

Nature, Human and City

(Appreciating the Effect of Covid-19 on Human and City)

Majid Nikjooy¹, Amin Khakpour², Parisa Ghasemzadeh³ & Shabnam Eghdam⁴

¹ PhD in Urban Design and Policy and Dot. in Architecture, Polytechnic University of Milan, Milan, Italy

² PhD student in Urban Planning, Art University of Isfahan, Isfahan, Iran

³ Master of Urban Design, Tehran University of Arts, Tehran, Iran

⁴ Master of GIS&RS, University of Tehran, Tehran, Iran

Correspondence: Parisa Ghasemzadeh, Aria Noor Poya Consultants, No.2755-Golestan Complex 2-A Shahnavaaz Ave. Amanieh Valieh St. Tehran, Iran. Tel: 98-21-2205-2580. E-mail: anp.ghasemzade@gmail.com

Received: July 14, 2021

Accepted: October 19, 2021

Online Published: October 29, 2021

doi:10.5539/jsd.v14n6p28

URL: <https://doi.org/10.5539/jsd.v14n6p28>

Abstract

Despite the existing and potential characteristics of nature in urban planning process, technological progress and the rate of change in the physical identity of cities have increased natural mutations and taken the relationship between humans and nature out of the normal process. Among the natural mutations, we can mention infectious diseases, which have been nature's reaction against the city and the density of the urban population. Health issues and infectious diseases have long plagued cities, leading to changes in architecture and its rules and regulations. This process has been done less in urban planning regulations and this has increased the vulnerability of citizens in the urban environment against infectious diseases. Accordingly, this study attempted to offer principles centered on the physical nature of the city, while reviewing the history of infectious diseases in the world and considering urban planning theories related to urban health and pollution and the statistics of sample cities in the face of Covid-19 in order to accompany urban physical changes with human, technological, identity and natural changes to help urban management to reduce citizens' vulnerability against infectious diseases. Data were collected using library and internet resources. Principles are derived from the Delphi method of experts. Some of the proposed principles are balanced building density, observing the minimum ratio of open space to urban residential space and balanced distribution of open space in the city, reducing per capita office use, establishing a crisis center with isolated conditions in each neighborhood, increasing per capita urban equipment and facilities land use, balanced distribution of neighborhood services, moving to multi-center cities, reducing concentration in city centers and using multifunctional urban spaces. Currently, due to natural mutations as well as changes in culture, traditions, and technological mutations, we need flexible rules and regulations to identify cities and align with nature. Therefore, it should be considered that the proposals offered are following the current situation and should be amended and updated over time and as circumstances change.

Keywords: infectious diseases, Coronavirus virus, urban environment, city physic, urban planning solutions

1. Introduction

1.1 Introduce the Problem

With the outbreak of the Industrial Revolution and an increase in human power of conquest and control of nature, the almost harmonious and balanced relationship between people, nature, and the city, which existed for many centuries, changed. Accordingly, we have encountered an increase in population concentration in cities, which has led to many imbalances and problems, including health problems, of which infectious diseases are a significant part. With the increasing rate of technological progress and resulting identity and cultural changes, there were also mutations in nature that revealed their opposition to urbanization and even more so to the existing density in cities. Besides, the world is facing an increasing trend of infectious diseases. The Spanish flu is the last worldwide pandemic before the outbreak of the coronavirus. According to unofficial statistics, more than 50 million people died in this epidemic (Johnson and Mueller, 2002).

The incidence of each disease has different effects on people, societies, and their lives according to the conditions

and characteristics it has. One of the acute issues currently affecting all human life on the planet is the outbreak of Covid-19. As of writing, and according to official statistics from the World Health Organization, more than 40 million people worldwide have been diagnosed with Covid-19 disease, and the epidemic is continuing rapidly.

Due to the ongoing pandemic of coronavirus and the possibility of its continued spread in the future (such as the Spanish flu) or the occurrence of similar infectious diseases worldwide that can affect human lives and economy, culture, and normal life of communities, show this issue is considerable. On the other hand, if we do not pay attention to this issue, we will see the spread of the epidemic of infectious diseases in biological complexes. Therefore, it is necessary for urban planners and urban designers to plan and design collective living environments in a way that limits the spread of infectious diseases and increases the adaptation of urban planning criteria to changes in nature. Therefore, the present study was conducted with the aim of "providing physical principles to reduce the vulnerability of citizens to the spread of infectious diseases, including Coronavirus disease." The main question of this research is: "How should the urban environment be organized against the spread of infectious diseases?"

