency appropriate to the situation (Canadian Nurses Association [CNA], 2008). The scope of a review reported the main domains of the core capabilities of disaster nurses and found that the most common domains correlated with communication, programming, decontamination and safety, incident command systems and moral rules (Al Thobaity et al., 2017). Researchers believe that lack of disaster experience and training was the main obstacle to an effective response to infectious disease emergencies, and we should take some measures to improve this situation (Kim, 2015; Said & Chiang, 2020).

BACKGROUND

The demand for nurses has become more prominent after the outbreak of COVID-19, and it is becoming more and more important to increase investment in nurse training (Rosa & Davidson, 2020). As indicated by the State of the World's Nursing report released in April 2020, providing nurses with more opportunities for education and strengthening professional capabilities can promote the improvement of population health (WHO 2020). Therefore, emergency managers should pay attention to emergency preparedness, mitigation and response, and restoring the situation to the previous state (Al Thobaity et al., 2016).

However, the Chinese government has taken drastic action to reform the public health system after the SARS outbreak, especially in infectious disease management (Wang et al., 2019). The Public Health Emergency Management System (PHEMS) has been improved for preparation, readiness, and response to emergency events (Sun et al., 2018). Nevertheless, compared with other countries, China still lacks stable development of disaster nursing research, and focuses less on disaster prevention, preparedness, and post-disaster recovery (Zhang et al., 2018). The competencies of nurses in China to handle COVID-19 was unknown. Therefore, it was essential

to know the core emergency competencies of nurses to handle COVID-19 and identify potential factors that influence those core competencies. We hope to provide some constructive suggestions related to emergency preparedness for our PHEMS.

Aim of this study

In this study, we conducted a cross-sectional survey and aimed to investigate the status of nurses' emergency competencies to handle COVID-19 and analyse the factors that influence these.

METHODS

Study design

Our study was a cross-sectional design, which was in accordance with the Strengthening the Reporting of Observational Studies in epidemiology recommendations.

Instrument

The self-report questionnaire in this study originated from the study by Kan et al. (2018). This questionnaire was validated, and the results showed that the experts' authority coefficients were 0.88, Kendall's coefficients of concordance were 0.274, and the coefficients in the variation of each item were 0%–22.5% (Kan et al., 2018). Another related survey showed the content validity index at the scale level (S-CVI) was 0.870, and the Cronbach's α coefficient was 0.957 (Liu et al., 2019).

This questionnaire consisted of two parts, basic characteristic of participants and knowledge about COVID-19, with a total of 52 questions and 185 scores. The knowledge of COVID-19 was divided into three parts: prevention, emergency readiness and emergency rescue capabilities.

Prevention capabilities

In this part, only three items about basic knowledge of COVID-19 were considered, with 15 scores. A 5-point Likert scale was used to evaluate the familiarity of the content. The scores ranged from 1 to 5 for completely unfamiliar to very familiar.

Emergency readiness capabilities

This part included four secondary items (emergency plan, laws and regulations, emergency rehearsals, training) with a total of six questions and 30 scores. Notably, the results for emergency rehearsals and training were only divided to 'Yes' or 'No' and scored a 5 or 0, respectively.



Emergency rescue capability

This part had the highest score, 140 points. There were six secondary items (surveillance, reporting, clinical disposal, public health disposal, risk communication, emergent infectious disease disposal) with 28 questions.

Participants

We surveyed nurses from 22 provinces in China who were selected with simple sampling. The included provinces were Sichuan, Anhui, Chongqing, Hunan, Yunnan, Gansu, Inner Mongolia, Shanghai, Guizhou, Beijing, Shandong, Guangdong, Guangxi, Hubei, Hunan, Henan, Hebei, Liaoning, Jiangxi, Jilin, Jiangsu, and Heilongjiang.

The inclusion criteria were having obtained a nurse qualification certificate and being registered and voluntarily participating in this research. The exclusion criterion was not completing all questionnaire information. The survey was conducted over the course of 1 week from 6 to 13 February 2020.

Sample size

The estimated sample size in this study was based on a method reported in the literature (Liu et al., 2019). The average score on the core emergency competencies was 116.13 points, and the standard deviation was 22.84 points. The tolerance and confidence levels were regarded as 1 and 0.95, respectively. With the addition of a 20% non-response rate, the final sample size required was 2505. We included 2574 participants in this study. PASS 11.0 software was used to calculate the sample size.

