# Investigation on Critical Care Nurses' Emergency Competency of Public Health Emergencies during the COVID-19

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## Abstract

**Objective:** To understand the current situation of emergency response of public health emergency during the COVID-19, and to provide a theoretical basis for improving the emergency capabilities of critical care nurses in public health emergencies.

**Methods:** 171 critical care nurses on the front lines in Hubei were surveyed in terms of their public health emergency competency.

**Results:** Critical care nurses have a good knowledge of the standard prevention and have a strong ability to adapt to new environment. They have various physiological and psychological changes in the rescue and are most worried about their own infections. The practical skills of most critical care nurses are improved to varying degrees after rescue.

**Conclusion:** The emergency response ability of critical care nurses to public health emergencies needs to be further improved. Targeted and different forms of emergency training should be strengthened. Public health emergencies monitoring and early warning need to be trained and enhanced. When responding to this type of incidents, the way of taking over the whole system is more respected. At the same time, mental health education and stress coping should be emphasized, so as to improve their ability to deal with public health emergencies.

## Introduction

### *Trans-fats in Indian scenario*

In December 2019, a new type of coronavirus-induced pneumonia broke out in Wuhan, Hubei Province. More than 30 provinces and cities in China as well as Italy, France, the United States and other foreign countries began to detect and spread the disease [1]. At present, the epidemic situation in China continues to improve, but the global situation of fighting the epidemic is grim [2]. COVID-19 has the characteristics of strong infectivity and high mortality, in response to the epidemic, medical teams from all over the country were quickly dispatched to rescue Hubei. Experts said that among the medical teams dispatched by the state, a total of more than 5,500 critical care nurses were dispatched, accounting for about 21 percent of the total number of stationed nurses, three quarters of the total number of critical care medical personnel at a press conference of the Joint Defense and Joint Control

Mechanism of the State Council on February 29. As the main place of treating critical patients, the intensive care unit concentrates on the patients with severe and critically ill with COVID-19. The emergency response ability of the intensive care medical staff is closely related to the success rate and fatality rate of the patients with COVID-19 and the intensive care nurses play a huge role in the treatment of this epidemic [5]. The emergency response ability of nurses means that the nursing staff can observe the patient's condition changes in clinical nursing work, analyze and judge this, use skilled skills, and cooperate with rescue and nursing calmly and decisively [6], which reflects nursing one of the important indicators of connotative quality[7]. Therefore, it is necessary to have a deep understanding of the working experience and emergency response ability of critical care nurses on the front line of the epidemic, to provide scientific theoretical basis and policy direction for the construction of an evaluation and training system of critical care nurses' emergency response to public health emergencies, and to promote the further

development of critical care nursing.

## Objects and Methods

### Respondents

Objective to select 171 critical care nurses who met the inclusion criteria for an electronic questionnaire survey among nurses to aid Hubei during the epidemic of COVID-19. Inclusion criteria: in the original unit affiliated to intensive care nurses; anti-epidemic time in Hubei province ≥2 Weeks; voluntary participation in the survey; clear thinking and normal spirit.

### Method

**(1) Survey Tools:** Based on a large number of literature review and expert consultation, the contents were screened and corrected, and combined with the background of the epidemic situation of COVID-19, self-designed questionnaire on critical public health emergency response ability of critical care nurses to aid Hubei. There are 50 entries in the questionnaire, which mainly covers the general information of the supporters, the cognition of nursing staff and themselves in public health emergencies, work experience and stress burden, change in psychological state, the situation of emergency capabilities at different stages, the obstacles to the smooth progress of the support work, their own deficiencies in support work, the main gains from support work and other issues.

