

Shifts in the urban planning paradigm following the COVID-19 pandemic

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Abstract: The worldwide COVID-19 pandemic has prompted significant transformations in several facets of human existence as it has disseminated over the globe, hence instigating extensive investigations into urban environments and public health. Recent research has investigated the correlation between cities, urban planning, and COVID-19. This signifies a shift in the urban planning paradigm. Resume focusing on and giving priority to health, particularly in relation to infectious diseases. This article seeks to elucidate the paradigm shift in cities and health as a result of due to the COVID-19 pandemic by employing a Systematic Literature Review. The research findings demonstrate a significant change in how health and cities are perceived due to the COVID-19 pandemic. This research also contributes novel insights into the significance of urban design that prioritises public health, particularly in relation to infectious diseases.

Keywords: urban planning; paradigms; COVID-19; infectious diseases

1. Introduction

Urban planning is a combination of diverse scientific fields characterized by a series of common themes from various cross-sectors, such as organizational improvements adapted to various needs; development carried out through open, participatory processes, and the integration of knowledge and collective action (Myers and Banerjee, 2005). So that urban planning discussions have a diverse focus from various scientific disciplines, urban planning also talks about geography, such as land use planning, community planning, urbanism, city and regional planning or town and village planning (Vicuña and Galland, 2018). The breadth and many aspects of urban planning make the substance of the discussion about cities rich. Furthermore, the definition of paradigm according to Khun is a basis for thinking, a basic concept as a model for scientists in conducting their studies (Khun, 1993), while according to Guba (1990), a paradigm is a collection of basic beliefs that guide the actions carried out by humans in their lives. Therefore, the urban planning paradigm is a basis for thinking or basic concepts as a model for scientists in conducting urban planning studies, which consist of various scientific disciplines, including spatial planning, community planning, urbanism, and city and regional planning.

The global COVID-19 pandemic has brought changes to many aspects of human life because its spread covers the entire world (Jasiński, 2022). COVID-19 and related efforts to prevent the spread of the disease cause stress, anxiety, confusion, anger, depression, food insecurity, unemployment and loss of economic activity (Brooks et al., 2020).

Recent research has widely explored the relationship between cities, urban planning and COVID-19 (Connolly et al., 2020). The potential long-term implications of COVID-19 on cities and the built environment, including changes in building

design, increased remote working, reconfiguration of roads, changes in travel modes, provision of parks and green spaces, and population movement away from city centers, have been raised by a variety of opinions (Frumkin, 2021).

Based on what has been mentioned above, research opportunities regarding the COVID-19 pandemic are still open considering that this pandemic has turned into an endemic and is still being debated and researched by many parties. According to a historical review, the experience of a pandemic brings changes to the physical environment (Pinheiro and Luis, 2020). Infectious disease pandemics bring physical changes to the built environment (BE) as a measure to prevent the spread of infection. Meanwhile, the changes that have occurred can be seen in the use of AI and IT (Peduli Protect application), the provision of hand washing stations, thermal sensors, HVAC filters, touch-free digital, changes in transportation modes, returning to the use of private vehicles, adding open space, walking paths one-way legs (Pinheiro and Luis, 2020).

The dramatic and widespread impact of the COVID-19 pandemic requires the revision of many principles regarding the organization of social life, access to health, public safety and urban planning. This pandemic is changing the way cities are planned, managed and regulated in the future, so the issue of urban resilience needs to be rethought and revisited. Contemporary urban planning that pursues high building density, the use of public transportation, and the democratic character of urban space require rethinking in order to develop post-pandemic cities that pay attention to human health (Jasiński, 2022). The COVID-19 pandemic has been running since 2019; in this reborn journey, as noted by Megahed and Ghoneim, the pandemic has changed cities and the built environment because of people's fear of infection again so that architecture and urbanism after the pandemic will never be the same (Megahed and Ghoneim, 2020).

