

The Role of Urban Disaster Risk Management in Major Catastrophic Events: A Case Study of Resilience in Chinese Cities During the COVID-19 Pandemic

Yiyang Pu^{1,a,*}

¹National University of Singapore, Nus Business School, Mochtar Riady Building, 15 Kent Ridge Dr, 119245, Singapore

a. yiyang_pu@outlook.com

**corresponding author*

Abstract: The emergence of infectious diseases has historically influenced urban development, necessitating the evolution of urban planning toward greater disaster resilience. The COVID-19 pandemic, in particular, has revealed weaknesses in modern urban planning and governance, emphasizing the need for enhanced urban resilience and disaster risk management. For China, as urban populations continue to grow, urban resilience and disaster risk management have become focal points for urban planners and policymakers, ensuring that cities can rapidly adapt and effectively respond to various challenges. This study summarizes a series of emergency measures adopted by the Chinese government during the COVID-19 pandemic and analyzes their effectiveness. China's response, characterized by early intervention, social distancing, extensive testing, and advanced tracking technologies, effectively curtailed the virus's spread, especially in Hubei province and its capital, Wuhan. Despite these successes, the paper identifies areas where China's urban resilience could be improved, including coordination of emergency plans, information dissemination, and social cohesion, among other aspects, to better confront future challenges.

Keywords: novel coronavirus pneumonia, risk response, Urban Governance, public health, risk management ability

1. Introduction

Cities, as the core of human society, not only concentrate large populations and wealth but also face multiple threats from natural and man-made disasters [1]. These threats endanger lives and property, leading to substantial socio-economic impacts and challenging the sustainability and functionality of urban societies. Historically, the outbreak of infectious diseases has consistently been a significant factor influencing urban development. Events such as the outbreaks of plague and cholera have compelled societies to reevaluate their urban resilience and disaster management capabilities, leading to the continuous iteration and updating of regulations related to urban management and construction [1]. Effective urban disaster risk management involves early warning and prevention, scientific planning, preparation, and resource allocation, as well as achieving the sustainability of urban society, economy, and environment in the aftermath of disasters [2]. The COVID-19 pandemic, emerging in 2019, underscored the multifaceted disaster challenges faced by cities, highlighting vulnerabilities in

urban resilience and disaster risk management. In this context, this thesis aims to use the example of the COVID-19 pandemic to analyze the resilience of Chinese cities during the crisis, delve into the crucial role of urban disaster risk management during such moments, and provide valuable insights into existing measures, shortcomings, and future urban planning and response strategies in Chinese cities.

2. Case studies of the COVID-19 Pandemic in China and Important Factors for Urban Resilience

As of November 16, 2023, Central European Time, according to the World Health Organization [3], China has reported a total of 99,319,332 confirmed cases of COVID-19, accounting for 12.87% of the global total [4]. Despite the sudden onset of the pandemic in a highly urbanized environment with high city density and population mobility, the Chinese government, through early control measures, mandatory social distancing, testing, high-tech contact tracing, and the high compliance of the population, successfully mitigated the COVID-19 outbreak at that time [5].

2.1. Isolation and Community Containment Measures

Due to the absence of safe and effective treatment methods or validated vaccines, China had to rely entirely on traditional non-pharmaceutical interventions (NPIs), such as controlling the source of infection, interrupting transmission, and protecting susceptible populations. On January 23, Wuhan implemented a "lockdown," followed by 15 other cities in Hubei within the next three days, placing approximately 60 million citizens under community isolation [5]. Strict controls were imposed on entry and exit from these cities, with any movement within the cities prohibited without special permission. However, since this period coincided with China's Lunar New Year holiday on February 1, there was extensive population movement nationwide. Despite Wuhan implementing rapid lockdown measures, the virus still spread throughout the country. Subsequently, residents both inside and outside Hubei province were instructed to stay at home and avoid contact with others [6].

The Chinese government immediately took unprecedented measures to control the spread of COVID-19, including suspending public transportation, closing public places, canceling public gatherings, implementing strict community management, and isolating and caring for confirmed and suspected cases [7]. To obtain a better and faster understanding of the situation and enable the government to conduct risk assessments and determine priorities, regions were categorized into four levels based on the number and types of cases, ranging from low-risk areas (no confirmed cases or no new cases for 14 consecutive days) to high-risk areas (ongoing community transmission) [5]. Each region had corresponding control and lockdown measures to adapt to the local situation. Community police, religious groups, and community volunteers conducted comprehensive screening and registration of residents through telephone or face-to-face inquiries, self-checks, and self-reporting, reporting their findings to higher authorities [8].

