Eco Cities (2023) Volume 4 Issue 1
doi: 10.54517/ec.v4i1.2346

Asia Pacific Academy of Science Pte. Ltd.

REVIEW ARTICLE

Measuring the positive effects of the pandemic disease in the environmental planning of healthy cities

Hadi Rezaeirad[1,*], Tarlan Sadeghipour[2]

[1] *Urban Planning and Design Department, Bu-Ali Sina University, Hamadan 65175-4161, Iran*

[2] *Graduate of Urban Planning, Shiraz University, Shiraz 71946-84471, Iran*

*** Corresponding author:** Hadi Rezaeirad, H.Rezaeirad@BASU.AC.IR

ABSTRACT

The city as a living system and a dynamic structure throughout history, from birth to the present day, has shown a flexible attitude to the challenges ahead and has been constantly trying to overcome the challenges and reproduce its elements for the opportunity to become efficient and usable in the future. In the face of the corona pandemic challenge, the city has acted in the same way, shown reciprocal behavior, and tried to overcome this crisis effectively. Therefore, city planners and managers must approach the healthy city and its elements with a different approach and perspective. Apart from the destructive effects it has had on the human body and soul, the corona pandemic has also changed the quality of life in cities and their environments so much that new living patterns have been formed and some of the past structures have been discarded. For this purpose, after studying the literature review and the international experiences, the dimensions, factors, and effective indicators of the corona pandemic have been identified. The present study is a descriptive-analytical type, and the desired findings have been explained through a questionnaire using quantitative and qualitative methods and confirmatory factor analysis tools. During the COVID-19 pandemic, the concept of healthy cities has been compromised. It has unveiled the need to give more prominence to caring tasks while addressing intersectional social inequities and environmental injustices. The results of the analysis indicate that 14 indicators including lifestyle changes and health protocols, increase in virtual socialization, reduction of inequality among different groups of people in access to the internet, promotion, and expansion of digital tourism (virtual trips), starting development of apps and start-ups, increasing small-scale commercial markets, upgrading medical equipment, increasing countries interaction in the field of health, the importance of planting trees, using public transportation, increasing public transportation capacity, designing more open and green spaces in the city, more attention to deprived areas and slums and redesign of public spaces based on the prevailing conditions will provide positive effects during the pandemic of Tehran. Therefore, in order to improve and enhance the quality of life in healthy cities, especially during pandemics, suggestions have been made.

Keywords: COVID pandemic; quality of life; confirmatory factor analysis; healthy city

1. Introduction

Cities are similar to human organs and have their own life and death, and if their biological equivalent is not controlled over time, they may be gradually damaged[1]. The history of cities has always been a reminder of various situations of occurrence and fight against pandemic diseases, from widespread plagues in Rome,

ARTICLE INFO
Received: 23 October 2023 | Accepted: 27 November 2023 | Available online: 2 January 2024

CITATION
Rezaeirad H, Sadeghipour T. Measuring the positive effects of the pandemic disease in the environmental planning of healthy cities. *Eco Cities* 2023; 4(1): 2346. doi: 10.54517/ec.v4i1.2346

Greece, and America to yellow fever, influenza, etc., which are still raging in some parts of this earth[2]. Pandemic diseases have always had a great impact on human history and especially on urbanization in various societies around the world because they have always been a turning point for fundamental changes in urban structures and design and planning systems. Cities are houses for most of the world's inhabitants and are centers of economic growth and innovation[3]. On the other hand, the increasing population growth in the world has increased the rate of urbanization and urban population density[4]. Therefore, the high concentration of people and activities in cities makes them vulnerable to many different things such as natural and artificial disasters. Studying the history of global diseases and their effects can reach great results and achievements. In this regard, we can conclude that human beings have always changed their lives according to the events that have occurred and adapted their lifestyles, and discovered new solutions. Globalization has increased the spread of infectious diseases. And also improves the speed of increasing reactions and responding to them[5].

By examining various diseases throughout the world and history, it can be acknowledged that the extensive evolution and development of cities until today in various areas related to social health and cleanliness of cities, as well as new paradigms formed in this direction, arise from the social and physical responses of cities. to the pandemics that occurred in them, as well as other cities following the example of the disease control process in infected cities, the widening of roads, the greater use of the street for the benefit of pedestrians, the increase of public health and the improvement of water and sewage systems in cities such as London and Paris are some of the most important transformations of cities[5].

