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Discussion on Emergency Renewal Design of Indoor Space of Multi-Storey Residential Building under Public Health Emergency

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Abstract: In order to deal with public health emergencies, five residential areas in the main urban area of Handan were selected for on-the-spot measurement and questionnaire survey, and the survey data were sorted out and sequenced regression analysis. it is summarized that the main problems of indoor space in emergency are poor spatial independence, unreasonable layout, low flexibility and poor natural lighting effect. On the basis of this, the corresponding optimization strategy is put forward in order to help to update and improve the emergency design of interior space in multi-storey residential buildings.

Keywords: Public Health Emergency; Interior Space of Multi-Storey Residential Building; Emergency Design Update; Residential

Introduction

The outbreak of novel coronavirus at the beginning of 2020 has aroused great concern all over the world. However, due to the lack of objective understanding of epidemic prevention emergency design in traditional residential buildings, the emergency response ability of indoor space in the face of epidemic situation is poor. Therefore, it is very necessary to analyze the new demand of residential buildings under public health emergencies and to build an updated design framework to promote resilience and epidemic prevention.

1. Understanding Public Health Emergencies: From the Promotion of Resilience and Epidemic Prevention

1.1 Public Health Emergencies and Residential Indoor Space

In the face of this menacing epidemic situation, the epidemic prevention board of residential indoor space has gradually become a research hotspot, and family protection has become a feasible way to deal with the epidemic situation [1]. In view of how to improve the sanitary and epidemic prevention ability of residential indoor space, it is necessary to systematically put forward emergency measures of indoor space epidemic prevention combined with domestic and foreign residential health prevention and control experience, in order to provide reference for the improvement of residential indoor epidemic prevention ability under such public health emergencies.

1.2 New Requirements for Resilient Safety of Epidemic Prevention Support

In order to deal with public health emergencies, many countries have explored to improve the emergency response capacity of epidemic prevention [2]. For the United States to promote the construction of "disaster prevention community" throughout the country; Japan puts forward the concept of "public assistance + co-assistance + self-help", and strengthens the cooperative relationship of "public rescue + mutual rescue + self-help". Australia does not put forward the concept of "prepared community", which aims to formulate different emergency plans according to different types of public health emergencies, and update and improve each plan [3-5]

Generally speaking, in dealing with public health emergencies, the research from the perspective of residential buildings is less and less concerned, which leads to the lack of emergency capacity of indoor space in residential buildings.

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2. Reflection on Public Health Emergencies: the Concept of Resilience and Design Framework

2.1 the Connotation and Logic of Resilient Cities

Resilient city means that when a disaster occurs, the city can withstand the impact, respond and recover quickly, maintain the normal operation of the city function, and better deal with the disaster risk in the future through adaptation. With the continuous deepening and expansion of the study of resilient cities, the world has set off a new wave of resilient urban planning and practice, and this concept and strategy has been gradually applied to all kinds of unknown risk fields.

2.2 Resilient Residence

In the face of public health emergencies and complex environment, resilient housing is mentioned as an extension of resilient cities to form a complete resilient vertical system. With regard to resilient housing, first of all, the positive effect of spatial combination promotes the improvement of spatial resilience. That is, the arrangement of the space is based on the reasonable organization of the indoor streamline in order to improve the toughness of the space. Secondly, integrate the elements of indoor space from the perspective of epidemic prevention and emergency, and actively organize the indoor line of defense to deal with public health emergencies.

3. Analysis of Public Health Emergencies: Current Situation of Emergency Capacity of Residential Buildings

Select the main urban area of Handan City as the study area, select five representative communities for questionnaire survey, carry out digital visualization analysis of indoor space, and get the evaluation of residents' emergency ability of indoor space; and carry out sequential regression to analyze the differences of the impact of different indoor space areas on indoor epidemic prevention under public health emergencies. 250 questionnaires were distributed, 227 were valid, and the effective rate of the questionnaire was 90.08%.

3.1 Questionnaire Survey and Analysis

The construction age of the five communities from far to near is Luochengtou No. 4 Hospital, Railway Courtyard, Guangtai District, Guanghua Yuan North District and Asia-Pacific Century Garden. From the analysis, we can see that the residents' evaluation of the multi-storey housing built in different periods is different. And in the overall evaluation, the satisfaction of Asia-Pacific Century Garden is the highest, while that of Luochengtou No. 4 Hospital is the lowest.

According to the sequential regression of residents' evaluation of indoor space factors, it is found that porch space, kitchen space and toilet space have a significant impact on indoor epidemic prevention evaluation.