As the Wuhan outbreak reached its most severe stage, with thousands of new infection cases daily, designated hospitals treating the virus ran out of beds for COVID-19 patients [9]. The government urgently issued orders to construct temporary treatment centers and isolation points. The establishment of makeshift hospitals, such as field hospitals set up in exhibition centers and sports stadiums, emphasized the rapid renovation and conversion of existing buildings at low cost. These facilities provided a large number of beds and appropriate care for patients with non-severe or critical illnesses, offering emotional and social support to help patients recover and grow during the chaotic period of their lives [8]. This approach facilitated the hospitalization and isolation of all confirmed COVID-19 patients, avoiding issues related to home isolation, such as exposure of family members and a lack of monitoring. In addition to makeshift hospitals, extensive temporary isolation points

were set up nationwide, including hotels, training centers, sanatoriums, university dormitories, etc., to centrally accommodate suspected COVID-19 patients and close contacts with confirmed patients for protective isolation [7].

2.2. Case Testing and Contact Tracing

China's response to the epidemic has been marked by a strategic embrace of emerging technologies such as 5G, cloud computing, artificial intelligence, and blockchain to fortify its prevention and control measures [4]. These tools aid in better understanding the development trends of the pandemic and predictive models under specific circumstances, assisting in the prevention and control of epidemics, releasing and reducing risk exposure. The use of health codes, QR codes, allows for more information about individual risk exposure, and mandatory health screenings in public places to curb transmission [9]. By scanning the code to obtain health status, city managers can obtain real-time health information in public places, helping to promptly identify and isolate individuals with infectious diseases, intelligently allocate medical resources, personnel, and equipment, and improve the efficiency of urban disaster management. For individuals with potential risks, measures such as isolation or enhanced testing can be taken to curb the spread of infectious diseases. Scanning codes to record entry and exit times help trace the movements of the infected and promptly notify individuals who have been in contact.

2.3. Logistics and Supply Chain

During the peak of the COVID-19 pandemic, when 230 million Chinese people had restricted travel, severe food shortages and rapid price increases were addressed through centralized food planning and distribution, as well as later online food purchases [10]. The State Council arranged the supply for each province and city based on daily reports of food prices and market supply from local governments, ensuring the supply of essential necessities such as vegetables, meat, and grains through real-time monitoring, unloading and distribution, and coordinated transportation [11]. In addition, provinces were required to prioritize the passage of vehicles transporting epidemic prevention and control materials on highways, establish "green channels" for basic agricultural products, and improve transportation efficiency while reducing transit time. Local private e-commerce platforms also delivered fresh agricultural products to residential communities, accepting orders in advance and delivering them to buyers in a contactless manner. In Beijing, JD Technology and suburban agricultural production bases collaborated to create the "Fenghe Canteen" online community basket program through a digital supply and sales platform. Similarly, in Jiangsu, goods on online platforms are delivered from 4 a.m. to 5 p.m. every day, with each delivery driver completing an average of 900 orders per day [12].

3. COVID-19 in China: Responses, Gaps, and Urban Resilience Moving Forward

Upon the emergence of COVID-19, the Chinese government deployed a stratified, precise, and pragmatic array of strategies, achieving substantial control over the epidemic's trajectory. Initially, rapid and decisive actions established a multi-tiered coordination system among governmental echelons, ensuring expeditious dissemination of information and judicious allocation of resources [13]. Local authorities swiftly undertook immediate actions, offering support and enacting economic revival strategies within their regions. Simultaneously, the central government allocated resources to bolster urban jurisdictions, augmenting preparedness and fortifying resources for disaster response. A robust health infrastructure, comprising state-of-the-art medical facilities, avant-garde health technologies, and an extensive public health service network, was instrumental in enabling prompt diagnosis, isolation, and treatment of cases, thereby attenuating the epidemic's proliferation. The

improvisation of makeshift hospitals underscored the adaptive use of urban spaces, circumventing the inefficient long-term occupation of these spaces, a critical aspect in high-density urban areas. The allocation of testing kits, management of resources, and subsequent vaccine rollout epitomized the synchronized efforts at the national level, optimizing the efficacy of the epidemic's containment. Moreover, leveraging big data, artificial intelligence, and 5G technologies enhanced remote management, surveillance of the epidemic, and distribution of essential life resources, thus expediting the restoration of societal functional capabilities [4]. The proactive engagement in combating the pandemic underscored the centrality of technological innovation as an essential pillar for future urban evolution. Chinese municipalities are poised to maintain an intimate collaboration with corporate entities, government bodies, and civil society to further the development and integration of technology into urban resilience. This symbiosis is anticipated to broaden the scope of public services and infrastructure integral to urban operations and governance, promoting the inception of a novel urban resilience paradigm underscored by digital infrastructure. In parallel, the collective endeavors of citizens, volunteers, and community organizations underscored social solidarity's pivotal role. This collective ethos not only reinforced policy implementation but also cultivated a shared sense of accountability, forming the bedrock of a resilient community [14].

