

How community medical facilities can promote resilient community constructions under the background of pandemics

Fang Wang¹ , Yuanyang Fang¹, Handuo Deng² and Fangzhen Wei³ 

Abstract

Nowadays, urban and community resilience have become the core issues of urban theoretical research and construction practices. While there are many studies on climate change, natural hazards and environmental pollution, relatively less attention has been paid to public and human health. However, the current COVID-19 pandemic, which is a major global public health crisis, is posing severe challenges to the resilience of cities and communities in the context of high-mobility, high-density and high-intensity, as well as expands the connotation of community resilience to public health. To compensate for the lack of current research, this study examined the characteristics of community medical facilities in response to pandemics at urban, community and individual multi-spatial scales based on a thorough review of current research and relevant practice. It also emphasized the significant role played by community medical facilities in improving resilient community constructions in the face of large-scale public health emergencies. These characteristics were fully utilized to explore ways to build and govern the ‘resilience’ of communities in the future, help people to survive better as well as develop in complex and changeable external environments.

Keywords

COVID-19, Resilience, Healthcare facilities, Community governance, Urban planning

Accepted: 6 September 2021

Introduction

The outbreak of SARS-CoV-2, a novel coronavirus and its related diseases, coronavirus disease 2019 (COVID-19), has triggered a global public health crisis, which has seriously affected people’s normal life, work schedules, physical and mental health,¹ and has caused devastating consequences like the loss of human lives and economic decline in countries all over the world. Such sudden public health events pose a serious challenge to urban planning and community governance under the background of high mobility, high density and high intensity.² How to systematically improve the ‘resilience’ of human settlements in the face of sudden changes and disturbances, and how to help people survive better

and develop in complex and changeable external environments, are particularly important problems, having both theoretical and practical value.

¹NSFC-DFG Sino-German Cooperation Group on Urbanization and Locality (UAL), Peking University, College of Architecture and Landscape, Peking University, Beijing, P. R. China

²College of Urban and Environmental Sciences, Peking University, Beijing, P.R. China

³Peking University Hospital, Peking University, Beijing, P.R. China

Corresponding author:

Fangzhen Wei, Peking University Hospital, Peking University, Beijing, P.R. China.

Email: pkuh-wfz@pku.edu.cn

In a sudden or pandemic situation, if proper community medical facilities are not available in a locality, prevention/mitigation and recovery of and preparedness and response for such pandemic towards the betterment of the community people could be broken, which would ultimately affect community resilience. For a better understanding of the related key issues of community resilience and community medical facilities, and their relationship, this paper discusses the following issues in subsections.

Community resilience

The resilience of human settlements refers to the aggregation of a series of human abilities to deal with uncertainty³ and instability. While the former two abilities are passive, the latter two are active. These capability sets run through the three stages of emergencies, disasters or hazards: prevention/mitigation and preparedness; response; and recovery/reconstruction.⁴ Due to spatial scale differences, the subjects of resilience form patterns comprising the following levels: families/individuals, local communities, urban, regional, national and global.^{5,6} Among them, cities, the most complex social ecosystem, have been continuously suffering from various impacts and disturbances from the outside and inside since their formation. Community, as the basic unit of a city, is the cellular organization of social organisms and has been at the forefront of disaster prevention and mitigation. As a result, ‘community resilience’ has become the core issue of relevant theoretical research and construction practices.

Resilience has been gradually applied to various disciplines and fields related to human communities and social systems,^{7,8} after Holling,⁷ an ecologist in Canada, introduced it into ecosystem research in 1973. The concept of ‘disaster resilient community’ was first proposed by Mileti and Noji.⁹ Subsequently, scholars and organizations such as Adger,¹⁰ Bruneau,¹¹ UNDRR (The United Nations Office for Disaster Risk Reduction)¹² and CARRI (Community and Regional Resilience Institute)¹³ further enriched the connotation and extension of ‘community resilience’.

Presently, the ability of communities to cope with and recover from large-scale emergencies is often referred to as ‘community resilience’.¹⁴ There have been many studies on climate change, natural hazards and environmental pollution in the research and practice of community resilience.