There has been a lot of research since the start of the pandemic which provides opinions and views about cities and the built environment changing as well as providing recommendations on how to plan and design cities that are resistant to future pandemics (Mouratidis and Yiannakou, 2022), how to direct and develop post-pandemic cities and changes in development due to COVID-19 (Jasiński, 2022). The study of health, the built environment and cities has never been more intense in the last century starting from building technology, architecture, urban design, urban planning, landscape architecture and interior design (Cheshmehzangi, 2021). With a large amount of research on cities, the built environment and health, as well as recommendations for planning and designing cities that are resistant to future pandemics, this indicates that there is a change in the urban planning paradigm, which again pays attention to and prioritizes health, especially infectious diseases.

This article aims to explain the paradigm shift in urban planning and health due to COVID-19. The findings of this research provide a research gap for further research. The results of this research are proof of a paradigm shift in city planning in relation to health due to COVID-19. This research will provide new knowledge about the importance of city planning that pays attention to infectious diseases.

2. Methods

To prove the paradigm change in urban planning after COVID-19 using SLR (Systematic Literature Review) from online journals. The articles are collected using predetermined terms or keywords that explain paradigm changes in urban planning. The inclusion criteria determined use the keyword urban planning paradigm in several search databases such as Google Scholar, Science Direct, Scopus and DOAJ. The articles collected are divided into two periods, namely, 5 years before COVID-19, namely from 2014 to December 2019 and when COVID-19 appeared until now. The exclusion criteria are non-English and Indonesian papers and non-electronic papers. Validating results used only papers that were relevant to the research. Those that were not relevant were removed.

3. Review process

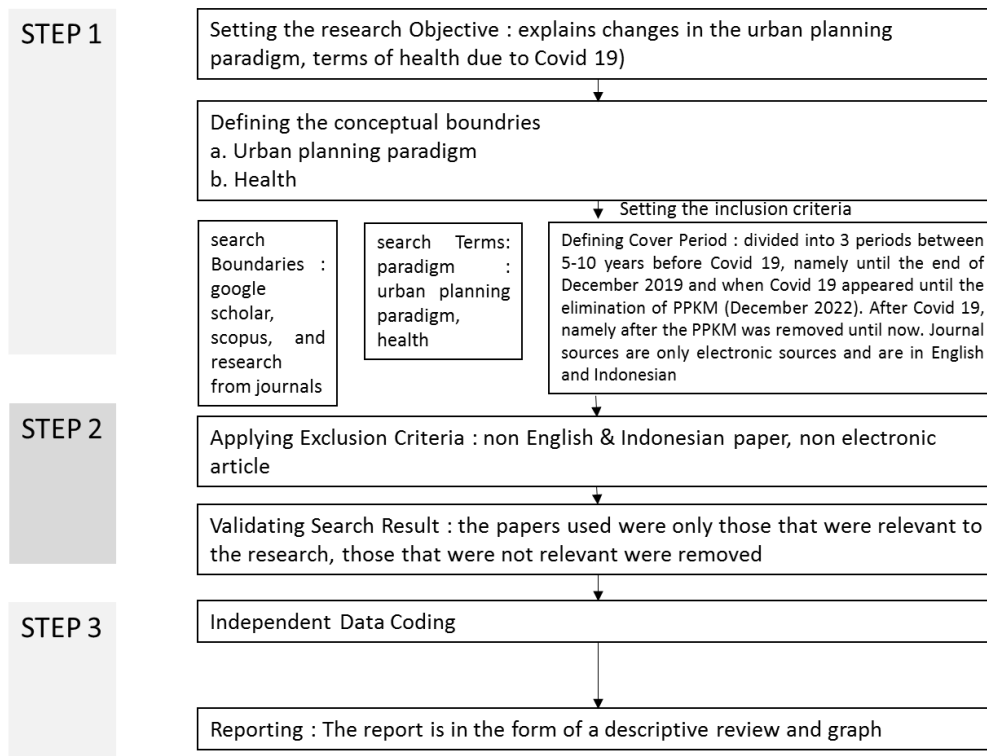


Figure 1. Simplified systematic literature review oleh Wilson et al. (2017).

In this stage of the review process only articles that meet the previously determined inclusion and exclusion criteria (**Table 1** and **Figure 1**) were selected. The inclusion criteria determined are using the keyword “urban planning paradigm”. Paradigm is the keyword in the article being searched for. The article explains the paradigm or foundation of thinking, the basic concept as a model for scientists conducting their studies. This paradigm trend is divided into two periods to explain paradigm changes that occurred due to COVID-19. This period period was 5 years before COVID-19 appeared. The emergence of COVID 19 was in December/end of 2019, so the time period used is articles from 2014 to 2019. Meanwhile, the second period is from when COVID-19 first appeared until now, namely December 2019. The

exclusion criteria are non-English and Indonesian papers and non-electronic papers (See **Figure 1**).