The corona crisis can also be considered a risk because this pandemic has spread through modernity and turned into a crisis. According to Beck, the risk is a systematic way of facing conflicts and insecurities produced by modernizatio. Accordingly, in this research, an attempt has been made to take a different look at the crisis of human society, by examining global experiences in this regard, the benefits of the spread of the COVID pandemic for cities and citizens, and then by learning from the experiences gained, in order to improve the quality of urban life and through the analysis, proposed solutions in the field of urban planning, design, and management during pandemics have been presented[5].

In **Table 1**, the research conducted in the last two years, regarding the crisis of the COVID-19 pandemic, from the beginning of its appearance until today, has been separated by continents.

Table 1. Research background.

Research achievement	Research title	Author/year
This research recommendation is that the government should aligning the Healthy Cities initiative in China with strategic national and global level agendas such as Healthy China 2030 and the Sustainable Development Goals (SDGs) by providing an integrative governance framework to facilitate a coherent intersectoral program to systemically improve population health.	Healthy cities initiative in China: Progress, challenges, and the way forward	Yuqi Bai et al.[6]
This article presents a narrative review to explore considerations and necessary requirements to achieve health and well-being within strategies for healthy design and urban planning whilst rethinking urban spaces for a post-COVID-19 and carbon neutral future. Spaces and public health and improving of the population's well-being. Public health needs to be prioritized systematically in planning of built environments, energy generations, sustainable food production, and nutrition.	Build healthier: Post-COVID-19 urban requirements for healthy and sustainable living	Marija Jevtic et al.[7]
The Healthy Cities and Sustainable Development Goals are interlinked, and the Healthy Cities movement has received widespread response and support worldwide over the past 30 years. The European Healthy Cities Networks covers about 1400 cities. China started the Healthy Cities Movement in 1994 and put forward the Healthy China Strategy in the report of 19th national congress of CPC. this paper goes through the basic literature and its framework in China.	Development and evaluation of healthy cities	Kai Xia et al.[8]

Table 1. (*Continued*).