Community resilience and public health

Firstly, community resilience emphasizes disaster prevention and mitigation capabilities to cope with the impact of extreme weather and various natural hazards

caused by climate change on human settlements. A series of international slogans or proposals show that disaster prevention and mitigation has become an international consensus as to the primary goal of community resilience enhancement. The management forum of the World Conference on Disaster Reduction in 1999 proposed that ‘communities should be regarded as the basic unit of disaster reduction’.¹⁵ In 2001, on the International Day for Disaster Reduction, the United Nations put forward the slogan of ‘developing community-based disaster reduction strategy’.¹² The 2005 World Conference on Disaster Reduction listed community disaster reduction as important content and proposed to establish emergency response mechanisms for improving emergency response capacities in all social strata, especially communities.¹⁶ Specifically, Australian scholars are concerned about the rising energy costs caused by climate change and the impact of freezing, heat waves and storms on communities and families, and have considered transforming residences using block designs to adapt to bad weather.¹⁷ In the Middle East, urban planning has paid attention to the impact of extremely high temperatures, water shortages, floods and power interruptions on vulnerable communities in summer, when designing key infrastructure.¹⁸ American scholars found that the inherent conditions of communities (including the environment, social economy and industry) play a key role in post-disaster recovery.¹⁹

Secondly, community resilience is often associated with ‘sustainability’ and emphasizes the ecological environment and inclusive growth,²⁰ which is a new way to guide the sustainable development of modern cities based on the traditional planning theory. The 2015 United Nations Conference on Sustainable Development proposed, ‘make cities inclusive, safe, resilient and sustainable’ in the next 15 years.²¹ The New Urban Agenda of the 2016 United Nations Conference on Housing and Urban Sustainable Development²² put forward the vision of urban development:

ensure that all inhabitants, of present and future generations, without discrimination of any kind, are able to inhabit and produce just, safe, healthy, accessible, affordable, resilient and sustainable cities and human settlements, to foster prosperity and quality of life for all.

With the development of the economy and the increase of the urban population, cities are facing challenges such as environmental pollution, traffic congestion, ageing population and the shortage of education, medical and social resources. Therefore, in this context, community resilience construction pays more attention

to comprehensive sustainable development in order to improve people's quality of life and promote urban development.

The current measurement of community resilience is also focused on disaster prevention, ecology and environment, as well as on macro-level evaluations.²³ Bene²⁴ corresponded the index of community resilience to governance cost, while Chang and Shinozuka²⁵ extended monetary measurement to organizations, technology and society. Tian et al.²⁶ proposed a framework for measuring community resilience based on five aspects: original conditions, coping capacity, adaptability, disaster loss and disaster exposure. Although scholars construct a community resilience evaluation system from multi-dimensional and multi-scale synthesis, they pay less attention to public and human health aspects. Correspondingly, research on community resilience in major public health emergencies is also relatively less.²⁷

Since 2020, the community's response to the outbreak of the novel coronavirus pneumonia pandemic has enriched the connotation of community resilience and led to a rethinking about the community spatial resilience strategy based on public health crisis management. In the global scope, the response speed and governance effect of different communities in different countries, regions and cities are not the same,²⁰ which reflects the resilience strength of comprehensive management of public health crisis at two levels: city and community.

Community medical facilities and community resilience

Community action has been proven to be a vital part of the public health effort in the pandemic.¹⁴ Community medical facilities, at the core of enhancing community resilience in public health, have attracted considerable attention during the pandemic. They have acted as the 'brain' of the community defence system construction, which drives the community residents' self-organization and self-governance, and plays a crucial role in promoting the 'resilience' construction of the community.

In the pandemic, community medical facilities are another important medical resource outside the hospital system, including hardware facilities such as health centres, sanatoriums and soft facilities such as human capital. Various medical services based on community medical facilities play a key role in flattening the transmission curve, improving the rescue rate and reducing the mortality rate. Community medical facilities are the key line of defence for primary prevention and rescue. Early detection, contact tracking, risk assessment, isolation and other measures can relieve the pressure of

hospitals and maintain the health of the population²⁸ and are more important for areas having scarce per capita hospital resources and vulnerable groups.

During the economic recession following the pandemic, some studies show that disinvesting in maternal and child health will sow the seeds of later health inequality and Non-infectious Chronic Disease (NCD) risk, which will undermine community resilience to future health emergencies.²⁹ Therefore, the community medical facilities concerned with these problems will contribute to the construction of community resilience.

In addition to pandemic periods, community medical facilities also protect people's health in their daily lives. Community-based family monitoring and care can help prevent and predict diseases and reduce social medical costs. The patient-centred community medical centre is an important way of primary health care, which helps to improve residents' access to care, enhances the utilization of medical services and reduces the overall cost of medical care.³⁰ Community medical facilities can also build social support networks, which are conducive to the mental health of patients in recovery, which is proven to help in improving community resilience and decreasing the impact of the threats of the COVID-19 pandemic.³¹

Although many countries have established, or are in the process of establishing, a complete hierarchical diagnosis and treatment system and strongly emphasize the importance of community medical facilities, there is a lack of research on how community medical facilities can continue to play a role in the pandemic, communicate with normalized medical care and various emergency measures, and improve the public health safety dimension's community resilience.