**(2) Survey Methodology:** The investigators were trained and sent to the team leaders of the Guangxi Zhuang Autonomous Region's Hubei anti-epidemic medical team by www.wjx.cn(an online crowdsourcing platform in mainland China, which provides functions equivalent to Amazon Mechanical Turk), then the team leader sent to the specific medical team work WeChat group, and inform the critical care personnel to fill out the questionnaire and requirements. After the questionnaires were withdrawn, the members of the task group downloaded all the original questionnaires from the background and checked them one by one, and rejected the answer sheets with a single option or obvious filling errors. In our study, a total of 171 questionnaires were recovered. All questionnaires are valid and the effective recovery rate is 100%.

### Statistical Methods

After the questionnaires were collected, all the answers were classified, summarized and sorted, and analyzed by Excel and SPSS23.0 software. The count data is expressed by frequency, percentage (%) and the measurement data is described by mean with standard deviation ($\bar{x}\pm s$).

### Results

(**Table 1**) shows that general information on critical care nurses assisting Hubei. The 171 critical care nurses age between 20 and 60, with an average age of 32.50±6.83. The ratio of males to females is about 1:4.

*Table 1: General information on critical care nurses assisting Hubei (n=171)*

| Project | Classification | Quantity (people) | Percentage(%) |
|---|---|---|---|
| Sex | Male | 34 | 19.88 |
| | Female | 137 | 80.12 |
| Age(year old) | 20-30 | 66 | 38.6 |
| | 31-40 | 89 | 52.05 |
| | 41-50 | 14 | 8.19 |
| | 51-60 | 2 | 1.17 |
| Title | Primary | 82 | 47.95 |
| | Intermediate | 72 | 42.11 |
| | High | 17 | 9.94 |
| Highest level of education | Junior college and below | 24 | 14.04 |
| | Undergraduate | 142 | 83.04 |
| | Master degree and above | 5 | 2.92 |
| Hospital grade | Upper first-class | 133 | 77.78 |
| | Middle first-class | 22 | 12.87 |
| | Upper second-class | 14 | 8.19 |
| | Middle second-class | 2 | 1.17 |
| Position | No | 88 | 51.46 |
| | Nursing team leader | 39 | 22.81 |
| | Head nurse | 30 | 17.54 |
| | Department head nurse | 4 | 2.34 |
| | Chief/Co-chief of nursing department | 3 | 1.75 |
| | Other | 7 | 4.09 |
| Years of nursing service(year old) | ‹3 | 6 | 3.51 |
| | 3-5 | 22 | 12.87 |
| | 6-10 | 73 | 42.69 |
| | 11-20 | 56 | 32.75 |
| | >20 | 14 | 8.19 |

| | | | |
|---|---|---|---|
| Years of professional work(year old) | <3 | 12 | 7.02 |
| | 3-5 | 31 | 18.13 |
| | 6-10 | 71 | 41.52 |
| | 11-20 | 47 | 27.49 |
| | >20 | 10 | 5.85 |
| Workplace in Hubei | Shelter Hospital | 19 | 11.11 |
| | General wards of designated medical institutions | 56 | 32.75 |
| | Intensive care units of designated medical institutions | 77 | 45.03 |
| | Close observation of medical points at designated points | 3 | 1.75 |
| | Other | 16 | 9.36 |
| Work in Hubei | Treatment of mild patients | 27 | 15.79 |
| | Treatment of severe and critical patients in general ward | 75 | 43.86 |
| | Treatment of severe and critical patients in intensive care unit | 55 | 32.16 |
| | Treatment of various types of patients | 13 | 7.6 |
| | Other | 1 | 0.58 |
| The degree of relevance between the work in Hubei and the original profession | Closely related to give full play to the professional advantages of intensive care | 91 | 53.22 |
| | Partly related, partly using the advantages of intensive care professional | 67 | 39.18 |
| | Highly irrelevant, unable to take advantage of the intensive care specialty | 13 | 7.6 |
| | | | |
| Have you participated in the treatment of public health emergencies in the practice before this aid | Yes | 62 | 36.26 |
| | No | 109 | 63.74 |
| Have you received emergency training for public health emergencies before this aid assignment | Yes | 135 | 78.95 |
| | No | 36 | 21.05 |