4. Data synthesis

The final studies conducted were grouped based on periods and predetermined inclusion and exclusion criteria. The first is the urban planning paradigm before COVID-19 and the urban planning paradigm after COVID-19. Then a meta analysis was carried out based on the keywords, results and the study design.

Research findings are synthesised qualitatively in each group of urban planning paradigms. Each article was assessed for the risk of selection bias, outcome bias and other sources of bias. Each study was scored in terms of overall risk of bias as low risk, moderate risk and high risk.

The image above shows the flow diagram of this article’s identification and review process (see **Figure 2**). Search results on the Google Scholar and Science Direct databases with the keyword urban planning paradigms produced 309 relevant articles. Then, the articles were filtered based on the article title, 109 articles which were not relevant because, based on the search, many of the articles discussed paradigms but were not related to urban planning, resulting in 200 relevant articles. The remaining articles, through abstract review and full text review, recovered 53 articles relevant to answering paradigm changes in urban planning due to COVID-19. A total of 147 articles were irrelevant because the articles did not explain urban planning paradigms, but phenomena and case studies in planning. city, and there is no discussion about the urban planning paradigm. Then, the 53 articles were grouped into two time periods, namely 5 years before COVID-19 and articles during and after COVID-19.

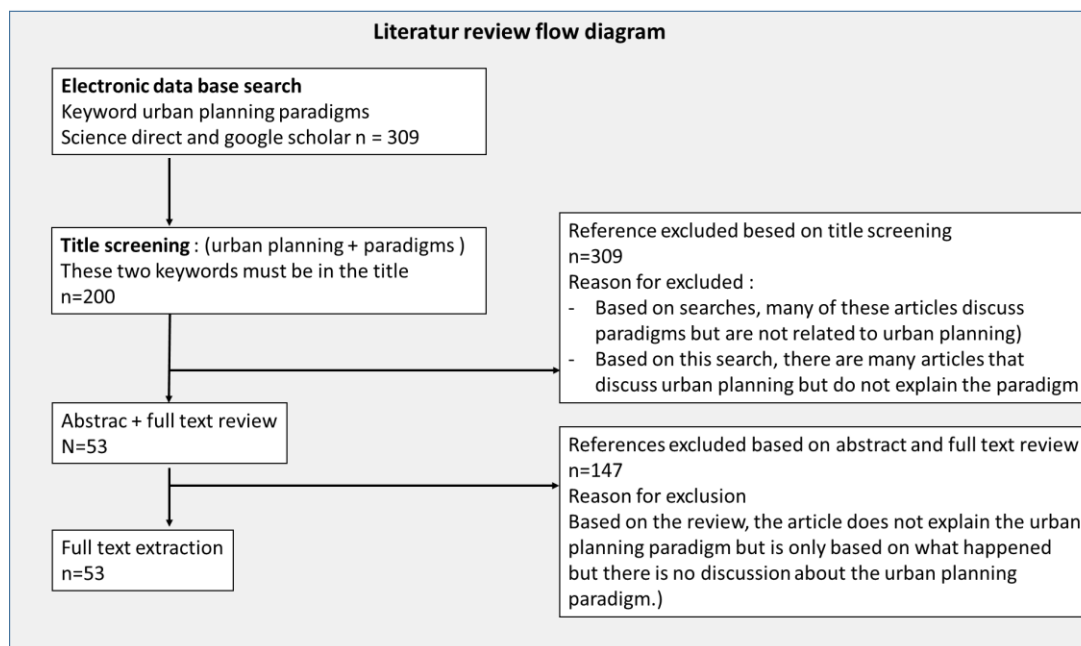


Figure 2. Literature review flow diagram.

