

Layout Plan Study of Community-Based Cabin Hospital in Normalized Epidemic Prevention and Control Perspective-Taking: A Case of Guangzhou

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Abstract. In the face of the sporadic outbreak of the coronavirus pandemic nationwide, normalized epidemic prevention and control have become an important part of social and economic recovery. The "zero-COVID status at the community level" has posed a new challenge to the emergency response capability of community health, and the temporary isolation spaces need to be improved. This paper further explores the prerequisites and layout strategies for the construction of cabin hospitals in communities based on the transmission characteristics of COVID-19 in the community. In an attempt to improve the normalized epidemic prevention function based on communities and grids in the post-epidemic era, this paper uses the Tangxi South community in Baiyun District, Guangzhou City, as an example to build feasible operation spaces in communities during epidemics.

Keywords: cabin hospital · normalized prevention · community · COVID-19

1 Introduction

In the early stages of the epidemic, China rapidly increased its area's healthcare capacity in a short period by converting large-scale public venues into cabin hospitals or building new temporary hospitals to treat COVID-19 cases. With the introduction and development of normalized epidemic prevention and control, governments have increasingly improved their epidemic prevention and control measures instead of locking down cities entirely. Nevertheless, in communities where outbreaks occur, a closed-off management strategy is still being used, in which confirmed cases are sent to designated hospitals far from the community. Specifically, this paper investigates the feasibility of building a community-based cabin hospital under normalized epidemic prevention and control by containing more elaborate epidemic prevention measures, exploring strategies for isolating patients with mild symptoms and suspected patients in the community, easing the strain on the urban healthcare system, and preparing for an upcoming, unidentified global public health security event.

2 Cabin Hospitals in the Community

2.1 Cabin Hospital

A cabin hospital is a temporary quarantine facility with healthcare facilities that use the cabin as a carrier while integrating medical treatment and clinical technology functions [1, 2]. During the year 2020, Wuhan experienced rapid transmission of Coronavirus. This resulted in a significant shortage of medical resources, which prevented an increasing number of patients from receiving timely medical care. In order to isolate patients with mild or no symptoms as quickly as possible, Wuhan converted stadiums, convention centers, industrial parks, and university dormitories into isolation facilities. In addition, it has set up makeshift hospitals such as the Huoshenshan Hospital and the Leishengshan Hospital. In many localities today, cabin hospitals remain an effective method of preventing epidemics.

2.2 Interpretation of COVID-19 Transmission and Control at the Community Level

An epidemiological investigation can provide information regarding the transmission characteristics of the epidemic within the community. Following the activity trajectory of confirmed cases, it is possible to determine the origin, mode of transmission, and transmission characteristics of communicable diseases so as to understand the relationship between regions, time, and confirmed cases. This can help researchers and decision makers make more precise and scientific judgments and decisions in a variety of domains. Based on the flow survey information available on the Guangzhou Municipal Health Commission website [3], Fig. 1 illustrates the progression of confirmed cases in Guangzhou from April 2, 2022, to May 3, 2022. It took 41 days from the discovery of the first confirmed case to "zero-COVID status at the community level", with 32 days being the longest and 2 days being the shortest.



Fig. 1. The development of the confirmed cases

2.3 The Changes in the Process of Community-Based Epidemic Prevention

Community-based epidemic prevention and emergency response procedures have shifted from pandemic to normalized since the beginning of the COVID-19 epidemic. As shown in Figs. 2, the community-based epidemic prevention and emergency plan throughout the pandemic period as well as the subsequent normalized period of prevention and control [4] can be seen as a flowchart.

After the proposal of normalized epidemic prevention and control, the isolation grid was set up more precisely and the management model became more intelligent. However, the route of patient transport and the selection of isolation hospitals have not changed with the transition to the normalized period. Given that more than 80% of people infected with COVID-19 will have mild symptoms [5] that do not require emergency care, it is important to consider the ability of community spaces to isolate infections as well as changes in management. Therefore, it is imperative for newly diagnosed patients to receive early isolation and treatment, as well as to utilize emergency isolation facilities.