This paper studies how exactly community medical facilities can improve community resilience based on a multi-scale analytic framework. At the beginning of the next section, the three spatial scales of community medical facilities and the characteristics are introduced. Then, the specific effects of these characteristics at different spatial scales improving community resilience are concretely reviewed. The discussion part claims the need to build a healthy urban governance system with community medical facilities as the core and take the community as the 'health unit' of the city in order to build sustainable cities. Finally, the paper concludes that community medical facilities play a key role in enhancing community resilience in public health. Community medical facilities drive the construction of medical support networks at different spatial scales and promote the improvement of abilities, processes, goals and other aspects of community resilience ultimately.

Community medical facilities improving community resilience

Although the academic community has recognized the importance of community medical facilities in strengthening the community resilience system, few studies have focused on the role of community medical facilities in constructing medical support networks at different spatial scales. Therefore, to compensate for the lack of current research, this study aims to expound on the promotion of community medical facilities to community resilience construction from multiple spatial scales (i.e. urban, community and individual facility). The paper aims to contribute to deepen the understanding of the role of community medical facilities in community resilience under the background of a pandemic situation.

Community medical facilities are an important entry point to enhance the resilience of community public health, which is of great significance in the three spatial scales of cities, communities and individuals. In general, community medical facilities can help to improve urban resilience at the urban level with policy flexibility and pertinence; at the community network level with network and node nature, and at the individual facilities level with infrastructure and functionality of facilities; ultimately promoting abilities, processes, goals and other aspects in community resilience (Figure 1).

Urban policy: Flexibility and pertinence

As the core of the community’s ‘defence unit’, community medical facilities can promote the construction of urban public medical and health systems. As a research subject, they can champion the formulation of special planning of medical facilities and emergency plans of relevant government departments for flexibly responding to a variety of complex situations and solving corresponding problems.

Implementation of special planning for medical and health facilities. The planning and health departments of the government carry out special planning of medical and health facilities, which builds a medical and health system covering urban and rural areas. It also provides high-quality services based on community medical institutions, public health institutions and various specialized hospitals to realize the efficient operation of medical facilities and carry out a comprehensive balance to ensure the implementation of the planning.³²

The special planning is particularly important to prevent, control and reduce as much as possible the spread and harm of infectious diseases that have a great impact on the daily work and life of residents. There is a need to consider how the daily life and production of cities can be carried out normally, without being affected or less affected when a pandemic occurs and how to utilize the community residents’ digital information resources,³³ so that regional infectious diseases can be detected and nipped in the bud, and the spread of the pandemic can be prevented in advance.

Formulation of emergency response plan for large-scale public health events. The urban space system, with community medical facilities as the core of the ‘defence unit’, can boost the level of emergency plans for large-scale public health events, improve the process management of emergency plans with the scenario as the mainline and facilitate the emergency drills of each unit, to optimize emergency mechanisms and the quality of residents’ preparedness to deal with emergencies.

In this way, emergency plans which are compatible with extreme conditions can realize effective space control and supply of materials; maintain the operation order of multi-level spaces under extreme conditions and ensure basic travel and living needs of communities

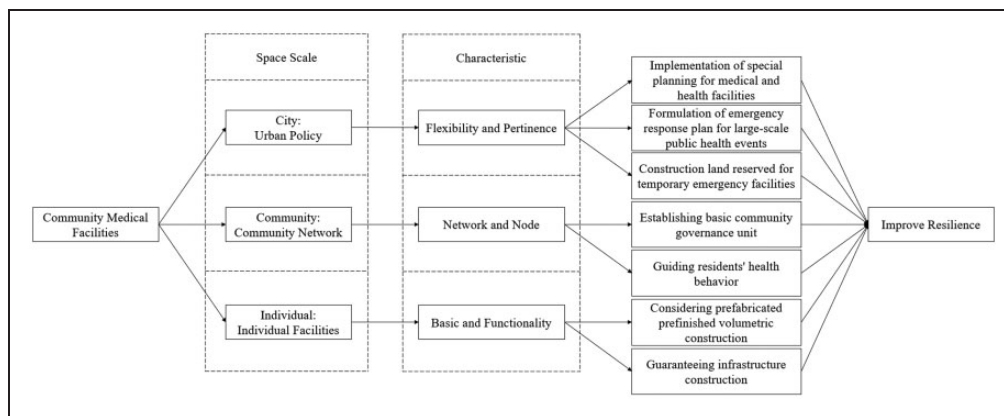


Figure 1. Community medical facilities’ characteristics in three space scales to improve resilience.

and families under normal and abnormal conditions, while avoiding high concentration of personnel.³⁴

In addition, the participation of various social groups from the private and public sectors can be included in consideration of emergency plans. These groups and organizations can coordinate various projects such as health care, construction, safety and hotel management. Such strong cross-organizational cooperation and clear communication channels can effectively utilize social resources and better guarantee the establishment and operation of emergency plans.³⁵

