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# FANGCANG SHELTER HOSPITAL FOR COVID-19

## CONSTRUCTION AND OPERATION MANUAL



马云公益基金会  
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## Foreword

The novel coronavirus (SARS – CoV – 2) is a newly emerging pathogen, and has the characteristics of strong infectivity and fast propagation. The transmission of the SARS – CoV – 2 occurs through respiratory droplets between people with close contact. Since December 2019, China and other countries have successively identified and reported the 2019 coronavirus disease (COVID – 19) cases. By 15th April 2020, the epidemic of COVID – 19 has been contained and brought under full control in China, and the number of existing confirmed cases has dropped to 1, 949. However, the outbreak is still spreading worldwide with confirmed cases exceeding 2 million, and this figure is still rapidly increasing.

As a novel public health concept, the Fangcang Shelter Hospital was first proposed by Professor Wang Chen, an academician of Chinese Academy Engineering, in Wuhan, China, in February 2020. While responding to the coronavirus disease 2019 (COVID – 19) outbreak, medical staff faced the pressing situation of limited medical supplies, which led Prof. Wang Chen to the suggestion of converting large – scale public venues such as exhibition centers and indoor stadiums into shelter hospitals to receive large number of patients, as this involved

minimum time and monetary costs. The five essential functions of Fangcang Shelter Hospitals (isolation, triage, basic medical care, close monitoring and rapid referral, and essential living and social engagement) enable shelter hospitals to receive patients with mild to moderate symptoms of COVID – 19, and have the greatest impact on isolating the source of infection and expanding the area's health – care capacity.

With the great experience from Zall Foundation's crews who contributed to the designing, renovating and operating of these shelter hospitals, this booklet encompasses knowledge and experience distilled from the running of these Fangcang Shelter Hospitals. Covering five important aspects, namely the proposal, design, renovation, operation and logistical support for shelter hospitals, this manual aims to be a useful reference for other epidemic prevention and control work in regions around the world.

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# **Chapter I**

## **Proposing Strategies of Establishment of Fangcang Shelter Hospital**

### **1.1 Construction background of Fangcang shelter hospital**

Wuhan, a metropolitan city with millions of people, went into lockdown on January 23, 2020, to interrupt the transmission of novel coronavirus. The number of confirmed cases of COVID-19 grew rapidly, which overburdened medical resources. The situation of "A ward bed is hard to beg" emerged. In this case, a large number of confirmed patients could not be admitted to the hospital and had to choose home quarantine. Prof. Wang Chen, the Vice President of Chinese Academy of Engineering, the President of Chinese Academy of Medical Sciences and an expert in Pulmonary and Critical Care Medicine (PCCM) supported at the frontline in the fight against the epidemic and put forward the idea of constructing Fangcang shelter hospital as soon as possible on January 1 after full investigation, to implement the strategy of "All suspected and confirmed patients should be admitted to the hospital and all confirmed patients should be treated" , which was put forward by

the central government. The China Culture Expo Center of Wuhan Salon, Wuhan International Conference and Exhibition Center and Hongshan Gymnasium in Wuhan were expropriated on February 3, to build this first batches of Fangcang shelter hospitals in Wuhan.

Fangcang shelter hospital was constructed using mainly existing buildings or resources, to admit COVID-19 patients with mild to moderate symptoms in the shortest time and at minimum cost to the greatest extent. This not only provides basic medical care for patients, transfers them to designated hospitals and provides them with basic living conditions, but also controls the source of infection effectively and cuts off the route of transmission of the virus, which prevents the spread of pandemic, improves the recovery rate and reduces the fatality rate. The construction of Fangcang shelter hospital is not a "perfect strategy", but an advisable and realistic strategy. In the course of epidemic prevention and control in China, Fangcang shelter hospital plays an important role, which provides a new idea and creates a new model for other countries in dealing with the epidemic and expanding medical resources rapidly.

The number of confirmed cases of COVID-19 is on the rise all over the world, which results in a desperate lack of medical resources in all countries, especially the number of ward beds for the treatment of confirmed patients. A significant proportion of confirmed patients cannot be admitted to the hospital and receive treatment under quarantine. Self-quarantine at

home will put family members at risk, cause cross infection and lead to further spread of the epidemic. Upon the establishment of Fangcang shelter hospital, scientific classified treatment measures can be adopted, to admit severe patients and critical patients into designated hospitals. A large number of patients with mild to moderate symptoms are admitted into Fangcang shelter hospital in a centralized way, which improves the utilization efficiency of medical resources.

## 1.2 Definition of Fangcang shelter hospital

Fangcang shelter hospital in China is a large improvised hospital which is constructed rapidly by reconstructing the convention and exhibition centers, stadiums and other existing large places into medical facilities. It is used to isolate a large number of COVID – 19 patients with mild to moderate symptoms from family members and communities, and also provide medical care, disease surveillance and referral as well as living and social spaces.

## 1.3 Characteristics of Fangcang shelter hospital

An article (*Fangcang Shelter Hospital: A New Idea for Responding to Public Health Emergencies*) focusing on China's construction and use of Fangcang shelter hospitals was published on April 2 in *The Lancet*, one of the world's top medical

journals. This article was prepared jointly by Prof. Wang Chen and Institute for Global Public Health of University of Heidelberg, Germany. Three characteristics of Fangcang shelter hospital are listed in the article: fast construction, large scale and low cost. These characteristics enable it to respond to public health emergencies in an efficient way.

Patients unable to be admitted to hospitals are mainly admitted to Fangcang shelter hospital, which not only prevents infection to family members but also provides timely medical treatment for the patients. All patients admitted to Fangcang shelter hospital are those tested positive in the nucleic acid testing (NAT) which rules out infection factors of influenza. Admitted patients shall wear masks and other preventive measures are also taken. Therefore, there is basically no cross infection between patients admitted into Fangcang shelter hospital.

## **1.4 Functions of Fangcang shelter hospital**

Fangcang shelter hospital has five critical functions: effective isolation; a large number of patients with mild to moderate symptoms are admitted and provided with basic medical care. Besides, close monitoring is performed on the patients. Triage is provided for severe patients and critical patients who are quickly transferred to more professional high-level COVID-19 designated hospitals for treatment. Moreover, Fangcang shelter hospital is also a community for patients with mild

symptoms to moderate symptoms, where mutual assistance between the medical staff and patients and social activities participated by the patients will ease the anxiety caused by the disease and isolation, so as to promote rehabilitation.

## **Chapter II**

# **Project Design of Fangcang Shelter Hospital for COVID – 19**

### **2.1 Functional areas of Fangcang shelter hospital**

Fangcang shelter hospital shall be divided into "three zones and two passages" in a reasonable manner according to functions. Traffic shall be arranged according to the streamline organization of separating doctors from patients and separating clean zones from contaminated zones. Negative pressure ventilation system and moderate activity space is reserved for patients.

"Three zones" include the contaminated zone, semi – contaminated zone and clean zone. The contaminated zone includes the treatment area, ward bed area, observation and treatment room, disposal room, waste room and admission and discharge office for mild patients; The clean zone includes the dressing room, meal preparation room, duty room and storehouse; The semi – contaminated zone refers to the area between the clean zone and the contaminated zone, which may be contaminated

by the patient's blood and body fluids, including the office for the medical staff, treatment room, nurse station, treatment room for medical devices and other devices and the internal corridor. Clear marks or isolation belt shall be set in different areas, for which signs in different colors can be used for differentiation. "Two passages" refer to the entrance for medical staff and the entrance for patients, which should be completely separated.

The entrance of the clean zone that leads to and from the contaminated zone shall be arranged with buffer rooms for entering and returning respectively. Procedures of entering: primary dressing – secondary dressing – buffer room. Medical staff wears protective equipment and then enter the contaminated zone from the clean zone. Procedure for returning: buffer room – take off protective suit – buffer room – take off isolation gown and take a shower – change clothes. Then return from the contaminated zone to the clean zone. The buffer rooms should be for men and women respectively.

## **2.2 Design of ward bed in Fangcang shelter hospital**

Each ward area shall be divided by specified number of beds and gender (i.e., male patients and female patients shall be placed in different areas). The number of beds in each area should not be more than 42, where there shall be 2 evacuation



exits. The distance between any position in the area and the evacuation exit shall not be more than 30m. There shall be fire evacuation routes between areas. The width of the fire evacuation route between areas in high and large space should not be less than 4m. Ground evacuation signs shall be pasted on the ground of the corridor in the area and that of the evacuation route. Incombustible or incombustible material shall be selected as partition material, which has a washable surface and has a height of not less than 1.8m. Beds shall be arranged with proper spacing, to facilitate doctor care and treatment. The clear distance between two parallel beds should not be less than 1.2m, and bedside tables shall be arranged. The clear distance (corridor) between double-row beds (end of bed) should not be less than 1.4m. The clear width of the corridor between the bed and the wall on the opposite should not be less than 1.1m.

## **2.3 Design of toilet in Fangcang shelter hospital**

Toilets for patients and medical staff shall be arranged separately. Temporary toilets are arranged for patients. A special channel shall be set between the temporary toilet area and the ward area. Foam-blocked portable toilets are preferred. The number of toilets shall be determined based on the principle of 20 people/position for male toilets and 10 people/position for female toilets, with appropriate increase according to actual demands of the patients. Toilets shall be in the downwind direc-

tion of Fangcang and be far away from the dining area and water supply point. Domestic sewage and bath wastewater generated by use of the temporary toilets by patients shall be disinfected in a dedicated reservoir. Sewage in the ward area, medical sewage and pollutants in the ward area, which are not disinfected or fail to achieve the discharge standard, are strictly prohibited to be discharged into the municipal sewer.

Original toilets and bathing areas in Fangcang are only available for the staff and logistics support staff that are in good health condition, or should be closed temporarily.

## **2.4 Firefighting and non – barrier design in Fangcang shelter hospital**

The number of people to be accommodated by Fangcang shelter hospital after the reconstruction shall be determined by the evacuation width of the existing escape stair and emergency exit. The clear width of the emergency exit in the evacuation stairwell or high and large space shall comply with the local fire code or shall not be less than 1m for 100 people.

There shall be barrier – free access at main entrances and internal medical corridor, which lead to all medical departments. Ramps should be set to connect areas with height difference in the internal corridor of existing buildings. The ramp shall meet requirements of the barrier – free access, and shall have a

width necessary for the passage of mobile sickbed and attendants simultaneously.

## **2.5 Design of auxiliary rooms in Fangcang shelter hospital**

Storage, disinfection and safety check room for personal belongings, dressing rooms for male patients and female patients shall be arranged at the entrance of the ward area. There shall be a disinfection area and packaging area for patents to be transferred and recovered patients. Moreover, emergency rescue and treatment room, disposal room, diet preparation room for patients, linen locker, water heater room, domestic waste temporary storeroom (filth cleaning room, the temporary storeroom should be close to the outer wall and the pollutant outlet) and other rooms shall be set near the ward area. The fluid preparation (dispensing) room, drug storehouse, aseptic supply storeroom, diet preparation room for patients, duty room, office, etc. can be set up in the cleaning working area for medical staff.

## **2.6 Case reference for design of Fangcang shelter hospital**

In large and medium – sized cities with a relatively dense population, large stadiums such as gymnasiums, exhibition halls,

waiting halls at stations, vacant plants and multi – purpose venues at schools can be requisitioned to build Fangcang shelter hospitals. Here are some examples.

### 2.6.1 Fangcang shelter hospital reconstructed from single – story exhibition hall

Case: For the Fangcang shelter hospital reconstructed from single – story exhibition hall, we take Zall (Wuhan Salon) Fangcang Shelter Hospital reconstructed from Wuhan Salon's Chinese Cultural Exhibition Center in Dongxihu District, Wuhan as an example. Zall (Wuhan Salon) Fangcang Shelter Hospital is built from three connected tall and empty exhibition halls (A, B, C). It is of single story. The plan is shown in Fig. 2 – 2.

First of all, the existing building——Wuhan Salon's Chinese cultural exhibition center was selected for detailed review of drawings and site survey, and the feasibility plan and technical indicators were quickly worked out. The plan was jointly reviewed, discussed and confirmed by professionals.



Fig. 2-1 Aerial view of Zall (Wuhan Salon) Fangcang Shelter Hospital

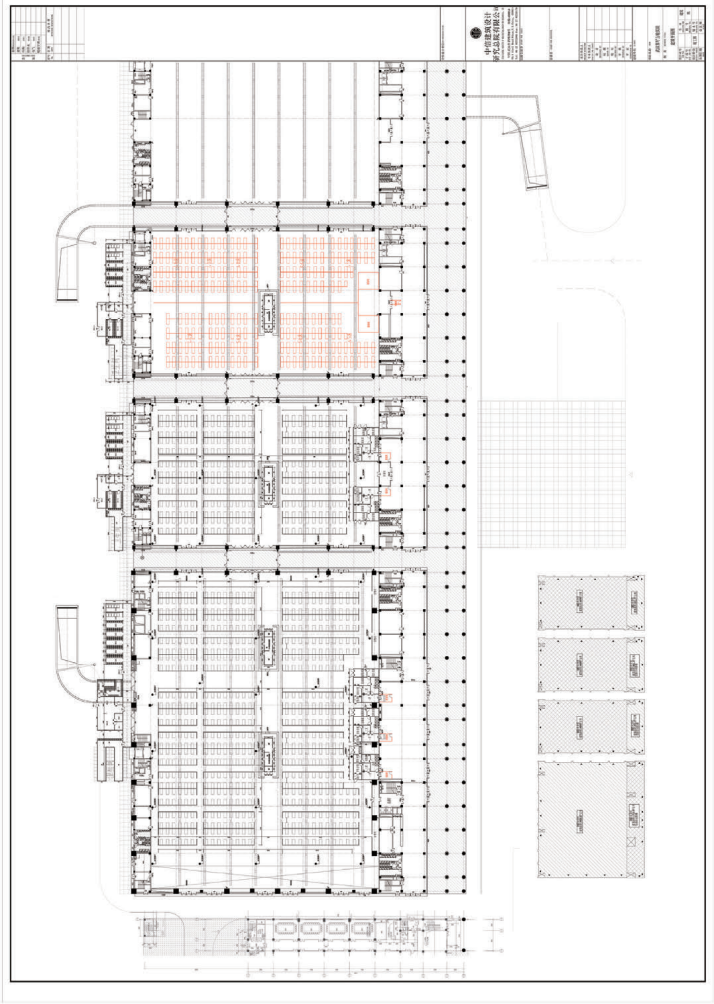


Fig. 2-2 Functional division map of Zall (Wuhan Salon) Fangcang Shelter Hospital

Zall (Wuhan Salon) Fangcang Shelter Hospital is reasonably divided into three zones and two passages according to its functions (refer to Chapter II *Project Design of Fangcang Shelter Hospital for COVID-19* 2.1 Functional Division of Fangcang Shelter Hospital for details), and in order to meet the functional requirement of the Fangcang shelter hospital to admit patients, functional renovation is carried out for the main exhibition hall (Exhibition Hall A) and two side exhibition halls (Exhibition Hall B and Hall C) according to the plane of Wuhan Salon's Chinese Cultural Exhibition Center. Among them, the contaminated area mainly includes the working area of nursing staff and the area for receiving and treating patients; the clean area includes the living area of medical staff and the material guarantee area. The hallway in the middle is sanitation area. The accommodation of the medical staff after the shift is arranged in other surrounding places, and they cannot leave until they have been isolated for two weeks and are in good condition. Refer to functional division map Fig.2-3.