Research achievement	Research title	Author/year
This article clarifies important differences between the content, scope, and outcomes of interdisciplinary and transdisciplinary projects about public health and urban planning and explains why transdisciplinary contributions are more likely to bridge the applicability gap between knowledge and practice in response to persistent urban health challenges.	Co-benefits of transdisciplinary planning for healthy cities	Lawrence[9]
The just ecofeminist healthy cities approach understands human health as interconnected with the health of non-human animals and the ecosystem. this paper illustrates the proposed new approach focusing on the implications for women's health and public green spaces research and propose principles and practices for its operationalization.	Healthy cities after COVID-19 pandemic: The just ecofeminist healthy cities approach	Triguero-Mas[10]
The specific aim of this paper was to discuss the concept of a healthy city, indicate a new urban model, and advocate for the increased use of bicycles, outdoor gym/outdoor exercise, walking to reducing pollution, and improving physical, psychological, and social fitness.	COVID-19 and the city: A healthy city strategy for pandemic challenges, from planning to action	Hasyim and Dale[11]
This paper approaches the post-COVID-19 city in a historical perspective to reflect on new solutions for a common European urban development.	Open issues and opportunities to guarantee the "right to the 'healthy' city" in the post-COVID-19 European city	Camerin[12]
The changes in PM10 pollutant concentration in Istanbul and Ankara were investigated in the months when the quarantine was imposed by the government with less and more intensity. As a result of the imposed restrictions, the use of vehicles, industrial activities, fuel consumption, etc., reduced pollutants and cleanliness.	Impact of the COVID-19 event on PM10 air pollution in Istanbul and Ankara	Bacak and Toros[13]
The epidemic of COVID-19 and its disturbances in the existing situation has had lasting effects in the short term on the way of urban regeneration. The findings of the research indicate that the value of urban nature and open spaces has multiplied after the pandemic, especially among the young.	Back to nature: Norwegians sustain increased recreational use of urban green space months after the COVID-19 outbreak	Zander[14]
A comprehensive analysis of factors such as changes in fuel consumption, traffic volumes, and emission levels can help societies assess the impact of the COVID crisis on transport and adopt a suitable strategy for such future epidemics.	Assessing the impact of the COVID-19 pandemic on urban transportation and air quality in Canada	Tian[15]
This research investigates the policies and practices of changing urban ecosystems that are mainly affected by the COVID-19 pandemic in the central business district, ecosystem and transportation, and hospitality tourism ecosystem.	Next city: Learning from cities during COVID-19 to tackle climate change	Kakderi[16]
Pollutants such as CO, NO_2, and SO_2 have been significantly reduced in the examined sample during the outbreak of Corona. This study suggests some plant species resistant to air pollution to continue the harmonious relationship between humans, the environment, and activity.	Significant impacts of COVID-19 lockdown on urban air pollution in Kolkata (India) and amelioration of environmental health	Bera et al.[17]
This article examines the impact of the COVID-19 pandemic on the development of smart cities and the policies for expanding and applying digital technologies in urban development.	Smart cities after COVID-19: Ten narratives	Kunzmann[18]
This study aimed to analyze the indicators of a healthy city in urban settlements of Ardabil province. Ardabil city was ranked based on 42 criteria for health indicators.	Spatial analysis of the healthy city indicators in urban settlements (Case study: Ardabil province)	Nazmfar et al.[19]
Applying a conceptual framework combining insights from knowledge utilization theory, theoretical perspectives on (health) policy development, theory-based evaluations and planned intervention approaches, it demonstrates that, although the evidence is overwhelming, there are barriers to the implementation of such evidence that should be further addressed by "Healthy Cities".	Evidence for healthy cities: Reflections on practice, method and theory	de Leeuw[20]
The purpose of this paper is to evaluate the progress made by European cities in relation to Healthy Urban Planning (HUP) during Phase IV of the World Health Organization's Healthy Cities programme (2003–2008).	Urban planning for healthy cities a review of the progress of the European healthy cities programme	Barton and Grant[21]

Reference: Authors.

2. Literature review

The world is now witnessing the birth of an epidemic phenomenon that is currently causing enormous pain and suffering, death, disruption to the natural state of life, and the uncertainty of existing conditions and

the fear of worsening this situation are new and disturbing. However, deadly epidemics and disease outbreaks are not new phenomena; they have challenged human existence. As recorded throughout history, some of them have killed a significant percentage of humans, but humans have always sought and often found ways to reduce harm[22].

In each of the mentioned cases, citing history, it can be concluded that even though pandemic diseases have challenged the cities and caused huge damages and casualties in various areas, they have been able to take an effective step in the future development of the cities. And the development of concepts of resilience and urban sustainability is also the source of these issues and problems. Even today, the coronavirus has had a profound effect on the construction of the world and has changed many technical strategies used in the last century.

2.1. What is corona virus?

A novel corona virus, Sars-cov-2, was first identified on 30 December 2019, in Wuhan, a city in China's Hubei province with a population of 11 million, after an unprovoked pneumonia outbreak. This virus belongs to a family of single-stranded RNA viruses known as corona virus, which is a common type of virus that affects mammals, birds, and reptiles. In humans, this disease usually causes mild infections similar to a cold and accounts for 10%–30% of upper respiratory tract infections in adults. The recovery period of this disease is between two weeks and one month and it is very common and contagious. For this reason, it has been strongly considered by the World Health Organization[23].

Today, the world is learning that public health efforts, such as social distancing, closing businesses, preventing large gatherings, travel restrictions, etc., can be very effective if adopted early and carefully. All actions taken in this direction should be in the form of joint global actions because it can be expected that the world will face epidemic challenges again and again, and global epidemic threats cannot be managed only with national responses[22].

2.2. Integration of the health perspective in the city regarding pandemics

Based on both historical and contemporary views, this point will address city design and urban planning such as (cities density, street design, public transport, public spaces, parks and green areas, and building design) as it pertains to the health of the population during the epidemic, when cities face major risks, with increasing numbers of positive cases and deaths related to the size of cities and population density. The COVID-19 pandemic may be a chance to optimize cities by integrating social behavior during a pandemic time through a health perspective in planning and design; see **Table 1**. For example, the idea of introducing a health perspective into the design of public spaces as a consequence of the pandemic is not new, but it needs to be reactivated social behavior and citizen awareness are considered important factors in dealing with this pandemic[24].