5. Results and discussion

The results of the search for this article, which has carried out a full text review and extraction, are the articles that will be discussed in this paper. The results of the extracted articles were $n = 53$, then the articles, based on the year they were published, were grouped into two time periods, namely the 5-year period before COVID-19 and the time period after COVID-19 emerged until now. This is to describe changes in the urban planning paradigm after COVID-19. The results were $n=23$ articles that described the urban planning paradigm before COVID-19 and $n = 24$ articles that explained the urban planning paradigm after COVID-19.

5.1. City planning paradigm before COVID 19 (starting from 2014 to December 2019)

In general, we found that at the beginning of 2014 and 2015, discussions about Green Infrastructure (GI)-based urban planning became a growing topic that time; there was a shift in the Green Infrastructure (GI) paradigm which provides a unifying framework for integrating cities, urban farming and other green components (Borelli et al., 2015). Green infrastructure is a process that promotes systems and strategic approaches to land conservation and encourages planning and land use practices that are good for nature and humans. At that time, green infrastructure developed as a landscape planning approach that addressed fragmented thinking related to urban development. Meanwhile, in the housing sector in 2015, the developed paradigm was about modern real estate, the need to stimulate the investment process around housing, the formation of integrated housing and orientation towards social housing (Ershova and Smirnov, 2015).

In the following year, 2016, the urban planning paradigm talked a lot about urban stormwater, urban water management and smart city models, becoming the topic of discussion in many papers at that time. The paradigm regarding urban stormwater (urban water management) talks a lot about the mismatch between technology and governance, thus demanding a paradigm shift in governance from centralised and technocratic governance to distributed and participatory governance (Dhakal and Chevalier, 2016). Meanwhile, the urban water management paradigm talks a lot about sustainable cities that move from traditional urban water management characterised by a fragmented and transitional approach to forming a new paradigm for managing urban water in an integrated way (Díaz et al., 2016). And even this year, there was a lot of discussion about smart cities, a technological leap that affected architecture and infrastructure, which gave birth to the vision of smart cities; various models of smart cities also developed in that year (Arroub et al., 2016).

In 2017 and 2018, the urban planning paradigm placed more emphasis on urban mobility, public transportation, climate change policy, and functional city models, which are discussed in various papers. Discussion about the shift in the urban mobility paradigm in the future, developments such as new forms of locomotion, new forms of vehicle control, changing business models of ownership and use of cellular technology, and opportunities to carry out activities without travelling (Lyons, 2018). Meanwhile, in terms of public transportation, the paradigm that was developing at that time was that urban mode choice behaviour was not expected to shift from private vehicles to

public transportation in the future (Ercan et al., 2017). Meanwhile, other paradigms were also developing. is about climate change policy, which talks about climate change strategies to reduce emissions, increase RES, save energy, mitigate and also energy governance (Galera, 2017). The last paradigm developing at that time was the functional city, a contemporary paradigm that suggests that planning practice still relies on functional urbanism (city functional) (Calderón, 2017).

And finally, in 2019 before COVID-19 emerged, the paradigm of regional expansion became a developing paradigm and was widely put forward. A paradigm shift in relation to spatial strategies is identified in the rural-urban transmission process; regional expansion and local agglomeration strategies are intended to achieve a balance between growth and equality (Zhu et al., 2019). Based on the above, it can be seen that discussions about smart city planning, functional cities, urban mobility, and green infrastructure (GI) became an urban planning paradigm that developed in the 5 years before COVID-19. Discussions about health-based urban planning did not appear and become very popular. discussions in the era of 5 years before COVID-19 emerged. Research findings prove that in the 5 years before the pandemic the trend of urban planning was more emphasis on the use and development of technology and climate change as well as environmentally friendly infrastructure in cities. There is very little discussion about health-based urban planning, especially infectious diseases, which are almost non-existent (see **Figure 3** and **Table 1**).

Table 1. Table of articles and urban planning paradigms before COVID-19.

