



Developing Strategies to Improve the Urban Environmental Structure Resiliency During and After Corona Pandemic: A Literature Review

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Accepted: 4 September 2022 / Published online: 9 September 2022
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Abstract

Purpose of Review The objective of this study is to review the literature on the role of urban environmental structures and to develop proper strategies to strengthen their resilience so that the management performance of the Corona disease can be enhanced.

Recent Findings Cities have been severely affected by the Coronavirus pandemic. Changes in the lifestyle of citizens during the pandemic have led urban planners to the realization that the current structure and function of cities do not meet the needs of citizens. Hence, the structure of urban landscape must be transformed so that cities become livable ecosystems for citizens and the urban environment becomes resilient to all kinds of crises. As a result, considering the new standards of life during the pandemic, the question of what changes to the urban planning and design are required to make cities viable and resilient systems arises. Since the year 2020, much research has been published on the impact of Coronavirus on the lifestyle of citizens and the urban environment. These impacts have positively or negatively affected the structure and function of cities in a direct or indirect manner. Similar to all the related studies, the necessity of making changes to the planning and design of urban landscapes has been emphasized here.

Summary The present study reviews the literature on the effect of the structure of the urban environment on the corona pandemic management. The objective is to develop proper strategies for planning and designing resilient urban landscapes. It is emphasized that in order to realize the dream of resilient cities during and after the pandemic, the need to develop an interconnected network of green and open urban patches, green transportation system, green neighborhoods, and green residential buildings should be met so that urban resilience and livability can be achieved at a higher level.

Keywords Corona · Post Corona · Urban planning and design · Urban landscape structure · Resilient cities

Introduction

The rise of Coronavirus pandemic in 2019 gave rise to an unprecedented set of restrictions on country and city scales and affected human life. It also disrupted the economic and health conditions in different societies [1••, 2].

Generally, during the outbreak of respiratory epidemics such as Corona, one of the most important measures to control the crisis is to close public space and enforce quarantine

[3]. Measures like quarantine enforcement affect the environment and people's lives.

In this regard, several studies have pointed out the positive and negative impacts of the Corona pandemic. For instance, one positive environmental effect of the pandemic is the reduction of urban air pollution [4], while the negative one is the increased level of household and health waste. In general, it can be claimed that the Corona pandemic has changed the environmental conditions and lifestyle of humans, especially in urban areas [5].

As the world's densest population centers, cities have been thirsting for infectious disease-control measures. Thus, at the peak of the pandemic, cities and public spaces have turned into empty environments in image, and this, in turn, affects the lives of citizens from social, economic, and psychological angles. These changes and new living standards will lead to a new lifestyle in cities [6, 7].

This article is part of the Topical Collection on *Landscape Ecological Science from Iran*

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From a professional point of view, it can be argued that based on the close relationship between the structure and function [8, 9] of socio-ecological systems [10] such as cities, a crisis like Corona will change the urban planning systems sooner or later. Of course, these changes can be considered an opportunity to turn cities into resilient environments.

Over the past decades, ideas and concepts such as healthy city [11], livable city [12, 13], and biophilic city [14, 15] have always been proposed to facilitate the road to sustainability in the future. The intellectual basis of these scientific concepts and approaches is to transform cities into socio-ecological ecosystems in which the health of the environment and citizens is a priority.

Urban resilience is one of the most widely used approaches that has been adopted from the 1970s to the present [16], especially during the Corona pandemic [17–19]. The main objective of all fields of research on urban resilience is to enhance the quality of the urban environment and the lives of citizens [20]. In general, resilience is defined by such terms as resistance, absorption, adaptation, and recovery of a system against a wide range of different threats such as terrorism, climate change, economic crisis, and epidemics like Corona [16]. In general, “resilience” involves planning to prepare societies against disasters [21], and it is basically a specific program that targets more successful absorption, resuscitation, and acceptance of maladaptive events. Increased resilience provides the basis for risk prediction and better planning to reduce losses. This approach can replace the expectation of hazards and overcome possible unpleasant consequences [22].

For the past 2 years, Corona has been recognized as a catastrophe that challenges urban resilience. Many studies have investigated the impact of the Corona pandemic on urban landscape structures and functions in this period [23–29], and they have all focused on the inefficiency of urban structures and infrastructure in meeting the needs of citizens. These studies emphasize the necessity of transforming traditional urban management and planning methods. In addition, researchers have stressed the need to reorganize future cities based on the needs of citizens to resist disasters like epidemics.