How to reduce the pollution and loss of protective equipment for critical care nurses to assist Hubei? Almost all critical care nurses predictably expected to take some measures to reduce the pollution of protective equipment before they had been dispatched, accounting for 96.49%. In actual front-line work, 92.98% of nurses didn't eat or drink after wearing protective equipment, 88.30% of nurses cut their hair, 75.44% used relief pants, and even 7 serious nurses took progesterone or other similar drugs. In view of short-term shortfalls and tensions in the supply of early protection, 80.12% of critical care nurses tried to avoid unnecessary pollution, and about half of the staff would seek outside help and self-made protective equipment.

The content of the training that needs to be strengthened for critical care nurses assisting Hubei according to the current situation of participating in the treatment and competence are listed in (**Table 2**). In the response to the degree of mastery of COVID-19, the proportion of nursing staff who can fully master is 26.9%. And most nurses were in the familiar stage, with a specific proportion of 67.25%. Almost all nurses could perform standard isolation and care for diagnosed and suspected patients, and the proportions of very good and good effects are 45.03% and 50.88%, respectively. In this aid to Hubei, 82.46% of the nurses believed that their knowledge and capabilities were capable of fighting the epidemic, more than 10% of the nursing staff believed that the existing knowledge and capabilities were more than adequate to deal with the epidemic, and 5.85% of nurses were competent.

*Table 2: The content of the training that needs to be strengthened for critical care nurses assisting Hubei (n=171)*

| The content of the training that needs to be strengthened | Quantity (people) | Percentage(%) |
|---|---|---|
| Basic information on emergency mechanism | 110 | 64.33 |
| Monitoring and early warning of public health emergency | 139 | 81.29 |
| On-site rescue and medical treatment | 103 | 60.23 |
| Public outreach and media communication | 102 | 59.65 |
| Sanitary epidemic prevention and disinfection isolation | 108 | 63.16 |
| Psychological stress and adjustment | 110 | 64.33 |
| Other | 1 | 0.58 |

The physical and psychological changes of critical care nurses assisting Hubei are shown in (**Table 3**). To cope with these changes, critical care nurses in Hubei Province adopted the following methods: role adaptation, emotional transfer,

active learning, cognitive reconstruction and seeking help, their respective percentages are 74.85% , 70.18% , 64.33% , 54.39% and 48.54%. 4.68% of the nurses used other methods. Among the stressors that caused the above-mentioned physiological and psychological changes of nursing staff, self-objective reasons and work reasons account for the largest proportion, both 47.95%, self-subjective reasons, family reasons, and other reasons percentages are 39.18%, 10.53%, and 9.94%, respectively. (**Table 4**) shows that the changes in the practical skills of critical care nurses after assisting Hubei.

*Table 3: The physical and psychological changes of critical care nurses assisting Hubei (n=171)*

| Project | Quantity (people) | Percentage (%) |
|---|---|---|
| **Physical change** | | |
| Poor sleep | 111 | 64.91 |
| Mental fatigue | 85 | 49.71 |
| No appetite | 66 | 38.6 |
| Have dizziness, palpitation, bloating, constipation or diarrhea and other symptoms | 53 | 30.99 |
| No | 37 | 21.64 |
| **Psychological change** | | |
| Somatization (such as irrational, neurotic physical discomfort and anxiety) | 44 | 25.73 |
| Obsessive-compulsive symptoms | 39 | 22.81 |
| Cognitive decline | 18 | 10.53 |
| Significant emotional changes (such as depression, anxiety, fear) | 31 | 18.13 |
| No | 99 | 57.89 |