Through normalized prevention and control, by incorporating the cabin hospital into the design of the community's emergency support facilities, these vacant public spaces during the epidemic period can be converted into isolation hospitals, which can save time and prevent secondary transmission during the transfer process. A community-based cabin hospital and centralized isolation facilities throughout the community collaborate to activate the isolation and treatment mechanism as soon as a confirmed case is discovered among close contacts. As a result, infectious disease hospitals are greatly reduced, and other residents do not have to deal with the inconvenience resulting from requisition of public facilities in other parts of the city. Further, the mental health of confirmed cases will benefit from living in a more familiar environment rather than living in an unfamiliar, closed environment for an extended period of time, which is not conducive to their rehabilitation [6].



Fig. 2. Pandemic period (left); Normalized period (Right)

3 Layout Plan of Community-Based Cabin Hospital

3.1 Facility Characteristics

Preventing rapid spread of the disease is accomplished by immediately constructing isolation and protective facilities. Using the characteristics of current city-based cabin hospitals, general rules can be derived for the development of community-based cabin hospitals. In comparison to the newly-built temporary infectious disease hospitals, the fast conversion of urban ordinary spaces for epidemic prevention is an important method for rapidly increasing medical space resources in a short period of time [7]. Sharing medical facilities is recommended as a means to facilitate an orderly and convenient admission and isolation process. The use of assembly technology allows for the rapid construction of negative pressure isolation wards in large indoor or outdoor areas, as well as overcoming the limitations of building type and location. The distribution and number of potential patients, as well as the number of beds, medical supplies, and medical workers, determine the allocation of resources [8]. Moreover, the selection of specific sites must meet basic technical requirements, such as the separation of buildings from surrounding buildings, the avoidance of densely populated areas, as well as the dominance of downwind winds in the city.

3.2 Layout Strategies in Community

3.2.1 Convert Existing Public Facilities into Cabin Hospitals.

Select public buildings within the community that meet admissions and regulatory requirements. First, make use of existing shelters in the community and plan for the necessary support facilities during the early design stages. Second, the structural form of the building is primarily long span or modular, which has the advantage of rapid refurbishment as well as high efficiency. Third, considering that the hospital's capacity should match the present and anticipated numbers of patients, the number of beds should be as high as possible. Fourth, the renovated facility should be located near a convenient transit system and have easy access to the nearby hospital, thus creating a double layer of security. Finally, the feature of the layout illustrates the advantages of centralization, which facilitates operations, management, and patient transfers, while paying attention to accessibility and equitable distribution of locations, as well as to the prevention of cross-infections between different flows.

3.2.2 Use Open Spaces for Mobile Cabin Hospitals.

Open spaces enable mobile cabin hospitals to meet the capacity requirements in a variety of configurations. First, consider the locations that are adjacent to the community hospital, which are capable of providing several types of support, including medical equipment and medical personnel. The second recommendation is to maintain safe distances from surrounding buildings from large green spaces, parking lots, plazas, schools' playgrounds, etc. in the community that meet the requirements for emergency isolation. A temporary ward is constructed quickly using containers and moveable panels in an epidemic outbreak to create a manageable yard-within-yard, which is ordinarily utilized for recreation and entertainment, as well as for regular nucleic acid testing in the community's open spaces. For a faster delivery of mobile cabin hospitals, an offsite construction approach may also be utilized to reduce the interaction between open areas and cabin hospitals as well as to improve the scalability and flexibility of isolation facilities [9].