3.2 Summary of Indoor Space Problems

According to investigation and analysis, there are the following problems in residential indoor space in epidemic prevention emergency: mutual nesting of functional space, unreasonable layout, poor flexibility of functional space and poor quality of ventilation and lighting. Therefore, based on the update of emergency capacity, the following paper further discusses the update of epidemic prevention and emergency capability of indoor space in multi-storey residential buildings under public health emergencies.。

4. Dealing with Public Health Emergencies: Emergency Update Design Strategy

4.1 Enter the Household to form an Independent Space to Isolate the Source of Infection

In the household space, you can set up the garden and the porch space to form an independent space. In this space, functions such as changing, washing hands, placing things, hanging ironing and hanging receiving clothes are placed in the order of use, so as to meet the eliminate virus epidemic prevention process of residents entering the room from outdoor to indoor and the process of changing clothes from indoor to outdoors, so that residents can better complete the protection under the epidemic situation.

4.2 Optimize Indoor Layout and Improve Layout Flexibility

4.2.1 Bathroom Space Layou

As the residents pay more attention to the epidemic situation, the residents are more inclined to the arrangement of the two sanitary facilities. In the layout of the toilet, the multi-function is arranged in the same space, the dry and wet separation is not carried out, and the toilet is in a moist state for a long time and the utilization rate is low. In order to avoid conflicts among residents, the toilet layout needs to do dry-wet separation or three separation to facilitate the clean eliminate virus of the toilet space, and improve the epidemic prevention ability of residents at home.

4.2.2 Layout of Indoor Isolated Space

In case of public health emergency, residents can choose indoor near-end or far-end rooms as isolation space to reduce the streamline crossing between isolated and unisolated residents. In the layout of the isolated space, the needs of isolated residents such as rest, grooming and leisure should be met.

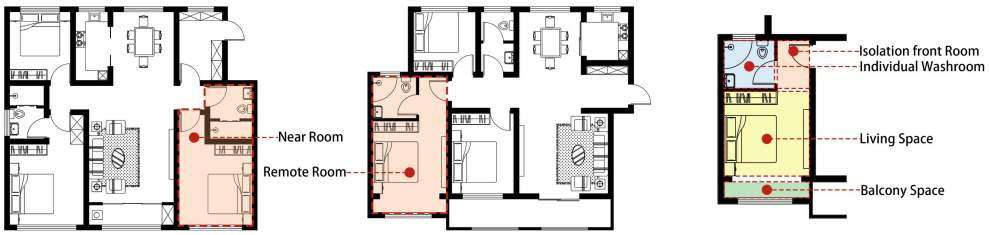

Fig. 1 Schematic Diagram of Isolation Space Design

4.3 Create Functional Composite Space and Improve Space Utilization

To improve the space utilization, it can be designed in both horizontal and vertical dimensions. In the horizontal direction, light partition can be used to complete the mutual transfer and borrowing of space, expand the living room space and form a closed porch to facilitate family epidemic prevention and meet the needs of residents. In the vertical direction, the near-ground space can use multi-functional furniture to complete the functional space conversion in different periods; in the indoor top space, more lockers are placed to increase the indoor storage space to meet the storage needs of residents under public health emergencies.

4.4 Improve Indoor Ventilation and Lighting and Improve Living Quality

In the event of a public health emergency, a reasonable form of natural ventilation can maintain the appropriate indoor temperature and humidity and contribute to the circulation and replacement of indoor air. In order to improve the quality of indoor ventilation, it can be considered from four aspects: selecting separate traffic core, setting suitable air inlet and outlet, selecting suitable air inlet form and window sterilization.

To improve the quality of indoor lighting, first of all, we can expand the building room to expand the building lighting surface, and at the same time facilitate ventilation. Secondly, to ensure the transparency of the windows, to ensure the normal use of windows and natural light to enter the room normally. Finally, window holes can be designed on the indoor lightweight partition to make natural light enter the space, and transparent but opaque glass walls or other material partitions can also be used to replace concrete walls to form a more transparent and bright indoor environment.

5. Conclusion

With the frequent occurrence of public health emergencies, the design and practice of emergency renewal of indoor space in residential buildings has become the focus of architectural research. Taking the present situation of the main urban area of Handan as an example, according to the analysis and summary, this paper puts forward the design to enhance the emergency ability and resilience of epidemic prevention in indoor space from four aspects: independent space, interior layout, functional compound space and daylighting ventilation. in order to provide a feasible basis for the improvement of indoor space emergency capacity of multi-storey residential buildings.

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