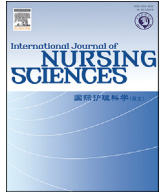


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journal homepage: <http://www.elsevier.com/journals/international-journal-of-nursing-sciences/2352-0132>Emergency management of nursing human resources and supplies to respond to coronavirus disease 2019 epidemic[☆]Yu Liu^a, Hui Wang^{a,*}, Junhua Chen^b, Xiaoyun Zhang^c, Xiao Yue^a, Jian Ke^a, Binghua Wang^a, Chaohua Peng^a^a Nursing Department, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China^b Outpatient Department, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China^c Infections Department, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

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ABSTRACT

Objective: To introduce the emergency management of nursing human resources and supplies of a large general hospital when facing the outbreak of coronavirus disease 2019(COVID-19).**Method:** The Nursing Department of the hospital fully executed its functional authority to establish a three-level echelon of sustainable support, allocate human resources dynamically, organize pre-service training, supervise the key working steps, formulate positive incentive methods, and deploy medical supplies scientifically.**Result:** By taking these strategies, the hospital effectively improved the coping capacity of the nursing team and played a positive role in the prevention and treatment of COVID-19.**Conclusion:** The emergency management of nursing human resources and material resources for COVID-19 of the hospital is successful. But several deficiencies were identified as well, which indicated that the hospital needs to establish an efficient emergency management system, and pay attention to the practice of nursing emergency plans to enhance coping capacities in public health emergencies.© 2020 Chinese Nursing Association. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

What is known?

- It was a great challenge for emergency management of all hospitals to respond to coronavirus disease 2019(COVID-19) outbreak at the early stage in Wuhan. The most prominent problems were the arrangement of medical staff to diagnose and treat patients with COVID-19 and the allocation of medical protective equipment.

What is new?

- It is effective to establish a three-level echelon of sustainable support in a tertiary hospital in Wuhan at the early stage of the

epidemic outbreak. Management ideas of magnet hospitals and the empowerment of head nurses in different departments are feasible for emergency management to respond to COVID-19.

1. Introduction

Since the end of December 2019, cases of coronavirus disease 2019(COVID-19) have successively occurred in Wuhan in Hubei Province and other regions in China [1]. The Chinese Center for Disease Control and Prevention has announced that COVID-19 is a category B infectious disease, for which category A infectious disease control measures are employed [2]. As the outbreak occurred close to the Chinese New Year, population movement and activities before the outbreak were extensive. Meanwhile, COVID-19 is infectious during the incubation period, and symptoms on onset are non-specific. Consequently, there was a widespread transmission of the virus, and the increasing number of confirmed cases has exceeded that of the severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS). The COVID-19 outbreak in Wuhan is serious, and epidemic control is a huge

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challenge. As a major tertiary hospital at the center of the epidemic, our hospital provided treatment for the first batch of infected patients in Wuhan. The Nursing Department of our hospital employed a series of efficient and scientific measures to obtain good results in epidemic control.

2. Emergency resource management of nursing manpower

2.1. Immediate response and full hospital mobilization

Control of the epidemic was challenging. To respond to the epidemic of COVID-19, the nursing department organized a COVID-19 control leadership team immediately, with the director of the Nursing Department as the leader of the team, who was fully responsible for the deployment and implementation of treatment work. The leadership team adjusted priorities in nursing work according to the hospital's actual situation, and formulated nursing work systems for the fever outpatient clinics and quarantine ward, as well as the corresponding standards for staff, to ensure that nursing work adheres to guidelines and standards. The team immediately conducted an ideological mobilization within the entire hospital to ensure that all nursing staff would be aware of their responsibilities and obligations in the face of difficulties and the epidemic and prepare to fight at the frontline of the epidemic. Simultaneously, training on knowledge related to COVID-19 and epidemic control methods were carried out.

2.2. Scientific selection, echelon construction and unified deployment

2.2.1. Staff qualifications standards

According to the characteristics of this epidemic, the Nursing Department formulated unified selection criteria for head nurses and nurses. When selecting the head nurse for the fever outpatient clinics, priority was given to candidates with extensive outpatient management experience, external assistance experience, and good physical health. When selecting the head nurse for the quarantine ward, the emphasis was placed on disinfection and quarantine management experience, and priority was given to head nurses with good integrated qualities in the emergency and infectious diseases departments. The selection criteria for nurses were as follows: with two or more years of work experience, good physical health, and proficient in basic nursing techniques (infusion, oxygen ventilation, and condition observation). Candidates who possessed nursing techniques for critical patients (usage of invasive/non-invasive ventilator, transnasal high-flow oxygen, and closed airway suction) or disinfection and quarantine techniques were given priority. Hence, nurses who were dispatched to the fever outpatient clinics and isolation wards at first were mostly nurses from the Infectious Disease Department, the Respiratory Department, and ICU. At the later stages, the dispatch system was gradually expanded to staff from all departments.