Therefore, the present study attempts to respond to the following question: ‘Which component of urban structures has been challenged the most in terms of efficiency (during Corona)?’ Furthermore, based on the experience gained from the quarantine period and its impacts on the urban form and infrastructure, effective strategies are proposed here to make plans on the resilient urban landscape structure during and after the corona pandemic.

Methods

The research method adopted here is a qualitative systematic review approach to developing strategies for planning on a resilient urban landscape structure

establishment during and after Corona. In line with the purpose of this research, a comprehensive literature review was carried out to analyze various dimensions of this issue with emphasis on the following these key words and terms: (“Cities OR “Urban Environment” OR “Urban”) AND (“Urban Landscape Structure” OR “Urban Environmental Quality”) AND (“Corona Pandemic” OR “Corona Era” OR “Post Corona”). The following highlights have been used in choosing the target terms:

- Identifying the effects of Corona on cities and citizens;
- Determining which urban landscape structure components are more important to meet the new lifestyle and needs of citizens during and after Corona; and
- What strategies to consider in urban environmental planning to ensure the development of resilient cities.

This research was performed in 6 stages, first of which was conducted on 15th January 2021, and it involved searching the entire database of Web of Science. As a result, 2086 articles were collected and screened in 4 stages. In the first stage of screening, the main inclusion criterion was the selection of papers that had already addressed “urban environmental quality” as a key term. In this respect, 965 articles were separated. After reviewing the abstracts of these, 602 articles were selected. These papers developed proper strategies to improve the urban environmental quality during and after the pandemic. In the third screening stage, 497 papers that had focused on economic, social, and demographic factors, urban management, and urban governance aspects were excluded. In this stage, 105 papers on the “urban landscape structure” were selected. In the final stage of screening, following a comprehensive review of the selected papers, 48 articles were selected in line with the objectives of this research. Four dimensions affecting the “quality and resiliency of the urban landscape structure” were identified and extracted from these papers. For each dimension, a certain number of related articles were identified. Then, the strategies corresponding to each of these dimensions were extracted and summarized.

- Urban green and open network (14 articles)
- Urban green transportation system (13 articles)
- Urban green neighborhoods (11 articles)
- Urban green residential buildings (10 articles)

In the final step, the ideas derived from the extracted strategies were designed by employing CityEngines software [30]. Figure 1 shows the research steps and the number of reviewed papers in this study.

Results

The obtained results take two parallel directions. First, the results of literature review were discussed in terms of four main urban landscape components: urban green and open network, urban green transportation system, urban green neighborhoods, and green residential buildings, all of which affect urban resiliency during and after the pandemic. Second, effective strategies for planning and designing resilient urban landscapes are presented in a table. Finally, this table is designed for each of the components based on the strategies developed in this research.

Results of Literature Review

Most of the related studies have already discussed the four main components of the urban landscape structure that affect urban resilience during the pandemic. Therefore, upon reviewing the findings in this field, the current study explores the planning and design requirements of urban resilience for each component during and after the pandemic. In the following, each of these components is explained in detail.