*Table 4: The changes in the practical skills of critical care nurses after assisting Hubei(n=171)*

| Project | Significant improvement n(%) | Big improvement n(%) | Slight improvement n(%) | Keep it as it is n(%) |
|---|---|---|---|---|
| Personal protection skills | 122 (71.35) | 44 (25.73) | 4 (2.34) | 1 (0.58) |
| Communication and collaboration skills | 67 (39.18) | 86 (50.29) | 15 (8.77) | 3 (1.75) |
| Emergency response capability | 66 (38.60) | 83 (48.54) | 21 (12.28) | 1 (0.58) |
| Critical thinking and clinical decision-making ability | 60 (35.09) | 86 (50.29) | 22 (12.87) | 3 (1.75) |
| Psychological quality of dealing with public health emergency | 72 (42.11) | 84 (49.12) | 14 (8.19) | 1 (0.58) |
| Ability to treat critical patients in major public health events (such as airway management, organ function monitoring and support techniques, etc.) | 50 (29.24) | 65 (38.01) | 39 (22.81) | 17 (9.94) |
| Ability to use first-aid materials (such as wearing protective clothing, using first-aid drugs, etc.) | 93 (54.39) | 69 (40.35) | 7 (4.09) | 2 (1.17) |
| Ability of health education for patients on public health emergency (such as persuasion to isolate, life education, medication education, etc.) | 71 (41.52) | 78 (45.61) | 18 (10.53) | 4 (2.34) |
| Ability to identify the psychological or emotional needs of patients during public health emergencies | 62 (36.26) | 85 (49.71) | 19 (11.11) | 5 (2.92) |

The factors hindering the smooth progress of the support work and the insufficient aspects of critical care nurses in Hubei are detailed. After fighting the epidemic, critical care nurses improved their abilities in different aspects. 95.91% of critical care nurses improved their anti-stress ability, 84.21% improved their coordination ability, and 83.63% improved their emergency response ability. The percentage of nurses with improved communication skills, nursing skills and management skills are 78.95%, 71.35% and 59.06%, respectively. There are 8 nursing staff who had a serious impact on their future work and life in this aid experience, accounting for 4.68%, 74 with a large impact, accounting for 43.27%, the number of people with medium impact, less impact, and no impact are 29, 33, 27, accounting for 16.96%, 19.30%, 15.79% respectively.

Views on the treatment process of the COVID-19 aided by the critical care nurses in Hubei. 98 nurses believed that various treatment procedures for COVID-19 were reasonable, accounting for 57.31%. There are 72 people who thought they were basically reasonable, accounting for 42.11%, and only 1 person thought it unreasonable. There are 107 (62.57%) nurses who believed that some critical patients may have a better outcome if they had been rescued in their own department, and stayed in the ICU for a shorter time. There are 154 nurses who believe that when a huge public health event such as COVID-19 occurs, the takeover of the whole system, such as a team or department, and the overall takeover of medical care in one hospital, can improve the critical patient's treatment success rate more than the model of the joint formation of multiple hospitals. As for the doctor-nurse relationship between the epidemic situation, 86.96% of the nurses thought that they could cooperate well with other medical personnel, and the general and acceptable cooperation account for 12.87% and 1.17% respectively. The actual survey results of the degree of coordination of doctor-nurse relationship in the treatment of pneumonia showed that 54.39% of nurses cooperated very well, 36.26% cooperated well, and 9.36% believed that cooperation was general.

2.8 The core knowledge and core capabilities of nursing staff involved in public health emergency. Regarding the response that nurses should assume a role when a public health incident occurs, more than 90% of the critical care nurses in this survey believed that nursing staff should provide on-site first aid, psychological support, epidemic prevention and publicity, and health education when participating in public health emergencies; 87.72% of the investigators believed that nurses should also organize crowd escape, self-help, and mutual rescue on the spot, and 77.19% of them also believed that nurses should coordinate the work of medical settlements and hospitals.