1.2 Background

The trend of research related to the effect of coronavirus on the course of urban life and in particular on the urban physic has been increasing with the spread of the disease. Some of the most important studies on the impact of infectious diseases (especially Covid-19) on the urban environment are reviewed.

Zaheer Allam and David Jones (2020), in their article on the impact of the Coronavirus on Chinese cities, stress that surprisingly, urban planning and design professionals in the discourse related to current strategies are absent after COVID-19, although historically the past pandemic has had a profound effect on the urban fabric, society, and the economy. They call on international architectural and urban planning organizations to take action against the coronavirus and similar epidemics in crisis management strategies.

Lu Liu (2020), in his article on the coronavirus using the Chinese experience, identified the factors that contribute to the spread of coronavirus. According to this study, distance from the outbreak center has a negative relationship with the spread and transmission of the virus and the length of subway lines, the amount of sewage and household waste has a positive relationship with the spread and transmission of the virus. He also states that urban and population density in the early stages is negatively associated with coronavirus expansion.

Yuan Lai, Wesley Yeung, and Leo Anthony Celli (2020), in their research, emphasize the importance of urban-level information and limit the use of information during a pandemic crisis. By reviewing urban-level information, they combined the executive and analytical ability to define urban intelligence to respond to and use in times of disease crisis.

In their paper, Jordi Honey-Rosés and colleagues (2020) identify questions that arise regarding the impact of Covid-19 on public space after the outbreak of the disease. In their view, the depth and breadth of change, especially in relation to future design, use, and perception of public space, is unclear. The Covid-19 crisis may fundamentally change our relationship with public space. Finally, the authors state that in order to shape the planning and urban design of post-Coronavirus, these changes must be studied critically.

Whittingham (2013) believes that the occurrence of health problems in cities can be due to the mismatch between the effect of urban spatial and design with the needs of individuals and society, which has reduced the health of urban living space. He seeks to better understand how cities are planned, designed, and managed based on sustainable development and citizens' health. To achieve such an understanding, he considers social, environmental, and health factors that affect urban quality and vitality.

1.3 History of Spread Infectious Diseases in the World

For a long time, human, nature, and city have been in a constant relationship with each other and have been influenced by each other. Among the effects of humans on nature have been the concentration, population density and city create. On the other hand, nature has reacted to the expansion of urbanization. Among the reactions of nature has been the occurrence and spread of infectious diseases.

The Spanish flu is another contagious disease that has had a profound effect on human life over a two-year period. This pandemic began in 1918 and continued until 1920. At the time of the outbreak, various scientific disciplines, including medicine, offered strategies to combat and reduce the disease, but the solutions were rarely presented on an urban scale with a holistic view. The inability of countries to prevent the spread of the Spanish flu was similar to the situation 500 years ago when the plague spread worldwide. The Spanish flu killed almost 1 percent of the world's population (Spreeuwenberg; et al, 2018).

In December 2019, a new strain of coronavirus, later named Covid-19, was discovered in Wuhan District, Hubei Province, China. It was first reported to the World Health Organization on December 31 that Chinese scientists have linked the disease to a family of viruses that include SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome). Although it soon became apparent that disease was less lethal than SARS and MERS, its rate of spread was astonishing. According to the latest statistics from the World Health Organization, despite infecting more than 50 million people worldwide, the virus has killed about one million people so far.

In general, the coronavirus is anti-urban and anti-congestion. This means that in dense and crowded urban environments, the virus is more likely to spread. Accordingly, the gathering and distribution areas of citizens in the city, such as transportation terminals, commercial and administrative areas, are at high risk of spreading the coronavirus. On the other hand, deteriorated and problematic urban fabrics are also examples of dense urban environments that the residents of these areas due to the physical structure of these areas are more exposed to the disease than residents of other urban areas.

Table 1 summarizes the history of infectious diseases in the world. Based on this, it can be seen that the number of infectious diseases has been increasing in the last century (Figure 1).