**Key point 1 of renovation:** With the large space of the exhibition hall, the sickbed area and nursing area are set up. The two have relatively independent functions, with uncrossed streamlines, showing a fish-bone layout. In the middle is the nursing area with both sides directly connected with different sickbed areas. Patients are treated on the lateral side in accordance with the procedures of admission management——peripheral corridor (patient service passage)——recovery——clean area for discharge——discharge. Refer to functional division map

Fig.2 - 4.

**Key point 2 of renovation:** The living area of medical staff and material guarantee area are set up. The storehouse, which is used for material storage in emergency situations, is set up around the original freight entrance and exit; the independent entrance and exit on the other side is for the entrance and exit of medical staff, with functional areas such as temporary duty, working, conference, tele - consultation, etc., which are connected with the nursing work through the sanitation area. Refer to functional division maps Fig. 2 - 5 and Fig. 2 - 6.



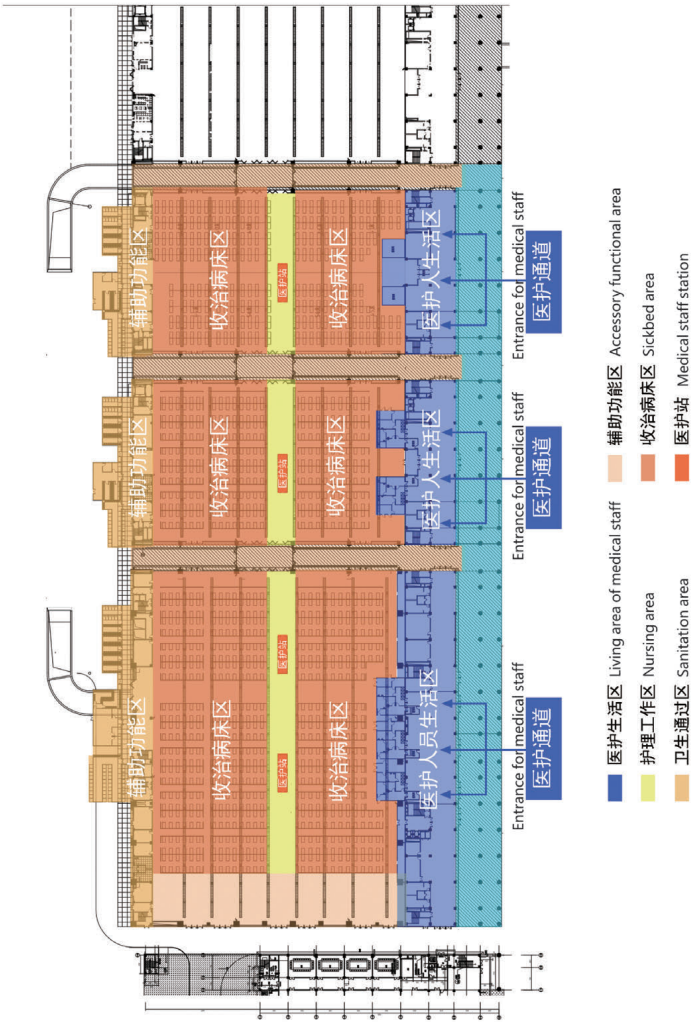


Fig. 2-3 Functional division map of Zall (Wuhan Salon) Fangcang Shelter Hospital

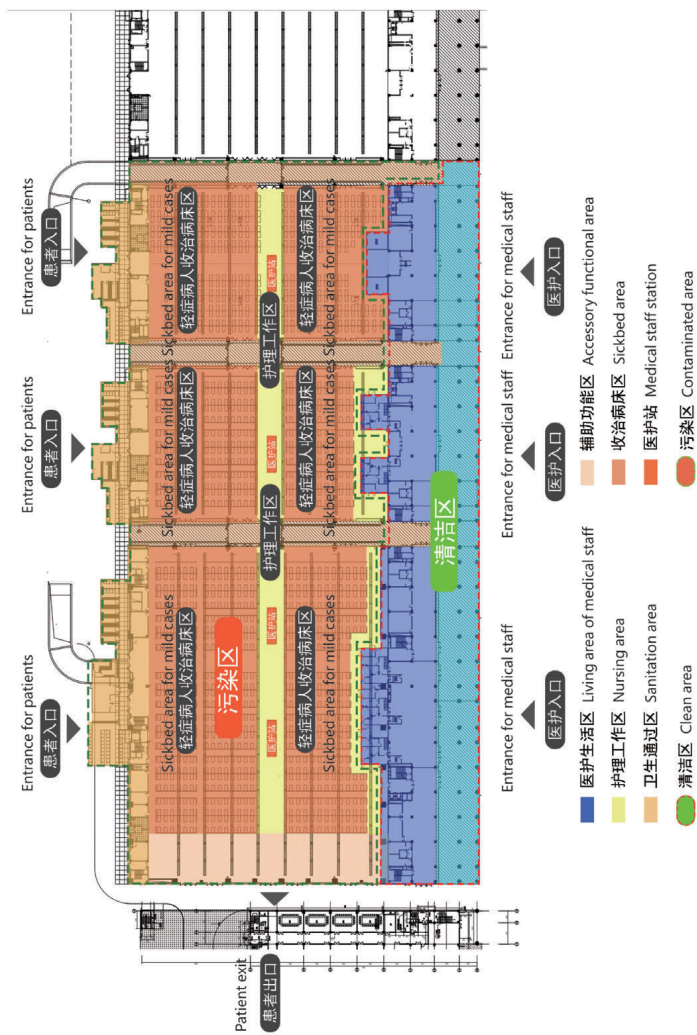


Fig.2-4 Functional division map of Zall (Wuhan Salon) Fangcang Shelter Hospital

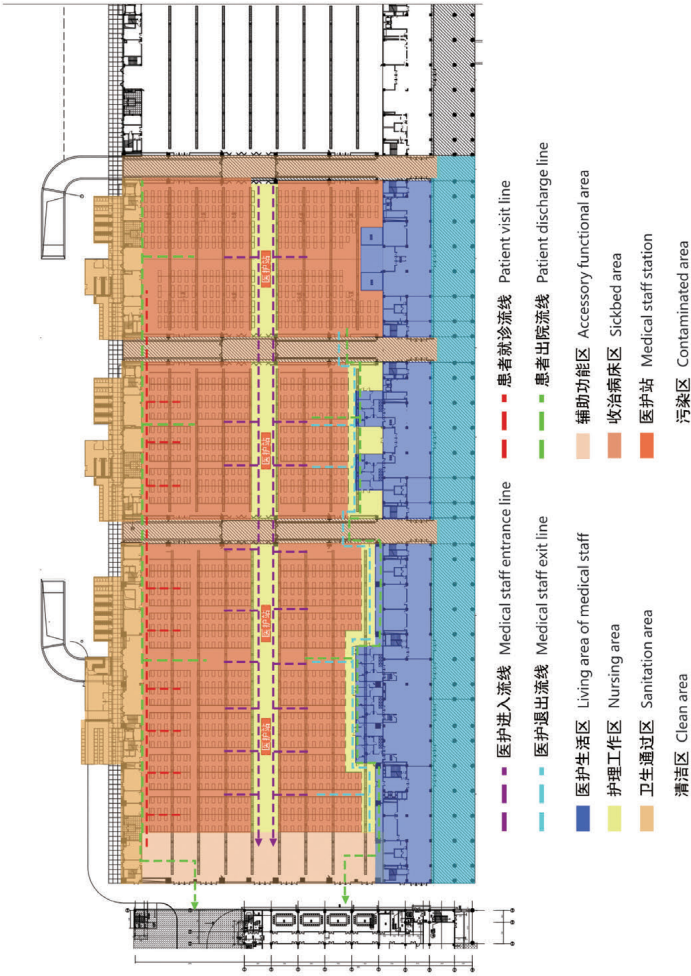


Fig. 2-5 Functional division map of Zall (Wuhan Salon) Fangcang Shelter Hospital

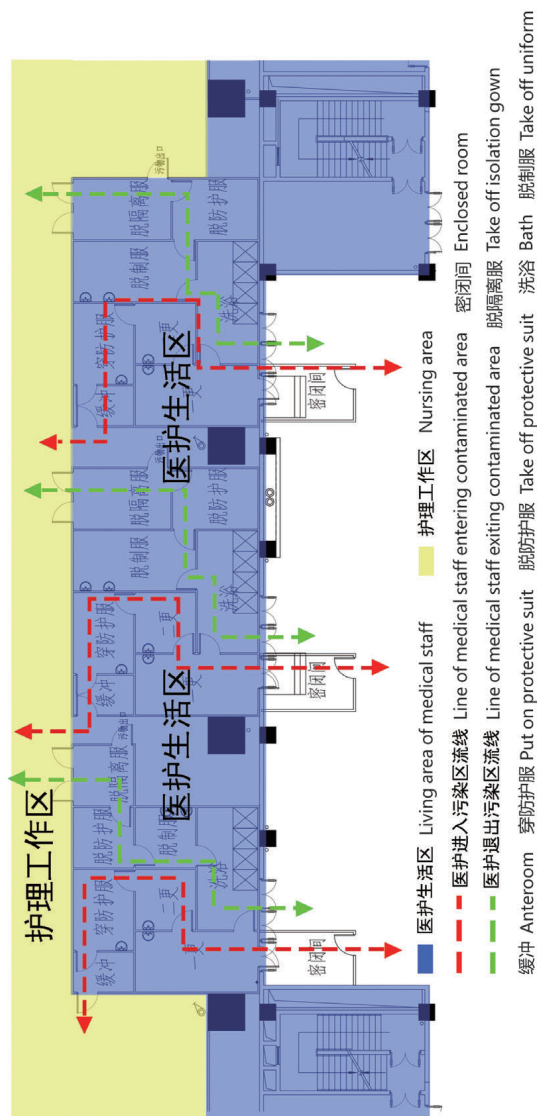


Fig.2-6 Functional division map of Zall (Wuhan Salon) Fangcang Shelter Hospital

### 2.6.2 Fangcang shelter hospital reconstructed from multi – story sexhibition hall

Case: For the Fangcang shelter hospital of the multi – story exhibition hall type, we take Zall (Jiangnan Wuzhan) Fangcang Shelter Hospital reconstructed from Wuhan International Convention and Exhibition Center in Jiangnan District, Wuhan, as an example. Wuhan International Convention and Exhibition Center is a multi – story exhibition hall. Like Zall (Wuhan Salon) Fangcang Shelter Hospital, it is reconstructed based on the tall and empty exhibition hall. The difference is that Zall (Jiangnan Wuzhan) Fangcang Shelter Hospital is divided into upper and lower floors. The first floor is a clean area or partially contaminated area, while the second floor is a contaminated area. Refer to Fig. 2 – 7 and Fig. 2 – 8 for the floor plan.

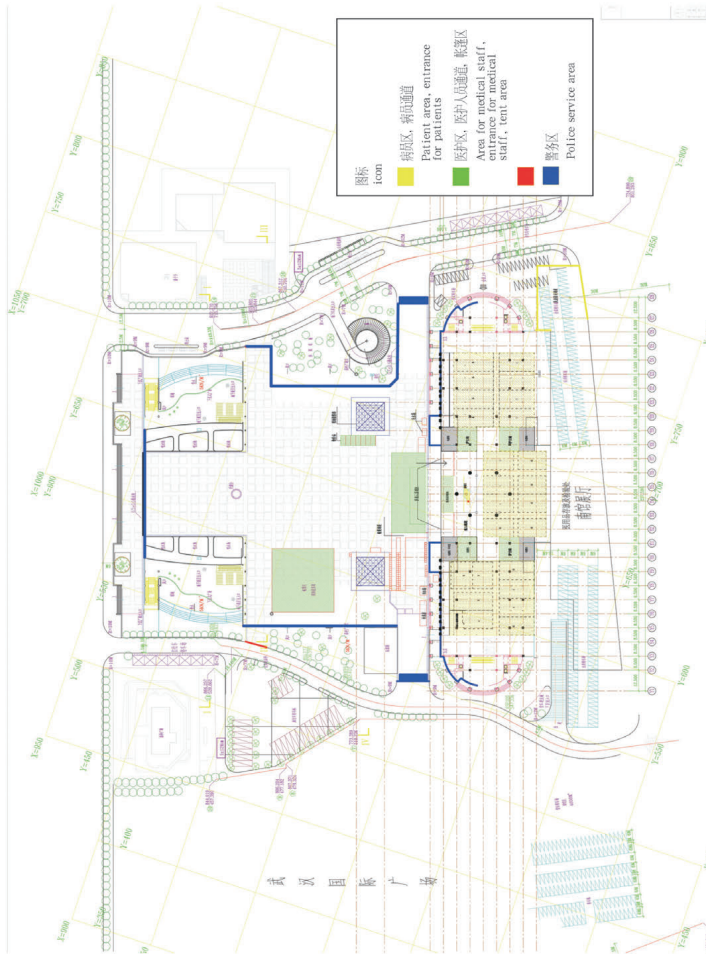


Fig. 2-7 Plan of Zall (Jiangnan Wuzhan) Fangcang Shelter Hospital Floor 1

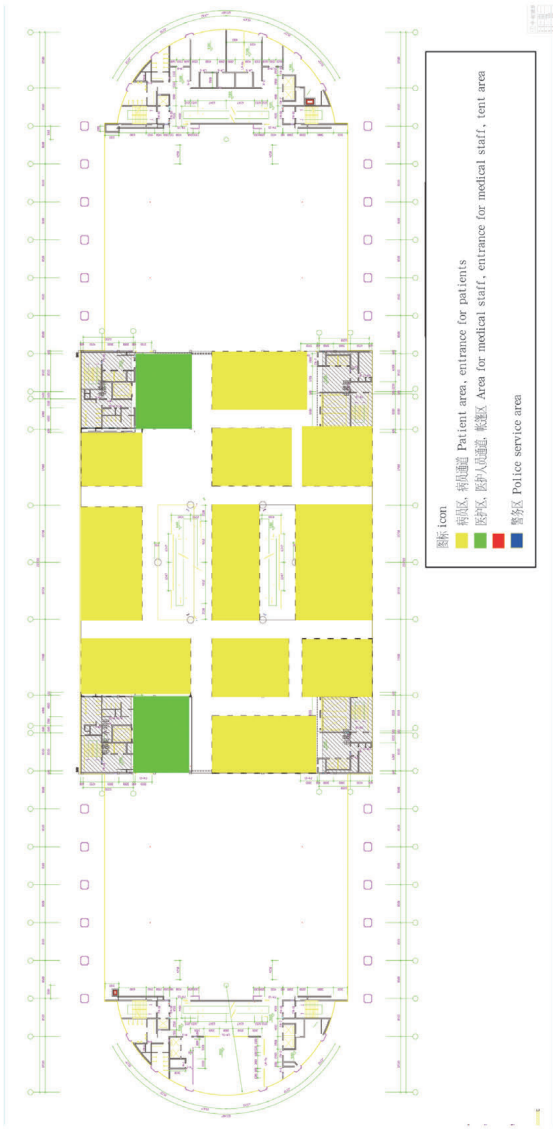


Fig.2-8 Plan of Zall (Jiangnan Wuzhan) Fangcang Shelter Hospital Floor 2



### 2.6.3 Fangcang shelter hospital reconstructed from gymnasium

Case: For Fangcang shelter hospital of the gymnasium type, we take Wuchang Fangcang Shelter Hospital reconstructed from Hongshan Gymnasium in Wuchang District, Wuhan. The reconstruction is based on a large indoor basketball court. Design drawings are shown in Fig. 2-9, Fig. 2-10, Fig. 2-11, Fig. 2-12, Fig. 2-13, and Fig. 2-14.