No	Articles Before COVID-19	Paradigm
1	Arroub, A., et al. (2016).	Smart City Model
2	Borelli, S., et al. (2015).	Green Infrastructure (GI)
4	Calderón, E. (2017).	City Functional
4	Chen, Y., et al. (2017).	Rural-urban paradigm—action-based planning
5	Dhakal, K. P. and Chevalier, L.R. (2016).	Urban Storm water (urban storm water management)
6	Díaz, P., et al. (2016).	Urban water management
6	Ercan, T., et al. (2017).	Public transportation
7	Ershova, S., & Smirnov, E. (2015). (2015).	Housing Development
9	Galera, S. (2017).	Climate Change Policy
10	Kasala, S. E. (2015).	Strategic Urban Development Planning (SUDP)
11	Lyons, G. (2018).	Urban Mobility
12	Zhu, J., et al. (2019).	Urbanization for Rural

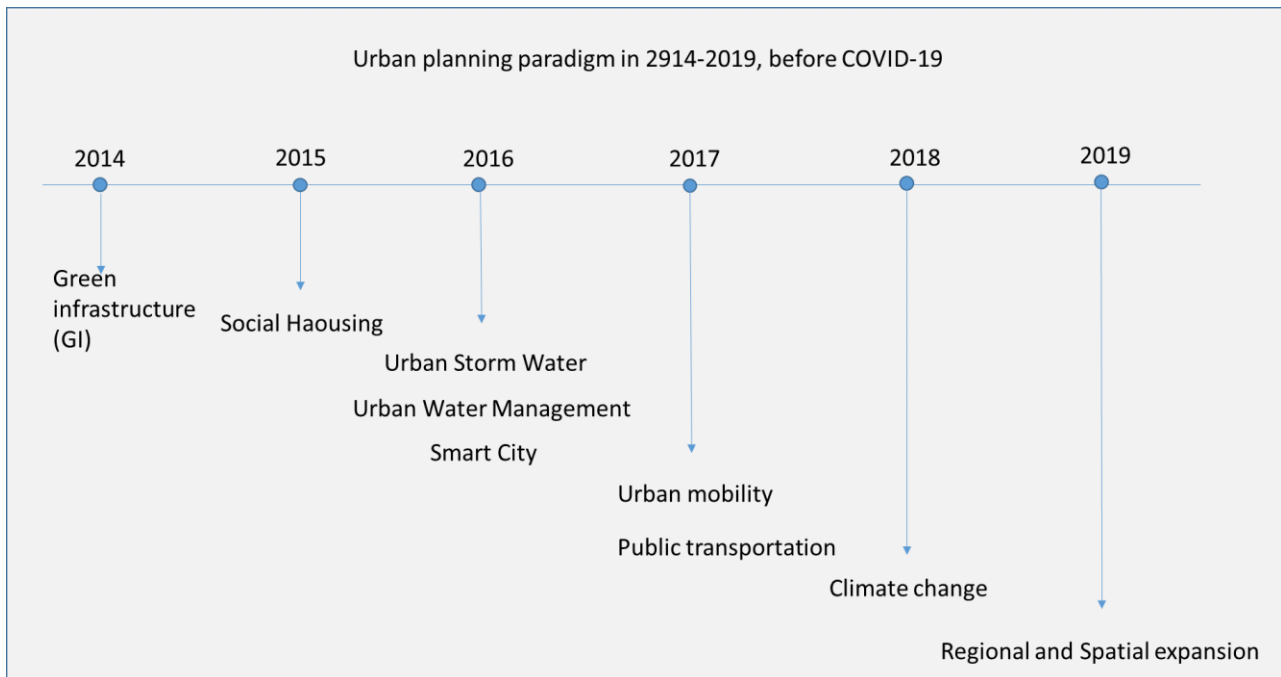


Figure 3. Urban planning paradigm in 2014–2019, before COVID-19.

5.2. Urban planning paradigm during and after COVID-19

The urban planning paradigm after COVID-, starting from 2020 to 2023, can be seen emerging as a new paradigm that dominates the views of urban planning academics and practitioners. The 15-minute city model, a urban planning concept based on the COVID-19 experience, namely creating new urban districts that are sustainable, walkability-oriented and carbon-free, integrating physical and digital city planning (Abdelfattah, 2022), is one of the paradigm changes in urban planning after COVID 19. The 15-minute city concept is for creating and maintaining health through walkability, becoming an element developed in post- COVID-19 urban planning. The 15-minute city approach has its roots in organic planning in the 60’s era, driven by the emergence of the COVID pandemic 19, making it a new approach that aims to create new sustainable cities. This 15-minute city is a contemporary synthesis of the Renaissance, where human measurement is interpreted into a geometrical perspective in a health and environmental approach. The essence of the 15-minute city concept is walkability in public spaces and the affordability of all important facilities and services within 15 minutes from home (Moreno, 2020). The birth of the 15-minute city reflects a change in perspective from urban planning to urban life planning (Abdelfattah et al., 2022). So, it can be said that the most important part of the 15-minute city is improving the quality of urban life in terms of health, livability and its relationship with society (Moreno, 2021; Pozoukidou and Chatziyiannaki, 2021).