Construction land reserved for temporary emergency facilities. During the implementation of special plans for medical and health facilities and the formulation of emergency response plans for large-scale public health events, reserving construction land for temporary emergency facilities based on community medical facilities is an important measure for improving the community emergency response capabilities. It is also necessary to fully consider emergency beds under public health events along with the ventilation and filtering systems,³⁶ material storage systems, surgical lighting and other ancillary facilities to meet the needs of hospitals and combine peacetime and wartime with disaster relief, to ensure rapid function conversion in special periods and realize the efficient utilization of space resources. For example, the 'mobile cabin hospitals' in Wuhan, China, provided a safe treatment place and an effective isolation area for patients with mild symptoms of COVID-19 when the pandemic broke out; thus, effectively preventing its spread.³⁷

The principle of 'small and even' can be referred to in relation to the preparation of dispersed public spaces for function conversion,³⁸ and for providing sufficient, simple medical and disaster prevention facilities. There is also a need to consider the needs of medical facilities for space and site, such as well-ventilated and compatible garbage disposal sites,^{39,40} along with the allocation of certain public spaces for the community's education and learning during special periods. Community residents' good knowledge literacy in response to disasters and pandemics is also an important way to improve the 'resilience' of communities.

Community network: Network and node

As a typical node, the community, the basic unit of urban space and the cellular organization of the organism,⁴¹ can participate in the formation of urban populations, spaces and organization networks because of its universality.⁴² The networking of community medical facilities has two connotations. On the one hand, as the core of the communities' defence system, it becomes

an important node of the urban public health network constructed by the government to effectively prevent and respond to emergencies by establishing community basic unit self-governance; while on the other hand, it connects individuals, families and communities, as well as connects and associates each basic node of pandemic prevention and control, and builds a community-level pandemic prevention and control support network by guiding residents' health behaviours. In short, community medical facilities promote a 'public health defence network' to reasonably organize the integration and blocking of social and urban spaces and effectively reduce the transmission capacity of viruses in high-density, high-mobility urban spaces.⁴³

Establishing a basic community governance unit.

The novel coronavirus pneumonia pandemic highlights the importance of a community-based medical system during pandemics. Some scholars have begun to reflect on the concept of patient-centred care in the past,^{44,45} since pandemics affect not only individuals but also families and communities related to the disease. If barriers are not built to prevent infection at the community level, and only the hospital system is relied upon to fight the pandemic, the healthcare system will collapse. Community autonomy means that when public health emergencies occur, the pressure of hospitals and large-scale public health places will be distributed to grassroots community hospitals and small clinics, 'distributed reception and centralized treatment'. In this way, as a key node of the urban public health system, community medical facilities help to improve the utilization efficiency of social medical resources and cope with the lack of hospitals and critical medical facilities.

Taking community medical facilities as the guiding institution of community governance, full play can be given to residents' self-organization and governance power from the bottom-up by guiding them in supporting and helping each other and promoting the improvement of their community governance abilities. The rise of community power can clearly be seen in the pandemic environment, and community governance issues will be comprehensively upgraded. The COVID-19 pandemic has made it necessary for governments to urgently overcome the obstacles of institutional weaknesses: weak administrative capacity, rigid bureaucracy and conflicts among political leaders, which are structural constraints,⁴⁶ as well as to encourage responsive grassroots governance. Therefore, there is a need to establish a social governance pattern of co-construction, co-governance and sharing by decentralizing the responsibility and power of community governance at the grassroots level, as well as guiding

and encouraging community autonomous governance, which will make the city, the basic cell, really live.⁴⁷

Guiding residents' health behaviour. Community medical facilities and related medical staff, regarded as key nodes in the urban public health network, provide urban residents with risk assessment and health knowledge education,⁴⁸ and guide their health behaviours. Research shows that medical facilities and medical staff in the community can promote the improvement of community-based health levels and disease prevention; effectively improve per capita health levels and the utilization rate of medical care⁴⁹; build a social knowledge network on environment and health; enhance residents' sense of participation.⁵⁰ Community public health intervention measures should not only focus on the construction of a healthy living environment but also pay attention to guiding residents' health behaviour, which is the key to promoting the quality of the living environment and the construction of resilient communities.⁵¹

In addition, the gradual increase of population density in urban residential areas will affect residents' physical and mental health as well as the community's social management to a certain extent. As a professional department, community medical facilities can carry out a comprehensive and systematic health risk assessment; health knowledge education and popularization; effectively integrate material and social spaces to guide individuals/families' health behaviours through regular health examinations and health education, which will greatly improve the community's anti-risk levels.⁵²

Community medical facilities should also play a key role in protecting vulnerable groups' health rights and interests. For example, from the perspective of age groups, the elderly are the most vulnerable group, since they often lose the opportunity of forming social networks with the outside world because they live alone and are at a disadvantage in receiving health care services. Community medical facilities can provide support in these two aspects, for example, by volunteering to provide regular health examinations and trying to help the single elderly contacting with others. European scholars have found that community medical facilities can help improve the relief rate of the infected population in poor communities and immigrant groups.³³ Studies have shown that communities with strong social ties are more resilient.⁵³ By strengthening the connection, trust and reciprocity between individuals, community medical facilities can also help to enhance social capital, strengthen the network support system at the community level, and enhance the effect of collective action and local governance.

