

# Unveiling Urban Health Resilience in the COVID-19 Pandemic: A Systematic PRISMA Exploration of Key Parameters and Strategies

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## Abstract

Urban health resilience is vital for cities, particularly during public health crises like the COVID-19 pandemic. It represents a city's capacity to anticipate, respond to, and recover from challenges across environmental, social, and health-related domains. This study presents a systematic review of the literature concerning urban health resilience, with a specific focus on identifying key parameters impacting urban health during the COVID-19 pandemic. Using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology, this research conducts an in-depth review of the literature from the year 2019, systematically evaluating studies discussing urban health resilience in relation to the COVID-19 pandemic in metropolitan areas. The study findings provide valuable insights by highlighting the connection between urban parameters related to urban form and the transmission of COVID-19, a recent pandemic. To reduce virus transmission during public health crises, cities must implement effective measures across various aspects, including cultural, spatial, ecological, and infrastructural factors. The article emphasizes the importance of strategic urban planning and response measures to enhance resilience against pandemics.

**Keywords:** Urban Health, Public Health, Resilience, COVID-19, Systematic Review, PRISMA, Urban Planning, Pandemic Response.

## 1. Introduction

Urbanization is an undeniable global trend. More than half of the world's population lives in urban areas. Cities offer economic opportunities, cultural richness, and social connections, but they also pose unique public health challenges, especially during times of crisis (Amen, 2021; Amen et al., 2023; Jacob, 2023; Moretti, 2023). The emergence of the COVID-19 pandemic in late 2019 highlighted the complex relationship between urban environments and public health resilience.

Health resilience is a concept that has gained attention in both academic and policy communities and refers to the capacity of individuals, communities, and systems to adapt and thrive in the face of adversity, such as disease outbreaks, natural disasters, and socio-economic disruptions.

In the context of urban environments, health resilience includes not only the ability to respond effectively to immediate health threats, but also the ability to address underlying social determinants of health and promote long-term well-being. The COVID-19 pandemic has highlighted the importance of urban health resilience, revealing both strengths and vulnerabilities within urban systems around the world. From rapid transmission in densely populated areas to unequal access to healthcare and essential services, cities are feeling the impacts of the pandemic in different ways.

However, despite these challenges, examples of resilience are emerging that demonstrate innovative public health measures, community solidarity, and adaptive governance approaches. This study aims to fill this gap by systematically analyzing the influence of key resilience parameters on response and recovery phases in urban environments during the pandemic (WHO, 2020).

Objectives include identifying and classifying key urban health resilience metrics, assessing their impact on COVID-19 response in different urban contexts, evaluating their role in the post-Covid-19 recovery phase and develop policy recommendations to improve future urban health resilience. public health emergency (United Nations, 2018). By addressing these questions and hypotheses, this study aims to contribute to the understanding of urban health resilience and inform the development of strategies to build resilience in urban areas against future pandemics. This study answers the following question: How urban form can affect the urban health ? How the urban form help the propagation of pandemic case study COVID 19 ? What are the urban parameters that influence COVID 19 ? and What is the level of influence of urban parameters that affect COVID 19 ?

Urban health resilience parameters such as health infrastructure, social support networks, environmental quality, and policy responses are believed to significantly affect the effectiveness of urban resident's response and recovery after the COVID-19 pandemic. The COVID-19 pandemic has revealed significant vulnerabilities in urban health systems and highlighted the importance of resilience in urban areas. In this context, resilience refers to the ability of urban residents to withstand and recover from public health crises. Although there is a growing literature

on resilience in urban health (Patel et al., 2017; Cutter et al., 2008), there is a lack of in-depth studies investigating the impact of resilience indicators on outcomes, especially during the COVID-19 pandemic.

The structure of this article aims to present our research on urban health resilience during the COVID-19 pandemic in a clear and logical manner.

**Introduction:** The introduction sets the context for the study by defining urban health resilience and explaining its importance in light of the COVID-19 pandemic. It outlines the research question, highlights gap in the literature, and presents the main research questions and hypotheses. This section discusses the significance of the study and its relevance to current health challenges in cities.

**Methods:** This section describes the study design and methodology, including the use of the PRISMA methodology and the PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). It describes the search strategy, selection criteria, data collection methods, and data analysis techniques. It also describes the use of the PICO (Population, Intervention, Comparison, Outcome) framework. This section ensures transparency and reproducibility of the research process.

**Results:** In the Results section, the findings of the study are systematically presented, organized around the main parameters of urban health resilience identified in the review. It provides a detailed analysis and quantifies the impact rate of these parameters on the response and recovery of urban populations during the COVID-19 pandemic. This section provides a comprehensive overview of the data and their implications.