3.2.3 System for Coordinated Prevention and Control of Inter-community Cabin Hospitals.

There is no region or city that is exempt from the threat of global public health security. As part of medical system planning, regional limitations must be overcome, a crossregional epidemic prevention linking platform should be established, prevention and control information and treatment plans should be shared and individual resources should be transformed into common resources to prevent epidemic spread. During normalized epidemic prevention and control, community-based cabin hospitals are established with an appropriate service radius and a shared data platform is established. All communitybased cabin hospitals collaborate with one another and develop mechanisms for patient transfer in accordance with designated hospitals receiving severe patients.

4 Tangxi South Community in Guangzhou

Tangxi South, located in the southwest of Baiyun District in Guangzhou, is part of the 30th and 34th grid for epidemic prevention and control of Tangjing Street. On April 8, 2022, NO.10 confirmed case was discovered on Tangjing Street. On the next day, NO.1109, NO.1111, and NO.1515 on Sanyuanli Avenue were classified as lockdown zones, and certain regions of the city undertook region-specific, multi-level prevention and control measures. On April 26, 2022, the lockdown zones and controlled zones of Tangjing Street were adjusted to normalized management. During this span of time, 37 cases were confirmed on Tangjing Street, with the last case found on April 18, 2022 (Fig. 3).



Fig. 3. The change in the confirmed cases



Fig. 4. Tangxi South community

4.1 Overview of Community-Based Epidemic Prevention and Control

A field investigation was conducted based on the prevention and control unit in which the Tangxi South community was positioned during the outbreak. Under normalized epidemic prevention and control, the Tangxi South community is split into 15 management grids, and its public amenities include a community committee, a high school, a hospital with an outpatient department, a health station, and an emergency shelter (Fig. 4). Since there are a limited number of beds available in the centralized isolation hotels in Guangzhou and most of the confirmed cases were found in the Baiyun District, the supply and demand of isolation hotels in the Baiyun District were not balanced during the outbreak. It appears that the most straightforward and least resource-intensive method is to initially control and isolate close contacts at home. Additionally, in the context of normalized epidemic prevention and control, the treatment plan for patients with mild symptoms should be modified, such as optimizing transportation routes and changing the diagnosed hospitals for patients so as to shorten the period of isolation and recovery.

4.2 Preliminary Layout Plan of Community-Based Cabin Hospital

The preliminary layout plan of the community-based cabin hospital is proposed based on the research findings (Fig. 5). Since there are no large-scale facilities in the Tangxi South community, the adjacent office buildings and hotels are the choices for the conversion. However, because there are fewer than 50 confirmed cases in the community during this wave of the epidemic, it is not necessary to set aside a large number of hospital beds.



Fig.5. Preliminary layout plan

Alternatively, the community health station can be converted directly into a communitybased cabin hospital that can use the existing medical equipment in the area. Optionally, set up the negative pressure mobile cabin hospital on the school sports field and the playground underneath the teaching building, which served as an emergency shelter initially. This enables governors to dynamically adjust the number of isolation cabins based on trends in the number of confirmed cases. According to the indicator that the net usable area per bed should not be less than six square meters, Table 1 shows the construction options for community-based cabin hospitals in Tangxi South.

Table 1.	Construction	Options
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Category	Area	Predict Number of Bed	Category	Area	Predict Number of Bed
Office Building	53760m ²	3840	High School	2898m ²	483
Hotel	9432m ²	377	specialized hospital	460m ²	76
Square	3125m ²	520	health station	680m ²	113

5 Conclusion

Having experienced COVID-19, we are acutely aware of the increasing level of uncertainty that will face cities in the future. The emergency response capacity of cities must be increased from the inside out in order to combat the ongoing epidemic and any future communicable diseases that may emerge. Also, the role of the city as a defense base must be strengthened. In the post-epidemic era, cabin hospitals in the development or renovation of community-based epidemic prevention facilities, together with other community hospitals, centralized isolation hotels, and designated hospitals, constitute the community-wide prevention and control system. With this approach, the community governance can be improved in the context of normalized epidemic prevention and control, people's health can be protected, and the "Healthy China" initiative can be further developed.

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