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Exploration on the safe management of multi-hospital transportation in a large public hospital during the pandemic of 2019-nCoV

1. Introduction

In December 2019, multiple cases of pneumonia emerged in Wuhan, Hubei Province, China, and then spread across the country [1,2]. According to the document issued by the Health Commission of China, pneumonia caused by this virus was named as "Novel Coronavirus Pneumonia (NCP)". On January 12, 2020, World Health Organization officially named the viral pneumonia as novel Coronavirus 2019 (2019-nCoV) [3]. As of June 25, 2020, there have been 9,534,494 confirmed cases of 2019-nCoV with 485,263 deaths globally [4], 85,119 cases with 4648 deaths in China, and 589 cases with three deaths in Sichuan province [5]. Since the outbreak of the pandemic of 2019-nCoV, the health care institutes in the worldwide have being facing enormous challenges and pressures. To deal with these, West China Hospital of Sichuan University responded positively at the first time, which on January 16, 2020, formulated the first edition of <Emergency Plan for the Prevention and Treatment of 2019-nCoV in West China Hospital of Sichuan University> and timely updated relevant contents.

Wenjiang District Hospital of West China Hospital is a branch of West China Hospital of Sichuan University, which implements multi-hospital integrated management with the main hospital. Wenjiang District Hospital has more than 750 employees, who are uniformly assigned by West China Hospital of Sichuan University. The branch hospital is 23 km away from the main hospital, whose public transportation is every underdeveloped. In order to facilitate the communication of both staffs and patients between two districts, Wenjiang District Hospital of West China Hospital has set up 12 shuttle buses within the hospital, going to and from the two areas every day.

As we have known, 2019-nCoV is an acute respiratory infectious disease transmitted mainly by droplets and contact, and people are generally susceptible to infection [6,7]. During the pandemic of 2019-nCoV, reasonable and efficient organizations of traffic vehicles, as well as safe and comfortable transportations of personnel have posed new requirements and challenges to administrative management. Under the modern concept of hospital management with continually pursuing elaborate management, Wenjiang District Hospital of West China Hospital needs constant practice, exploration and improvement, which has achieved some good results. As of June 25, 2020, there has been no case of cross-infection with 2019-nCoV in the branch hospital. Hereby, we retrospectively analyzed and summarized the practical experience of efficient organization and transportation in our branch area.

2. Establish an organizational structure with multi-department collaboration

West China Hospital of Sichuan University takes the main hospital as the core area, which set up Wenjiang District Hospital according to the development requirements, with a volume of 437 patients' beds. The administrative management structure of Wenjiang branch district is streamlined and efficient, which adopts the multi-level cooperation mode for flat management by using vertical compression of management level and horizontally one post with multiple responsibilities [8].

A General Management Office is set up in Wenjiang District Hospital under the overall management and support of West China Hospital of Sichuan University, which consists of 1 general office director with 2 internal personnel, 1 hospital infection manager, 1 medical section chief, 1 outpatient director, 1 logistics general section chief, 1 operation management section chief, 1 finance section chief, and 2 information managers. These staffs form the administrative management structure of the branch hospital, which work together in the mode of horizontal communications and multi-department collaborations. At the beginning of the pandemic of 2019-nCoV, a leading group for epidemic prevention and control was quickly established in Wenjiang District Hospital under the overall arrangement of the main hospital, with the general office director as leader in charge of the overall situation. The leading group established emergency operation mechanisms for epidemic prevention and control according to the actual situation of Wenjiang District Hospital, such as the organization and management of transportation between the branch and main hospital [9].

3. Adjust the traffic management strategy dynamically according to the national prevention and control requirements

3.1. The regional and hierarchical prevention and control requirements formulated by the Ministry of Transport of China

On 24 January 2020, the Ministry of Transport of China issued the <Emergency Notice on the Control of Vehicles Entering and Leaving Wuhan for the Prevention and Control of the Pandemic of 2019-nCoV>, which required all transport departments in each province to guarantee and implement the system. In accordance with the national guidelines about traffic management for the prevention and control of the pandemic of 2019-nCoV, high-risk area, medium-risk area and low-risk area was respectively defined. The passenger load factor (PLF) of inter-provincial and inter-city line or chartered buses for high-risk area and medium-risk area was respectively no more than 50% and 70%, while that for low-risk area had no special requirements [10].

3.2. Make detailed transportation plans according to the risk classification

As of 24:00 on February 27, 2020, a total of 143 cases of 2019-nCoV had been confirmed in Chengdu, Sichuan province, where West China Hospital of Sichuan University is located, among which, Wuhou District

[1]These authors contributed equally to this work as first authors.

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and Wenjiang District were listed as medium-risk area [11]. According to the risk level, the number of patients and family members visiting Wenjiang District Hospital of West China Hospital was strictly controlled. As of the above date, there were 590 outpatient visits and 199 inpatients per day, with a respective decrease of 46.36% and 45.53% compared to that before the outbreak of 2019-nCoV. Then, the corresponding number of employees in the branch hospital has also dropped sharply, with about 150 people making trips to and from work each day. According to the national regulations of PLF [11] but considering the special environment of hospital, we dispatched 7 48-seater vehicles for staffs to maintain the PLF at about 45%. One traffic vehicle with 48 seaters was prepared for patients, whose PLF was controlled <70%.