Data collection

Data collection in our study was anonymous, and the specific collected items were based on the self-report questionnaire. We sent an invitation to these participants with an anonymous electronic survey link by WeChat address to consult the wishes. Nurses who volunteered and were in compliance with the inclusion criteria in this survey were further invited to complete the questionnaire. A total of 2574 questionnaires were returned, so response rate was 100%. All questionnaires were completed electronically.

Ethical considerations

This study was approved by the ethics committee of the West China Hospital, Sichuan University, number 2019(881). The participants were provided with informed consent forms

before completing the survey. They joined this study voluntarily and anonymously, and there were no negative consequences for non-participation. In order to protect the privacy of participants, we had carefully considered the questionnaire design, collection and data analysis stages of the study. First, we only collected essential basic information anonymously, and no identified personal privacy data was recorded in this survey. Second, all questionnaires were collected by a professional worker through a unique WeChat address. Third, all researchers were informed and agreed to abide by the confidentiality of the study, and these data would be only used for research analysis.

Data analysis

Continuous variables were described as mean and standard deviation ($M \pm SD$), and categorical data were described as numbers and proportions. The completion rate was equal to the average score divided by the total scores for each item. Linear regression was used to analyse the factors associated with the core emergency competencies, and the enter method was used in multiple regression analysis. In multiple regression analysis, all polytomous variables were converted into dichotomous variables. All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant. All data analysis was conducted with SPSS 22.0 (SPSS Inc.) for Windows.

RESULTS

A total of 2574 nurses participated in this investigation, and four nurses were excluded for incomplete questionnaire information. Of these participants, 2479 (96.5%) were female, and the mean age was 32.01 ± 7.40 years. Most nurses were from tertiary hospitals (2451, 95.4%), and the average working time was 10.64 ± 8.30 years. For geographic distribution, the majority of nurses were from the southwest region of China (94.9%). Other characteristics are shown in Appendix Table S1 (available online).

The nursing staff's ability to handle COVID-19

To understand the nurses' response to an unexpected infectious disease, we analysed the nurses' scores on emergency preparation, basic knowledge, medical care capacity, prevention and self-protection when handling COVID-19 (see Table 1). We found that emergency preparation had the lowest completion rate, at 45.0%. Especially in initial isolation ward work and emergency rehearsal, the completion rates were 1.2% and 39.4%, respectively. As expected, the mastery of basic knowledge about COVID-19 had the highest completion rate at 85.9%. Followed by the COVID-19 prevention and self-protection, and medical care ability, the completion rates were 84.2% and 77.9%, respectively.

TABLE 1 Investigation results of nursing staff's ability to control coronavirus disease-19 (COVID-19) during the epidemic