Individual facilities: Basic and functional

An essential prerequisite for dealing with public health emergencies is the construction of communities with substantial basic medical facilities that will ensure the infrastructure and functionality of grassroots facilities. Opening and closure are a city's normal and abnormal states, respectively. Thus, to strike a suitable balance is necessary, considering the city's vitality and safety. Since infrastructure construction is one of the key nodes, there is a need to grasp the spatial layout and allocation of resource elements.

Considering prefabricated prefinished volumetric construction. Modular design is a new standardized mode developed in the late 20th century. It can be used to deal with complex and diverse problems,⁵⁴ including uncertain emergencies and external environmental changes, through its convenient process of prefabrication, transportation, installation and disassembly, as well as its unique adaptability and economy. Thus, it is a better way to improve the resilience of communities.

Under the background of the novel coronavirus pneumonia pandemic, the modularization design in community health systems can be used to improve the configuration and management guarantee efficiency in the module, establish a mode of cooperation and independent functionality, as well as protect the whole area from being affected.⁵⁵ It also helps to reduce the difficulty of governance.

Moreover, modular designs can make the layout of key infrastructure and related facilities, the lifeline system of disaster relief, realize equalization and modularization based on stable operation for coping with unexpected uncertainties and changing situations. In case of emergencies, modular spaces and sites can provide activity spaces for residents and effectively inhibit the survival and spread of the virus by creating an environment with good lighting and ventilation.⁵⁶

Guaranteeing infrastructure construction. The present COVID-19 pandemic clearly showed home isolation to be a very effective measure. To guarantee the basic quality of life of those living at home requires stable infrastructure, material supplies and community services, such as communication facilities, networks, transportation, logistics, energy, water supply, distance education and entertainment.

In addition, digital technology can be considered helpful for improving the level of community infrastructure construction and quality of community services, necessary to promote the improvement of community functions.⁵⁷ The pandemic's outbreak has clearly shown that the construction of an intelligent

pandemic prevention system in the community depends on various new technologies, such as contactless take-out and express deliveries, personal itinerary cards, and so on. Thus, intelligent management networks based on the new generation of communication technology cover everyone and contributions to the control and protection of pandemic situations.⁵⁸

Infrastructure construction should not only meet the needs of daily life, but also of situations during special periods. Only in this way can effective space control and material supplies under extreme conditions be achieved with the community as the basic unit. Such a multi-level spatial operational plan will be the infrastructure construction work that every city must plan for.

Discussion

Novel coronavirus pneumonia prevention should be implemented in the grassroots community, and the community should be the last line of defence for pandemic prevention and control, and the key role of community medical facilities should be brought into full play. It is an effective strategy for the world to cope with the outbreak of the COVID-19 pandemic because resilient communities can help people face and deal with all kinds of losses and external pressures caused by emergencies.

Nowadays, because of the normalization of the pandemic's prevention and control, the important role of community medical facilities cannot be ignored. It is necessary to make full use of community medical facilities' characters at the urban policy level, the community network level and the individual facilities level, integrate the theory and practice of resilience into the multi-disciplinary environment of economy, society and ecology, and explore methods and ways to adapt to various emergencies and complex environments. These strategies help to build and manage community 'resilience' and guide sustainable urban development in the future.

People can never reach a city without disease but should have a city that is safe, healthy, prosperous and able to cope with all kinds of dangers, emergencies and long-term challenges. Therefore, to build a healthy urban governance system with community medical facilities as the core and take the community as the 'health unit' of the city is necessary. This goal can be achieved through three measures. First, set up a 'health unit' based on a '15-minute community life circle', optimize residents' lifestyle with the main purpose of promoting exercise activities and social interaction and implement emergency measures related to public space with the main purpose of epidemic prevention, isolation and rescue. Second, decision-makers in city

planning and related scholars should cooperate to promote the health planning program, clarify the health needs of different groups of people and fully consider the health effect of space in the daily design and use of public space. Third, they should promote the Health Impact Assessment (HIA) of large-scale urban construction projects, which is also a health policy vigorously promoted by the World Health Organization.

The core of urban governance to deal with the pandemic situation lies in: based on the community life circle, taking the public health unit as the core, aiming at the outbreak of infectious diseases and the growth of chronic diseases, integrating all kinds of health promotion facilities, resources and work, forming an efficient and high-quality health governance model and constructing a healthy urban governance system. This pandemic prevention and control are undoubtedly an arduous, lasting and comprehensive 'urban defence war'. We believe that the prospect of a 'beautiful community' in the new era will come.