The compact city model, a clear synergy between the underlying strategies in terms of cooperation to produce a combined effect greater than the separate effects in relation to sustainability benefits, is a paradigm that is also being discussed during and after COVID-19 (Bibri, 2020). Changes in two main sectors, namely construction and the built environment, which prioritise health, have become a topic widely discussed after COVID 19 (Cheshmehzangi, 2021). Potential changes and developments in these two sectors include paradigm shifts in architectural practice, civil engineering practice,

project management and urbanism. There is also a paradigm shift towards health, which aims to develop more connections between health and the built environment (Drewnowski et al., 2018). Furthermore, the reason for the paradigm shifts to be more oriented towards health can be seen from the number of studies on health and the built environment, which have never been as great as in the last century. Previously, the impact of climate change and its potential for human health had never taken a perspective from the built environment. These changes can also be seen in design guidelines, updated regulations, project management direction and resilience (Agarwala and Vaidya, 2020; Cheeshmenzangi, 2020).

The city singularity model is one of the city concepts studied and developed after COVID-19, a city concept that studies the concept of city development and interaction between cities, using the relationship between gravity and geographic proximity to create better city architecture after COVID-19 (Elshater, 2022). This city singularity concept provides an opportunity to build back better and reconfigure cities to be more humane, responsive to community needs and responsive to community needs. It must not prioritize the allure of financial gain but must also pay attention to and prioritize health (Elshashtawy, 2021). Furthermore, this concept has become a developing paradigm also after COVID-19.

What is important is that a paradigm has emerged in post COVID-19 urban health, consisting of a medical industry city, a health science city, a built environment, and a health social movement, becoming a paradigm shift that dominates urban planning (Kim, 2022). It is stated that the physical environment that has been built by humans creates opportunities and risks for the health and equal distribution of the health of city residents (Kim, 2022). Urban health is concerned not only with the complex cause-and-effect relationship between urban form and its influence on health but also with political processes that influence the form and quality of cities. Various studies have emerged in the COVID-19 and post- COVID-19 era that relate to health, namely the physical environment (such as air pollution, noise, housing, and indoor air quality). Health outcomes (diseases and risk factors), social environment (socioeconomic factors, social and cultural conditions, interventions (health services and planning, health behaviour change, monitoring, urban planning).

According to Kim (2022), four paradigms have been strengthened again, especially after the COVID-19 pandemic, namely: first, the medieval industrial city is a paradigm driven by the business and industrial sectors as well as the government where health infrastructure is the main driver of urban economic growth and urban change, especially post COVID-19. The second is health science city, a paradigm for understanding complex causal relationships in urban health to develop effective interventions based on these causal relationships. The third is the healthy built environment paradigm, which proposes the integration of health into spatial planning goals and tries to influence planning institutions to adopt health as the main goal of urban planning and design. And finally, the health social science paradigm is a movement that takes a values-based approach to promoting health through urban planning.

The smart city model developed after COVID-19 also includes elements of urban resilience in its city planning model, highlighting problems, socio-economic inequality, economic growth and innovation, urban ecology, land use planning, urban

policy and governance. After COVID-19, the issue of smart cities, big data analytics, urban resilience and governance has become a special concern (Thombre et al. 2021); this has also become one of the paradigm changes in post- COVID-19 city planning.

The shifting paradigm of urban mobility resilience against the backdrop of the COVID-19 outbreak encourages the urban mobility model to be prioritised for personal welfare and disaster-resistant cities. Resilience planning must be an integral part of the public transportation system to deal with future shocks from pandemics and other emergencies. In addition, an independent environment must be encouraged to substantially reduce long mobility or the need for personal transportation for various secondary purposes (Thombre and Agarwal, 2021). After COVID-19, China's 14th five-year planning trend emerged regarding the urban design, which prioritized new value qualities, new dynamic spatial performance, coordination of new target areas and new, improved governance based on COVID-19 (Wang et al., 2022).