2.2.2. Establishing a sustainable support echelon

As the epidemic continued, nurses in ordinary wards, isolation wards, and the fever outpatient clinics were all overworked. To ensure sufficient personnel in fever outpatient clinics and isolation wards, while ensuring nursing quality in the entire hospital, the Nursing Department reassessed and matched workload and personnel requirements in the entire hospital. The Department decided to establish three echelons, and the echelon composition principles were determined as follows: A certain number of mid-level staff must be present along with several senior or specialist nurses from the ICU and the Respiratory Department. In consideration of a large number of nurses (4,000) in the hospital, the

Nursing Department referred to the concept of magnet hospital [3], staff selection was delegated to various departments in the hospital. Based on voluntary registration, the head nurse of each department dispatched the first echelon of support nurses according to the echelon composition principles and nurse selection criteria and then determined name lists of the second and third echelons as reinforcements for fever outpatient clinics and isolation wards.

2.2.3. Unified and dynamic personnel deployment by the nursing department

Based on the daily number of patients in the fever outpatient clinics and the patients in the isolation ward, the first echelon of 150 nurses was dispatched to the fever outpatient clinic and the isolation ward in the main area of the hospital, 45 nurses in the fever outpatient clinics with an average of 600 patient visits daily, 105 nurses in the isolation ward, and each nurse was responsible for four patients on average in each shift. As the early number of patients in the fever outpatient clinics and isolation ward was highly variable, two reserve shifts were prepared for every shift according to elastic shift principles. Two groups of reinforcements for each department were preparing in case of insufficient personnel. If the manpower was still insufficient, the Nursing Department would dispatch nurses for support. To ensure nursing quality, the Nursing Department followed the management model of Beijing Xiaotangshan Hospital during the SARS epidemic, and four 6 h-shift model was used in the fever outpatient clinics and the isolation ward. The nurse shift schedule was changed every two or three weeks. At the later stage of the intensified epidemic, the infected patients continuously increased, and the manpower needs for the fever outpatient clinics and the isolation ward continuously increased. Then, nurses in the two key departments rotated once a month, and nurses had been working for a month would rest for two weeks and be quarantined at home. Only a part of nurses were replaced for each rotation to ensure the normal operation of the departments. The leaders dynamically adjusted the deployment of first-line nurses according to the epidemic situation. Any nurse experiencing discomfort would be replaced after reporting to the head nurse and the Nursing Department. In addition, to alleviate personnel resource shortage in other ordinary wards, personnel resource emergency plans were established. Meanwhile, all head nurses in the entire hospital maintained effective communications to achieve mutual understanding and cohesion.

2.3. Focused training and supervision

2.3.1. Coordinated training arrangements

COVID-19 is a novel infectious disease. Currently, there is no effective treatment regimen, and the number of suspected or confirmed patients is large. Some first-line nurses were not from the Infectious Diseases Department or the Respiratory Department. To decrease the infection risk of nursing staff, the Nursing Department conducted a half-day focused training for all head nurses and nurses deployed to fever outpatient clinics or isolation wards. Our hospital has two branches besides the main area. Nurses in the main area of the hospital received on-site training, while nurses in two branch areas were trained online. Thus, all nurses were able to start working on the same day after they were trained in the morning.

2.3.2. Pre-service training and assessment

The training content included self-protection knowledge and skills, professional knowledge and skills, and preventive psychology counseling, based on national policies and guidelines [4–6]. (1) Self-protection knowledge and skills include epidemiological

characteristics, transmission route of COVID-19, and personal protection techniques, such as gowning/degowning of protective gown and mask. (2) Professional knowledge and skills include clinical diagnostic criteria for COVID-19, current treatment regimens, physical and psychological needs of patients, usage of invasive and non-invasive ventilation, transnasal high-flow oxygen therapy, closed sputum suction, and other nursing skills. (3) Preventive psychology counseling includes coping strategies and methods for emotional adjustment. Training methods included face-to-face training, practice, and lessons online. Videos, PPT, manuals, and images were provided for nurses whenever possible. As the epidemic situation was critical, nurses in deferent areas of the hospital were assessed by head nurses or senior nurse and began their work at the first-line immediately after passing the assessment.

2.3.3. Focused supervision in wards

To ensure safety of nursing staff, supervision in isolation wards focused on layout and zone arrangement, accesses and flow direction management, and process of donning and removing personal protective equipment (PPE). When first entering the isolation ward, new nurses were accompanied by nurses with working experience in the isolation ward. For every shift, a nurse from the Infectious Disease Department was responsible for supervising disinfection and protection work in the ward. In addition, the implementation of nurse protection measures was considered to be important content in the quality control and night ward round by head nurses, thereby ensuring the proper protection of nurses.