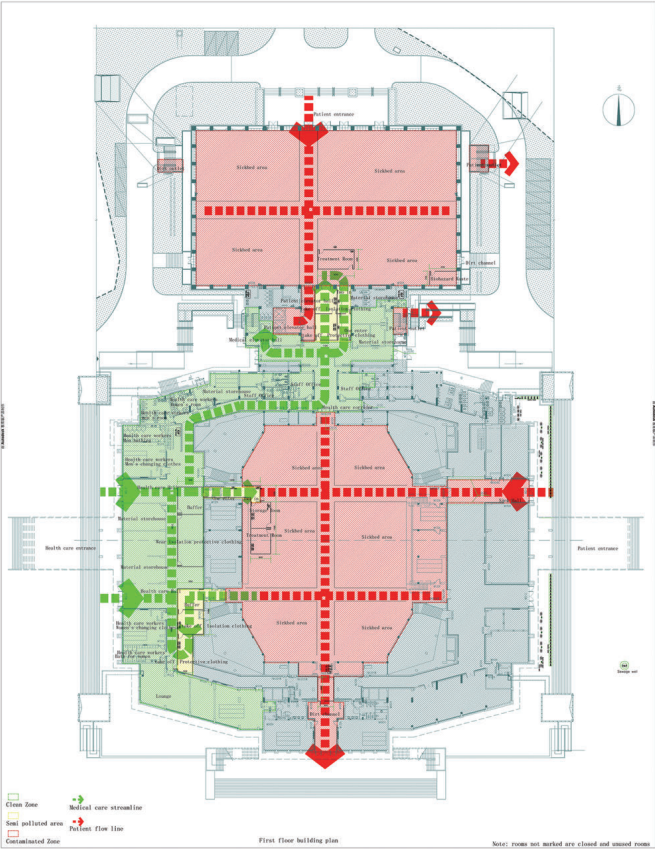


Fig.2 – 9 Plan of Wuchang Fangcang Shelter Hospital Floor 1



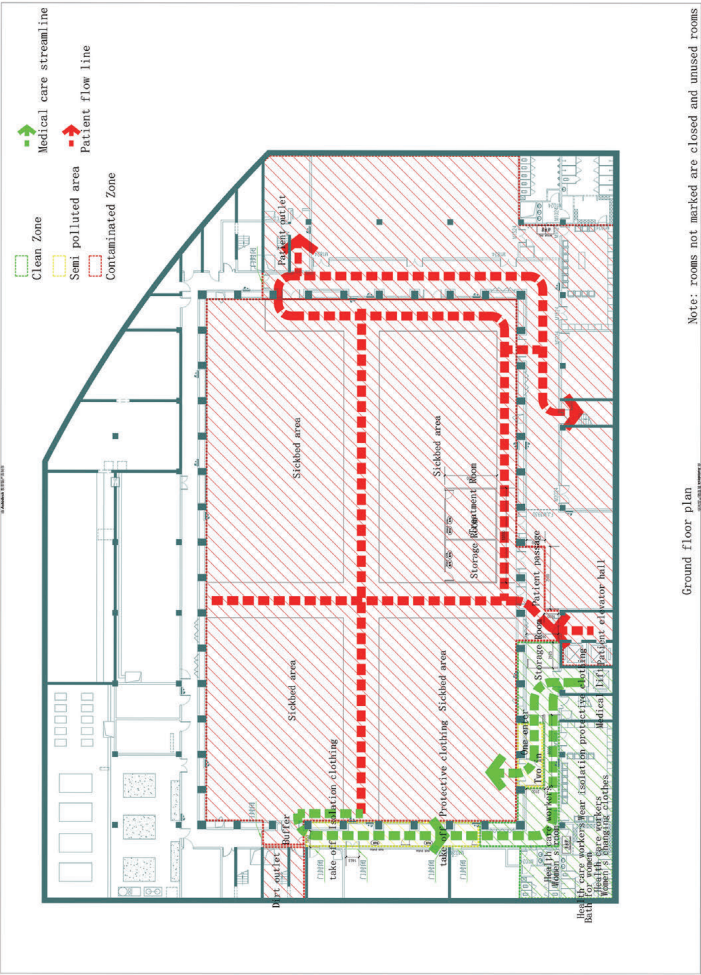


Fig.2-11 Plan of Wuchang Fangcang Shelter Hospital Basement 1



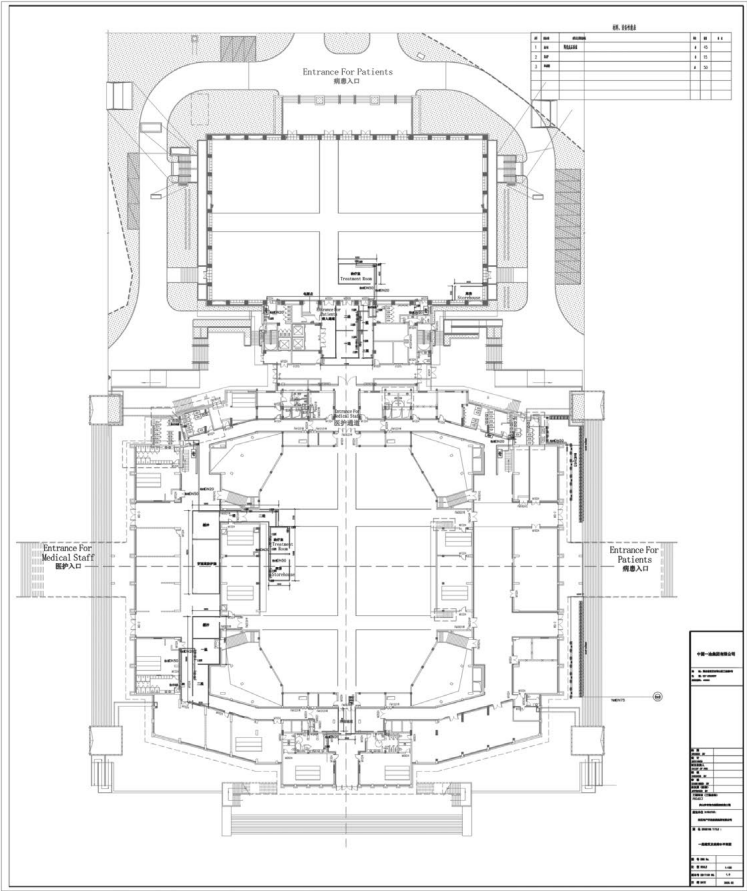


Fig. 2-13 Building, water supply and drainage plan of Wuchang Fangcang Shelter Hospital Floor 1

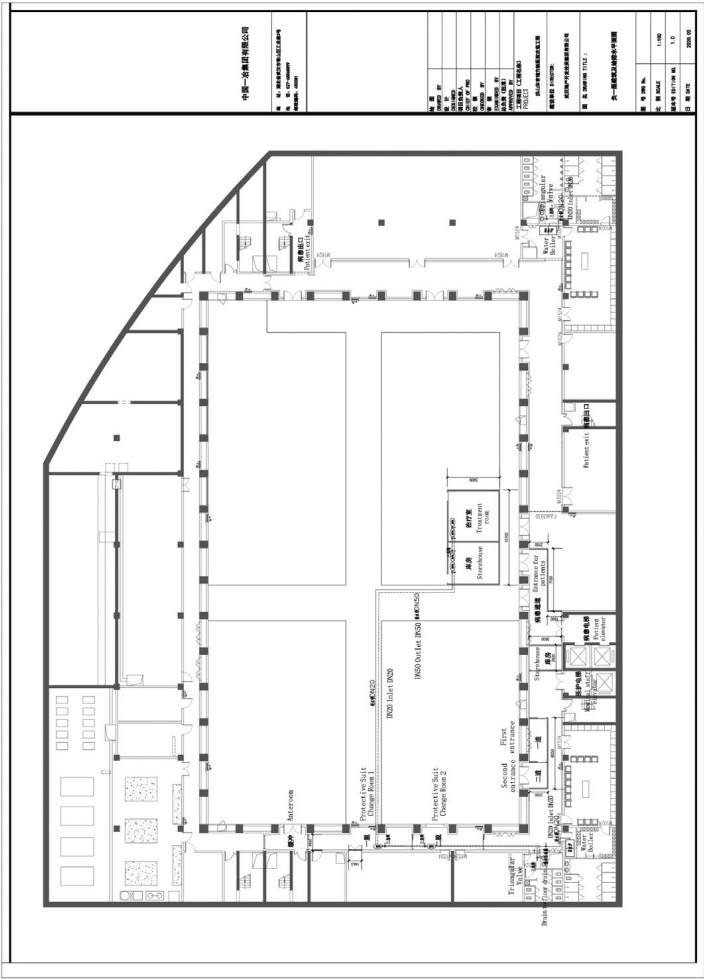


Fig. 2-14 Building, Water Supply and Drainage Plan of Wuchang Fangcang Shelter Hospital Basement 1

## 2.6.4 Fangcang shelter hospital reconstructed from vacant plant

Case: For the Fangcang shelter hospital reconstructed from vacant plant, we take Zall Rehabilitation Station in the Yangtze River Demonstration District, Wuhan as an example. Zall Rehabilitation Station in the Yangtze River Demonstration District is composed of 10 "small Fangcang" reconstructed from 10 vacant plants, and each "small Fangcang" covers an area of 1,200 square meters. The floor plan is shown in Fig. 2 - 15.

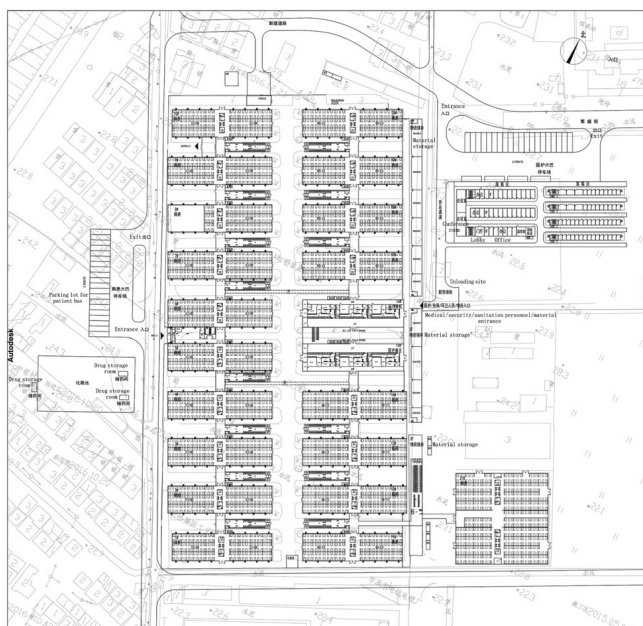


Fig.2 - 15 Plan of Zall Rehabilitation Station in Yangtze River Demonstration District

### 2.6.5 Fangcang shelter hospital reconstructed from waiting hall

**Case:** For Fangcang shelter hospitals reconstructed from waiting halls at bus and train stations, we take Zall (North Hankou) Fangcang Shelter Hospital as an example. Zall (North Hankou) Fangcang Shelter Hospital was reconstructed from the waiting hall at North Hankou Passenger Terminal in Huangpi District, Wuhan. The plane is shown in Fig. 2-16.





### 2.6.6 Fangcang shelter hospital reconstructed from multi – purpose venue in school

Case: For the Fangcang shelter hospital reconstructed from multi – purpose venue in school, we take Hanyang Fangcang Shelter Hospital located in Hanyang District, Wuhan as an example. The hall was reconstructed from the multi – purpose venue of Wuhan Sports School (three – story, 13,000 square meters) and Tennis Hall (4,800 square meters). The plans are shown in Fig. 2 – 17, Fig. 2 – 18, 2 – 19 and Fig. 2 – 20.