2.3. The healthy cities approach

World Health Organization (WHO) published a manifesto for healthy and green recovery from COVID-19, including building healthy and decent habitation. Creating a healthy city is important during COVID-19 pandemic, which requires support and investment. Healthy cities are defined as cities that constantly develop and improve the physical and social environment and expand the power base of communities that enable people to support each other to carry out all life functions mutually. Healthy City is an attempt to prioritize the agenda for a social, economic, and political government town. For the past 30 years, the WHO European Healthy Cities Network has included approximately 100 major cities and about 30 national networks. Population growth in urban areas is a global phenomenon, and countries in the Pacific West area are no

exception. It is great to make cities carbon neutral, more habitable, and healthier by transport the city planning. Recently, the WHO for the Region Pacific West has been working together with its members, developing several Healthy City initiatives to improve the health of urban areas. However, it is not easy to measure the results: an index is required, standards are set, and the impact of each component of health needs to be determined. It further supports the idea that rating the effect of fitness is required to develop public policy[11].

Healthy Cities should not be limited to medical and health care, nor should they be shackled to urban construction, but should have the overall development of human beings as its core goal and value orientation. Healthy Cities is a comprehensive concept that involves many aspects of urban construction and development, and requires the collaboration of departments and extensive social participation. Healthy Cities is not confined to one or more health problems, but "is intended to build health into the decision-making processes of local governments, community organizations and business, to develop a broad range of strategies to address the broad social, environmental and economic determinants of health". Furthermore, the main features of the Healthy City project include a political commitment with high levels of collaboration amongst the cross-sectoral community; community participation; integration of activities; development of urban health profiles and local action plans; monitoring and evaluation periodically. In addition, there needs to be participatory research and analysis, sharing information, media engagement, the incorporation of views from all groups in the community, sustainability mechanisms, connection with society and the development of human beings, and national and international networks[22].

Our proposal to incorporate care, intersectional social inequalities, and environmental justice into the healthy cities approach is inspired by a diversity of complementary disciplines. The healthy cities movement emphasizes equity, participatory governance, solidarity (i.e., explicit political commitment, leadership, and institutional change), and inter pectoral partnerships with public, private, voluntary, and communication and organizations. However, despite that the healthy cities movement refers to goals such as sustainable development, conservation of resources and environmental health, and ecosystems that are stable now and sustainable in the long term, its approach has been mainly at the local scale and focusing on the existing city population[25].

In September 2015, the United Nations Sustainable Development Summit adopted one of the UN Summit Outcomes, "Transforming our World: 2030 Agenda for Sustainable Development". The document proposes 17 Sustainable Development Goals (SDGs) and 169 targets. The goals and targets encompass the three dimensions of sustainable development: economic, social and environmental, which are in line with the main theme of Healthy Cities. Thus, the construction of Healthy Cities has become increasingly important and is an inevitable requirement for sustainable human development[8].

2.4. Planning for urban health

The 2012 Lancet Commission report was based on their synthesis of a large volume of expert reviews and desk-top research about the health of urban populations. The Commission formulated five recommendations:

- Local authorities should collaborate with a wide range of stakeholders including professional practitioners in urban planning and public health.
- Health inequalities in cities should be a focus of urban planning and policymaking.
- "The urban advantage" of population health in cities should be maintained using public policies for urban planning.

- Systems analysis is needed to better understand the complexity of planning for urban health.
- Local experimentation can provide progress for action to promote urban health, and these projects should include practitioners and representatives of local communities.

The Lancet Commission used case studies to show how health can be improved by modifying buildings, infrastructure, and outdoor public spaces in cities. Then it argued for a new approach to planning for urban health having three key components. First is the need for experimentation, including trial and error, without any reference to the checkered history of experimentation in housing, building, and city planning. Second, specific urban projects are cases for learning based on assessment and feedback of these projects, without mentioning that post occupancy evaluation of housing, building, and urban planning projects is anathema to architecture, urban design, and city planning professions. Third is accounting for the value laden nature of urban policies, including ethical and moral dimensions of planning for urban health, without acknowledging the role and responsibility of elected officials, professional practitioners and investors in housing, land, and property markets[25].