Conclusion

In response to the current novel coronavirus pneumonia pandemic, community medical facilities play a key role in enhancing community resilience in public health. As an additional important medical resource outside the hospital system, community medical facilities are the key line of defence for primary prevention and relief in various regions. They can promote the construction of medical support networks in different spatial scales.

At the urban policy level, community medical facilities have policy flexibility and pertinence. As a research subject, it can encourage relevant government departments to implement special plans relating to medical and health facilities, formulate emergency plans for extreme cases of large-scale public health events and reserve construction land for facilities, so as to flexibly respond to a variety of complex situations and solve corresponding problems with pertinence.

At the community network level, community medical facilities have a network and nodal nature. On the one hand, as the core of the community defence system, community medical facilities participate in the construction of urban public health networks to prevent and respond to health emergencies. On the other hand, individuals and families, the basic nodes of pandemic prevention and control, are closely connected with the community to build community-level pandemic prevention and provide control support.

At the individual facilities level, community medical facilities reflect a basic and functional nature. The guarantee of the construction of basic facilities and

the control of the spatial layout and allocation of resource elements can promote effective space control and material supplies during special periods, with the community, as the basic unit.

The medical facilities in the community are the core and ‘brain’ of the whole community defence system construction. Community medical facilities drive the self-organization and self-governance of community residents as well as the construction of medical support networks at different spatial scales, and ultimately promote the improvement of abilities, processes, goals and other aspects of community resilience. Furthermore, the ‘resilience’ of human settlements can help people survive and develop better in complex and changeable external environments.

Authors’ contribution

Fang Wang provided research inspiration for the research design and organised and promoted the study through the entire process. Yuanyang Fang was primarily responsible for the entire research, writing and revising process. Handuo Deng was involved in the writing and revising processes. Fangzhen Wei offered valuable research ideas and collected some information and data.

Authors Note

Author Handuo Deng is also affiliated to The Department of Land Economy, University of Cambridge.

Declaration of conflicting interests


The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: from the Peking University’s Humanities and Social Sciences Special Project (Grant No. 34).

ORCID iDs

Fang Wang  <https://orcid.org/0000-0001-6038-2002>

Fangzhen Wei  <https://orcid.org/0000-0002-3709-5803>

References

- World Health Organization (WHO). *Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV)*, [www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](http://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)) (accessed Feb 7, 2021).
- Raj VAR and Haghightat F. The contribution of dry indoor built environment on the spread of coronavirus: data from various Indian states. *Sustain Cities Soc* 2020; 62: 102371.
- Gray SF and Ocampo MA. Resilient imaginaries: socio-ecological urban design in metro Manila, The Philippines. *Landsc Archit Front* 2018; 6: 98–113.
- Meyer MA. *Social Capital and collective efficacy for disaster resilience: connecting individuals with communities and vulnerability with resilience in hurricane-prone communities in Florida*. Fort Collins: ProQuest Dissertations Publishing, 2013.
- Hill E, Wial H and Wolman H. *Exploring regional economic resilience*. Working Paper, Institute of Urban and Regional Development, University of California, Oakland, 2018.
- Peng C, Guo ZY and Peng ZR. Research progress on the theory and practice of foreign community resilience. *Upi* 2017; 32: 60–66.
- Holling CS. Resilience and stability of ecological systems. *Annu Rev Ecol Syst* 1973; 4: 1–23.
- Bajc K and Stokman A. Design for resilience: re-connecting communities and environments. *Landsc Archit Front* 2018; 6: 14–31.
- Mileti D and Noji E. *Disasters by design: a reassessment of natural hazards in the United States*. Boulder: The National Academies Press, 1999.
- Adger NW. Social and ecological resilience: are they related? *Progr Hum Geogr* 2000; 24: 347–364.
- Bruneau M, Chang SE, Eguchi RT, Lee GC, O’Rourke TD, Reinhorn AM, Shinozuka M, Tierney K, Wallace WA and Winterfeldt D. A framework to quantitatively assess and enhance the seismic resilience of communities. *Earthquake Spectra* 2003; 19: 733–752.
- The United Nations Office for Disaster Risk Reduction (UNDRR). *Framework for action for the Implementation of the International Strategy for Disaster Reduction (ISDR)*, www.eird.org/eng/acerca-eird/marco-accion-eng.htm (accessed 8 August 2021).
- Community Resilience System Initiative Steering Committee. *Community Resilience System Initiative (CRSI) Steering Committee Final Report: A Roadmap to Increased Community Resilience*, merid.org/case-study/community-and-regional-resilience-institute (accessed 2 September 2021).
- South J, Stansfield J, Amlôt R and Weston D. Sustaining and strengthening community resilience throughout the COVID-19 pandemic and beyond. *Perspect Public Health* 2020; 140: 305–308.
- Wang AS and Shi HE. Overview of the World Conference on disaster reduction. *Disaster Reduction China* 1994; 4: 2–4.
- United Nations. *Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters*, www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf (accessed 8 August 2021).
- Tapswan S, Mathot C, Walker I and Barnett G. Preferences for sustainable, liveable and resilient neighbourhoods and homes: a case of Canberra, Australia. *Sustainable Cities Soc* 2018; 37: 133–145.