**Discussion:** In the Discussion section, the results are interpreted and linked to the existing literature. This section examines the implications of the study findings for urban planning and public health policy and highlights the strengths and weaknesses of the study. Insights are gained into the complex interplay between urban health resilience parameters and pandemic responses, providing a deeper understanding of the topic.

**Conclusions:** The conclusions summarize the study's main findings, acknowledge its weaknesses, and suggest future research directions. We summarize the significance of the study and its contribution to the field, and provide final considerations and recommendations for improving urban health resilience in the face of future health emergencies.

This structured approach makes the research accessible to a broad audience, including academics, policy makers and urban planners, and allows for a comprehensive understanding of the complex relationship between urban health resilience and pandemic response.

## 2. Methods

This study used systematic review methodology and followed **PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and protocols**. The study design includes a comprehensive literature review to identify relevant studies on urban health resilience parameters and their impact during the COVID-19 pandemic. The **PICO (Population, Intervention, Comparison, Outcome) framework** is used to formulate the research questions and guide the literature review process. The sample size will consist of peer-reviewed articles, reports, and grey literature that meet the inclusion criteria. Data collection included a comprehensive search of electronic database "Scopus" only. Keywords and search terms will be used to collect studies related to "Built Environment, decision making, environmental Health, health risks, public health, resilience, risk assessment, wellbeing, urban area, urban health, urban planning, urban resilience, COVID-19 Pandemic, risk factor, vulnerability".

Once relevant studies are identified, data extraction will be performed using a standardized form to ensure consistency and completeness. Extracted data will include information on study design, population characteristics, interventions, outcomes, and measured impact rates of different resilience parameters. Data analysis will include both qualitative and quantitative methods.

A narrative synthesis will be conducted to summarize and interpret the findings of the included studies. Furthermore, a meta-analysis was conducted to quantify the impact rate of the identified resilience parameters on the response and recovery of urban populations during the COVID-19 pandemic. The results are then categorized and analyzed to identify patterns and draw conclusions about the impact of urban health resilience parameters. This systematic approach ensures a rigorous and transparent review of the existing literature, providing solid evidence to support the study's findings and recommendations.

### 3. Eligibility Criteria

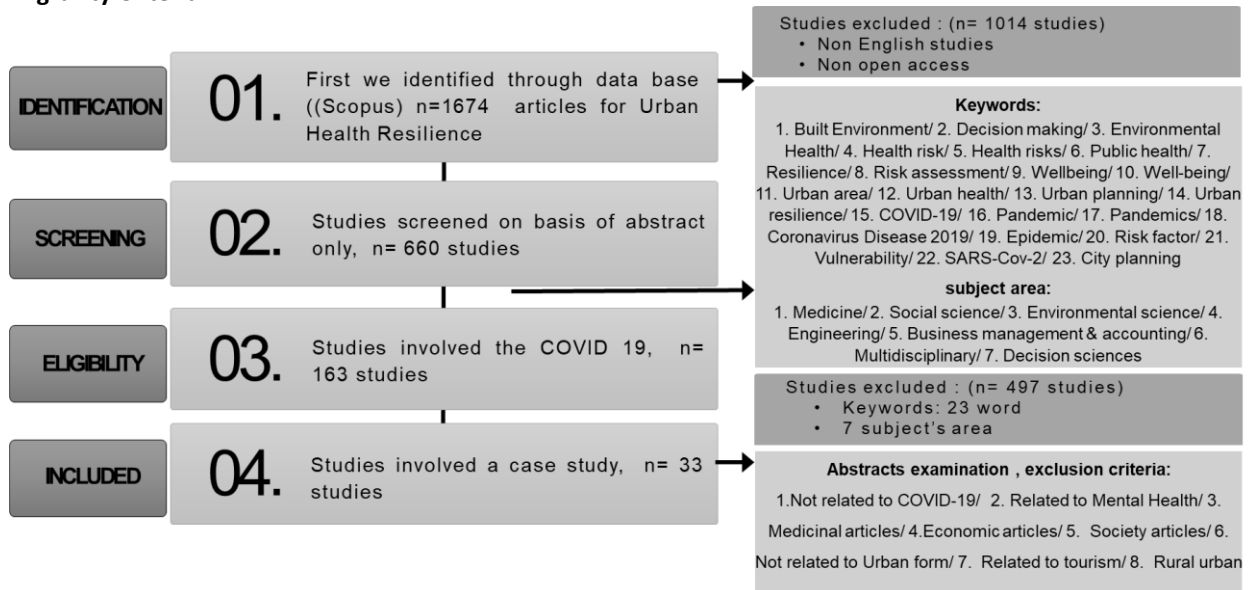


Figure 1. Structure of the Study (Developed by Authors).

**Identification:** The process starts by identifying pertinent articles from the Scopus database using only abstracts. Initially, 1674 articles on urban health resilience were pinpointed. Following the initial screening, 1014 studies were excluded for being either non-English or non-open access.