## Discussion

Critical care nurses have a good knowledge of the standard prevention of public health emergencies and have a strong ability to adapt to new environment. The results of this study showed that the percentage of nurses who could master the standard protection of sudden major infectious diseases before aid was 42.11%, more than half of the critical care nurses had basic control, accounting for 50.88%, and 6.43% of the them had general control. Indicating ICU nurses have better self-protection knowledge reserves. As for the degree of adaptation to the new environment, including work intensity and job content, 54.97% of critical care nurses could fully adapt to the new environment. The proportion of critical care nurses who could generally adapt is 34.50%. 9.94% were acceptable, and only one nurse had not being able to adapt, it means that ICU nurses can well adapt to the new environment. 70.18% of critical care nurses had worked under extreme conditions before supporting Wuhan, such as not drinking water or going to the toilet for 6 hours, etc. The characteristics of intensive care unit and emergency department are similar. The patients' condition is complex and changeable, the workload of nursing is large, and the pressure burden is heavy. In their daily work, critical care nurses often face multi-system disease care, receive longer-term education in emergency and critical care, and possess rich knowledge and skills in first aid [8]. Due to the particularity of the department, intensive care nurses have more opportunities to deal with emergencies and see rare cases than ordinary nurses, which makes them have more clinical experience and more skillful rescue techniques, and a better first aid knowledge structure. To a certain extent, these will affect the ability of critical care nurses to adapt to new environment and respond to public health emergencies. Therefore, in the future work, the hospital should increase the opportunity of rotation of nursing staff in other departments to the intensive care department, and can also select nurse representatives in each department for key training, mainly in the theory and clinical operation training of intensive care specialty, including early identification of critical patients, airway management and care, function monitoring and support technology of various organs, use of major instruments (such as ventilator, various pumps, etc.), hospital sense protection [9,10].

Intensive nurses have various physiological and psychological changes in response to public health emergencies. The results of this survey showed that 64.91% of the critical care nurses in the process of assisting Hubei had poor sleep, and 49.71% of the nursing staff was mentally fatigued. The percentage of nurses without appetite and having symptoms of dizziness, palpitation, bloating, constipation, or diarrhea are 38.60% and 30.99%, respectively. The rate of Intensive nurses who had somatization, such as irrational, neurotic physical discomfort and anxiety, is 25.73%, 22.81% of nurses had obsessive-compulsive symptoms, 10.53% of nurses' conscious cognitive declined, and 18.13% of the nurses had major emotional changes, such as depression, fear and so on. Multiple studies

[11,12] have shown that frontline medical and nursing staff has different mental health problems when responding to public health emergencies. Therefore, in the process of combating COVID-19, management should increase alertness and pay attention to the mental health problems and emotional fluctuations of first-line medical staff. In order to improve the mental health status of medical staff, psychological intervention can be carried out appropriately, caring for and supporting from both physical and psychological aspects, establishing an online psychological service consultation platform, and formulating intervention plans for high-risk groups; providing more accurate and positive information about the epidemic, effective incentives, and fully mobilize the enthusiasm of nursing staff; guaranteeing the rest and nutrition of the front-line staff as much as possible, lay a good foundation for the body; and can also contact the relevant department of the hospital where the first-line nurse belongs to do the rear support work and convey emotional information. The scientific and reasonable division of labor, the harmonious working atmosphere also help the frontline medical staff maintain psychological stability [13], therefore, when dealing with public health emergencies in the future, priority can be given to taking over the entire organizational system, and as far as possible arrange the same department or hospital staff to work together.

Changes in practice skills of critical care nurses after assisting Hubei. After assisting Hubei, the practical skills of most intensive care nurses were improved to varying degrees. Among them, the improvement of personal protection skills was the most significant, and the ability to treat critical patients in major public health events (such as airway management, monitoring and support technology of various organ functions, etc.) was improved not obvious. The proportion of critical nurses who had participated in the treatment of public health emergencies was 36.26% and the proportion of nurses who had received emergency training for public health emergencies was 78.95% before fighting pneumonia. Research by Qu Ronglan [14] and others has pointed out that different titles, hospital grades, whether they have participated in public health emergency rescue and whether conducted simulated rescue training for public health emergencies will affect the emergency ability scores of hospital nurses. However, there is no statistically significant difference in the educational background, years of nursing profession and age in this kind of nurses' public health emergency response ability score comparison. Researches such as Mainur Tohetti have indicated that the main factors affecting nurses' ability to respond to public health emergencies include education, department, emergency training and emergency drills. It can be seen that emergency training will affect the emergency ability of nursing staff, in view of this, strengthening emergency drill training may be an effective method. The emergency drill training can include the following: routine