According to WHO, a healthy city is evaluated in following indicators:

- A clean, safe physical environment of high-quality (including housing quality);
- An ecosystem that is stable now and sustainable in the long term;
- A strong, mutually supportive and non-exploitative community;
- A high degree of public participation in and control by the public over the decisions affecting their lives, health, and well-being;
- The meeting of basic needs (food, water, shelter, income, safety and work) for all the city's people;
- Access to a wide variety of experiences and resources, with the possibility of multiple contacts, interactions, and communication;
- A diverse, vital and innovative city economy;
- Encouragement of connectedness with the past, with the cultural and biological heritage, and with other groups and individuals;
- A city form that is compatible with and enhances the above parameters and behaviours;
- An optimum level of appropriate public health and sick-care services accessible to all;
- High health status (both high positive health status and low disease status)[21].

2.5. Urban changes after the COVID-19 pandemic

Today's developments traverse the wrong models of the past in different urban dimensions and are reproducing new systems in order to the promotion of modernity and new urban lifestyles. The corona pandemic, along with other past epidemics such as Sars and Cholera, but this time with a much faster speed, is seeking to create fundamental changes in cities. The environment and cities realized the importance of public spaces and smart cities. The forced isolation and social distance during the epidemic have intensified loneliness and anxiety for a part of our population[22]. Although the widespread quarantine of cities in various countries improved the control and management of the disease, it seems that it has also created many social problems for individuals and families. **Table 2** will examine some of the events and changes created in cities due to the corona pandemic.

Table 2. Changes made in cities due to the corona pandemic.

References	Post-pandemic changes	Factors
Nenad N. Petrović et al, 2021; Robin Hambleton, 2021; LUIS ALBERTO CASADO-ARANDA et al, 2020; Hisham Abusaada, Abeer Elshater, 2020; Daniel G. Costa, João Paulo J. Peixoto, 2020; Hiroshi Onoda, 2020; Mohammad Shorfuzzaman et al, 2020; Klaus R. Kunzmann, 2020; Angeliki Kylili et al, 2020; Matthew Gevers, 2020; Sara Eltarabily, Dalia Elghezanwy, 2020; Ayyoob Sharifi, Amir Reza Khavarian-Garmsir, 2020; R. Morello et al, 2017	Connecting the physical and digital world; using smart tools for control and care; development of technology and digital sectors in the tourism industry; using artificial intelligence in control and care in cities; using robots and autonomous vehicles in the city; using unmanned aircraft in health services; increasing e-commerce and virtual buying and selling; improving transparency and disclosure of information; liberating citizens from the captivity of receiving information and getting them used to creating information and ideas; developing technological infrastructure including optical fiber, WIFI, etc.; development of sustainable transportation systems and smart parking lots; using smart sensors and efficient applications; improvement of offline services; promotion of electronic government and the quality of urban democracy; usage of smart tools virtual reality in distance education; development of smart startups and virtual labor market	Smart city
Delaram Shahbazian, 2021; Hanmao Liu, Po H Wang, 2021; Anne-Marie broudehoux, 2021; Sara Eltarabily, Dalia Elghezanwy, 2020; Ayyoob Sharifi, Amir Reza Khavarian-Garmsir, 2020; Lorenz von Seidlein et al, 2020; Ka Yan Lai et al, 2020; Naglaa A. Megahed, Ehab M. Ghoneim, 2020; Rooij R et al, 2020; Louis Rice, 2020; Bradley Bereitschaft, Daniel Scheller, 2020	Allocating more space to active transportation; increasing the area of open spaces; providing more space for cyclists and pedestrians; increasing the importance of green space; increasing small-scale green spaces; redesigning the size of urban blocks and mixed uses; improving access to amenities and health infrastructure; paying more attention to slums and deprived areas; providing quarantine stations; providing suitable health infrastructure; providing suitable sanitary services in the city; redesigning streets; preventing high density and paying more attention to horizontal development; increasing small commercial markets; redesigning neighborhoods as centers of exit from the privacy of homes	Urban forms design
Anne-Marie broudehoux, 2021; Sara Eltarabily, Dalia Elghezanwy, 2020; Mingwang Shen et al, 2020; Artur Jasiński, 2020; EMIL VAN ECK et al, 2020; Jordi Honey-Rosés et al, 2020	Social distancing in order to limit crowding; suspension and closure of most public spaces including cinemas, theaters, and stadiums; redesign of flexible public spaces; increasing the distance between benches in public spaces for social distancing; closing some streets to cars and turning into pedestrian and bicycle paths; increasing neighborhood links; decreasing the value of public spaces; closing shopping spaces and markets	Public spaces
Delaram Shahbazian, 2021; Anne-Marie broudehoux, 2021; Sara Eltarabily, Dalia Elghezanwy, 2020; Ka Yan Lai et al, 2020; Naglaa A. Megahed, Ehab M. Ghoneim, 2020; Andrea Amerio, 2020; Vincenzo Del Giudice et al, 2020; Baris K. Yörük, 2020	Flexible and healthy redesign of buildings; improvement of building elements in order to reduce isolation; creation of porches in houses in order to make a connection with the city and green landscape; expanding social relations between neighbors; increasing the importance of ventilation system in buildings; construction buildings with fewer floors compared to towers; Increasing the width of corridors; creating more partitions in offices and homes; designing buildings with bigger and more skylights; designing terraces and roofs for buildings; development of green spaces adjacent to residential houses; increasing the price of personal and quality housing	Housing