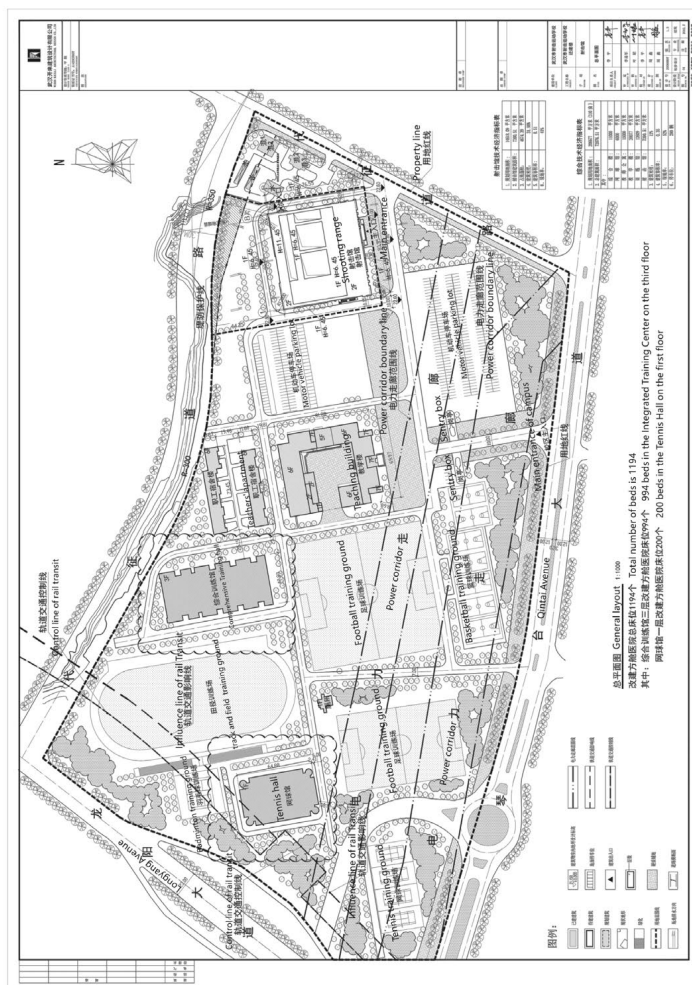


Fig. 2-17 Plan of Hanyang Fangcang Shelter Hospital



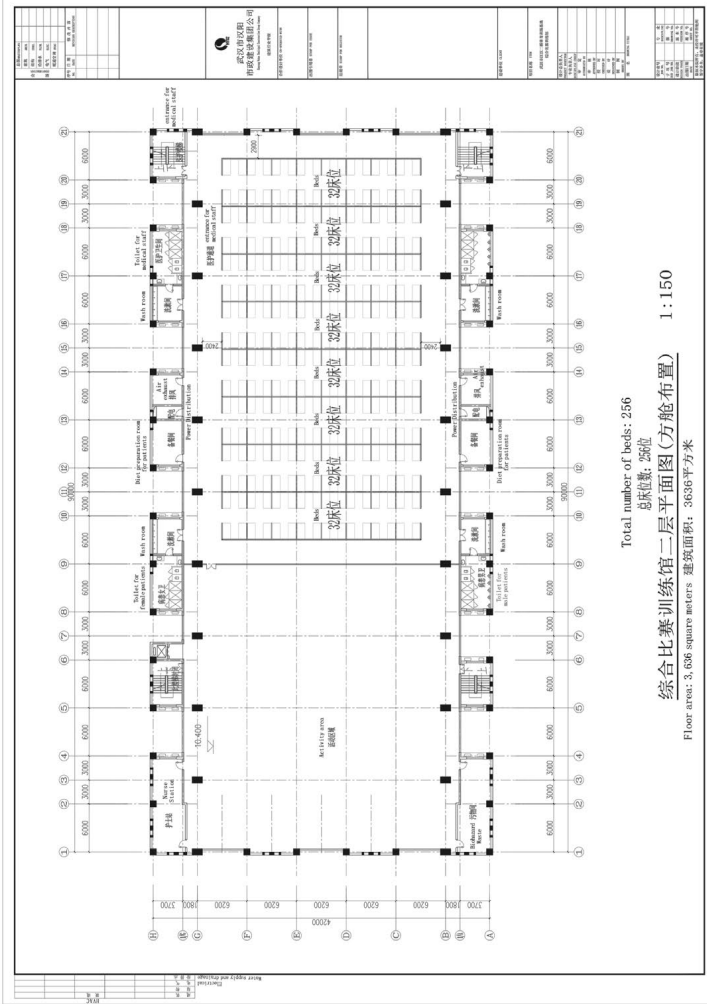


Fig.2-19 Plan of Hanyang Fangcang Shelter Hospital Floor 2

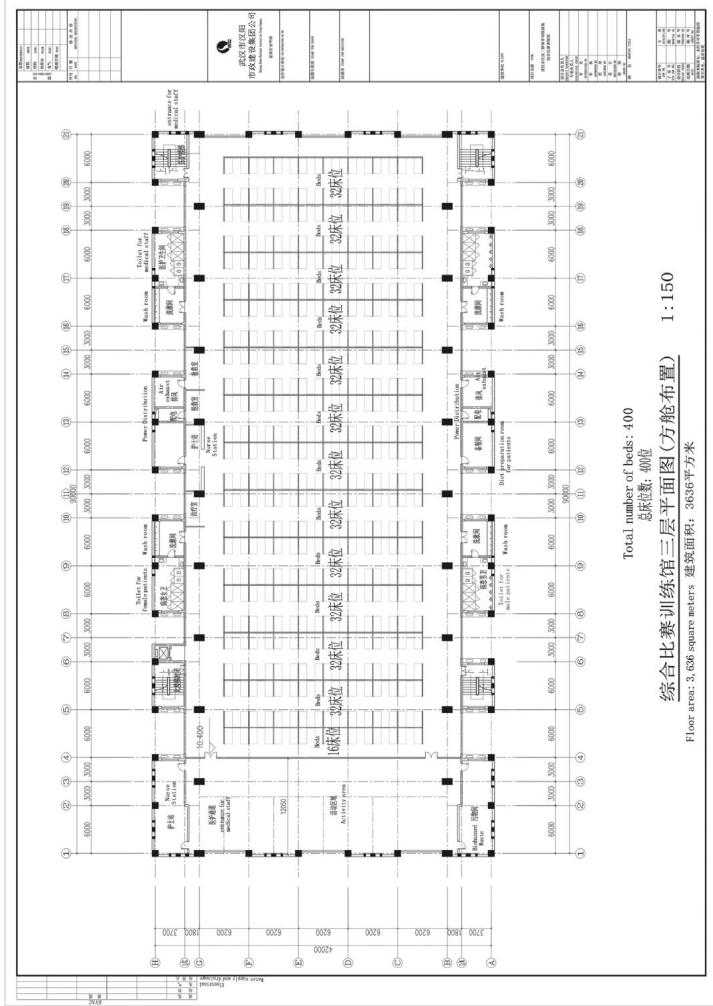


Fig.2-20 Plan of Hanyang Fangcang Shelter Hospital Floor 3

## **Chapter III**

# **Renovation into Fangcang Shelter Hospital for COVID – 19**

### **3.1 Contents of renovation into Fangcang shelter hospital**

#### **3.1.1 Basic contents**

The renovation of Fangcang shelter hospitals includes outdoor municipal facilities, sewage treatment facilities, internal building partitions, internal building facilities and equipment, external traffic passages, transportation passages for personnel and materials, adjacent environmental protection and improvement, health and epidemic prevention, biological safety, and safety protection and other aspects.

From renovation to the end of requisition, the building can only be used as the Fangcang shelter hospital.

The reconstructed Fangcang shelter hospital should meet the requirements of health departments and disease control departments at all levels.

The existing buildings should be appropriately reconstructed if they cannot meet the needs of " requirements of to be renovated buildings" perfectly.

### 3.1.2 Case reference

For large space such as exhibition halls, gymnasiums, waiting halls, multi - purpose venues at schools and vacant plants to be transformed into Fangcang shelter hospitals in a short time, water supply and drainage, HVAC, electricity and bed zoning should be renovated. We take Zall (Wuhan Salon) Fangcang Shelter Hospital as an example.



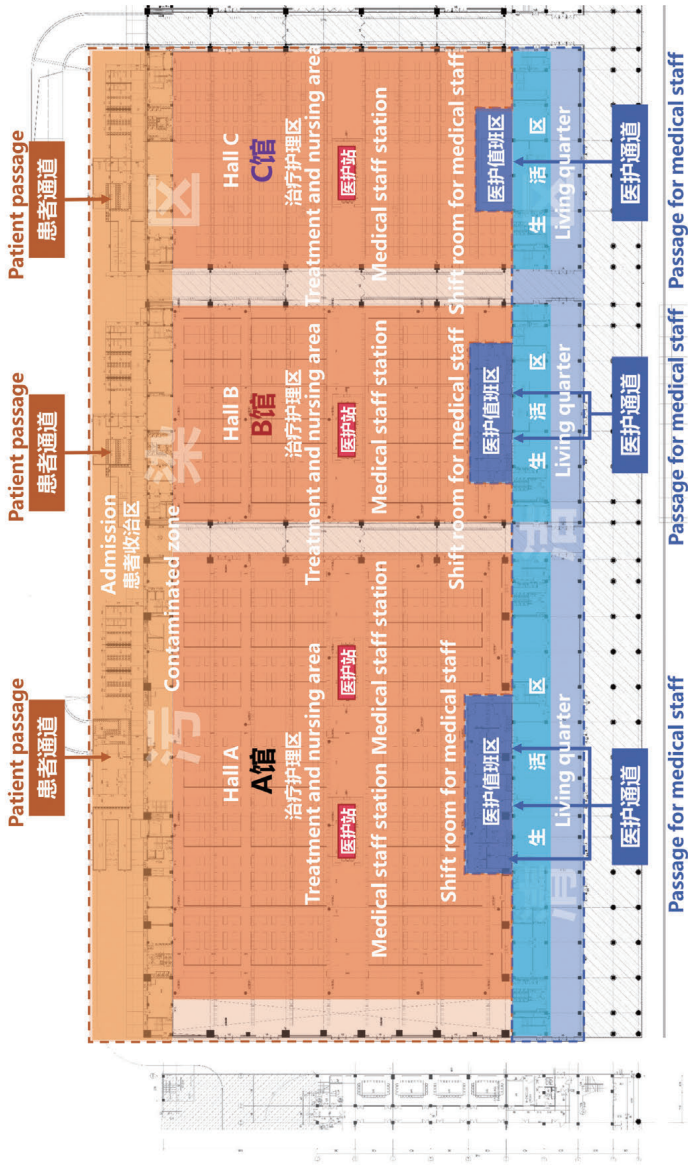


Fig.3-1 Contents of renovation into Fangcang shelter hospital

(1) About 1,500 beds in halls A, B and C are wired with strong electricity, and each bed is equipped with a socket; Indoor partition is installed.

(2) Civil and electrical installation is conducted for indoor nurse stations (medical waste room, storehouse and treatment room) in halls A, B and C.

(3) The partially contaminated indoor area (first changing room, second changing room, buffer room, rooms for wearing/taking off protective clothing, etc.) of halls A and C is equipped with mechanical air supply and exhaust system, power distribution are provided for supply and exhaust air fans, distribution boxes are made and electrical cables are laid, etc. Closed rooms (five in total for halls A and C) are added to the entrance of each partially contaminated area.

(4) Washrooms and shower rooms are arranged outside halls A, B and C. There are four lavatory containers outside Hall A (including 40 sets of upright wash basin and 40 sets of small kitchen water heater), two shower containers (including 12 sets of shower and 12 sets of electric water heater), four lavatory containers outside Hall B and Hall C (including 40 sets of upright wash basin and 40 sets of small kitchen water heater), and 2 shower containers (including 12 sets of shower and 12 sets of electric water heater). The above places are equipped with lighting lamps and cables, power is distributed for disinfection facilities and heating facilities, and for outdoor sewage

pumps, distribution boxes are made and cables are laid.

(5) The outdoor water supply system of Fangcang (PE main feed pipe of DN100, branch pipe connected to each water container, matching valves, etc.) is renovated.

(6) The outdoor drainage system of Fangcang [UPVC main drainage pipe of [DN150, 75 – cubic JHHFCD at the entrance of underground garages in Areas A and C, and one set of sewage hoisting equipment in areas A and C (four sets of submersible sewage pumps, two sets of control cabinets and corresponding valve fittings)] is renovated.

(7) Distribution boxes are made and electrical cables are laid for indoor mechanical exhaust systems and electrical exhaust air fans of Hall A and Hall C.

(8) The ward bed areas of Hall A, Hall B and Hall C are partitioned with ecological decorative boards to meet the requirements of fire prevention, beauty and privacy protection. Sockets are installed and cables are laid.

## **3.2 Requirements for renovation into Fangcang shelter hospital**

### **3.2.1 Site selection principles and requirements**

The buildings to be renovated into Fangcang shelter hospitals should be single – story or multi – story, and the building structure, fire resistance rating, fire prevention zoning, safe evacuation, firefighting facilities and firefighting lanes should meet the relevant requirements of the current specifications.

Fangcang Shelter hospitals should be as far away as possible from residential areas, commercial areas, schools and other crowded urban areas, away from production and storage sites of flammable, explosive, toxic and harmful gases. Danger signs should be set up at the periphery of the hospital, and there should be no less than 20m of green isolation distance between the existing buildings and the surrounding buildings. If there is no landscape, the isolation distance should not be less than 30 meters.

At the entrance of the reconstructed building, there should be parking and turning spaces for the rapid arrival and evacuation of ambulances. Convenient access, smooth internal contact, well – equipped basic medical facilities and barrier – free facilities should be ensured, and aside space should be set for tem-

porary parking and material turnover. The surrounding area should be equipped with necessary security facilities. The site should have space for temporary houses or tents, temporary medical facilities such as mobile inspection room and mobile CT room, as well as temporary toilets, washrooms and corresponding sewage treatment facilities. The internal space of the building should facilitate the rapid construction of partition. Facilities such as exhibition centers, gymnasiums, large-scale plants, storehouses, multi-purpose venues at schools as well as buildings with good fire-fighting conditions can be selected.

### 3.2.2 Requirements for structural safety

During the renovation and construction of the Fangcang shelter hospital, the structural designer shall obtain relevant load data for review whenever the load involved may exceed the design load of the original floor and take corresponding measures according to the review results. Focus on the following aspects:

(1) If there is heavy medical equipment, it shall be rechecked according to the equipment load information and its floor plan, and no treatment (the equipment load is less than the design live load), reinforcement or replacement of the layout position (the equipment load is greater than the design live load) shall be adopted respectively according to the rechecking results.

(2) When the partition is arranged on the floor, review shall be

conducted according to the layout of partitions and the load information of partition materials, and no treatment (equipment load is less than the design live load), reinforcement or lighter partition materials (equipment load is greater than the design live load) shall be adopted respectively according to the review results.

(3) If there is heavy mobile equipment, review shall be carried out according to the weight and the mobile route map, and corresponding measures shall be taken according to the review results.

(4) Newly – built partitions shall be installed firmly and connected tightly.

### 3.2.3 Requirements for firefighting facilities

(1) The original firefighting facilities and equipment are functioning properly. Ensure emergency evacuation lighting is functioning properly. Clear evacuation signs in each area. Original emergency exits meet the requirements and remain unblocked.

(2) Portable ammonium phosphate dry powder extinguishers shall be equipped in indoor spaces which are classified as fire hazardous area——category A of severely hazardous areas. A single extinguisher in severely hazardous areas shall have a minimum rating of 3A and a maximum area to be protected of

50m<sup>2</sup>. Ammonium phosphate MF/ABC5 shall be selected, and the configuration of building extinguishers shall be implemented in accordance with relevant national standards.

(3) Gas extinguishers shall be equipped in valuable equipment rooms, medical record rooms and (network) machine rooms of information centers.

(4) If a domestic water supply system is added in the Fangcang shelter hospital, and the fire hose reel is not provided in the original indoor fire control system of the building, a fire hose reel or a portable fire faucet can be added, and the arrangement should meet the requirement that at least one jet of water on the same plane can reach any part.

(5) Medical staff shall be provided with a filtering respiratory protective device for self-rescue from fire, which shall be placed in a conspicuous place with easy access in the Fangcang shelter hospital.

(6) The nurse station should be equipped with a micro fire station, and the portable high-pressure water mist fire suppression system shall have a storage capacity of 100L.

(7) If conditions permit, it is necessary to ensure that the renovated automatic fire alarm and fire linkage control system can operate reliably, and to set aside reasonable time intervals between working procedures.

### 3.2.4 Requirements for site construction

(1) A building model integrating design, procurement, construction and acceptance shall be adopted. Design, procurement and construction shall be highly integrated and all units shall cooperate closely on the construction site.

(2) Teams and groups responsible for different divisions, sections and operations shall carry out construction according to the requirements of modularity, standardization and assembly, so as to avoid cross-operation between teams and groups and to set aside reasonable intervals between working procedures.

(3) The construction of partition wall shall be organized according to design requirements of the building plan and the layout of isolation in different areas. The partition wall shall be made of lightweight fire-proof materials and has combustion performance of Class B1 or above. Taking separation unit as inspection lot, the stiffness, strength and stability of partition wall as well as the tightness of joints shall be inspected and accepted.

(4) Pipes running through the partition wall as well as equipment attached in the partition wall shall be locally reinforced; and the joints between lightweight partition wall and ceiling or other walls shall be prevented from cracking.



(5) Relevant indexes of ventilation, air conditioning and building electricity shall be tested to ensure compliance with the design as well as related standards.