Variables	Degree of familiarity on COVID-19*					Total score	Scoring rate** (%)
	0	1	2	3	4		
Emergency preparation on COVID-19, <i>n</i> (%)	0	1				0–15	45.0
Initial isolation ward work	2409 (93.7)	161 (6.3)	—	—	—	0.06 ± 0.24	1.2
Emergency rehearse	1556 (60.5)	1014 (39.5)	—	—	—	1.97 ± 2.44	39.4
Emergency training	143 (5.6)	2427 (94.4)	—	—	—	4.72 ± 1.15	94.4
Basic knowledge on COVID-19, <i>n</i> (%)	1	2	3	4	5	3–15	85.9
Postinfectious state	6 (0.2)	92 (3.6)	468 (18.2)	1105 (43.0)	899 (35.0)	4.09 ± 0.83	81.8
Transmission route	1 (0.0)	34 (1.3)	268 (10.4)	673 (26.2)	1594 (62.0)	4.49 ± 0.74	89.8
Prevention principle	2 (0.1)	48 (1.9)	278 (10.8)	1061 (41.3)	1181 (46.0)	4.31 ± 0.74	86.2
Medical care capacity on COVID-19, <i>n</i> (%)	1	2	3	4	5	6–35	77.9
Clinical features	1 (0.0)	57 (2.2)	360 (14.0)	1055 (41.1)	1097 (42.7)	4.24 ± 0.77	84.8
Course of disease	5 (0.2)	100 (3.9)	468 (18.2)	1027 (40.0)	970 (37.7)	4.11 ± 0.85	82.2
Diagnostic criteria	568 (22.1)	—	—	—	2002 (77.9)	3.89 ± 2.01	77.8
Treatment principle	14 (0.5)	192 (7.5)	602 (23.4)	998 (38.8)	764 (29.7)	3.90 ± 0.93	78.0
Specimen collection	14 (0.5)	192 (7.5)	602 (23.4)	998 (38.8)	764 (29.7)	3.61 ± 1.16	72.2
Specimen preservation and transport	155 (6.0)	409 (15.9)	589 (22.9)	781 (30.4)	636 (24.7)	3.52 ± 1.19	70.4
Psychological adaptation	8 (0.3)	129 (5.0)	545 (21.2)	1020 (39.7)	868 (33.8)	4.02 ± 0.88	80.4
Prevention and self-protective ability	1	2	3	4	5	9–45	84.2
Security protection requirements	3 (0.1)	89 (3.5)	394 (15.3)	940 (36.6)	1144 (44.5)	4.22 ± 0.84	84.4
Protective equipment usage	11 (0.4)	187 (7.3)	469 (18.2)	837 (32.6)	1066 (41.5)	4.07 ± 0.96	81.4
Medical exposure dispose	33 (1.3)	281 (10.9)	523 (20.4)	821 (31.9)	912 (35.5)	3.89 ± 1.05	77.8
Eligible hand hygiene	0 (0.0)	11 (0.4)	136 (5.3)	295 (11.5)	2128 (82.8)	4.77 ± 0.56	95.4
Medical waste disposal	0	22 (0.9)	169 (6.6)	390 (15.2)	1989 (77.4)	4.69 ± 0.63	93.8
Corpse disposal	107 (0.7)	311 (12.1)	544 (21.2)	725 (28.2)	883 (34.4)	3.76 ± 1.17	75.2
Isolation principle in ward	3 (0.1)	72 (2.8)	357 (13.9)	744 (28.9)	1394 (54.2)	4.34 ± 0.83	86.8
Environmental disinfection	18 (0.7)	170 (6.6)	463 (18.0)	812 (31.6)	1107 (43.1)	4.10 ± 0.96	82.0
Close contacts management	18 (0.7)	182 (7.1)	480 (18.7)	862 (33.5)	1028 (40.0)	4.05 ± 0.97	81.0

Note:

*The degree of familiarity on COVID-19 was divided into five grades from completely unfamiliar to very familiar, with a score of 1 to 5 for each grade, respectively. Apart from the items of emergency preparation on COVID-19 and diagnostic criteria in medical care capacity, there are only divided to two grades, and the score was 0 or 5 for two grades.

**Scoring rate was calculated as average score divided by the total scores.

Nurses' core emergency abilities for handling COVID-19

Collectively, the average score for core emergency abilities was 146.70 ± 27.29 , and the completion rate was 79.3%. The average scores for prevention, emergency rescue, and emergency readiness capabilities were ordinal 12.78 ± 2.11 , 21.93 ± 5.59 , and 111.99 ± 21.56 . The completion rate from high to low was prevention, emergency rescue, and emergency readiness capabilities at 85.2%, 80.0% and 73.1%, respectively. Notably, emergency rehearsal, among the emergency readiness capabilities, had the lowest completion rate, at 39.4% (1.97/5.00), but training had the highest percentage (94.4%). Except for emergency rehearsal, all items had a higher completion rate of over 70% (see Table 2).

Factors associated with nurses' core emergency competencies

We conducted a linear regression analysis to explore the possible variables associated with nurses' core emergency competencies as shown in Table 3. In the univariate analysis, the results revealed that age ($\beta = 0.20$, $p = 0.004$), total work time ($\beta = 0.25$, $p < 0.001$), and experience with isolation wards ($\beta = 10.92$, $p < 0.001$), infectious disease rescue ($\beta = 11.49$, $p < 0.001$), disaster rescue ($\beta = 12.00$, $p < 0.001$), emergency rehearsal ($\beta = 22.86$, $p < 0.001$) and infectious disease training ($\beta = 24.33$, $p < 0.001$) improved the scores. However, the hospital level ($\beta = -4.18$, $p < 0.001$) was associated with lower core emergency competency scores.