Reference: Authors.

2.6. Advantages of COVID-19 in different dimensions

Based on the mentioned cases, as was discussed that the corona crisis has played a great role in the creation of modern urban systems as well as social and political organizations, researches show that in addition to all the negative consequences of the corona, this disease also has positive aspects. It has been accompanied and has been able to cause the positive aspects in human life's dimensions. The consequences of these effects can be investigated in several aspects, including political, sociocultural, economic, digital developments, etc. The stated dimensions, based on the studies carried out in the field of COVID disease in

global dimensions and affecting various aspects of human societies, will be discussed in **Table 3**. It is worth mentioning that the current research, among the dimensions investigated in other studies conducted in the field of corona, has examined aspects with the most frequency and impact.

Table 3. The results of the questionnaire and the first-order factor analysis of the research indicators.

The effectiveness percentage of the component from the respondents' point of view (Base on Likert scale)	1. Change of lifestyle and adherence to health protocols	2. Improvement of family relationships	3. increase of virtual socializing	4. Reduction of crimes outside the home	5. Reduction of crimes in public spaces	6. Reduction of inequality between groups with access to smart computers and the Internet compared to disadvantaged people	7. Expansion and quality improvement of intelligent educational infrastructures	8. Promotion and expansion of digital tourism (virtual travel)	9. Start–up development (start–up business)	10. Increase of micro–scale commercial markets	11. Transformation of the economic status of countries	12. Reducing the development of poverty in countries Less developed	13. Increasing production and supporting domestic services	14. entrance of women into the business market	15. Saving economic costs and time	16. Increasing job security	17. Reducing the adjustment of the workforce of economic enterprises	18. Improving medical equipment
0	8%	25%	4%	12%	4%	0%	3%	2%	4%	0%	2%	0%	5%	0%	4%	6%	3%	1%
1	6%	32%	12%	40%	5%	3%	0%	19%	27%	23%	5%	1%	53%	2%	18%	31%	18%	1%
2	33%	25%	27%	34%	35%	13%	13%	58%	40%	51%	7%	8%	25%	60%	5%	35%	52%	11%
3	12%	12%	35%	8%	52%	53%	70%	14%	19%	16%	49%	77%	12%	30%	15%	16%	18%	66%
4	41%	6%	22%	6%	4%	31%	14%	7%	10%	10%	37%	14%	5%	8%	10%	12%	9%	21%
5	3/72	2/6	3/59	2/56	3/47	4/09	4/49	3/05	3/04	3/13	4/14	4/04	2/59	3/8	1/65	2/97	3/12	4/05
λ	0/75	0/79	0/84	0/36	–0/19	0/05	0/32	0/6	0/66	0/83	0/05	–0/31	0/77	–0/38	–0.5	–0/63	–0/6	0/46

Table 3. (*Continued*).