**Screening:** Subsequently, the articles underwent filtering based on keywords and domains. The specific keywords included terms such as built environment, decision-making, environmental health, public health, resilience, COVID-19, and pandemic. The selected disciplines encompassed medicine, social science, environmental science, engineering, business management, interdisciplinary studies, and decision science. At this juncture, 497 studies were excluded based on keywords (23 terms) and domains (7 domains).

**Eligibility (Detailed Review):** A further 163 studies related to COVID-19 were scrutinized against detailed eligibility criteria. Exclusions at this stage were determined through abstract review and included studies related to Medicine, social science, environmental science, engineering, business management & accounting, multidisciplinary and Decision sciences.

**Final Selection:** 33 case studies on urban health resilience during the COVID-19 pandemic were included. This process is vital to ensuring that the review comprises relevant, high-quality studies that offer valuable insights into Urban form parameters affecting the COVID-19 transmission. The use of specific keywords and topic areas helps narrow down the extensive literature to those most relevant to the research question.

Adhering to the PRISMA principles ensures transparency and reproducibility of the evaluation process, enhancing the reliability and trustworthiness of the results. This systematic approach enables a comprehensive examination of how different indicators of urban health resilience impact cities' capacity to respond to and recover from the COVID-19 pandemic, providing a solid foundation for the study's conclusions and recommendations.

### 4. Results

In this study, we chose to evaluate urban health resilience through four primary requirement scales based on an extensive analysis of the literature: Interior Spaces, Intermediate Spaces, Exterior Spaces, and Functionality. Each scale encompasses various indicators that reflect different aspects of urban resilience and public health considerations.

#### Requirements and Indicators

To effectively assess urban health resilience during the COVID-19 pandemic, this study identified four primary requirements scales based on a comprehensive analysis of the literature. Each scale includes specific indicators that reflect various aspects of urban resilience, focusing on enhancing living conditions, promoting health, and ensuring adaptability in urban environments. Below are the detailed descriptions of these requirements and their corresponding indicators:

#### 1. Interior Spaces: Architectural Quality of Living (12.2%)

**Indicators:** Air control, control of solar and radiant factors, private balconies and terraces, green roofs and facades, wider staircases, windows that open.

**Description:** These indicators aim to improve the indoor environmental quality, which is crucial for individual well-being, especially in densely populated urban areas where residents spend significant time indoors. Enhanced air control and natural ventilation help reduce the spread of airborne diseases, including COVID-19. Solar and radiant control contribute to energy efficiency and thermal comfort, while private balconies and green roofs offer residents personal outdoor spaces for recreation and relaxation. Wider staircases facilitate physical distancing, reducing the risk of virus transmission in shared indoor spaces.

**Significance:** By improving the architectural quality of living, cities can ensure healthier and more comfortable living conditions, which directly impact residents' physical and mental health. These measures are particularly critical during health crises, as they help mitigate the adverse effects of prolonged indoor confinement.

## 2. Intermediate Spaces (6.06%)

**Indicators:** Green spaces and corridors, intermediate housing, public spaces between buildings, physical distancing in public spaces.

**Description:** Intermediate spaces serve as vital transition zones between indoor and outdoor environments. Green spaces and corridors enhance urban biodiversity, provide recreational areas, and improve air quality. Intermediate housing options increase the availability of diverse living arrangements, catering to various population needs. Public spaces between buildings and measures for physical distancing in these areas ensure that people can safely interact and move around.

**Significance:** These spaces are crucial for maintaining mental and physical health by providing accessible outdoor areas where residents can exercise, socialize, and enjoy nature. They also facilitate safe movement and interactions, essential for reducing stress and promoting community well-being during pandemic lockdowns and social distancing mandates.

## 3. Exterior Spaces: Physical Distancing Between Users in Public Spaces (56.06%)

**Indicators:** Health hygiene conditions, road sections of bicycle routes, accessibility to urban services through pedestrian and bicycle paths, shared mobility, dimension of parking areas based on the number of pedestrian users, number of pedestrian paths, width of pedestrian paths, number of one-way paths, green spaces and infrastructure, open spaces, shopping centers and downtown areas.

**Description:** This scale focuses on the broader urban infrastructure, emphasizing the need for well-planned exterior spaces that support physical distancing and promote active transportation. Health hygiene conditions are critical for preventing the spread of diseases in public areas. Well-designed bicycle routes and pedestrian paths encourage walking and cycling, reducing vehicular dependency and traffic congestion. Green and open spaces offer areas for recreation and relaxation, essential for public health and well-being.

**Significance:** Exterior spaces play a fundamental role in urban resilience by ensuring safe and accessible environments for all residents. By promoting active transportation and providing ample green and open spaces, cities can enhance their overall resilience to health crises and improve the quality of life for their inhabitants.