Urban Green and Open Network

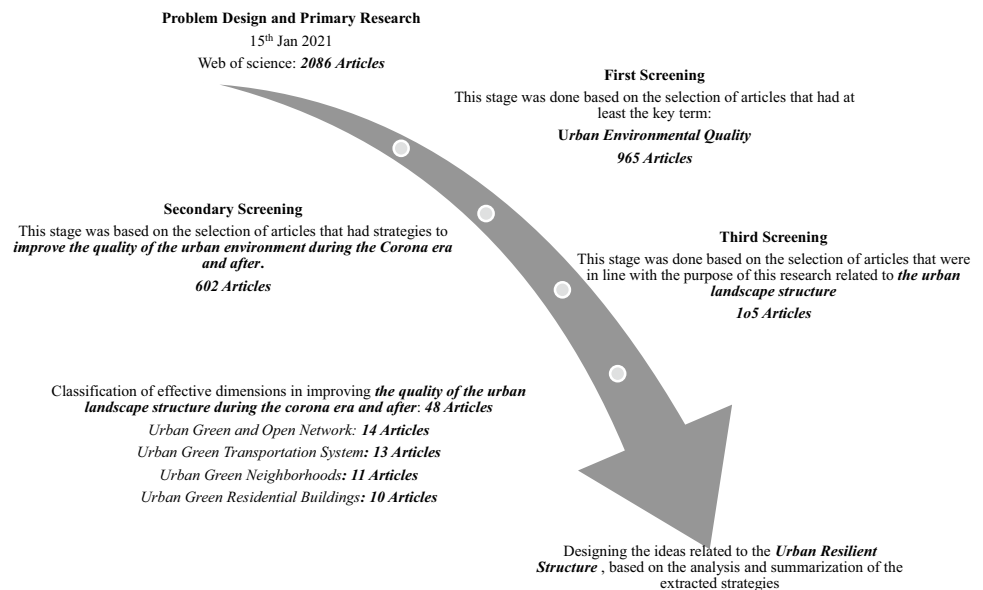
With the growth of population and construction in urban spaces, lack of green and open spaces has emerged as an obvious problem. Thus, the role of urban green spaces in maintaining the morale of citizens during the quarantine has become quite important.

Numerous studies in the field of psychology have shown that contact with nature improves mental stability and functioning as well as reduces stress [29, 31], mental fatigue [31], and mental disorders [32]. Moreover, the experience of quarantine in most large cities has shown that citizens exhibit a stronger longing for nature while maintaining social distance [33]. Since citizens were officially forced to avoid many public recreations and entertainments during the outbreak, attending to such activities as gardening and agriculture, especially in cities, can positively contribute to the mental health and stability of citizens. As a result, planning to build a network of green and open urban patches (parks, urban gardens, etc.) will become an important measure in future cities. A platform for activities such as horticulture and urban agriculture should be established so that many socio-cultural services such as creating a space to grow and plant food products, increased access to healthy food [34–37], and cheap and fresh [37] products may be provided or facilitated for people. This measure promotes the life quality by (a) allocating proper spaces and opportunities needed to improve social relations and form social solidarity in open space [36, 38] and (b) addressing such concerns as social distance, proximity to nature [39–41], and the need for increased physical activities for the citizens [39]. Therefore, the design of a network of green and open urban patches [42] will play a significant role in making cities resilient during and after the pandemic.

Urban Green Transportation System

The Corona pandemic has dramatically changed the urban transportation system [6, 43]. There has been an unprecedented decline in demand for public transport systems [5,

Fig. 1 The framework of research steps and the number of reviewed papers



44]. As a result, many citizens tend to use private cars [45] as part of the social distancing mandate.

Of note, dependence on private vehicles exerts negative effects on the environment and the health of citizens. Among its negative effects, we can mention air pollution, traffic, and greenhouse gas emissions [7].

Therefore, in many cities around the world such as London, Milan, Barcelona, Paris, and Sardinia [46], urban development plans like the 15-min city [47] have been put on the agenda of municipalities. The main objective of these projects is to encourage citizens to reduce the use of private vehicles in order to provide opportunities for more physical activities while meeting the requirements of social distance.

In such projects, the design of footpaths [48], cycling, and scooters routes is a priority. Such plans will have positive impacts including calming traffic and reducing congestion on traffic routes [29, 49]. Therefore, based on the numerous benefits to be expected for the health of the entire city and its citizens [50], it is of necessity to develop future cities with proper design and planning to reduce consumer dependence on private vehicles [46, 51].

Urban Green Neighborhoods

Neighborhood, as a smaller community within a larger city, is an important element to consider in urban planning [52]. On a neighborhood scale, basic infrastructure for the lives of citizens is provided. Principled planning on this scale provides citizens with a sense of identity [53]. During the pandemic, the significance of this scale has become quite apparent due to traffic restrictions at the city level in many cities dealing with the compulsory quarantine. As a result, citizens should meet their daily needs including access to parks and green spaces, shopping malls, and clinics in their neighborhoods [54].