Concurrently, throughout the pandemic, Chinese cities and counties revealed pronounced deficiencies and prospects for enhancement in their emergency response mechanisms to urban calamities, accentuating the imperative for bolstering urban resilience. Research by Yuan, Z.H., and Hu, W.Y. illuminated China's susceptibilities during the epidemic's incipient phase, particularly in the domains of early warning systems and transparency in information dissemination [14]. Despite the National Health Commission and the State Council's Joint Prevention and Control Mechanism's daily bulletins [7], which effectively informed the public and guided protective measures, these efforts could not entirely obscure the initial institutional inefficacy and a lack of vigilance among pertinent departments [15]. This was manifest in the initial stance of Wuhan officials, who proscribed unauthorized public dissemination of epidemic information. An early acknowledgment of the epidemic's gravity and transparent communication with the populace might have enabled Wuhan to arrest the spread of COVID-19 during the critical containment window. Moreover, the government's prior health education initiatives and dissemination channels were found wanting, leaving the populace ill-equipped to adopt efficacious measures in the face of an abrupt public health crisis [16]. Furthermore, the need for more nuanced and tailored application of restrictive protocols became apparent as the blanket isolation and quarantine measures intermittently hampered normal urban operations. Extended periods of social isolation provoked community disconnection and interpersonal estrangement, exacerbating loneliness and psychological distress. Regarding sustenance logistics, Dai and Qi (2020) noted that the logistical capacities of some municipal administrations—specifically manpower and transportation—were stretched thin, resulting in delayed food deliveries and challenges in fulfilling individual orders, thus spotlighting disparities in resource distribution [17]. Lastly, the deployment of QR codes introduced complexities concerning routine medical services, opportunistic exploitation within communities, escalated interpersonal conflicts, and the maintenance of living standards for those in isolation. These challenges warrant meticulous reconsideration and strategic redress.

4. Conclusion

In sum, the advent of pandemics has uncovered flaws in the nexus of modern urban planning and governance, prompting a critical reassessment and recognition of the imperative for fortified disaster resilience in urban settings. The Chinese government's swift and layered response strategies during the COVID-19 pandemic effectively contained the virus's proliferation, demonstrating the strength of urban resilience in times of adversity. Nonetheless, the pandemic also highlighted noticeable gaps

in public health preparedness and emergency response. While this analysis offers valuable perspectives on China's urban resilience in the face of COVID-19, its scope is primarily limited to government emergency actions and urban resilience outcomes during the crisis, omitting an in-depth examination of enduring structural urban planning and governance issues. Furthermore, the assessment of urban resilience construction is predominantly centered on pandemic management, with other influential factors on urban resilience receiving less attention. As the urban resilience construction landscape is dynamic, continuous updates and research are vital to maintain an accurate comprehension of its progression. Ultimately, the urban experiences gleaned from the pandemic serve as instructive lessons for future urban planning and governance, steering efforts toward crafting more resilient and sustainable urban environments. In the face of crises, cities must persist in learning and innovating to safeguard resident safety and promote sustainable urban development.