18. Salimi M and Al-Ghamdi SG. Climate change impacts on critical urban infrastructure and urban resiliency strategies for the Middle East. *Sustain Cities Soc* 2020; 54: 101948.
19. Qiang Y, Huang QX and Xu JW. Observing community resilience from space: using nighttime lights to model economic disturbance and recovery pattern in natural disaster. *Sustain Cities Soc* 2020; 57: 102115.
20. Qin HL. Strengthening community resilience to cope with public health crisis. *Urban Rural Dev.* 2020; 19: 12–15. (in Chinese)
21. United Nations. *SDG 11: Make cities inclusive, safe, resilient and sustainable*, www.unodc.org/unodc/en/about-unodc/sustainable-development-goals/sdg11_-sustainable-cities-and-communities.html (accessed 7 February 2021).
22. United Nations. *The New Urban Agenda*. habitat3.org/the-new-urban-agenda/ (accessed 7 February 2021).
23. Li LY, Ma ZH and Cao T. Leveraging social media data to study the community resilience of New York City to 2019 power outage. *Int J Disaster Risk Reduct* 2020; 51: 101776.
24. Bene C. Towards a quantifiable measure of resilience. *IDS Working Papers* 2013; 434, Brighton: Institute of Development Studies, p.27.
25. Chang SE and Shinozuka M. Measuring improvements in the disaster resilience of communities. *Earthquake Spectra* 2004; 20: 739–755.
26. Tian CS, Fang YP, Liang EY and Zhang CJ. Spatial-temporal analysis of community resilience to multi-hazards in the Anning River basin, Southwest China. *Int J Disaster Risk Reduct* 2019; 39: 101144.
27. Zang XY and Wang Z. Concept evolution, research content and development trend of urban resilience. *Sci Technol Rev* 2019; 37: 94–104. (in Chinese)
28. Poulas K, Kouretas D, Vantarakis A, Leotsinidis M, Kouvelas D, Oana DA, Kostoff RN, Gerotziapas GT, Antoniou MN, Polosa R, Barbouni A, Yiakoumaki V, Giannouchos T, Bagos P, Lazopoulos G, Izotov BN, Tutelyan VA, Aschner M, Hartung T, Wallace HM, Carvalho F, Domingo JL and Tsatsakis AM. Improved strategies to counter the COVID-19 pandemic: lockdowns vs. primary and community healthcare. *Toxicol Rep* 2021; 8: 1–9.
29. Penkler M, Müller R, Kenney M and Hanson M. Back to normal? Building community resilience after COVID-19. *Lancet Diabetes Endocrinol* 2020; 8: 664–665.
30. May CK. Resilience, vulnerability, & transformation: exploring community adaptability in coastal North Carolina. *Ocean Coastal Manage* 2019; 169: 86–95.
31. Kimhi S, Marciano H, Eshel Y and Adini B. Recovery from the COVID-19 pandemic: distress and resilience. *Int J Disaster Risk Reduct* 2020; 50: 101843.
32. Miao Q, Schwarz S and Schwarz G. Responding to COVID-19: community volunteerism and coproduction in China. *World Dev* 2021; 137: 105128.
33. Valeriani G, Vukovic IS, Lindegaard T, Felici R, Mollica R and Andersson G. Addressing healthcare gaps in Sweden during the COVID-19 outbreak: on community outreach and empowering ethnic minority groups in a digitalized context. *Healthcare* 2020; 8: 445.
34. Sharifi A and Khavarian-Garmsir AR. The COVID-19 pandemic: impacts on cities and major lessons for urban planning, design, and management. *Sci Total Environ* 2020; 749: 142391.
35. Goei A and Tiruchittampalam M. community care facility – a novel concept to deal with the COVID-19 pandemic: a Singaporean institution’s experience. *J Public Health Manag Pract* 2020; 26: 613–621.
36. Hosseini MR, Fouladi-Fard R and Aali R. COVID-19 pandemic and sick building syndrome. *Indoor Built Environ* 2020; 29: 1181–1183.
37. Xiong ZW, Can X, Yan XX, Cai YK, Zhou KY, Xie CS, Zhang TB, Wu XH, Liu K, Li ZQ, Wang W and Chen JC. Clinical characteristics and outcomes of 421 patients with coronavirus disease 2019 treated in a mobile cabin hospital. *Chest* 2020; 158: 939–946.
38. Liang HF. Experience and enlightenment of resilient community in Japan: reconstruction of Rokkomichi Station North District. *Planners* 2017; 33: 38–43. (in Chinese)
39. Sun CJ and Zhai ZQ. The efficacy of social distance and ventilation effectiveness in preventing COVID-19 transmission. *Sustain Cities Soc* 2020; 62: 102390.
40. Lakhouti A. Practical recommendations for temporary storage of medical wastes during the COVID-19 pandemic. *Indoor Built Environ* 2020; 29: 1186–1188.
41. Xiang MM, Gu LS and Han ZQ. A review of the research on resilient community construction and development. *Beauty & Times*. 2016; 07: 117–118. (in Chinese)
42. Odendaal N. Recombining place: COVID-19 and community action networks in South Africa. *Int J E-Planning Res* 2021; 10: 124–131.
43. Duan J. Planning improves city’s immunity: a written conversation on Covid-19 breakout. *City Plann Rev* 2020; 44: 115–136. (in Chinese)
44. Ambrosio FD, Belvis AG, Morsella A, Castellini G, Graffigna G and Laurenti P. Life after COVID-19: rethinking the healthcare system and valuing the role of citizens’ engagement in health prevention. *Front Psychol* 2020; 11: 589249.
45. Ludwick T, Morgan A, Kane S, Kelaher M and McPake B. The distinctive roles of urban community health workers in low- and middle-income countries: a scoping review of the literature. *Health Policy Plan* 2020; 35: 1039–1052.
46. Mali NV, Yerramsetti S and Manoharan A. Communicative governance to mitigate the COVID-19 pandemic: a case study of Delhi, India. *Int J E-Planning Res* 2021; 10: 116–123.
47. Halperin J, Conner K, Telleria C, Agins B and Butler I. The vital role of a federally qualified community health center in New Orleans, Louisiana, during the COVID-19 pandemic. *J Ambul Care Manage* 2021; 44: 2–6.
48. Casella F. Can the COVID-19 epidemic be controlled on the basis of daily test reports? *IEEE Control Syst Lett* 2021; 5: 1079–1084.
49. Agarwal G, McDonough B, Angeles R, Pirrie M, Marzanek F, Mcleod B and Dolovich L. Rationale and