As a result, planning to create self-sufficient neighborhoods that meet the needs of citizens is an important principle to consider in future urban planning. Therefore, urban planning for the development of green and low-carbon neighborhoods [55, 56] should be on the agenda of municipalities because such neighborhoods protect the health of citizens and reduce unnecessary mobility [56], costs, and environmental impacts [57]. In the future, it is recommended that open public spaces [58, 59] be designed at the urban neighborhood level. These plans for urban neighborhood positively contribute to the health of citizens significantly [59] and enhance their life quality on a neighborhood scale [54].

Urban Green Residential Buildings

During the Corona pandemic, the living conditions of citizens have changed due to imperative enforcement of

quarantines and development of a culture of teleworking [60]. It is predicted that human life will be affected by these changes in the future. Changing values, habits, social behaviors, and tendency for isolation will be among the new conditions in the post-Corona era [61]. Therefore, given the pervasive culture of telecommuting, the use of residential spaces for different purposes during and after the quarantine will increase.

Citizens' inclination to telecommuting causes higher water consumption [7] and increased waste production [61]. Therefore, in the future, the design of green and safe residential buildings by creating versatile and flexible spaces [2, 62] that guarantee the physical and mental health of citizens is recommended. Also, given that citizens spend many hours of their lives indoors, the use of building materials derived from natural elements [63–65] as well as the maximum use of renewable energy [24] should be on the agenda for the construction of residential units.

In general, in order to make residential buildings livable, it is recommended that green buildings [63, 66] be designed with emphasis on energy management and environmentally friendly materials [66], maximum use of sunlight and optimal energy consumption [67], and roof gardens [65].

Strategies for the Urban Resilient Structures During and After the Pandemic

According to the reviewed literature, to maintain the physical and mental health of citizens and make cities resilient to all types of crises, especially pandemics like Corona, it is quite necessary to establish a platform that is compliant with not only multiple scales of urban landscape structures but also natural environment. Figure 2 presents a framework of resilient cities during and after the pandemic.

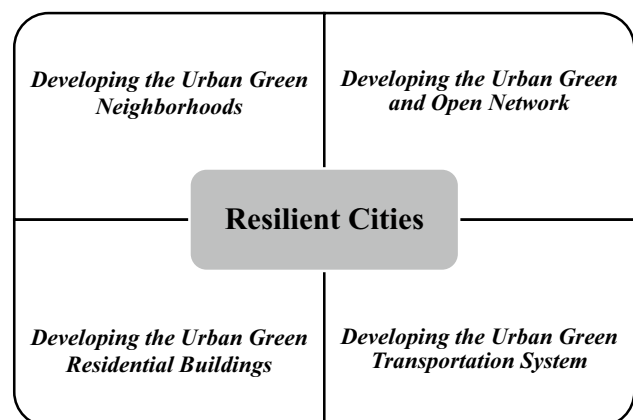


Fig. 2 The framework of resilient cities during and after the pandemic (source: prepared by the authors)

Table 1 Strategies for resilient urban structures during and after the pandemic

Main components	Necessity	Strategies	Policies
Urban green and open network	Citizens' need for access to safe green and open urban spaces & Improving the urban environmental quality	Facilitating easy access to green and open urban spaces for citizens Ensuring the health of citizens in green and open urban spaces Redesigning urban green spaces with the aim of maintaining social distances Reducing the effect of population density on public transportation Developing green transportation systems in cities Reducing city trips by private vehicles Developing a culture of telecommuting	Designing green corridors in cities Increasing the number of green and open patches in cities Creating a network of green and open patches by increasing connectivity and reducing the distance between open and green patches Increasing the number of public transport vehicles Developing cycling and scooter routes Developing green pavements Determining incentives to use the public transportation system
Urban green transportation system	Citizens' need for access to safe and green public transport system		Equipping neighborhoods with numerous land uses; Developing green pavements on a neighborhood scale
Urban green neighborhoods	Citizens' need to live in self-sufficient and green neighborhoods	Designing green neighborhoods with multi-functional green and open spaces Equipping urban green neighborhoods through the land use development	Developing open spaces for living room purpose
Urban green residential buildings	Citizens' need to live in green residential buildings with multipurpose spaces	Designing green and flexible buildings with multifunctional spaces	Designing separate spaces in residential buildings for work, education, living, and children's play spaces Designing green roofs Using natural materials in the design of interior and exterior building spaces Designing buildings with new technologies for reducing energy and water consumption