The effectiveness percentage of the component from the respondents' point of view (Base on Likert scale)	19. Increasing the interaction of countries in the field of health and hygiene	20. Reducing the consumption of various energies	21. Increasing Exploitation of sustainable energy sources	22. Increasing air quality	23. Importance of planting trees	24. Using public transportation	25. Increasing the capacity of public transportation	26. Building more open and green spaces in the city	27. Designing pedestrian and bicycle paths	28. redesigning the streets with a vitality approach	29. More attention to deprived areas and slums	30. Redesign of public spaces	31. Design of new building elements such as balconies and green roofs	32. Reduction of building density and the number of floors	33. Development of vegetation near residential houses	34. Increase in housing prices
0	2%	31%	5%	9%	5%	3%	3%	8%	12%	10%	15%	6%	19%	54%	5%	3%
1	2%	48%	4%	38%	10%	2%	8%	8%	24%	17%	15%	9%	39%	29%	43%	11%
2	36%	11%	11%	40%	10%	9%	58%	60%	45%	35%	25%	41%	28%	9%	42%	36%
3	48%	2%	7%	6%	68%	75%	24%	16%	14%	34%	40%	40%	9%	2%	6%	37%
4	12%	3%	36%	7%	7%	11%	7%	8%	5%	4%	5%	4%	5%	6%	4%	13%
5	3/66	2/03	4/02	2/64	3/62	3/89	3/24	3/08	2/76	2/96	3/05	3/27	2/57	1/77	2/61	3/46
λ	0/4	0/39	–0/36	–0/01	0/3	0/43	0/3	0/6	0/6	0/79	0/62	0/79	0/69	0/96	0/59	0/19

Reference: Authors.

3. Methodology

The current research is applied research and qualitative-quantitative and descriptive-analytical research in terms of methodology. In order to go through the data collection process, the collection of documents, library methods, and access to electronic resources, as well as the use of successful global experiences in this field, led to the acquisition of information. For the next step, a questionnaire consisting of the items and indicators mentioned in the conceptual model was prepared and according to the statistical population of the research, the city of Tehran, 385 questionnaires were completed by the citizens. The results of the questionnaire have been evaluated and analyzed through methods such as confirmatory factor analysis in Lisrel software. Finally, the factors with the highest and lowest impact were determined. It should be noted that in the upcoming research, the positive effects of COVID-19 on the quality of the environment and life in human societies have been mentioned, and the negative aspect of this effect has been excluded from the scope of the present research.

4. Case study and analysis of findings

The city of Tehran is located at 35°35′ to 35°48′ N and 51°17′ to 51°33′ E in the southern foothills of the Alborz mountain range, with an area of about 800 km^2 and 22 municipal districts. And there is a population of 8,693,706 people. The city of Tehran is the largest city, the capital of Iran, the capital of Tehran province, and Tehran city. Due to the high population of residents in the capital and the high concentration of organizations in this province, the speed of the spread and infection of COVID-19 has been very high. Therefore, research on the effects of this disease on the quality of life in densely populated human societies is very important[26].

The results of the first-order factor analysis of the indicators, i.e., the amount of λ for each indicator in the form of different factors. According to the quantitative valuation of the Likert spectrum from 1 to 5, respectively, and according to the results of the expert's responses to the questionnaire, each index has been valued, and the results obtained by the confirmatory factor analysis of the first stage, the amount of λ for each index is listed in **Table 3**. Based on the average values obtained for each index in the questionnaire, values greater than 3 are approved, and based on the method of determining the desired indicators in the confirmatory factor analysis method, indicators with a value of λ, higher than 0.3, are approved in the study area. And the reliability of the indicators has been confirmed by matching and comparing these two indicators.

The results of the analysis show that the index of reducing inequality between groups with access to smart computers and the Internet compared to the more deprived people and the index of improving medical equipment have the highest rate and value of being affected by COVID-19. Also, among the 34 indicators counted in the measurement and conceptual model, with the matching and comparison between the two λ coefficients and the total scores of the questionnaires, 14 indicators were confirmed to be effective in the city of Tehran.