The Garden City model, which is an architectural and urban planning paradigm that was formed at the beginning of the 20th century, is being looked at again after COVID-19; the garden city concept, with its characteristics of wide green lines, circular highways, blocks structures, and large area allocations has become important in the urban planning paradigm. post COVID-19 (Arustamyan and Bagina, 2022). The concept of Green and Blue Urban Space planning, increasing focus on urban green space leads to an important component of the physical structure of cities as the renaturation of urban space through greening interventions to combat global warming and climate change and be a beautiful place to live (Dall, 2020).

The Urban Digital Twins model has also emerged as a concern in the urban and geospatial domain after COVID-19. The role of urban digital twins is an integrated and promising approach for data-based infrastructure management and efforts in urban sustainability. These urban digital twins are developing depending on the support of various technologies, including the Internet of Things (IoT), artificial intelligence (AI) and edge computing in collecting and processing data (Lei et al., 2023). In the housing sector, there has been a paradigm shift in social housing in terms of its social function and institutional and spatial form (Schönig, 2020), and this also occurred due to inflation in property prices during COVID-19 (Pinnegar et al., 2020). Various urban planning concepts that developed during and after COVID-19 can be seen in the image below (see **Figure 4** and **Table 2**).

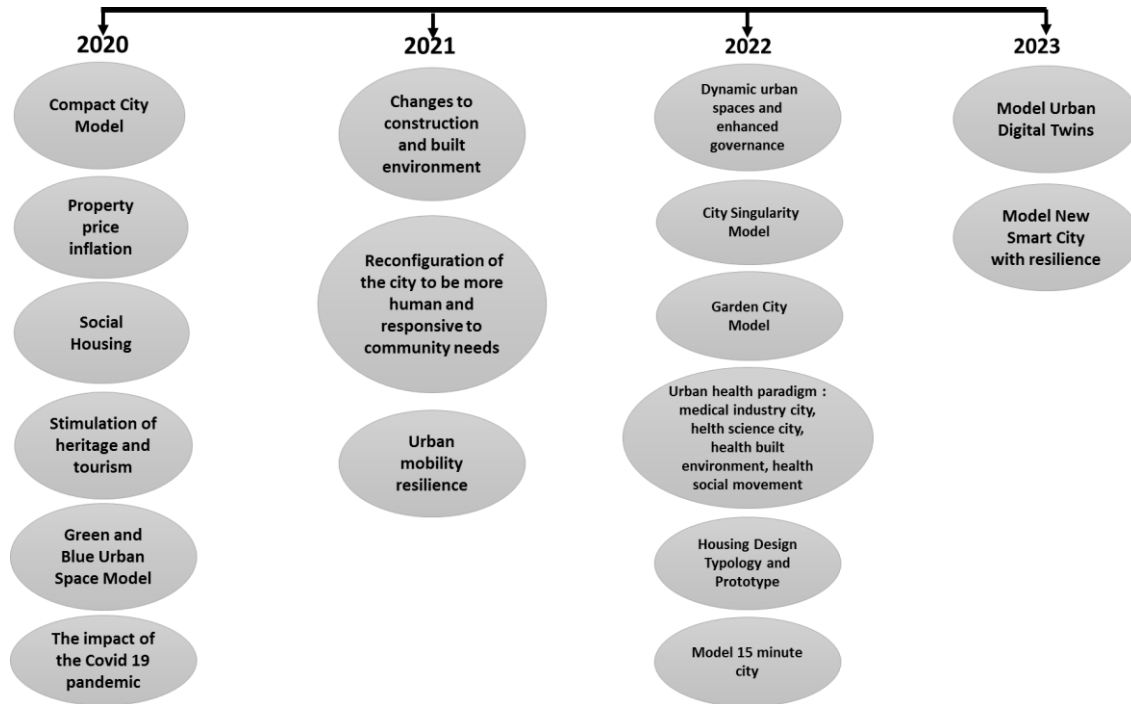


Figure 4. Urban planning paradigm during and after COVID-19.