Table 1. History of last century infectious diseases in the world

No.	Disease Name	Year of Outbreak	Duration	Number of People Dead
1	Spanish Flu	1918	2	Over 50 million
2	Asian influenza	1956	2	2 million
3	Hong Kong Flu	1968	2	1 million
4	SARS	2003	3	774
5	Swine flu	2009	2	151700 to 575400
6	Ebola	2014	3	11325
7	Covid-19	2019	Present	Over 1000000 up to now

Ref: WHO (2021)

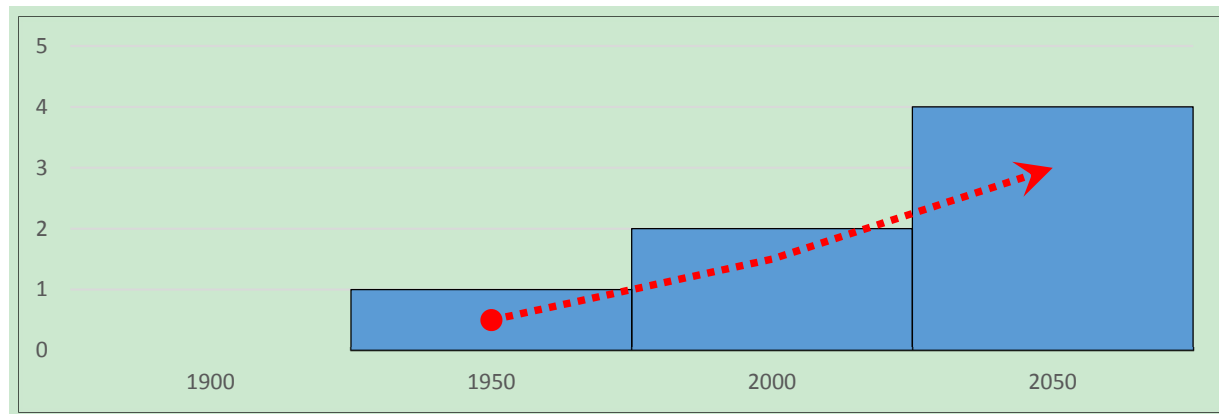


Figure 1. Prevalence of infectious diseases in the last century

Source: (Nikjooy, Khakpour, Ghasemzade, Eghdam, 2021)

As evidenced by the information gathered, infectious diseases are an important issue affecting existing communities. Accordingly, it is necessary to think about the relationship between infectious diseases, humans and city to prevent the growing trend of infectious diseases. In fact, it is necessary to provide flexible urban planning and regulations in accordance with natural and human changes and mutations (along with identity changes) in order to optimize the physic of cities in the face of infectious diseases. For this purpose, the effects of infectious diseases on urban development patterns must first be identified. More than 100 years have passed since the outbreak of the Spanish flu, and the disease has been like a coronavirus in terms of worldwide pandemic. Given that urban patterns do not change much in the short term, the effect of the Spanish flu on urban planning patterns

has been studied.

2. Identifying the Impact of the Spanish Flu on Urban Planning Patterns

In order to investigate the impact of infectious diseases (specifically Spanish influenza) on urban planning patterns, the first urban planning theories related to health and public health issues presented after 1918 (the year of the Spanish flu outbreak) were identified. In the next stage, the cities with the highest number of deaths due to the Spanish flu were identified, and finally, the new cities created after 1918 were identified.

2.1 Urban Planning Theories under the Influence of Infectious Diseases and Public Health (Theoretical Context)

2.1.1 Sustainable City

The theory of sustainable urban development is the result of environmentalists' discussions on environmental issues, especially the urban environment, which followed the theory of "sustainable development" to support environmental resources. After verified the sustainable urban development theory at Habitat II conference (Note 1) (1996) that was considered in many urban projects around the world (Azad and Eftekhari, 2010: 28-29).

A sustainable city is a city that is able to survive due to the economic use of resources, the avoidance of over-production of waste and its recycling as much as possible, and the adoption of useful policies in the long run. Sustainable city planners should focus on creating cities with less energy and materials and less waste and pollution (Turner, 2007: 180).

One of the salient features of this theory is its emphasis on high population and construction density and the emphasis on the compactness of the urban fabric. The focus on population and emphasis on compact tissue is the weak point of this theory in the face of infectious diseases. Among the positive points of this theory is the observance of the indicators of the balanced distribution of services and activities and the balanced distribution of open urban spaces in the city.