2.4. Magnet management and positive encouragement

First-line nursing staff had to endure high physiological and psychological stress, which may affect their physical and mental health. In view of this situation, the director of the Nursing Department and various head nurses led from the front and encouraged nursing staff at the front line every day. They were aware of the nurses' difficulties in life and work, such as long working hours resulting in a dry throat, long periods of mask-wearing resulting in chest tightness, allergy to the protective gown, and worry about infected family members. Great efforts were made to find solution manners. The workflow was adjusted and improved, and infected family members of nurses were treated in time. The official WeChat account of the Nursing Department and mobile phone messaging were used to deliver protection reminders and consolation messages. The exploits of nurses were disseminated by the official website and accounts. Psychological counseling and supports, and channels for emotion releasing were provided under the efforts of the Nursing Department together with other departments in the hospital.

3. Emergency resource management

When large general hospitals encounter public health emergencies, rational emergency resource deployment, layout, scheduling, and replenishment are extremely important during the response process, as these determine the success of emergency management [7]. The COVID-19 epidemic occurred during the Chinese New Year, a period when many factories, logistics, and sales workers were on leave. This situation resulted in a shortage of protective materials in various grades of hospitals in Wuhan, the entire Hubei Province, and even the whole of China. To solve these problems, hospitals employed a series of response measures, coordinated the relationships between various parties, and ensured the timely supply of protective gowns, masks, and disinfectants.

3.1. Advanced reserve and priority supply

Fever outpatient clinics and isolation wards are first-line regions in epidemic control in hospitals. During activation of the COVID-19 emergency plan in the hospital, budgeting of protective materials in the isolation wards and fever outpatient clinics during Chinese New Year was carried out. Simultaneously, a supply plan was formulated, supply channels organized, and reserves prepared in advance. Under the condition with limited supplies, the hospital prioritized supplies to isolation wards and fever outpatient clinics. Amid the supply shortage, the hospital contacted many departments or obtained materials from society through a public platform to solve first-line supply problems quickly. Medical equipment and supplies in isolation wards and fever outpatient clinics, especially disinfectants, ventilators, and ultraviolet lamps, needed to be replenished timely according to detailed requirements. Medical staff in isolation wards also faced personal hygiene and living problems. Conveniences were provided for them, such as shower water heaters, etc.

3.2. Unified scheduling and daily supply

As COVID-19 has high infectivity, and droplet and contact transmission may result in disease, first-line medical staff require large amounts of protective equipment [5]. Since the epidemic outbreak, hospitals have faced a shortage of surgical and N95 masks. In ensuring a sufficient supply of protective equipment and disinfection products, the distribution system is very important. The Nursing Department formulated an emergency plan for protective equipment distribution. Head nurses of wards took charge of requisition, storage and distribution of consumables, and communicated with the Nursing Department and the Materials Department every day for timely supplies. Lists of detailed requirements and standards for various protection equipment formulated by the Infection Control Department were delivered to head nurses of every ward, which were used to ensure that the donated equipment satisfied protection standards.

3.3. Attention to details and efficient usage

Our hospital organized training and implementation of documents on the use of common protective equipment for COVID-19 control [8]. In consideration of the effective duration of general protective equipment and the maximal usage of every set of protective equipment (e.g., protective gowns, goggles, N95 masks, latex gloves, and isolation gowns), usage rules of protective equipment were formulated. Nurses should complete personal preparation, such as drinking water and eating, urinating and defecating, before wearing the personal protective equipment (PPE) to avoid unnecessary wastage. Two to three sets of PPE were prepared for every shift as additional replenishment in case of responding to accidents, such as vomiting or syncope caused by long-term hypoxia in medical staff. For high-risk operations, such as collection of pharyngeal specimens, a concentrated cooperation manner was employed. After completing a round of concentrated collection, the protective face shield was changed.

4. Discussion

During the COVID-19 epidemic, some deficiencies were present as a major tertiary general hospital. Prediction capacity and strategic preparatory awareness for public health emergencies were not sufficient. This resulted in an evident lack of workforce and supplies at the beginning of the outbreak. The leadership team had

to adjust the management plan continuously to satisfy anti-epidemic requirements.

We have taken effective management measures to respond to the epidemic summarized as follows. (1) The epidemic control leadership team formulated a corresponding system and an emergency plan at the beginning, which ensured that nursing works be carried out in an orderly manner. (2) Three-level echelons of nurses were established in advance to ensure sufficient preparation of manpower. Nursing staffing efficiency was improved by empowerment of head nurses in different departments. This approach prevented blind selection by the Nursing Department during unified deployment. (3) The periodic rotation of first-line nursing staff maintained the model of combining novice and proficient staff. This model ensured that first-line nursing staff could obtain sufficient rest ensuring nursing quality and safety of new nurses in fever outpatient clinics or isolation wards. (4) The management ideas of magnet hospital were followed to increase cohesiveness. Nurse leaders worked at the forefront to act as role models and mentors, awaken the sense of purpose and responsibility in nurses, and activate the proactive spirit of nurses. (5) Equipment and materials for the first-line must be in sufficient supply without wastage.

For better responding to public health emergencies in the future, it is suggested that the various grades of hospitals establish pools of emergency nursing staff and improve their nursing skills and abilities by targeted training and assessment [9].

Ethical consideration

The ethical approval or individual consent was not applicable.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at

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