(6) Epidemic prevention and safety management of field operators shall be enhanced. A fixed temperature check point shall be set at each entrance and floating temperature checkers shall be designated to move around to check the temperatures of personnel every four hours. Every worker shall correctly wear a mask to prevent cross infection.

(7) The construction site shall be provided with ventilation measures to keep free air flow. During construction, all washrooms and offices shall be disinfected every 6 hours.

(8) No smoking is allowed on the construction site. Fire safety management shall be enhanced on the construction site, fire working shall be minimized, and fire extinguishers or miniature fire stations shall be provided according to fire protection requirements.

(9) A standby dual power system shall be provided, a leakage protector shall be provided for each area, and electrical safety shall be ensured during construction power supply and operation stage.

### **3.3 Renovation of water supply and drainage system of Fangcang shelter hospital**

#### **3.3.1 Design basis**

Information drawings and relevant design materials provided by the Owner; Current applicable national rules and local regulations;

#### **3.3.2 Water supply system**

Water shall be supplied by the existing tap water pipe network of Fangcang directly, a reduced-pressure type backflow preventer shall be added at the inlet of incoming pipe to prevent backflow pollution, or a break tank shall be used for water supply. The water supply pressure shall not be lower than the water pressure of 0.25 MPa, and domestic water pressurization and domestic water chlorination interfaces shall be reserved. Flushing and disinfection facilities shall be provided at the parking lot. Indoor water supply pipes shall be PPR ones of Class S3.2 pipe series, and subject to hot-melt connection. Indoor hot water pipes shall be PPR ones of Class S2.5 pipe series, and subject to hot-melt connection. In case of a water supply pipe of  $DN \leq 50\text{mm}$ , a copper-core globe valve shall be used; otherwise, a copper-core stop valve shall be used. Hot-resistant valves shall be installed on hot water pipes. The copper-core gate valve with ductile cast iron enclosure, which

shall have a nominal pressure of 100 MPa, shall be installed on the pressure drainage pipe.

### 3.3.3 Water heating system

Water shall be heated by an electric water heater in each shower. The selected product shall be provided with ground protector, devices against dry burning, overvoltage and high temperature, leakage protection function and function of automatic power off in case of no water left.

### 3.3.4 Boiling water system

Each ward area shall be provided with a drinking water supply point separately, where sufficient room temperature direct drinking water and boiling water shall be available. Domestic water shall comply with the local Sanitary Standard for Drinking Water in terms of water quality. The bottled water dispenser can also be used for boiling water system.

### 3.3.5 Drainage system

The feces, vomitus, sewage and waste water discharged from ward areas shall be disinfected. It's not allowed to discard, dump or discharge any solid infective wastes and various waste chemical liquid into the sewer. It's strictly forbidden to discharge any sewage, medical sewage or contaminant that's non-disinfected or below standard from ward areas.

Domestic sewage from temporary mobile toilets and bathing areas must be disinfected. Sewage must be disinfected in a centralized way according to the sewage treatment requirements of local hospitals, and the treated water shall comply with current local "Discharge Standard of Water Pollutants for Medical Organization" in terms of water quality. Relevant specific procedures are as follows:

(1) Upon using the mobile public toilet, throw an appropriate amount of disinfectant tablets (peracetic acid, sodium hypochlorite or bleaching powder) into it in time. The sewage shall be collected and transported by the local environment protection department to the sewage treatment station for disinfection. It is not allowed to discharge sewage into the drainage pipe network of hospital area.

(2) The sewage from ward areas shall be collected nearby and discharged into the nearest existing septic tank of the hospital area. The sewage from medical personnel areas can be discharged into the existing drainage inspection well of hospital area. Sewage from ward areas as well as sewage and waste water from medical areas shall be discharged into the existing septic tanks separately, instead of sharing the existing drainage pipe network.

(3) The sewage from Fangcang shelter hospital shall be disinfected twice. In case of a three-cell septic tank built, throw

disinfectant into the sewage in the first cell for primary disinfection and then keep them in contact for at least 15 hours. It's forbidden to discharge sewage directly or sewage below standard. Then, the sewage shall be disinfected for the second time at the entrance (a sewage well) of municipal sewage pipe network and then can be discharged into the municipal sewage pipe network after being up to the standards. As for discharge standards for treated sewage, the sanitation department shall bring up with specific requirements.

(4) If any of disinfectants such as liquid chlorine, chlorine dioxide, sodium hypochlorite, bleaching powder and calcium hypochlorite is dispensed for disinfection, the contact time in disinfecting tank shall be 15 hours or above, the content of residual chlorine 6.5mg/L (free chlorine), the number of fecal coliforms smaller than 100 ones/L, and the reference available chlorine dosage 50mg/L. If it's hard to meet the contact time mentioned above, the chlorine dosage and the content of residual chlorine shall be appropriately larger.

(5) In case of no sewage treatment facility built, temporary sewage treatment tanks or mobile septic tanks shall be provided according to local conditions to effectively treat sewage as required by competent departments.

(6) Ventilation pipes of mobile toilets shall be provided with hepa filters or UV disinfection equipment on the roof top, which shall also be supplied by the mobile toilet manufacturer.

(7) Sewage from flushing and disinfection of vehicles shall be discharged into the sewage system, and water seal measures with a water seal depth of 50 mm or above shall be taken under the outlet. It's forbidden to use moveable mechanical piston instead of water seal.

### 3.3.6 Installation of drainage pipe

Drainage pipes shall be UPVC ones and bonded with plastic cement. Each washroom shall be provided with straight floor drain or grid - type floor drain with filter screen, below which a water lock with a water seal height of 50 mm or above shall be installed. When a sanitary fixture free of water lock is connected to a domestic water drainage pipe or any other drainage pipe possible to produce harmful gas, a water lock with a water seal height of 50 mm or above shall be installed under its outlet. Drainage pipes shall be installed as per the slopes specified below unless otherwise specified in the drawings.

**Standard slopes for installation of drainage pipes  
of Fangcang shelter hospital**

Pipe size	DN75	DN100	DN150	DN200
Standard slopes for installation of sewage and waste water pipes	0.025	0.020	0.02	0.01

45° tee, 45° cross, 90° lateral tee or 90° lateral cross must be used between horizontal pipes and between horizontal pipes and vertical pipes of drainage pipelines.

### 3.3.7 Sanitary fixture

Sanitary fixtures at all water consumption points as well as other places with sterility requirements or hospital – acquired infection prevention requirements shall be provided with non – contact or non – manual switches, and sewage shall be prevented from splashing outside. Water consumption points provided with non – manual switches shall meet following requirements:

(1) Basins for medical personnel as well as sinks, laboratory sinks and others provided for the Bacteriological Laboratory shall be provided with sensor faucets or knee switch – type faucets.

(2) For public washrooms, basins shall be provided with automatic sensor faucets, urinals with automatic valves, pedestal pan with inductive flush valves, and squat closet pans should be provided with foot operated self – closing flush valves or inductive flush valves.

(3) Basins shall be provided with sensor faucets or foot operated outlet valves, and squatting pans with foot operated valves.

## **3.4 Renovation of air supply, ventilation and air conditioning systems of Fangcang shelter hospital**

### **3.4.1 Implementation necessity of ventilation engineering**

Most existing ventilation and air conditioning systems of buildings of Fangcang shelter hospital are positive – pressure ones and only a few are negative – pressure ones, unable to meet medical requirements. The renovation of ventilation system is to make the most use of existing ventilation and air conditioning equipment and facilities, add some equipment and facilities according to use requirements and design requirements, change the air supply and exhaust strategies of original system, and put clean area, contaminated area and partially contaminated area at different pressure gradients, with the pressure in the clean area ranking first followed by those in the partially contaminated area and contaminated area successively.

### **3.4.2 Implementation mode of ventilation engineering**

To accelerate the progress of the project and fully realize the design effect, the EPC mode of integrated "design – procurement – construction" can be adopted. Design, procurement and construction personnel shall communicate and discuss with



each other within the same space and the same time in a parallel way so that design schemes, equipment and goods as well as construction schemes can be determined at the same time. In addition, design drawing printing, equipment allocation as well as multiple construction links such as labors, materials and machines shall be carried out simultaneously. By this way, space is sacrificed for time so that the construction period can be shortened to save costs. At the design stage, procurement, construction and designer teams shall cooperate with each other precisely and communicate with each other in time. Site survey, equipment procurement, preparation of construction materials, organization of construction teams/groups and development of construction schemes shall be completed in advance. Once the preliminary design is completed, construction conditions are met. At the construction stage, the designer shall provide on-site service so that the design scheme can be adjusted according to the site conditions in time.

### 3.4.3 Design points of ventilation engineering

(1) Contaminated areas and partially contaminated areas shall mainly be mechanically ventilated, and low/medium/high-efficiency (sub-high efficiency) filters shall be installed at the inlets of exhaust air fans. Small spaces such as clean areas can be mechanically or naturally ventilated.

(2) Central air-conditioning systems for contaminated areas

and partially contaminated areas shall be provided with air cleaning and disinfection devices. If possible, clean air conditioning systems above sub - high efficiency filter level can be provided for air - conditioning units. Ultraviolet disinfection lamps can be installed nearby return air filters and surface air coolers.

(3) Temporary air intake and exhaust settings shall be made based on the designed medical personnel area and designed isolation ward area to ensure that air flows from the medical personnel area to the isolation ward area. Supply air fans and exhaust air fans (supply air inlets and exhaust air outlets) shall be arranged to form reasonable air flow corridor, without any ventilation dead corner left to the best extent.

(4) Original air conditioning and exhaust systems that can still be used shall be set as DC air supply and exhaust systems. Return air valves of air conditioning units shall be closed, and their outside air dampers shall all be opened to send full fresh air, with the exhaust air rate larger than the air supply rate (in case of insufficient exhaust air fan capacity, the smoke extraction fan can be started). When original air conditioning and exhaust systems cannot be used or no ventilation system is provided, a ventilation system shall be added. When it's necessary to install an additional exhaust system, a cabinet fan with a suitable blowing rate and a suitable wind pressure should be chosen. It shall be set to be 2 m high at most and provided with protection measures. The ventilation system shall operate

uninterruptedly 24 hours a day.

(5) The exhaust air rate shall be designed to be  $150 \text{ m}^3/\text{h}$  for per person or above.

(6) Medical personnel enter the contaminated area from the clean area via "primary changing room – secondary changing room – buffer room". An air supply rate of 30 times/h or above shall be set for "primary changing room". Each adjacent compartment shall be provided with a D300 vent spool, and the air shall flow from the clean area to the isolation area. Medical personnel get back to the clean area from the isolation area via "buffer room – isolation gown change room – protective suit change room – uniform removal room – shower – primary changing room". An exhaust air rate of 30 times/h or above shall be set for the "buffer room – isolation gown change room". Each adjacent compartment shall be provided with a D300 vent spool, and the air shall flow from the clean area to the contaminated area.

(7) Several air filters with disinfection function shall be provided in each isolation ward area. Several electrical oil heaters can be provided if heating facilities are required according to actual conditions.

(8) Isolation ward areas shall be provided with emergency dry toilets; Additional exhaust air fans shall be provided for toilets provided in the lavatories of isolation wards and the medical

personnel areas to meet an air exchange rate of 12 times/h. High-efficiency filters should be added at the inlets of exhaust air fans.

(9) Installation positions of supply air fans and exhaust air fans shall be set according to actual conditions. It shall be ensured that the fresh air is taken from outside. The air intake of fresh air and its surrounding environment must be clean to ensure uncontaminated fresh air. Outdoor air exhaust should be conducted at a high altitude and at a position 20 m or above away from any air inlet in terms of horizontal distance and 6 m or above in terms of vertical distance.

### **3.5 Renovation of electrical and intelligent management systems of Fangcang shelter hospital**

(1) The ventilation equipment control box should be a complete approved product and controlled from the nurse station (duty room) in a centralized way.

(2) To minimize glare impacts caused by the lighting fixtures on the top of original building, some lighting fixtures can be added on surrounding walls of large bays, or some pole lamps can be erected on the ground. Such lighting fixtures added should be provided with non-transparent covers or provide indirect lighting, and shall be supplied with power by the spare

circuit.

(3) Sufficient wireless network access conditions shall be provided to ensure the full coverage of 4G/5G network. Places meeting relevant conditions should be provided with the full coverage of wireless AP and WiFi.

(4) Lighting or socket power lines and LV lines added on the ground shall be laid in metallic conduits or metal troughs. Such conduits or troughs shall be laid away from personnel passages and cargo transportation passages. If this requirement cannot be met, necessary measures shall be taken.

(5) Buffer areas of washrooms shall be provided with UV sterilizer sockets or air sterilizer sockets which shall be supplied with power by the reserved circuit. UV sterilizers shall be provided with special switches, shall not be in parallel with those of common lamps, and shall be specially identified.

(6) Medical equipment rooms, showers or washrooms with bath functions shall be provided with supplementary (local) equipotential bonding.

(7) Nurse stations (duty rooms) shall be provided with one-key alarm buttons which can send signal to the security duty room.

(8) Patient rest areas and nurse stations should be fully covered

by video monitoring.

(9) Each patient rest area shall be provided with an overhead projector and a curtain in different zones, both of which shall be connected to the cable television system.

(10) Hospital beds meeting relevant conditions should be provided with sockets on their partitions. All circuits shall receive insulation test before transmitting power. The insulation resistance test voltage and insulation resistance between LV or ELV power distribution lines and between these lines and ground shall not be lower than 0.5 Ohm to ensure the safety and reliability of additional lines.

### **3.6 Configurations of ward areas in Fangcang shelter hospital**

Each ward area shall be provided with an exhaust system to maintain negative pressure, the exhaust air rate of which shall be set to be  $200\text{m}^3/\text{hxp}$  or above. The exhaust system shall be provided with a low-efficiency filter (G4) + a medium-efficiency filter (F8) + a high-efficiency filter (H11). The air to be exhausted will be processed by such filters before being exhausted via a vertical pipe at a high altitude. The outside door of each ward area shall be opened to make up air at an negative pressure.

The exhaust pipe at the fan outlet, which is made of fabric duct, shall be processed and transported by the supplier to the site for installation. The outdoor exhaust outlet of exhaust system shall not be lower than the eave and shall exhaust air at a high altitude. A rat-proof wire mesh shall be installed at the inlet of each exhaust air fan, and the gaps between fans and with door opening shall be tightly sealed.

Electrostatic air cleaners shall be provided in ward areas and main passages as well as at nurse stations so as to kill bacteria and viruses and purify the air in ward areas.

### **3.6.1 Configurations of buffer area**

The buffer area shall be provided with air supply and exhaust systems. The primary changing room in the buffer area shall be provided with an air supply rate of 30 times/h. A hole shall be made in the partition wall between primary and secondary changing rooms so that air can flow from the primary changing room to the secondary one. The bathroom, isolation gown change room and protective suit change room shall be provided with an exhaust system each.

All supply air fans and exhaust air fans in the buffer area shall be provided with air treatment devices (sub-high efficiency ones) internally. The air duct, with a diameter of D110, shall be made of metal bellows and UPVC pipes.