TABLE 2 The score results of core emergency ability of nurses on COVID-19 in China

Variables	Item/total score	Average score (M ± SD)	Scoring rate (%)
Prevention capability	3/15	12.78 ± 2.11	85.2
Emergency readiness capability	6/30	21.93 ± 5.59	73.1
Emergency plan	2/10	7.93 ± 1.90	79.3
Laws and regulations	2/10	7.31 ± 2.09	73.1
Emergency rehearse	1/5	1.97 ± 2.44	39.4
Training	1/5	4.72 ± 1.15	94.4
Emergency rescue capability	28/140	111.99 ± 21.56	80.0
Surveillance	3/15	12.25 ± 3.00	81.7
Report	4/20	14.78 ± 3.91	98.5
Clinical disposal	6/30	23.1 ± 5.19	77.0
Public health disposal	12/60	50.43 ± 8.62	84.1
Risk communication	1/5	4.22 ± 0.87	84.4
Emergent infectious disease disposal	2/10	7.20 ± 2.15	72.0
Summary	37/185	146.70 ± 27.29	79.3

TABLE 3 Factors influencing nursing core emergency ability as shown by linear regression analysis

Variable	Beta	Univariable analysis		Beta	Multivariable analysis	
		β (95%CI)	<i>p</i>		β (95%CI)	<i>p</i>
Male	0.04	5.55 (−0.25, 11.17)	0.061	0.02	3.50 (−1.64, 8.64)	0.182
Age, year	0.06	0.20 (0.07, 0.35)	0.004	−0.13	−0.46 (−1.64, 8.64)	0.038
Hospital level ^{††}	−0.07	−4.18 (−6.36, −1.99)	<0.001	−0.22	−1.22 (−3.20, 0.76)	0.226
Major work content ^{††}	0.03	2.25 (−1.28, 5.78)	0.212	0.05	4.62 (1.36, 7.88)	0.006
Professional title ^{††}	0.03	1.87 (−0.44, 4.17)	0.113	−0.72	−4.32 (−7.15, −1.48)	0.003
Education level ^{††}	0.02	1.48 (−0.88, 3.83)	0.220	0.03	1.87 (−0.27, 4.02)	0.087
Work department ^{††}	−0.01	−0.25 (−3.91, 3.41)	0.893	−0.05	−4.23 (−7.54, −0.93)	0.012
Total work experience, year	0.08	0.25 (0.12, 0.38)	<0.001	0.18	0.58 (0.20, 0.97)	0.003
Isolation ward work experience	0.10	10.92 (6.58, 15.26)	<0.001	0.03	3.48 (−0.73, 7.69)	0.105
Infectious disease rescue experience	0.14	11.49 (8.40, 14.59)	<0.001	0.02	1.32 (−1.84, 4.47)	0.413
Disaster rescue experience	0.15	12.00 (9.00, 14.99)	<0.001	0.09	6.63 (3.69, 9.56)	<0.001
Emergency rehearse experience	0.41	22.86 (20.90, 24.81)	<0.001	0.32	17.76 (15.68, 19.85)	<0.001
Infectious disease training	0.33	24.33 (21.67, 27.02)	<0.001	0.21	15.21 (12.51, 17.91)	<0.001

Note:

^{††}All the polytomous variables were transformed into dichotomous variables, and the compared categorical variable were listed as follows: hospital level: level 3 versus non-level 3, major work content: clinical services versus non-clinical service, professional title: supervisor nurse or above versus nurse and practitioner, education level: secondary graduates and college degree versus bachelor's degree or above, work department: emergency and ICU department versus others.

After multiple linear regression analysis, major work content ($\beta = 4.628$, $p = 0.006$), total working years ($\beta = 0.58$, $p = 0.003$), and experiences in disaster rescue ($\beta = 6.63$, $p < 0.001$), emergency rehearsal ($\beta = 17.76$, $p < 0.001$) and infectious disease training ($\beta = 15.21$, $p < 0.001$) were found to be positively correlated with core emergency competency scores. Age ($\beta = -0.46$, $p = 0.038$), professional title ($\beta = -4.32$, $p = 0.003$) and work department ($\beta = -4.23$, $p = 0.012$) were negatively associated with the scores. The variance explained by these factors

was 47.7%, which was statistically significant ($F = 57.93$, $p < 0.001$).