Table 2. Table of articles and urban planning paradigms during and after COVID-19.

No	Article	Bahasan Paradigma
1	Abdelfattah, L., et al. (2022).	Model 15 minutes city
2	Arustamyan, M. and Bagina E. (2022)	Garden City Model
3	Bibri, S. E., et al. (2020).	Compact city model
4	Cheshmehzangi, A. (2021).	Paradigm changes in two main sectors, namely construction and the built environment due to COVID 19
5	Coelho, P. A., & Rodríguez, V. B. C. (2020).	Landscape Before COVID 19
6	Dall’O’, G. (2020).	Green and Blue Urban Space planning model
7	du Toit, J., et al. (2022).	Interdisciplinary research on housing,
8	Elshater, A., et al. (2022).	City Singularity Model- Urban Form pluralist
9	Elsheshtawy, Y. (2021).	Post- COVID urbanization paradigm
10	Kim, J., et al. (2022).	Four urban health paradigms
11	Lei, B., et al. (2023).	Urban digital twins model
12	Pinnegar, S., et al. (2020).	Explains the causes and consequences of decades of property price inflation
13	Schönig, B. (2020).	Changes in the social housing paradigm
14	Sharifi, A. and A. R. Khavarian-Garmsir (2020).	The impact of the COVID-19 pandemic
15	Sharifi, A., et al. (2023).	Smart City Model
16	Thombre, A. and A. Agarwal (2021).	Urban mobility resilience
17	Wang, G., et al. (2022).	China’s 14th five-year planning trend on urban design

During the COVID-19 pandemic the world has shown that existing knowledge cannot deal with emerging problems, so we are facing a paradigm crisis. Therefore, urban planning requires a paradigm shift to overcome new problems that arise and increase the feasibility of urban resilience (McClellan and Tootoonchi, 2021). This is

in line with the explanation above as seen in the emergence of the 15-minute cities concept, an approach rooted in organic planning in the 60s, which was then redeveloped through the concept of creating new sustainable cities, walkability-oriented, carbon-free and improving the quality of urban life in terms of health. which is motivated by the COVID 19 pandemic. Health reasons are the driving factor in creating new concepts in urban planning. The paradigm shift can be seen in the number of studies that reaffirm the relationship between health and the built environment. Furthermore, the city singularity concept was also developed, motivated by COVID 19, which aims to create better city architecture by paying attention to and prioritising health. So, it can be said that there is a paradigm shift in urban planning which places greater emphasis on urban health and resilience.

6. Conclusion

The global COVID-19 pandemic has brought changes to many aspects of human life because it has spread throughout the world. The dramatic and widespread impact of the COVID-19 pandemic requires the revision of many principles regarding the organisation of life in urban planning. The number of studies on cities, the built environment and health, as well as recommendations for urban planning concepts that are resistant to future pandemics, indicate a change in the urban planning paradigm, which again prioritizes health, especially infectious diseases. Research findings prove that in the 5 years before COVID-19, discussions about green infrastructure, social housing, urban water management, urban mobility, smart cities and climate change were developing in city planning. The trend of urban planning emphasises the use and development of technology and climate change and environmentally friendly infrastructure. There is very little discussion about health-based urban planning, especially infectious diseases, which are almost non-existent. The COVID-19 pandemic shows that the previous urban planning concept cannot deal with the problems arising from COVID-19. Therefore, urban planning requires a paradigm change. Then the findings of this research prove that many articles during and after COVID-19 until now show the emergence of the concept of 15-minute city, city singularity and various old concepts such as smart cities, which are starting to include elements of health in them. With this, there is a paradigm shift in urban planning which places greater emphasis on the elements of urban health and resilience. Furthermore, this research can provide knowledge and show the importance of urban planning that includes health elements in its concept, especially infectious diseases, so that cities in the world will be more responsive and ready if events like this pandemic reappear.

Author contributions: Conceptualization, FW, HW and TAA; methodology, FW and HW; software, FW; validation, FW, HW and TAA; formal analysis, FW; resources, FW, HW and TAA; data curation, FW; writing—original draft preparation, FW; writing—review and editing, FW, HW and TAA; visualization, FW; supervision, FW. All authors have read and agreed to the published version of the manuscript.

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