Till 0:00 on March 19, 2020, A total of 540 confirmed cases of 2019-nCoV had been reported in Sichuan Province. With the discharge of the last local patient in Chengdu, Wuhou District has changed from a medium-risk area to a low-risk area and all places over Sichuan Province has also turned into a low-risk area [12,13]. Combining the risk level of related region with the need of business development, we adjusted the PLF of our traffic vehicles appropriately. However, since most passengers were hospital employees in close contact with patients, who had high risk of infection [14], the PLF of traffic vehicles for staffs was moderately controlled at 70%, while that of traffic vehicle for patients was also relatively controlled and gradually increased.

By May 20, 2020, there are 0 existing case and 561 confirmed cases of 2019-nCoV in Sichuan province, making it a still low-risk area [15]. With the gradual increasing number of employees to a maximum of about 300 passengers, we arranged 8 48-seator transportation vehicles for staffs, whose PLF was still controlled no more than 78.13%. The number of patients fluctuated between 20 and 40, who still had a 48-seat traffic vehicle with a PLF controlled between 41.67% and 83.33%. Complying with relevant national regulations, the General Management Office tried their best to meet the travel needs of employees and patients and to ensure their safety simultaneously in the pandemic of 2019-nCoV.

4. Compact layer-by-layer responsibility and strengthen per-link prevention and control

Under the pandemic of 2019-nCoV, in accordance with relevant national regulations and combined with the special scene of hospital, Wenjiang District Hospital of West China Hospital adopted the comprehensive administrative management mode to furthest ensure the safety of both employees and patients by controlling the PLF as well as simultaneously taking the following effective measures: (1). Confirm the first responsible persons of shuttle bus who would be the director of the General Management Office and the legal representative of the transportation company, formulate the plan of epidemic prevention and control, standardize the related systems and procedures, and define the responsibility of each staff. (2). Supervise the related affairs of epidemic prevention and control of traffic vehicles by both hospital infection manager and internal personnel of the General Management Office. It was required that after each shuttle, the driver on duty must keep the windows open for ventilation and spray the vehicle with Chlorine-containing disinfectant (500 mg/L), which was ready to be used and could be kept for 24 h. (3). The loading and unloading point for employees and patients were set differently, as well as their loading and unloading time to avoid the intersection of the environment. (4). Before taking a car, the driver must confirm the identity of each passenger. Workers should show the badge checking records on their own initiatives. Outpatient and his/her family members should explain the matters to be dealt with in the hospital and present the relevant information of admission. Inpatient should be confirmed and accompanied by specified person from the central transport department in hospital. (5). All passengers were required to wear surgical masks correctly. (6). All passengers should take their initiatives to cooperate with the body temperature measurement by driver before getting on the bus. If any abnormality was found, it should be reported to the relevant department of hospital immediately and further be dealt with according to the regulations.

5. Establish an efficient and coordinated mechanism for epidemic prevention and control both inside and outside the hospital

A successful campaign for the pandemic of 2019-nCoV was not only limited to detailed prevention and control work such as internal hospital systems and emergency regulations, but also required the coordination of government and health administration departments on making related decisions [16].

The Wenjiang District Hospital of West China Hospital has implemented a three-level surveillance system for the prevention and control of 2019-nCoV with some measures like monitoring body temperature, asking epidemiological history and checking electronic health code, etc. As we reported [17], the first-level prevention and control arrangement was the only entrance to the main building of hospital, the second-level one was the outpatient entrance, and the third-level one was the ward and each auxiliary inspection area. Once suspected, the case was report to the General Management Office immediately, after which priority would be given to an ambulance transfer for this person according to the his/her condition. Meanwhile, the hospital infection manager would guide the driver to take some protection measures, such as putting on isolation clothing, wearing N95 mask, medical face screen, glove, hat, and so on. Then, an assigned person was arranged to accompany the person to the fever clinic for further registration and management. After the transport of suspected person, we used Chlorine-containing disinfectant (2000 mg/L) to wipe the surface and internal of the ambulance, as well as sprayed the air for disinfection. The windows of the ambulance would also be continuously opened for ventilation [18].

Through effective communication with government and health administration departments in the early stage, we formed linkage mechanisms among government, community and hospital. If the ambulance was dispatched, we then contacted the community where the patient was located. The community would assign person and car to receive the patient in hospital, make handover registration and later follow-up, and report to the local Centers for Disease Control at the same time. As of June 25, 2020, a total of 13 patients with fever or suspected 2019-nCoV were transferred in Wenjiang District Hospital of West China Hospital, while no cases were confirmed during follow-up.