DISCUSSION

Main findings

Our study indicated that nurses had good clinical management, prevention and self-protection capabilities for handling

COVID-19 in general. Additionally, the results reflected that nurses had an instant response to prevention, preparation and rescue in emergencies, but most nurses lacked on-site emergency rehearsal and rescue experience, which has a strong negative impact on nurses' response ability to COVID-19. Apart from this, factors associated with regular experience and service time such as age, professional title, work content, department and total working years, were all related to the competencies for managing emergencies.

Nurses' abilities to manage COVID-19

We found that the included nurses had good learning and mastery skills in dealing with the prevention and treatment of the COVID-19 for their professional and long-term work experience. Many studies also have proved the important role of these experiences in improving emergency response (Uhm et al., 2019). In addition, the government's attitude and administrative measures also affected nurses' response-ability as important factors. After the COVID-19 outbreak, the Chinese government have taken a rapid response and promptly adopted strong administrative measures to prevent the spread of the disease. In a positive environment, the subjective initiative of nurses was mobilised to actively respond to this disease.

However, it was pessimistic that the completion rate of emergency preparedness ability was very low, especially for emergency rehearsal and isolation wards work. The results showed that most of the knowledge about the disease was obtained from theoretical studies and less from targeted clinical practice and emergency rehearsal. At the beginning of the epidemic, only 6.3% of nurses in our study worked in isolation wards. Some studies have also shown that medical staff like family doctors did not participate in any education activities to deal with disasters, and most nurses were not fully prepared to deal with disasters effectively (Labrague et al., 2018). As is now well known, the theory of knowledge and training experience of nurses has been the key to controlling the pandemic, and their clinical practice has become the basis of clinical practice care for patients affected by COVID 19 (Catton, 2020). Therefore, it was necessary to strengthen regular learning and long-term training of all front-line nursing staff for an emergency (Horrocks et al., 2019).

Core emergency competencies of nursing staff towards COVID-19

Our results showed that the emergency response abilities of nurses for prevention, preparation and rescue were above average. During the SARS epidemic in 2003, few researchers investigated nurses' emergency response abilities, but we cannot compare changes between the two emergencies. However, compared with the results of the previous survey on the responses of medical workers to public health emergencies, the ability to respond to emergencies has been significantly improved (36.2% to 80.0%) (Zhou et al., 2012). Since the

SARS crisis in 2003 and H7N9 in 2013, the response mechanism to sudden infectious diseases in China have been greatly improved (Wei et al., 2016). For example, the administrators recognised the importance of long-term public health surveillance, and they have adopted a series of measures to strengthen the response to public health emergencies (Wang et al., 2019). These changes also showed the importance of the governments in taking active measures and improving the medical system.

Factors associated with core emergency competencies

Our results indicated that previous experiences in emergency rehearsal, disaster rescue and infectious disease were the most important factors that influenced response abilities. These results were consistent with most literature reported (Labrague et al., 2018; Uhm et al., 2019). Additionally, as reported by Luo et al. (2013) and Taskiran and Baykal (2019), we found the nurses who were mainly engaged in clinical work were more competent in emergency response. These findings were easy to understand in that the accumulation of experience in dealing with similar crises and long working experience would help us to respond to emergent events. Surprisingly, in our study, people with higher professional titles and working in emergency and intensive care departments were negatively correlated with the ability to deal with COVID-19, but the correlation is not strong. This finding was inconsistent with our common sense. We believed that nurses with higher professional titles were more likely to engage in scientific research management, and long-term absence from clinical work may reduce their ability to respond to emergencies. In short, from the analysis of influencing factors, we recognised the importance of practical experience for nurses' emergency response ability, which has also been emphasised in studies in many other countries (Liu et al., 2020; Okeahalam et al., 2020).

In addition to the factors reported in our article, being male, disaster risk perception, attitude, self-efficacy for disasters (Uhm et al., 2019) and education level were associated with the ability to respond to emergencies.