training, which is mainly used to strengthen the learning of public health incidents; continuing education on disaster care and public health emergencies should also be encouraged; various scenario simulation exercises are used to improve the pre-hospital emergency nursing ability. Training should be carried out step by step, after firmly grasping theoretical knowledge, and then using repeated and repeated exercises to achieve the strengthening effect. In daily work, we should also focus on the development of critical thinking and clinical decision-making ability, and improve the nurse's ability to recognize the psychological or emotional needs of patients when public health emergencies occur.

Factors hindering the smooth progress of the support work. This study found that the top three factors affecting the smooth progress of the aid work of critical care nurses were the fear of infection (68.42%), the impact of medical facilities and protective equipment (63.16%) , and less experience in responding to public emergencies (54.39%). In response to the urgent need to strengthen training content for critical care nurses currently participating in treatment competence, the top three were public health emergency monitoring and early warning (81.29%), the basic situation of emergency mechanisms (64.33%), and psychological stress and debugging (64.33%). This epidemic and every public health emergency not only affects the security and stability of the country and society, but also involves people's lives and property. Therefore, it is imperative to overcome the factors that hinder the smooth progress of support work. The analysis of the survey results shows that it is important and urgent to increase the training of self-protection knowledge in the rescue of various public health emergencies for critical care personnel participating in the first-line rescue of public health emergencies. At the same time, the monitoring and early warning of such incidents also need corresponding training and enhancement. The level of nursing equipment, including the quantity and quality of nursing equipment, is one of the indicators reflecting the level of nursing practice and scientific research, and is closely related to the quality of medical care in disasters. Cui Lin and other studies have shown that China's nursing equipment has problems such as backward technology and lack of quantity, and has a large gap with the advanced level of other countries. It does not meet the medical security needs of modern society. It has a greater impact on the role of nurses and the level of treatment of the wounded. When responding to public health emergencies, nursing equipment and medical equipment can be supported at the national level, and hospitals can work together to better improve the success rate of patient treatment.

Shortcomings and prospects of this research: at present, there is a few research on the current status of emergency nurses' ability to respond to the COVID-19 epidemic and emergency response ability evaluation and training system for responding to public health emergencies. Therefore, it is necessary to

conduct in-depth discussions to continuously enhance the intensive care team's emergency response capabilities in the face of public health emergencies such as the COVID-19 epidemic. Due to time and survey methods, the number of questionnaires returned is relatively low. In order to further understand the current situation of emergency response capabilities of intensive care nurses in China, questionnaires should be designed and distributed in time after the outbreak of COVID-19. If possible, we can also contact the relevant nursing leaders in different aid places in Hubei to issue and collect questionnaires, so as to better understand the current situation of emergency response capabilities of critical care nurses in China, and provide a theoretical basis for promoting the better development of critical illness emergency capacity building [15].

In summary, critical care nurses have a good knowledge of standard prevention of public health emergencies and a strong ability to adapt to new environment. During the rescue, they had various physical and psychological changes and were most worried about infection. The practical skills of most intensive care nurses improved to varying degrees after rescue. When dealing with such incidents, the takeover method of the integrated system is even more respected. As an important part of the medical rescue team, nurses play an irreplaceable and important role in emergency rescue.

## Conclusion

Understand the current situation of critical care nurses' emergency response capabilities, strengthen training and improvement of emergency response capabilities, and focus on mental health and stress response. Based on this, construct an evaluation and training system for critical care nurses' emergency response capabilities to respond to public health emergencies, which plays an active role in promoting the further development of critical care nursing.

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