6. Pay attention to and strengthen the driver's psychological support and counseling

6.1. Drivers' mental state and skills for epidemic prevention and control were easy to be ignored

During the pandemic of 2019-nCoV, our transport vehicles and ambulances were responsible for the transport of staffs, patients and clinical samples or specimens between the branch and main hospital. Due to the aggravation of 2019-nCoV, traffic tasks of transport vehicles and ambulances increased obviously, with higher risk of infection than that of ordinary buses. In terms of mental health, the society has being focused on the psychological state of medical personnel, and the country has also being taken a number of measures to care medical personnel [19]. However, in the specific work of our hospitals, drivers were also in the front line of the prevention and control for 2019-nCoV, who were in close contact with medical staff and patients in a high-risk environment. What's more, due to occupational reasons and educational level, the mental state and skills for epidemic prevention and control of drivers were easy to be relaxed, which would directly affect the physical and mental health of the drivers and even be life-threatening, making it a major hidden trouble that couldn't be ignored in hospital transportation management.

6.2. Basic information of the drivers

The transport of hospital vehicles in Wenjiang District Hospital of West China Hospital was outsourced, with a total of 10 drivers, whose mean age was 45 years (Ranging from 40 years to 53 years). All drivers have been driving for more than 20 years and have been participated in passenger transportation during some major disasters, such as the pandemic of severe acute respiratory syndrome (SARS) in 2003, the Wenchuan Earthquake in 2008 and the pandemic of Influenza A (H1N1) in 2009, etc.

6.3. Strengthen psychological support and training of basic skills of epidemic prevention and control for drivers

Cooperating with the hospital infection manager, the internal personnel of the General Management Office performed professional training on the prevention and control of 2019-nCoV for the traffic vehicles and personal protection of drivers. We payed much attention to the protection of drivers to reduce their concerns in the risk of infection concerns as follows: (1). Care about drivers' physical and mental state, conduct professional psychological counseling, incorporate psychological management of drivers into the construction project of sunshine hospital and carried out Balint Group Psychological Intervention jointly with the mental health center in hospital. (2). Provide adequate protective equipment and disinfection supplies for drivers in accordance with the standards of first-line epidemic prevention personnel. (3). Arrange the work intensity properly to avoid the increased risk of secondary injury due to overwork. (4). Remind all staffs to cooperate with the drivers to monitor their body temperature and to show their badge checking records. (5). Accept the supervision by all staffs of the branch district and rectify problems as soon as they were found.

7. Effects of epidemic prevention and control

As of June 25, 2020, no cross-infection cases of 2019-nCoV and no traffic accidents have occurred in Wenjiang District Hospital of West China Hospital during the period of epidemic prevention and control. A total of 13 patients with fever or suspected 2019-nCoV were transported, while no cases were confirmed during follow-up. In accordance with our local conditions, we have taken targeted measures and carried out epidemic prevention and control work on the safe management of multi-hospital transportation, which have achieved remarkable effects right now.

8. Experience and thinking

During the pandemic of 2019-nCoV, the epidemic prevention and control work in branch hospitals of large public hospitals has been a new challenge throughout the world, which is worth our continuous thinking and exploration. When a medical institution is faced with a major public health emergency, how to respond quickly and implement prevention and control work accurately is also one of the hot topics of current attentions. Under the multi-hospital integrated management of West China Hospital of Sichuan University, Wenjiang District Hospital implemented the administrative multi-department collaboration mode, with efficient cooperation, clear division of labor and designated responsibility to someone. Continuous exploration and improvement of transport management strategies for all types of personnel in hospital not only ensured the safety of employees and patients, but also enabled all people to be transferred more efficiently. Facing the fierce epidemic of 2019-nCoV, Wenjiang District Hospital of West China Hospital has been making every effort to fight against this disease. The pandemic of 2019-nCoV is not over yet, and we still need to continue our exploration and practice.

Authors contributions

In this paper, ZL. And ZX. wrote the manuscript and contributed equally to this work as first authors. MX.Q. designed the study, participated in manuscript revision and final review. YM. performed the literature search. OYY. and LS.Y. made the data collection. MX.Q. and ZX. reviewed the whole manuscript and improved the discussion. All authors read and approved the final manuscript.

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Presentations

The work described in the manuscript has not been formally presented at a scientific meeting.

Declaration of Competing Interest

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Lin Zeng
President's Office, West China Hospital of Sichuan University, Chengdu, Sichuan Province, the People's Republic of China

Xin Zhao
President's Office, West China Hospital of Sichuan University, Chengdu, Sichuan Province, the People's Republic of China

Min Yang
Department of Pediatric Surgery, West China Hospital of Sichuan University, Chengdu, Sichuan Province, People's Republic of China

Ying Ouyang
Medical Affairs Department, West China Hospital of Sichuan University, Chengdu, Sichuan Province, People's Republic of China

Shi-yu Li
Department of Hospital Infection Management, West China Hospital of Sichuan University, Chengdu, Sichuan Province, People's Republic of China

Xiu-qing Ma
President's Office, West China Hospital of Sichuan University, Chengdu, Sichuan Province, the People's Republic of China
Corresponding author at: Address: No.37, Guoxue Road, Wuhou District, Chengdu 610041, Sichuan Province, People's Republic of China.
E-mail address: 424308210@qq.com

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