Implications for nursing and health policy

The WHO emphasises that in face of global public health challenges, it is important to reinforce comprehensive management of emergencies, containing the outbreak prevention, risk management, and researches on coping strategies and relevant policies formulation (Campbell-Lendrum et al., 2015). Public health agencies should endeavour to improve the core competencies of nurses because they can provide more opportunity for disease disposal. Unfortunately, as our study showed, the majority of nurses were inexperienced in combating of emergency events in South India and America (Ambat & Vyas, 2020; Fusco et al., 2020). The same concern was also observed



in many other countries, such as northern Ethiopia, Southern Italy and so forth, in which the emergency response capabilities of nurses were both not satisfactory (Ulrich et al., 2020). Great gaps still existed in the implementation of various programmes and procedures in Indian hospitals in terms of employee training, risk communication, surge ability, research ability and infectious disease control (Ambat & Vyas, 2020). From this perspective, improving the management system to strengthen the practical ability of nurses in emergencies is the common goal of the government, and it is also the direction of the government's joint efforts. Besides, these efforts may help achieve many health-related Sustainable Development Goals, including coverage of national health, mental state, non-communicable diseases, emergency preparedness and response, patient safety and the provision of comprehensive services for patients (World Health Organization, 2020b).

Moreover, our investigation suggested that strengthening daily emergency training and drills can improve nurses' core emergency response capabilities. The relevant study also showed that nursing practice was fundamental to the survival of patients with severe illness (Catton, 2020). Therefore, the emergency medical system should formulate a series of daily trainings, drill systems and procedures to enhance abilities. The training content needs to include disaster rescue, infectious disease prevention and other emergency response methods. In addition, developing clearer relevant guidelines can improve emergency response capabilities (Shipp et al., 2016). Relevant organisations and institutions need to seek innovative and more effective training methods to establish a platform to promote nursing quality, increase public awareness and share experiences about the pandemic so that nurses are fully prepared for any accidents (Huang et al., 2020; Ulrich et al., 2020).

Implications for nursing

Nurses provide vital care in disease control and prevention (Gridley-Smith, 2017). The comprehensive ability and quantity of nurses affected by infectious diseases (Kaba et al., 2017; Musau et al., 2015), in addition to formulating a nurse-patient ratio that suits the patients care situation, also plays an important role to improve nurses' emergency response capabilities, that is, precise nursing measures for infectious diseases. The outbreak of the COVID-19 pandemic has had a great impact on the global economy, politics, education and so on, and the care of nurses became more complicated and unmanageable under the epidemic pressure (Musau et al., 2015). In such a situation, the nurses' care and emergency capacity have been put forward to higher requirements. Potentially, the prevention and control of COVID-19 would be routine work as a part of our daily medical activities, to ensure that patients can receive normal treatment as before. Thus, it is imperative to improve core abilities to deal with infectious diseases, especially in COVID-19. To better prevent the outbreak of infectious diseases, it is necessary to encourage nurses to actively participate in emergency drills and clinical practice. But nurses in

many countries are facing more severe challenges on COVID-19. They do not have adequate personal protective equipment, coupled with long working hours and intensity so that their risk of infection is significantly increased (Turale et al., 2020). This situation should be noticed and changed as soon as possible because nursing staff need basic protection.

Limitations

Our study also has some limitations. First, a small number of people were included in other areas, and the study mainly represented the core emergency competencies of nurses in southwest China. In China, there was extremely low participation among men in the profession, and we had few male nurses to analyse. Second, because of the low proportion of responders involved in treating COVID-19 in our survey, we could not explore the differences between the two types of nurses in core emergency competencies. Third, to carry out our survey effectively and improve the response rate, we developed this study with simple sampling instead of stratified sampling. The results may be biased by sample selection. Fourth, the abilities of nurses responding to COVID-19 varied with the development of the disease, and our results represented only the initial response to the disease. Therefore, more related studies on core emergency competencies for COVID-19 are needed in the future.

CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

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AUTHOR CONTRIBUTIONS

Hongdan Li and Shuju Dong contributed equally to the manuscript as first authors. *Study design:* H. Li, L. Feng, S. Dong, H. Tang. *Data collection:* H. Li, R. Wang, S. Long, F. He. *Data analysis:* S. Dong, H. Li. *Study supervision:* H. Tang, L. Feng, L. He. *Manuscript writing:* H. Li, S. Dong. *Critical revisions for important intellectual content:* H. Tang, L. Feng, S. Dong, L. He.

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SUPPORTING INFORMATION

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