### 3.6.2 Configurations of other areas

Outdoor washrooms and showers shall be provided with exhaust systems, with the exhaust air rate designed to be 8 times/h or above. Every exhaust air fan shall be provided with an air treatment device (sub – high efficiency one) internally. The air duct, with a diameter of D110, shall be made of metal bellows and UPVC pipes.

## 3. 7 Hardware and software construction of Fangcang shelter hospital

### 3.7.1 Hardware construction

Construction in Fangcang: Hardware construction in Fangcang mainly involves ward beds. It's suggested to call bunk beds and folding beds from schools or troops, which can be disinfected after the end of the pandemic, and to separate them with environment – friendly and pollution – free ecological decorative boards. Additionally, quilts, mats and other bedding shall be procured. In case of low air temperature, some electric blankets, hand warmers, patch panels and others shall also be prepared. If possible, 5G communication network shall be provided to facilitate the communication between people in the Fangcang and those outside the Fangcang.

Construction outside Fangcang: High – tech equipment such as mobile scan vans, test vans, recovery trunks and P3 mobile la-



laboratories shall be equipped for virus examination and test.

### 3.7.2 Software construction

In Fangcang, a certain proportion of medical teams, cleaners and food delivery personnel shall be equipped based on the number of patients and the size of Fangcang. Take Zall (Wuhan Salon) Fangcang Shelter Hospital for example. Totally 1169 persons in totally 22 medical teams, 15 nursing teams and 1 radiographer team from across the country were assembled here successively. The four – level management system was implemented for medical personnel: head of the department of medical administration, exhibition hall director, Fangcang leader and doctor. The system of working in 4 shifts (A, P, N1 and N2, 6 hours per shift) was implemented for medical personnel. Each medical personnel can have a day off after working every two days. In each shift, there was a doctor and 5 nurses taking care of about 100 patients.

Logistics services, such as food delivery, public security, cleaning, disinfection, psychological counseling, water supply, heating and power supply, are mainly provided outside the Fangcang. Take Zall (Wuhan Salon) Fangcang Shelter Hospital for example. There was a logistics support team of over 100 persons, including 54 cleaners. These cleaners were classified into three shifts per day to perform uninterrupted cleaning, with each cleaner disposing 600 – 700 kg of wastes per day averagely.

## **Chapter IV**

# **Operating Scheme of Fangcang Shelter Hospital**

### **4.1 General rules for operational management of Fangcang shelter hospital**

#### **4.1.1 Management principles**

Targeted admission, centralized quarantine, zoned management by unit, standardized treatment, and two-way referral.

#### **4.1.2 Operation purpose**

Treat confirmed mild COVID-19 patients from communities in isolation, control sources of infection to avoid cross infection in communities, carry out propaganda and education on COVID-19 as well as psychological counseling in a unified way, and treat and observe patients scientifically in time to prevent the patients' conditions getting worse and lower down the number of severe patients and mortality.

### 4.1.3 Organizational structure

The Fangcang shelter hospital is under the unified dispatch of the prevention and control command center. The director of the hospital is fully responsible for its operation and management, and the deputy director is responsible for division of labor cooperation. Many work groups are provided in the hospital to carry out specific work:

(1) Integrated information group (with leader): preparation of operation schemes; determination of processes; overall division of labor and coordination; collection, publicity and reporting of various operation data; cooperation and coordination on transferring; scheduling of administration staffs; and coordination of operation issues.

(2) Health operation group (with leader): including medical group and nursing group. The medical group is responsible to prepare health care plans, develop relevant core systems and processes, summarize the information of doctors and make schedules. The nursing group is responsible to arrange nursing work, including preparing nursing plans and processes, summarize the information of nursing staffs and make schedules.

(3) Hospital infection control group (with leader): preparation and implementation of hospital infection prevention and control systems, protection training, and hospital infection patrol and monitoring during operation.

(4) Logistics support group (with leader): allocation of supplies, living security, support of equipment and facilities, preparation of medicines, environmental sanitation, disposal of medical wastes, sewage discharge etc.

(5) A functional management department can be provided for each hospital in combination with actual conditions.

#### 4.1.4 Working method

Each work group shall have a clear division of labor, perfect its own working system and work program, classify group members into different shifts and make schedules correspondingly, and implement the overall duty system. Besides, each work group shall be responsible for communication, coordination, information reporting, and urging relevant responsible group to address various problems arising from the operation of Fangcang in time. The system of scheduling based different time periods, shift change management system, and summary and report system shall be implemented.

#### 4.1.5 Work discipline

(1) Be subject to overall command, have clear division of labor, act proactively, and provide mutual support.

(2) Ensure unobstructed communication, and keep the phone

on 24 hours a day.

(3) Don't be late or leave early. In case of any exceptional case, please report it in advance.

(4) Observe the rules on information confidentiality. Do not disclose inappropriate information at will.

## **4.2 Admission standards for patients of Fangcang shelter hospital**

The confirmed cases of COVID – 19 admitted to Fangcang shelter hospital based on actual situation shall:

(1) Present mild symptoms (with mild symptoms, no evidence of pneumonia showed in imaging) or typical symptoms (fever, respiratory symptom and other symptoms, evidence of pneumonia on imaging).

(2) Be able to live independently and walk by themselves.

(3) Be free of severe chronic diseases, including hypertension, diabetes, coronary heart disease (CHD), malignant tumors, structural lung disease, pulmonary heart disease, and immunosuppression.

(4) Have no history of mental illness.

(5) Have a finger blood oxygen saturation ( $\text{SpO}_2$ ) of over 93% and a respiratory rate of less than 30 bpm at rest.

(6) With other special remarks to be given.

### **4.3 Admission procedure of Fangcang shelter hospital**

(1) Before 10 am every day, the head of the nursing group (head nurse) in each admission area of patients reports the number of patients that can be transferred to the director of the hospital office according to the status of available beds. Then the director of the hospital office contacts with the deputy director to determine the number of patients to be received on the same day and reports to the Epidemic Prevention and Control Command Center of Fangcang shelter hospital (hereinafter referred to as the Command Center).

(2) According to the number of available beds provided by Fangcang shelter hospital and the number of patients to be received, the Command Center determines the final number of patients transferred to Fangcang shelter hospital and sends the list and basic information of patients (including ID, contact number, state of illness, medication) to Fangcang shelter hospital.

(3) Fangcang shelter hospital organizes a panel to review the status of the patients according to the admission standards, determines the list of the patients to be received, assigns ward area and bed number for each patient on the same day, issues a transfer certificate for each patient and reports it to the Command Center.

(4) The Command Center prints the information of each patient (accompanied by patient ID) and delivers it to the patient with the transfer certificate.

(5) The Command Center is responsible for arranging the transfer of patients, coordinating ambulance dispatch, ambulance attendants, and ambulance information, and sending the ambulance number and patient ID to Fangcang shelter hospital upon the departure of the ambulance.

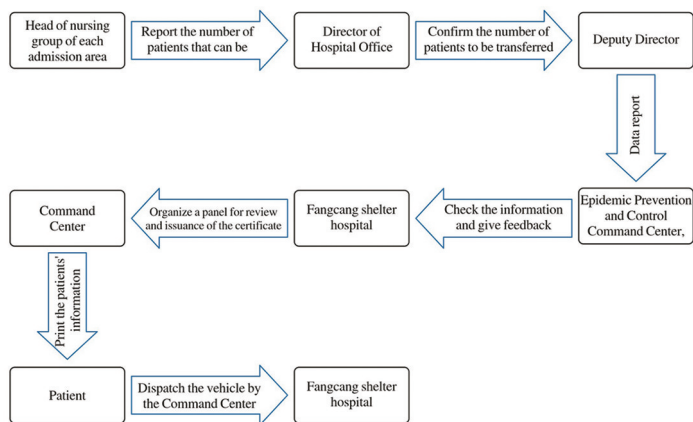


Fig. 4 – 1 Admission Procedure Chart of Fangcang shelter hospital

## 4.4 Pre – examination and triage of Fangcang shelter hospital

Fangcang shelter hospital arranges the medical staff to perform pre – examination and triage for the admitted patients. After pre – examination and assessment, the medical staff are responsible for guiding the patients who meet the admission standards to check in as soon as possible; the principle "admission first, transfer later" shall be followed for patients who do not meet the admission standards while present serious symptoms. To ensure medical safety, the medical staff shall place those patients in the observation and treatment area of severe cases of the hospital first, then give timely treatment and close monitoring, and contact the designated hospitals and arrange the transfer for treatment in time.



## **4.5 Daily examination of inpatients in Fangcang shelter hospital**

Closely monitoring the vital signs and oxygen saturation as per the following procedures:

(1) Measure and record body temperature at 8 am, 12 am, 4 pm and 8 pm, respectively;

(2) Record respiratory rate (RR) at 8 am and 8 pm, respectively;

(3) Measure heart rate (HR) and finger blood oxygen saturation at 8 am and 8 pm, respectively; Patients feeling uncomfortable may use a finger clip oximeter to detect the transcutaneous oxygen saturation; continuous monitoring of oxygen saturation is required for patients with the severe disease until the condition is relieved or the patients are transferred to another hospital.

(4) Whether to conduct laboratory tests or imaging tests is decided by the responsible physician according to the patient's condition;

(5) Whether to perform special examinations is decided by the responsible physician according to the patient's condition.

## 4.6 Management of severe patients in Fangcang shelter hospital

Severe patients refer to those who have been seriously ill at admission and the mild patients who have an exacerbation of the condition during hospitalization. In each ward area, a relatively independent observation and treatment area shall be set for severe patients. It shall be equipped with oxygen cylinders, rescue ambulance, rescue medicine, simple respirator, and monitoring and rescue equipment, as well as non-invasive ventilator and transfer wagon (where possible). A specially assigned person shall be responsible for the area and allocation of the medical staff shall be strengthened and prioritized.

### 4.6.1 Indications of severe patients in initiating consultation and transferring to the observation area of severe cases

- (1) Continuous subjective symptoms without alleviation or even showing a worsening trend;
- (2) Warm water intake and physical cooling when the body temperature is within  $38^{\circ}\text{C}$ , the symptoms are considered not relieved if the body temperature is still higher than  $38.5^{\circ}\text{C}$ ;
- (3)  $\text{RR} \geq 30$  bpm, oxygen inhalation, not relieved;

(4) Finger blood oxygen saturation  $\leq 93\%$ ;

(5)  $HR \geq 100\text{bpm}$ ,  $BP \geq 140/90\text{mmHg}$ ; Patients with hypertension are treated by taking antihypertensive drugs orally on a regular basis; Patients with hypertension do not get improvement after inhaling oxygen and bringing down the fever.

#### 4.6.2 Rescue procedure for severe patients

Transfer the patients to the observation and treatment area of severe cases with wheelchairs or wagons; Evaluate the state of illness, open the intravenous corridor and implement treatment; Provide life support and conduct monitoring; Apply to transfer the patients to the designated hospitals by reporting to the Command Center according to the above transfer procedures; Record the actual situation and report.

#### 4.6.3 Transfer standards for severe patients

Generally, patients who meet one of the following indicators are considered to satisfy the transfer standards: respiratory distress,  $RR \geq 30\text{bpm}$ ; Oxygen saturation  $\leq 93\%$  at rest; Arterial partial pressure of oxygen ( $\text{PaO}_2$ )/fraction of inspired oxygen ( $\text{FiO}_2$ )  $\leq 300\text{ mmHg}$  ( $1\text{ mmHg}=0.133\text{ kPa}$ ); The lesion shows a significant progression of  $>50\%$  within 24 to 48 hours as shown in lung imaging findings; Patients with combined severe chronic diseases, including hypertension, diabetes, coronary heart diseases, malignant tumor, structural lung

diseases, pulmonary heart diseases, and immunosuppression. Patients who need to be transferred out for other special and emergency reasons.

#### 4.6.4 Transfer procedure for severe patients

During the treatment, patients in Fangcang shelter hospital have changes in conditions and meet the transfer standards after consultation by the consultation group in the corresponding area of Fangcang shelter hospital shall refer to the following transfer procedures:

- (1) The responsible physician asks the superior physician in the corresponding area of Fangcang shelter hospital to conduct consultation after examination and evaluation;
- (2) Patients who meet the standard of the severe case after consultation shall be reported to the Command Center immediately and transferred to the designated hospitals for treatment;
- (3) Complete the transfer registration form and wait for the transfer instruction from the Command Center;
- (4) Coordinate to complete the handover of patients upon reception of the instruction; arrange medical personnel to escort the transfer, and develop and fill in the registration statement and report the information.

## **4.7 Discharge standards and procedure for patients of Fangcang shelter hospital**

### **4.7.1 Discharge standards**

Patients who meet all of the following conditions are allowed to be discharged from the hospitals:

- (1) Normal body temperature for over 3 days;
- (2) Significant improvement of respiratory symptoms;
- (3) Obvious absorption of inflammation as shown in lung imaging findings;
- (4) Positive results of two consecutive nucleic acid testing (NAT) of the respiratory pathogen (at least 24 hours of sampling interval).

Patients who meet the above conditions can be discharged from the hospital after the specialists from both the ward and hospital agree that the patients met the discharge conditions during the consultation.

### **4.7.2 Discharge procedure**

- (1) The responsible physician asks the superior physician in the

corresponding area of Fangcang shelter hospital to conduct consultation after relevant review for discharge standards;

(2) Patients who meet the discharge standards after consultation shall be reported to the medical group of the Command Center;

(3) Complete the transfer registration form and wait for the transfer instruction from the Command Center;

(4) Coordinate the Command Center to complete the handover and transfer of patients upon reception of the instruction; develop and fill in the registration statement and report the information.

(5) Inform the precautions of home quarantine: self-isolate in a single room while wearing a mask and avoid going out. Patients shall measure their body temperature every day during the 14-day home quarantine. For those who do not have conditions for home quarantine, the Command Center shall arrange centralized isolation. When the patients present fever, cough, and other symptoms, or the original symptoms worsen, it shall be immediately reported to the person in charge of the community, and the patients shall seek medical attention at the designated hospitals.

## 4.8 Disinfection process of discharged patients

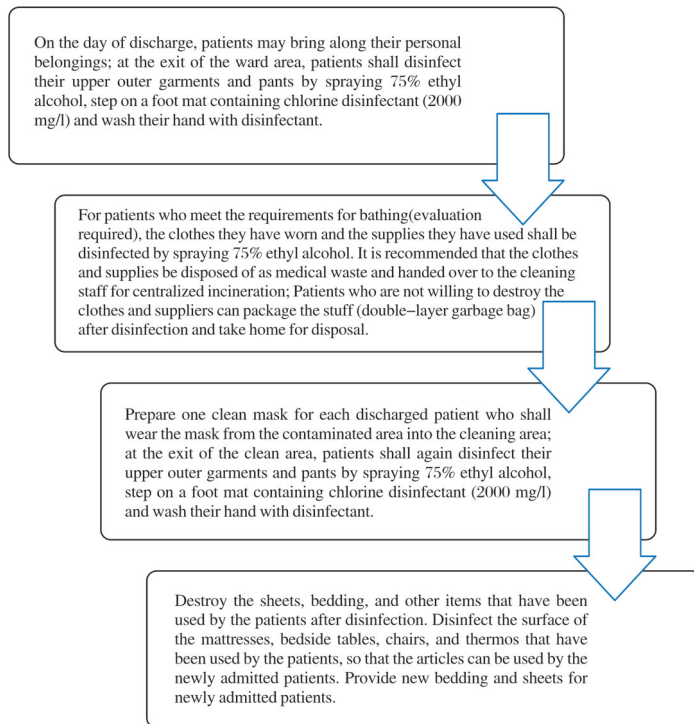


Fig. 4-2 Disinfection Process for Discharged Patients of Fangcang Shelter Hospital

# Chapter V

## Logistics Support Program of Fangcang Shelter Hospital

To ensure the logistic support and supply within Fangcang shelter hospital, the Logistics Support Group, in combination with the actual situation of logistics, formulates a detailed program in terms of the catering, accommodation, cleaning, supplies, other materials, etc.