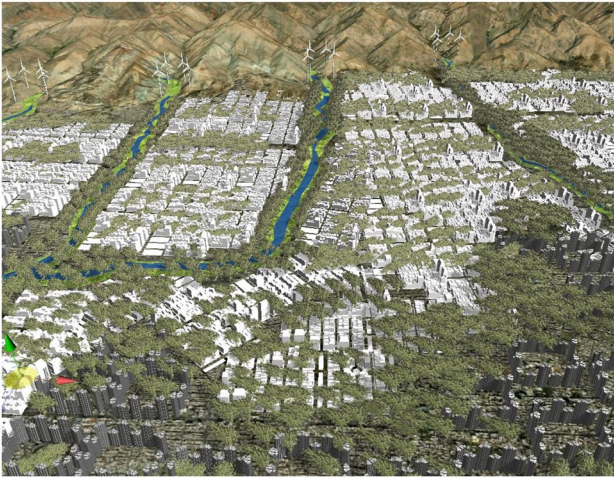


Fig. 3 Development of urban green and open network (source: prepared by the authors)

Table 1 shows the strategies for forming a resilient urban structure during and after the pandemic based on the main components of the urban landscape structure.

Discussion

In this stage, according to the strategies developed in Table 1, each of the components affecting urban resilience is illustrated.

Fig. 4 Designing the urban green neighborhoods (source: prepared by the authors)



Designing an Urban Green and Open Network

The purpose of designing an urban green and open network is to connect the isolated and fragmented patches of urban green spaces to each other so as to strengthen the connectivity of green and open urban spaces. Figure 3 presents an example of the designed network of green and open urban patches.

Urban Green Neighborhoods

In the process of designing green neighborhoods, the following items were considered. Figure 4 shows a design example of urban green neighborhoods.

- Designing multi-functional spaces to meet the needs of residents in the neighborhood;
- Designing green and open spaces fit for telecommuting in urban areas; and
- Multi-purpose green spaces (public gatherings).

Urban Green Transportation System

The following items have been considered in the design of urban green transportation. Figure 5 presents an example of the urban green transportation network design.

- Design of bicycle and scooter routes;
- Design of green sidewalks; and
- Design of narrow lanes for car traffic.



Fig. 5 Design of an urban green transportation system (source: prepared by the authors)

Urban Green Residential Buildings

In the process of designing green residential buildings, the following items have been considered. Figure 6 shows an example of one green building design.

- Planning on the use of green energy including solar energy in buildings;
- Green roof design for building occupants to spend leisure time;
- Creating a multi-purpose green area around buildings; and



Fig. 6 Design of an urban green residential building (source: prepared by the authors)

- Maximum use of energy and sunlight in the design of buildings.

Conclusions

Since the Industrial Revolution, cities have always been growing ecosystems dominated by human structures. However, the impact of the pandemic crisis indicates that the same urban characteristics that have transformed cities into human-centered ecosystems with “car centric urbanism” are jeopardizing the entire physical and mental health of citizens. This unfortunate phenomenon has made cities and citizens vulnerable to all kinds of crises.

In fact, the corona pandemic represents a wake-up call for all experts to realize that the structures and functions of cities are not efficient enough to maintain and support the health of the citizens. Therefore, in order to strengthen the resilience of urban landscape, short-term and long-term urban planning and investment should be seriously taken into account.

In fact, to date, the planning process for most cities, especially in developing countries, continues to rely merely on physical growth and construction development with almost no regard for human health and urban livability. During the Corona pandemic, many changes in the lives of citizens occurred. Besides the changes made to the employment process and working conditions, the pandemic impact on the functioning of urban services, transportation, etc. indicates that cities are on the verge of a great transformation. As a result, in response to such changes, such concepts as greater citizen access to green and open spaces, diverse land use cases, low-traffic designs, small projects, and bicycle-friendly, humanistic, and biophilic cities need to be considered by urban planners and designers.

In general, the main structures in cities should be planned and designed in a way that citizens and nature can live in harmony. Therefore, to ensure a modern and efficient urban planning and design, the following areas should receive undivided attention:

- Expansion of green infrastructure;
- Development of urban green neighborhoods;
- Development of green transportation; and
- Design of green buildings.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights This article does not contain any studies involving humans or animals performed by any of the authors.

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Papers of particular interests that have been published recently were highlighted as:

●● Of major importance

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