## 4. Functionality (24.4%)

**Indicators:** Residential building density, mixed-use neighborhoods, urban circuit functionality, flexibility and adaptability of spaces.

**Description:** Functional urban design supports diverse uses and ensures that urban areas can meet various needs and withstand disruptions. Residential building density influences how communities function and interact, with implications for social cohesion and resource use. Mixed-use neighborhoods integrate residential, commercial, and recreational spaces, reducing the need for long commutes and fostering vibrant communities. Urban circuit functionality refers to the efficiency and connectivity of urban infrastructure, facilitating smooth movement and access to services. Flexible and adaptable spaces can be repurposed quickly to respond to changing needs, such as converting public buildings into healthcare facilities during a pandemic.

**Significance:** The functionality of urban areas is crucial for resilience, as it determines how well cities can adapt to and recover from disruptions. Mixed-use neighborhoods and adaptable spaces enhance urban vibrancy and sustainability, supporting diverse needs and improving overall resilience.

**Table 1.** Requirements indicators rate.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	15 case study
Requirements	indicators	Italy 2020	Italy 2024	USA 2020	USA 2021	USA 2021	China 2021	Austria 2021	Iran 2021	Jordan 2022	Egypt 2022	Indonesia 2023	China 2023	Peru 2022	Hungary 2024	Poland 2024	
Interior spaces: Architectural Quality of living 12,22 %	Air control		X									X					2
	Control of solar and radiant factor										X	X					2
	Lawns, gardens, and private patio space			X	X												2
	private balconies and terraces			X													1
	Green roof & façade							X									1
	Wider staircases			X													1
	Windows that open			X								X					2
Intermediate spaces: 6,66 %	Green spaces & corridors			X				X			X						3
	intermediate housing		X														1
	Public spaces between buildings		X								X						2
Exterior spaces: Physical distancing between users in public spaces 56,66 %	Physical distancing between users in public spaces	X				X		X	X		X	X	X				7
	Control of health hygiene conditions	X	X	X							X	X					5
	Road section of Bicycle routs	X	X	X	X						X		X				6
	Accessibility to the Urban services through the use of pedestrian and bicycle paths to achieve health dimension										X		X	X			3
	Shared mobility		X	X	X				X	X	X		X				7
	Dimension of parking area based on the presictable number of users	X									X						2
	Number of pedestrian paths	X		X	X					X	X		X				6
	Width of pedestrian paths	X		X						X							3
	Number of one way paths	X															1
Functionality 24,44 %	Green spaces & infrastructure					X	X	X		X	X		X	X	X	X	9
	Open spaces						X						X				2
Functionality 24,44 %	Shopping proximity and downscaling	X	X		X				X								4
	Residential building density				X				X		X		X	X			5
	Mixed use neighborhoods	X	X	X	X			X	X		X		X	X	X		10
	Cleanability of the surfaces and systems	X	X														2
	Flexibility and equipability of spaces to be used for temporary functions	X															1

By focusing on these four requirements scales and their respective indicators, this study aims to provide a comprehensive framework for assessing and enhancing urban health resilience. This approach ensures that cities are better prepared to face future health crises and can continue to thrive in the face of adversity.

#### 4. Discussions

The analysis across the 15 case studies reveals the diverse application of these indicators in different urban contexts:

- Interior Spaces: The focus on air control, solar factors, and private outdoor spaces underscores the importance of creating healthy indoor environments. These features were particularly emphasized in case studies from Italy and the USA.
- Intermediate Spaces: Green corridors and public spaces are less frequently mentioned but are critical for providing residents with accessible green areas that support physical and mental well-being.
- Exterior Spaces: This category shows the highest frequency of indicators, highlighting the importance of outdoor urban infrastructure in promoting health resilience. Features such as health hygiene conditions, bicycle routes, and green spaces are common across multiple case studies, reflecting a global recognition of their significance.
- Functionality: The adaptability and mixed-use nature of neighborhoods were prominent in many studies, emphasizing the need for flexible urban design that can cater to various functions and withstand changing conditions.
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#### 5. Conclusion

By applying these four requirement scales, we have systematically examined how different urban health resilience indicators are implemented across various global contexts. The findings highlight the importance of a holistic approach that integrates interior quality, intermediate transition zones, robust exterior infrastructure, and functional adaptability to enhance urban resilience. Adhering to PRISMA principles ensures transparency and reproducibility, making our evaluation process reliable and trustworthy. This comprehensive examination provides a solid foundation for understanding the factors that contribute to urban health resilience, particularly in response to challenges posed by the COVID-19 pandemic.

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#### Conflict of Interests

The Authors declare that there is no conflict of interest.

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