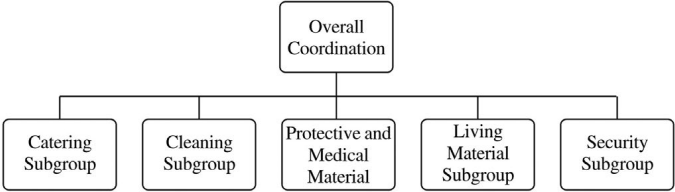


图 5-1 Logistics Support Chart of Fangcang Shelter Hospital

### 5.1 Materials support

#### 5.1.1 Catering assurance

##### 5.1.1.1 Personnel allocation

One responsible person shall provide the contact information and coordinate with other departments.



#### 5.1.1.2 Specific work

(1) Count the number of patients and staff every day and make a list, prepare the meals in advance and ensure a sufficient supply of meals.

(2) Distribute the meals according to the list in an orderly manner within the specified time.

(3) Keep close touch with the catering company.

(4) Ensure to provide a clean, safe and hygienic dining environment.

(5) Guarantee daily delivery of fresh food, and implement strict acceptance criteria for the quantity and quality to ensure food safety.

(6) According to the allocation of each meal, it is suggested to deliver breakfast, lunch, and dinner at 7:00 – 8:00, 11:30 – 12:30, and 17:30 – 18:30, respectively.

#### 5.1.1.3 Specific requirements

(1) Deliver the meals of the patients and medical staff to the designated areas before the specified time, and give notice in the communication group or other approaches of broadcasting.

(2) Summarize the delivery situation of three meals every day, including breakfast, lunch, dinner, and the status of patients

and staff in receiving the meals.

### 5.1.2 Cleaning assurance

#### 5.1.2.1 Personnel allocation

Two responsible persons shall provide the contact information and coordinate with other departments.

#### 5.1.2.2 Specific work

(1) Cleaning personnel shall be assigned for each area, including public areas, patient areas, clean areas, toilets, bathrooms, and other places.

(2) Arrange cleaning personnel as required; the cleaning personnel shall clean up the garbage in time and prevent a pile-up.

(3) Timely deployment shall be conducted in case of a shortage of manpower.

(4) Provide guidance for the patients in terms of personal hygiene.

#### 5.1.2.3 Specific requirements

(1) Carry out regular cleaning at 9:00, 14:00 and 19:00 (after each meal) every day and immediately rectify for any non-compliance; cleaning staff responsible for each area shall sign

in every one hour in corresponding responsible area.

(2)Garbage clearance; set waste containers in the aisles, doorways and dining areas on each floor; cleaning staff is responsible for cleaning up the garbage and transferring them to the garbage chamber; pile – up is not allowed.

### 5.1.3 Assurance of protective medical supplies

#### 5.1.3.1 Personnel allocation

Two responsible persons shall provide the contact information and coordinate with other departments.

#### 5.1.3.2 Specific work

Make the list based on the work schedule of physicians and nurses submitted every day and ensure the protective material supply of medical staff; Make registration for the use of temporary protective materials according to the temporary work schedule. All PPE shall be received within 6 hours to avoid wasting; Prepare a catalog concerning the reception of protective suits, and ensure making a correct account and consistency between the material and the account; Set up a special post for the distribution of protective materials (24h shift); Provide oxygen cylinders and medicinal products for the patients by area at any time.

#### 5.1.3.3 Specific requirements

(1) That the inventory of protective materials is less than 100 sets (the specific standard is determined according to the number of healthcare workers in Fangcang Shelter Hospital) shall be reported for coordination.

(2) Instruct the dress-up procedures of the protective equipment at the material distribution area to avoid cross infection.

(3) At the material distribution area, the receiver shall tell his real-name, sign with a real name and then receive the materials according to the work schedule.

#### 5.1.4 Living material support

##### 5.1.4.1 Personnel allocation

Two responsible persons shall provide the contact information and coordinate with other departments.

##### 5.1.4.2 Work contents

(1) Provide sufficient daily necessities for patients, such as quilts, electric blankets, cups, basins and towels.

(2) Coordinate the supply of water, electricity and network in time to guarantee patients available hot water and power source.

(3) Arrange working areas reasonably to contain computers,

stationary, desks, chairs and other office supplies.

(4)Contact with the donation office to make sure that donated materials are stored and distributed for timely and full use.

#### 5.1.4.3 Specific requirements

(1)The collection registration list shall be completed based on patients' bed numbers.

(2)The daily distribution of supplies shall be counted to ensure adequate supplies.

### 5.1.5 Drug management

#### 5.1.5.1 Development of drug catalog of the Fangcang shelter hospital

The demand for COVID-19 therapeutic drugs shall be assessed and analyzed on the basis of characteristics of patients admitted to the Fangcang shelter hospital, combining diagnosis and treatment protocols and guidelines and front-line clinical expert opinions, which mainly fall in drugs for symptomatic treatment, complication prevention and treatment, treatment of basic diseases and first aid. A drug catalog of the Fangcang shelter hospital shall be determined eventually by clinical pharmacists in the department of pharmacy and procurement department. Subsequently, drugs shall be adjusted and supplemented in quantity and variety according to clinical

actual situations.

The drug catalog of the Fangcang shelter hospital includes the following categories of drugs:

- (1) Antiviral, antibacterial, analgesic – antipyretic, antitussive, antiasthmatic and expectorant, gastrointestinal drugs;
- (2) Hypnotics and sedatives;
- (3) Drugs for blood pressure or glucose reduction, lipid regulation and other chronic diseases;
- (4) Chinese patent medicines or other traditional medicines clinically tested to be effective in the rehabilitation of COVID-19 patients;
- (5) Drugs for first aid;

#### 5.1.5.2 Establishment of Fangcang shelter hospital pharmacy

Take Zall (Jiangnan Wuzhan) Fangcang Shelter Hospital for example. Zall (Jiangnan Wuzhan) Fangcang Shelter Hospital Pharmacy covering an area of about 30m<sup>2</sup> in the clean area zone is divided into the qualified area, unqualified area and secondary storage area. The pharmacy is equipped with computers, printers, fire – fighting equipment, anti – theft equipment and other infrastructure to ensure that drug storage conditions meet requirements of relevant management regulations.

#### 5.1.5.3 Drug purchase and supply

The drug supply support group is responsible for the formulation of drug procurement and requisition plan and centralized purchasing. The emergency leading group for pharmaceutical affairs is responsible for determining the list of drugs to be urgently purchased based on the above-mentioned drug catalog of the Fangcang shelter hospital pharmacy. Basically, the supply of clinical essential drugs and common drugs shall be ensured. More importantly, the group shall guarantee the supply of drugs for COVID-19 prevention and treatment and provide a special area for their storage. These drugs must be purchased from legally qualified drug distributors, and qualifications of relevant distributors and business personnel shall be filed. In case of drug shortage, the group shall actively negotiate with suppliers and urge them to expand the purchase corridor or transfer drugs between regions. If any drug is difficult to purchase, the group shall actively seek its alternative medicines and issue the medicine guidelines to clinics.

#### 5.1.5.4 Management of donated drugs

##### (1) Acceptance criteria for donated drugs

① For drugs produced in China, the varieties must be approved by local drug administrations for production to obtain the approval number and meet quality standards with the shelf life of over 6 months.

② For drugs produced outside China, the varieties shall be ap-

proved and registered by local regulatory authorities, included in the international general pharmacopoeia and legally produced and marketed in registered countries, and meet quality standard; the expiry date is more than 6 months.

## (2) Standard procedure for accepting donated drugs

① Development of the donated drug catalog to the Fangcang shelter hospital: Relevant staff discusses and develops an acceptably donated drug catalog and regularly update it. Donation of drugs in the catalog can be accepted directly.

② Handling procedure of donated drugs outside the catalog: After receiving a donor's willingness to donate, the drug supply support group shall submit product information and instructions provided by the donor to the department of pharmacy for clinical demonstration and evaluation or consult the clinical medical team and experts to determine whether to accept the donation.

③ Quantity of donated drugs accepted: The emergency leading group for pharmaceutical affairs shall determine the quantity based on the drug usage and dosage, epidemic duration and epidemic development stage at its discretion.



## 5.2 Cultural support

The Fangcang shelter hospital is actually a "special community" for mild patients. In order to enrich the cultural life of patients in the Fangcang shelter hospital and enhance their confidence and courage to conquer the virus, the following facilities are recommended in the hospital:

(1) Book corner: Each Fangcang is provided with a bookshelf to place excellent books for patients' free reading. See Fig. 5-2.



Fig. 5-2 Book corner of Zall (North Hankou) Fangcang Shelter Hospital

(2) Food corner: Each Fangcang can have a love food corner to provide freely patients with love food, such as instant noodles, milk and fruits. See Fig. 5-3.



Fig. 5-3 Food corner of Zall (Wuhan Salon) Fangcang Shelter Hospital

(3)Charging station: One or more free charging stations are set up in each Fangcang to facilitate the charging of patients. See Fig. 5 - 4.

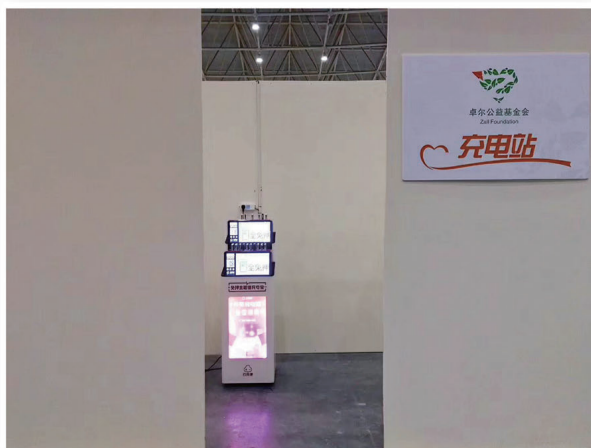


Fig.5 - 4 Charging station of Zall (Wuhan Salon)  
Fangcang Shelter Hospital

(4)Entertainment corner: One or two televisions are installed in the open space of each Fangcang so as to provide all kinds of TV programs for patients and assist in organizing square dance, game activities, poetry recitation, chorus and other cultural programs to enrich patients' life and enhance their confidence and courage in conquering the virus. See Fig. 5 - 5 and Fig. 5 - 6.



Fig. 5-5 Entertainment corner of Zall (Wuhan Salon)  
Fangcang Shelter Hospital



Fig. 5-6 Square dancing at the entertainment corner of  
Zall (Wuhan Salon) Fangcang Shelter Hospital

(5) Psychological guidance: COVID-19 is a new infectious disease. Its sudden attack often brings stress disorders and

anxiety to patients, and these patients require psychological guidance to some degree.

## 5.3 Safety support

### 5.3.1 Management system of medical waste from the Fangcang shelter hospital

(1) Implementation of primary responsibilities. Great importance shall be attached to the management of medical waste generated in Fangcang hospital, and primary responsibilities shall be effectively implemented. The person in charge of each area shall be the first responsible person for the management of medical waste, and the generator of medical waste shall be the directly responsible person. Efforts shall be intensified to improve environmental sanitation to create a healthy and hygienic environment by disposing of medical waste in time and avoid the accumulation of various wastes.

(2) Training system. All staff, including medical staff, nursing staff, technicians, management staff and laborers, is trained uniformly by the infection control group before work.

(3) Supervision system. The infection control group is responsible for regular inspection of the collection and disposal of medical waste and relevant problem collection, feedback and rectification supervision.

(4)Sorting collection system. All wastes generated in each area of Fangcang including medical waste and domestic waste shall be subject to sort collection as medical waste.

(5)Standard packing container. Medical waste bins with pedal and lid should be used for collection. When 3/4 of the packing bag or the sharps container is filled with medical wastes, the bag or the container should be tightly sealed. Medical waste shall be packaged with double packing bags which are tied using a gooseneck knot separately.

(6)Safe collection. Each packing bag and sharps container shall be affixed with a Chinese label indicating the medical waste generation unit, department and date, and its category, and "novel coronavirus - infected pneumonia" or "COVID - 19" shall be included in the special instructions.

(7)Disposal of clinical waste from the potentially contaminated area and contaminated area. Before transfer from a contaminated area, each package shall be sprayed evenly with 1000mg/L chlorine disinfectant for disinfection on the surface or shall be covered with another medical waste packaging bag.

(8)Treatment of pathogen specimens. High - risk waste such as specimens containing pathogens and the associated preservation solutions in the medical waste shall be subject to pressure steam sterilization or chemical disinfection at the places where the medical waste is generated and then collected and treated

as infectious waste.

(9) Transportation and storage of medical waste

① Safe transportation management. After everyday transportation, transport tools shall be cleaned and disinfected with chlorine disinfectant at a concentration of 1000 mg/L.

② Standardized storage handover.

③ Transfer registration. The set-bill administration in transfer of hazardous waste shall be strictly implemented with the registration of medical waste. The registration shall include the source of medical waste, category, weight or quantity, the transfer time, final destination and signature of the responsible person, especially indicating the "novel coronavirus-infected pneumonia" or "COVID-19". The registration information shall be kept for 3 years. Medical waste disposal entities shall be notified timely for on-site collection or self-building of medical waste disposal sites, and relevant records shall be completed. Health administrations at all levels and Fangcang shelter hospitals shall strengthen information exchange with departments of ecological environment and medical waste disposal entities and cooperate in standardized disposal of medical waste during COVID-19 epidemic.

## 5.3.2 Management program for hospital infection of the Fangcang shelter hospital

### 5.3.2.1 Objective

It aims to reduce the transmission risk of COVID-19 in the Fangcang shelter hospital and standardize the behavior of all staff in the hospital including healthcare workers to avoid infection.

### 5.3.2.2 Organizational structure

To set up a Hospital Infection Control Committee, which is composed of the hospital president, vice president of medical affairs, vice president of nursing, vice president of hospital infection control, vice president of logistics, ward head nurse and ward administrative director. The vice president of hospital infection control leads to set up a hospital infection work group, including ward head nurse, physicians and nurses for hospital infection, and contact persons of the logistics department, who are responsible for daily prevention and control of infection in the hospital.

### 5.3.2.3 Work contents

(1)Area division. The contaminated area, partially contaminated area and clean area shall be delimited in the hospital; public notices shall be posted in the appropriately prominent places in the hospital; and marked warning signs shall be set in the junctions of areas. Special personnel must be assigned to su-



pervise and inspect staff at the entrance or exit of the contaminated area so as to ensure compliance with the hospital infection specifications.