Considering the evaluations and as can be seen in **Table 4**, regarding the factors and dimensions examined in the upcoming research, the physical-spatial dimension with green color and the two factors of urban design and housing, the most, and the social dimension with red color and three factors of social distance, criminality and education have been given the least effectiveness by the respondents (ibid).

Table 4. Examining the effectiveness of dimensions and factors based on the results of the questionnaire.

The average effectiveness of the factors based on the related indicators	Factors	The average effectiveness of the dimensions based on factors and indicators	Dimensions
3/30	Social distancing	3/03	Social dimension
3/01	Criminality		
2/79	Education		
3/05	Tourism	3/1	Economic dimension
3/08	Emerging businesses		
3/18	Investment		
3/85	Medical system	3/36	Environmental dimension and public health
3/02	Energy		
3/13	Ecosystem		
3/56	Public transportation	3/56	Transportation
3/02	Urban design	4/59	Physical-spatial dimension
2/6	Housing		

Reference: Authors.

5. Conclusions and recommendations

After examining the results of the questionnaire and the first-order confirmatory factor analysis, the indicators were evaluated based on the level of desirability. In the end, out of the total of 34 investigated indicators, 14 indicators have been determined to be effective indicators of the COVID-19 crisis, according to the case study conditions of Tehran city, which include:

Changing lifestyles and observing health protocols, increasing virtual socializing, reducing inequality between groups with access to smart computers and the Internet compared to more disadvantaged people, promoting and expanding digital tourism (virtual travel), and developing startups and businesses. increasing small-scale commercial markets, improving medical equipment, increasing the interaction of countries in the field of health and hygiene, the importance of planting trees, using public transportation, increasing the capacity of public transportation, building more open and green spaces in the city, paying more attention to deprived areas and slums and redesigning public spaces based on prevailing conditions. In order to improve the quality of healthy cities, especially during the epidemic, the above results should be taken into consideration. Among them, the following can be mentioned:

- change in the way of communication/provision of required training;
- observance of personal hygiene in public spaces;
- compliance of work and study conditions and hours with the existing situation;
- providing access to the Internet for all social groups;
- providing new digital tools to the more disadvantaged/increasing technology literacy among the elderly;
- learning from successful experiences in the field of medical equipment;
- localization;
- absorption of new ideas in the field of creating medical equipment;

which can be seen in **Table 5** with more details.

Table 5. Explaining the role of the urban planner in measuring the positive effects of the pandemic disease in the environmental planning of healthy cities.

The effectiveness percentage of the component from the respondents' point of view	Urban planner's role
Change of lifestyle and adherence to health protocols	✓ Directing the public media ✓ Culture building
increase of virtual socializing	✓ Participating in upgrading the relevant infrastructure technology
Reduction of inequality between groups with access to smart computers and the Internet compared to disadvantaged people	✓ Participating in upgrading the relevant infrastructure technology
Promotion and expansion of digital tourism (virtual travel)	✓ Directing the public media ✓ Culture building
Start-up development (start-up business)	✓ Planning and designing urban infrastructure according to the components of the smart city
Increase of micro-scale commercial markets	✓ Urban planning and design with approaches such as Traditional Neighborhood Development (TND)
Improving medical equipment	✓ Participating in upgrading the relevant infrastructure technology
Increasing the interaction of countries in the field of health and hygiene	✓ Directing the public media ✓ Culture building
Importance of planting trees	✓ Directing the public media ✓ Culture building
Using public transportation	✓ Directing the public media ✓ Culture building ✓ Participating in upgrading the relevant infrastructure technology
Increasing the capacity of public transportation	✓ Participating in upgrading the relevant infrastructure technology
Building more open and green spaces in the city	✓ Participating in upgrading the relevant infrastructure technology
More attention to deprived areas and slums	✓ Planning the programs in order to empowering and organizing urban decays and slums.
Redesign of public spaces	✓ Replanning of city rules

Reference: Authors.

In order to explain the urban planner's role in the positive effects of pandemic disease in the environmental planning of healthy cities, it is possible to choose the role of mediation. An urban planner connects the essential elements of the city like puzzle pieces.

The specialized role of the urban planner and the effects of pandemic diseases on the urban environment and a healthy city, will be discussed in future research.

Conflict of interest

The authors declare no conflict of interest.

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