- methods of a multicentre randomised controlled trial of the effectiveness of a Community Health Assessment Programme with Emergency Medical Services (CHAP-EMS) implemented on residents aged 55 years and older in subsidised seniors' housing buildings in Ontario, Canada. *BMJ Open* 2015; 5: e008110–e008110.
50. Castellanos-González ME, Vera CEM, Calatayud MM, Dueñas RYG, González ARM, Pérez ARL and Oramas RMA. Social knowledge networks for promoting environmental education in coastal communities from central-southern region of Cuba. *Region Stud Marine Sci* 2020; 35: 101115.
 51. Bunker A, Barnighausen T, Woodward A and Bullen C. Housing structure and occupant behaviour to increase the environmental and health co-benefits of housing: insights from expert interviews in New Zealand. *Indoor Built Environ* 2021; 30: 535–553.
 52. Agarwal G, McDonough B, Angeles R, Pirrie M, Marzanek F, Mcleod B and Dolovich L. Development of a community health and wellness pilot in a subsidised seniors' apartment building in Hamilton, Ontario: Community Health Awareness Program delivered by Emergency Medical Services (CHAP-EMS). *BMC Res Notes* 2015; 8: 113.
 53. Fraser T, Cunningham L, Bancroft M, Hunt A, Lee E and Nasongo A. Climate crisis at city hall: how Japanese communities mobilize to eliminate emissions. *Environ Innov Soc Trans* 2020; 37: 361–380.
 54. Hwang BG, Shan M and Looi KY. Knowledge-based decision support system for prefabricated prefinished volumetric construction. *Autom Constr* 2018; 94: 168–178.
 55. Sun L, Zhang YY, Tian L and Zhang HH. Modular design strategy to enhance community resilience in the context of epidemic prevention. *Beijing Plann Rev* 2020; 05: 76–79. (in Chinese)
 56. Wang Y, Qiao F, Zhou FL and Yuan YF. Surface distribution of severe acute respiratory syndrome coronavirus 2 in Leishenshan Hospital in China. *Indoor Built Environ*. 2020; 1420326X20942938.
 57. Doyle A, Hynes W and Purcell SM. Building resilient, smart communities in a post-COVID era: insights from Ireland. *Int J E-Planning Res* 2021; 10: 18–26.
 58. Robinson PJ and Johnson PA. Pandemic-driven technology adoption: public decision makers need to tread cautiously. *Int J E-Planning Res* 2021; 10: 59–65.