(2) Training for all staff. All staff shall strictly implement the system that they begin to work after training. The training contents of different workers shall depend on their job nature and characteristics. Workers who need enter the contaminated area shall be primarily trained so as to master the knowledge, methods and skills in prevention and control of COVID-19 and improve the prevention and control awareness. All logistics workers shall be also trained so as to assist in the environmental cleaning and disinfection, patient transfer and disposal of medical waste.

(3) Protection of healthcare workers and logistics workers. The infection prevention and control shall be strengthened in contact transmission, droplet transmission and airborne transmission on the basis of strict implementation of prevention and control standards. Correctly select, wear and remove PPE, and carefully keep hand hygiene.

#### 5.3.2.4 Protection system

##### (1) Personal protection rating system

<b>Personal protection rating system form of Fangcang shelter hospital</b>				
Protection item	Primary protection	Secondary protection	Tertiary protection	
Hat	*	*	*	
Isolation gown	*			
Protective suit		*	*	
Disposable surgical mask	*			
Medical protective mask		*	*	
Goggles/protective face shield		Alternative	Both	
Gloves	*	*	*	
Boot/protective shoe cover		*	*	

## (2) Protection levels in different working areas

**Protection level form in different working areas  
of Fangcang shelter hospital**

Working area / work content	Primary protection	Secondary protection	Tertiary protection
contaminated zone		*	
semi - contaminated zone		*	
clean zone	*		
Specimen collection (specimens from the respiratory tract)			*
Specimen collection (specimens from the non - respiratory tract)		*	
Specimen delivery		*	
Disinfection (contaminated zone- and semi - contaminated zone)		*	
Disinfection (clean zone)	*		
Patient escort and transfer		*	
nucleic acid testing (NAT)			*
Laboratory test (specimens from the non - respiratory tract)		*	
Imaging examination		*	

(3) Specification for wearing or removal of protective suits

**Standard Operating Procedure (SOP) for Removal of Protective Suits**

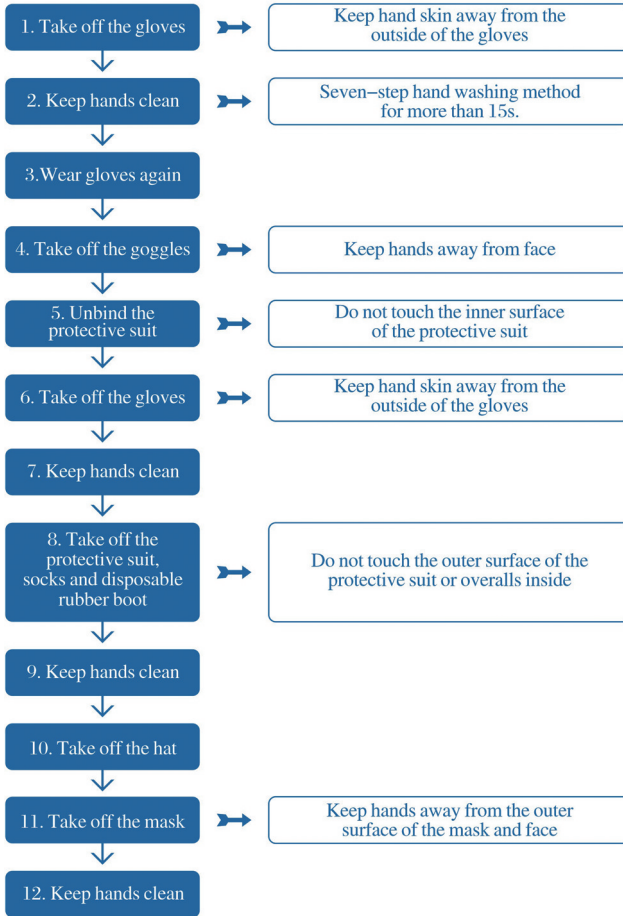


Fig. 5 - 7 Standard operating procedure for removal of protective suits in the Fangcang shelter hospital

#### (4) Environmental cleaning and disinfection

The Technical Specifications for Disinfection of Medical Institutions shall be strictly implemented to clean and disinfect environment for diagnosis and treatment (air, object surfaces, floor etc.), medical devices and patients' belongings, treat respiratory secretions, excreta and vomit strictly and conduct the terminal disinfection. The disinfection and cleaning tools for the contaminated zone, semi-contaminated zone and clean zone shall be marked with different colors. The tools for an area shall not be used for another area.

#### (5) Patient management and education

The education for patients in Fangcang shall be actively conducted to guide personal protection and cough etiquette. The mask shall be worn during the whole process of the transfer out of Fangcang for auxiliary examination and imaging examination.

### 5.3.3 Security guarantee

#### 5.3.3.1 Personnel allocation

One responsible person shall provide the contact and coordinate with other departments.

#### 5.3.3.2 Specific work

(1) Prohibit people without duties from entering or leaving at will.

(2) Promptly stop and dissuade any disturbance or dispute.

(3) Coordinate and assist in the handling of materials.

#### 5.3.3.3 Specific requirements:

(1) At least 2 security guards monitor the entry and exit.

(2) Security guards inspect the patient area for 24 hours.

### 5.3.4 Emergency response plan for the Fangcang shelter

#### 5.3.4.1 Emergency response plan for unexpected disputes

(1) **Objective:** It aims to prevent workers and patients in Fangcang from harming others due to emotional overreaction; It is used to handle unexpected disputes or violence in the Fangcang shelter hospital;

(2)Emergency procedure

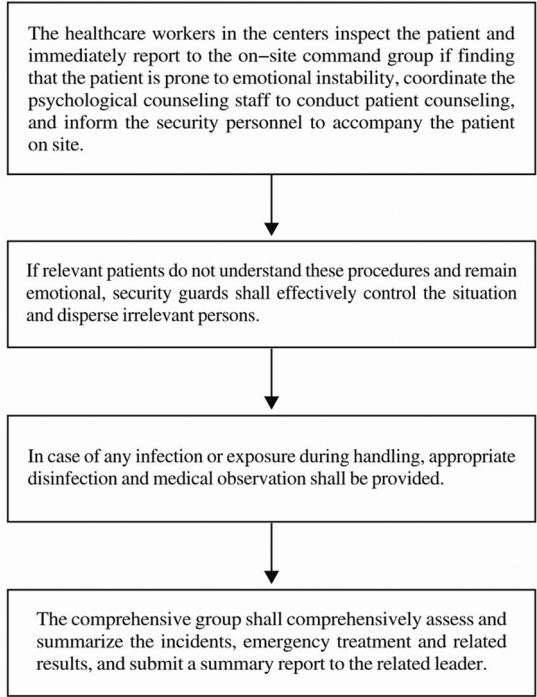


Fig. 5-8 Emergency Response Procedure  
of Fangcang Shelter Hospital

5.3.4.2 Emergency Response Procedure of Fangcang Shelter  
Hospital

Work objective: Deal with sudden incidents of water and power outages, prevent and control the damage caused by water and power outages, ensure the normal diagnosis and treatment order, ensure the safety of life and property of patients and medical personnel in Fangcang, and maintain the safety and

stability of the hospital. Emergency procedures:

(1) Information report: In case of water and power outages, the first finder and each receiver must immediately report it according to the procedures and requirements specified in the emergency response plan;

(2) Early disposal: After an emergency occurs, each receiver shall carry out early disposal while completing the information report, or start the on-site disposal plan or relevant emergency response plan according to responsibilities and specified authority to deal with and control the situation in a timely and effective manner;

(3) Emergency response: If the early disposal fails to effectively control the situation, the special emergency response plan for water and power outages shall be started in time, and the relevant responsible person shall uniformly direct or guide the relevant departments to carry out the disposal work. The head of the medical treatment team is responsible for directing emergency treatment. The healthcare workers shall organize the rescue work in this area according to the on-site disposal plan for water and power outages of the department.

In addition, water and electricity supply must be guaranteed in emergency:

(1) Members of the logistics working group shall ensure



smooth communication at any time;

(2) Daily inspection of water supply pipelines, circuits and on/off valves shall be carried out, and problems found shall be handled in time;

(3) Relevant logistics personnel shall be trained to know the emergency water supply, pipeline layout and emergency operation process;

(4) Water and electricity maintenance personnel shall be on duty 24 hours a day to be on call 24 hours a day.

#### 5.3.4.3 Emergency response plan for fire accidents

**Work objective:** In order to ensure the safety of personnel and property in the hospital area, in case of fire, under the unified command, fulfill duties, and avoid or reduce casualties and property losses to the greatest extent; Make the personnel in Fangcang master necessary escape skills. In case of emergency, they can use the safety passage for evacuation to evacuate to the nearest emergency shelter in time and learn to save themselves and others.

**Emergency procedures:**

(1) When a fire is found, the person in charge on site shall immediately organize the personnel on duty to put out the fire by using the nearest fire extinguishing equipment. In the process of putting out the fire, the relevant power switch of the failed

part shall be cut off as soon as possible according to the nature of the fire (in case of an electrical fire), and the security personnel shall be notified to confirm the specific situation of the fire and call 119 for alarm;

(2) Evacuate the crowd: issue evacuation instructions to the fire scene through emergency broadcasting. The medical personnel on duty in each region shall guide patients in each region to evacuate from the fire scene in an orderly manner. The staff of the evacuation guidance group shall have a clear division of labor and unified command;

(3) Notify the healthcare workers resting in the nearby hotel to treat the injured at the fire scene in time and contact other nearby hospitals for treatment if necessary;

(4) The security personnel shall rush to the fire scene to carry out on-site alert and maintain order;

(5) Logistics personnel shall register and keep the rescued and transferred materials, and coordinate with relevant departments to clean up and register the fire losses.

### 5.3.5 Operation and maintenance support of ventilation system

(1) According to the division of contaminated zone, semi-contaminated zone, clean zone, entrance for medical staff and en-

trance for patients, calculate the set operation scheme, open or close some fresh air valves, air supply valves and exhaust valves, adjust the angle of some air valves, open or close air inlets or windows, and open or stop some ventilation and air conditioning equipment;

(2) Monitor the fault alarm signals of the supply and exhaust air fans at any time to ensure the normal operation of the blower; Monitor the differential pressure alarm of all levels of air filters in the air supply and exhaust systems at any time, replace the blocked air filters in time, and ensure the air volume of air supply and exhaust;

(3) Air handling units and fresh air units shall be inspected regularly and kept clean;

(4) The coarse filter screen of fresh air unit should be cleaned every 2 days; The low efficiency filter should be replaced once every one month or two months; The medium efficiency filter should be inspected weekly and replaced every 3 months; Sub-high efficiency filters should be replaced every year. If pollution and blockage are found, replace them in time; The terminal high efficiency filter should be checked once a year and replaced when the resistance exceeds the initial design resistance by 160Pa or the filter has been used for more than 3 years;

(5) The medium efficiency filter in the exhaust air fan unit should be replaced every year. If pollution and blockage are

found, replace it in time;

(6) Regularly check the filter screen of the return air inlet and clean it once a week. In case of special pollution, replace it in time and wipe the inner surface of the return air inlet with disinfectant;

(7) Arrange special maintenance management personnel to follow the instructions for equipment maintenance, and formulate the operation manual with inspection and records;

(8) The replacement and operation personnel of the exhaust high-efficiency air filter shall protect themselves. The removed exhaust high-efficiency air filter shall be disinfected in situ by professional personnel, then packed into a safe container for disinfection and sterilization, and treated together with medical wastes.

## 5.4 Volunteer service

Learning from the experience of other emergency volunteer services, COVID-19 is a sudden public health event, and social resources need to be quickly organized and allocated when the government or professional resources are insufficient. In particular, volunteers participate in the logistic support for the epidemic prevention and control of COVID-19. Volunteers refer to social organizations or individuals who should voluntarily serve for the epidemic prevention and control without obtain-

ning any benefits if their own conditions permit.

#### 5.4.1 Conditions and requirements

(1) Participating in the epidemic prevention and control shall be carried out in strict accordance with the overall arrangement of the epidemic prevention and control institutions and under the unified organization, command and dispatch of Fangcang shelter hospital, and voluntary services for the epidemic prevention and control shall be carried out in an orderly manner.

(2) Volunteer service personnel must be in good health, have necessary protective measures and equipment, receive certain service training, reasonably determine the service scope, and not carry out volunteer service across regions.

(3) Priority shall be given to volunteers with certain medical and psychological specialties to participate in the work, and volunteer services with certain professional level shall be provided in epidemic prevention publicity, interpretation of policies and measures and stabilization of patients' psychological emotions.

(4) Volunteer service shall adhere to the principle of "safety first". Strengthen the management and training of epidemic prevention and control volunteers, strictly implement protective measures for on-the-job volunteers, and resolutely ensure that those who do not have adequate protective measures

will never take up their posts and those who do not have adequate protective training will never take up their posts. Scientifically set up volunteer posts, strictly control the number of volunteers, and reasonably set up volunteer service hours.

#### 5.4.2 Service classification

**Professional auxiliary services:** such volunteers need to enter the centers or other specially designated high – risk areas to jointly maintain the routine treatment services of Fangcang shelter hospital with frontline health workers.

**Medical material services:** distribute medical protective materials and provide medical equipment for Fangcang shelter hospital according to the division of labor. And assist in the statistics and professional storage of materials.

**Logistics support services:** provide all necessary living services for frontline health workers and patients in the centers, including commuting service, catering and caring materials, while ensuring 24h supply of water, electricity and heating in the Fangcang.

#### 5.4.3 Service contents

(1) Professional auxiliary services. Mainly maintain the public health order in the centers, coordinate and dispatch urgently needed medical materials and information on patients' receive-

ing and treatment, triage and referral, and clean the Fangcang. For example, in the Zall (Wuhan Salon) Fangcang Shelter Hospital, there are 54 volunteer cleaners who work three shifts a day, clean up the pollutants in the centers 24 hours a day and disinfect them in strict accordance with regulations.

(2) Medical material support services. Transport, distribute and make statistics of all kinds of medical materials, including drugs, protective suit, respirators, masks and gloves, etc., so that healthcare workers can be at ease to provide uninterrupted treatment services for patients in the centers.

(3) Life logistics support services. Provide frontline medical workers and patients in the Fangcang with materials support including but not limited to catering, commuting and caring materials and cultural services in sports, culture and entertainment; At the same time, provide uninterrupted guarantee for the normal operation of power supply, water supply and heating facilities in the Fangcang shelter hospital and respond to emergencies. For example, in the whole process of the Zall (Wuhan Salon) Fangcang Shelter Hospital, more than 100 volunteers from Zall Foundation completed the construction of 1,500 beds within 72 hours, helped to set up functional areas such as book corner, charging corner, food corner and television corner, and distributed caring materials or donated materials from society, maintained the normal operation of facilities such as water supply, power supply and heating 24 hours a day and ensured zero failure.

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## CONSTRUCTION AND OPERATION MANUAL OF FANGCANG SHELTER HOSPITAL FOR COVID-19

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Editor-in-chief : Yan Zhi

Editors : Yan Zhi , Zhang Liang , Du Shuwei , Fang Li , Pan Zijing , Cheng Longhua

Layout design : Huang Xuan , Song Jie , Ye Qinyun

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