References

- [1] Cutter, S.L. (2021). *Urban Risks and Resilience*. In: Shi, W., Goodchild, M.F., Batty, M., Kwan, M.P., Zhang, A. (eds) *Urban Informatics. The Urban Book Series*. Springer, Singapore. https://doi.org/10.1007/978-981-15-8983-6_13
- [2] Singh, N., Sharifi, A. (2022). *Resilient Cities: Concepts and Underlying Principles*. In: Sharifi, A., Salehi, P. (eds) *Resilient Smart Cities*. pp.67-92. *The Urban Book Series*. Springer, Cham. https://doi.org/10.1007/978-3-030-95037-8_4
- [3] WHO(2023). *WHO Coronavirus (COVID-19) Dashboard*. World Health Organization. <https://covid19.who.int/?mapFilter=deaths>
- [4] UN-Habitat (2022). *Future Cities Advisory Outlook 2022: Building New Urban Resilience*. United Nations Human Settlements Programme. https://unhabitat.org/sites/default/files/2023/03/future_cities_advisory_outlook_2022_building_new_urban_resilience_abridged_version_1.pdf
- [5] Lei Zhou, Zunyou Wu, Zhongjie Li, Yanping Zhang, Jennifer M McGoogan, Qun Li, Xiaoping Dong, Ruiqi Ren, Luzhao Feng, Xiaopeng Qi, Jingjing Xi, Ying Cui, Wenjie Tan, Guoqing Shi, Guizhen Wu, Wenbo Xu, Xiaoqi Wang, Jiaqi Ma, Xuemei Su, Zijian Feng, George F Gao, for the China COVID-19 Task Force, *One Hundred Days of Coronavirus Disease 2019 Prevention and Control in China, Clinical Infectious Diseases*, Volume 72, Issue 2, 15 January 2021, Pages 332–339, <https://doi.org/10.1093/cid/ciaa725>
- [6] Zhong, B. L., Luo, W., Li, H. M., Zhang, Q. Q., Liu, X. G., Li, W. T., & Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *International Journal of Biological Sciences*, 16(10), 1745-1752. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7098034/>
- [7] China Keywords (2020). *The Joint Prevention and Control Mechanism of the State Council*. http://www.china.org.cn/english/china_key_words/2020-03/13/content_75810658.htm
- [8] UN-Habitat China(2022). *COVID-19 Wuhan Guidance Papers*. UN-Habitat China. https://unhabitat.org/sites/default/files/2020/09/covid-19_wuhan_guidance_papers_2020.pdf
- [9] Simiao Chen, Zongjiu Zhang, Juntao Yang, Jian Wang, Xiaohui Zhai, Prof Till Bärnighausen, Prof Chen Wang, *Fangcang shelter hospitals: a novel concept for responding to public health emergencies. HEALTH POLICY/ VOLUME 395, ISSUE 10232, P1305-1314, APRIL 18, 2020*. [https://doi.org/10.1016/S0140-6736\(20\)30744-3](https://doi.org/10.1016/S0140-6736(20)30744-3)
- [10] Yi-Shin Chang, Zhenzhong Si, Jonathan Crush, Steffanie Scott, Taiyang Zhong, 2023, *Governing for food security during the COVID-19 pandemic in Wuhan and Nanjing, China, Urban Governance*, Volume 3, Issue 2, Pages 106-115, ISSN 2664- 3286, <https://doi.org/10.1016/j.ugj.2023.03.001>
- [11] Chinese Government Network (2020c). *The State Council Joint Defense and Joint Control Mechanism held a press conference at 10:00 on February 25 to introduce the maintenance of market order, support the resumption of production and production, and answer reporters 'questions*. <https://www.gov.cn/xinwen/gwylflkjz29/index.htm>
- [12] People's Daily (2020). *Buying food online has become a new way of life for Jiangsu residents*. https://www.sohu.com/a/372478134_114731
- [13] The World Bank (2022). *Urban and Disaster Risk Management Responses to COVID-19. The World Bank*. Retrieved from <https://pubdocs.worldbank.org/en/575581589235414090/World-Bank-Urban-DRM-COVID-19-Responses.pdf>
- [14] Yuan, Z.H.& Hu, W.Y. (2023). *Urban resilience to socioeconomic disruptions during the COVID-19 pandemic: Evidence from China. International Journal of Disaster Risk Reduction*, Volume 91, 103670, ISSN 2212-4209. <https://doi.org/10.1016/j.ijdr.2023.103670>.

- [15] Zhang, Jinrui, and Ruilian Zhang. 2020. "COVID-19 in China: Power, Transparency and Governance in Public Health Crisis" *Healthcare* 8, no. 3: 288. <https://doi.org/10.3390/healthcare8030288>
- [16] Xing, Cunhai, and Ruilian Zhang. 2021. "COVID-19 in China: Responses, Challenges and Implications for the Health System" *Healthcare* 9, no. 1: 82. <https://doi.org/10.3390/healthcare9010082>
- [17] N. Dai, D. Qi(2020).From wet markets to online purchasing: Food shopping patterns during COVID-19 in Wuhan and Nanjing, China. *Hungry Cities Partnership COVID-19 and Food Security Research Brief*, Waterloo <https://hungrycities.net/wp-content/uploads/2022/01/RB4.pdf>