2.1.2 Ecological City

The anchor point of the ecological city theory is the consideration of the natural environment in interaction with the city. This theory is one of the subsets of the theory of sustainable urban development and sits in the environmental dimension. A city that has the following 4 characteristics is known as an ecological city (Bahraini, 1999: 277-276):

- Minimal interference with the natural environment
- Maximum diversity (in terms of land use and activities)
- As far as possible as a closed system
- Optimal balance between population and resources

Other issues related to this theory include urban congestion and a lack of reliance on motor vehicles. Based on this, the ecological city theory has a desirable performance from the point of view of a balanced distribution of population, services and activities related to infectious diseases, but from the point of view of emphasis on urban density: in fact, it is urban and centralist theories, while, reducing the spread of epidemics requires theories that reduce urban density and concentration.

2.1.3 Smart Urban Growth

This theory seeks to take advantage of the design of compact buildings that increase population density in cities. Of course, this theory and other urban theories are not specifically targeted at infectious diseases; however, principles are presented that generally affect the health and pollution of the city. The principles of this theory do not mention the balanced distribution of population, services, and activities. Of course, the theory emphasizes the need to preserve open spaces and agricultural lands in terms of natural beauty. Like Frank Lloyd Wright's emphasis on the need for human-nature interaction, of course, this theory has not been proposed to combat infectious diseases, but if it is implemented, we will see a decrease in population density and concentration in residential areas.

2.1.4 Healthy City

The emergence of environmental issues, the rise of mental and physical illnesses, urban slums in the last half of the 20th century led to the World Health Organization's Declaration of Health for All by 2000 (Whittingham, 2013: 75). Thus, began the healthy city movement in the 1980s. This movement, in the beginning, focused on environmental goals and improvement of cities and human dwelling places health situation, but gradually pursued goals higher than cities' health matters. (Ahmadi, 1999: 1).

In relation with the concept of "healthy city", many studies and researches have been done based on the principles

of healthy city and related indicators from the point of view of the World Health Organization. The indicators considered by the World Health Organization in relation to a healthy city are the consideration of health in cities in general and do not specifically consider infectious diseases. Therefore, indicators such as a balanced distribution of population, activities and services in the city are not discussed in the indicators of this theory. Of course, indicators such as public access to green space and recreational and sports places are among the indicators that are related to access to open urban spaces, but still no indicator is provided in relation to the distribution of such spaces in the city. Based on the studies, it can be concluded that so far there is no urban theories that specifically target the spread of epidemics, and a theoretical gap is felt in this area.

2.2 Cities with High Mortality due to the Spanish Flu

Due to the outbreak of World War I and the censorship of the press in Britain, Germany and France, the exact number of cases and deaths due to the Spanish flu in the cities of these countries is not available. On the other hand, the census system in many countries had not yet begun. However, Vienna (Austria), Budapest (Hungary), London (UK), Zamora (Spain), Kerman (Iran), Pittsburgh (USA) and Philadelphia (USA) are the cities known for the highest mortality rates due to the Spanish flu. A noteworthy point about New York City is that, given the 20-year campaign to fight tuberculosis by 1918, officials and citizens were accustomed to public health interventions, and the city experienced the lowest mortality rates in the Spanish flu.

2.3 New Towns Created after 1918 or Cities Influenced by Urban Theories

Due to the high prevalence of the Spanish flu in 1918, it was expected that urban planning patterns and new cities would be affected by this event and that would have an impact on urban planning and design as a breeding ground for infectious diseases. Accordingly, in the present section, new towns created after 1918, and also cities created or influenced by urban planning theories related to urban health and diseases (mentioned in Section 4-1) in terms of success in counteracting the expansion of the coronavirus were evaluated. As shown in Table 3, the cities of Astana (Kazakhstan), Chandigarh (India), Brasilia (Brazil) and Abuja (Nigeria) are new cities. London (England), Vienna (Austria), Budapest (Hungary), Pennsylvania (USA), Zamora (Spain) are the cities with the highest mortality in the Spanish flu. New York City is a city with a low mortality rate in the Spanish flu. Liverpool (UK), Copenhagen (Denmark), Tokyo (Japan) are successful cities in terms of the healthy city theory. The cities of Shanghai (China), Vancouver (Canada), Cortiba (Brazil) and Seattle (USA) have been identified as sustainable cities.

Due to the fact that the newly identified cities were all built after a global epidemic (Spanish flu) and with considering urban planning theories, it was expected that they would be able to perform successfully in the face of the coronavirus virus. Accordingly, in this section, the performance of the identified cities is evaluated in terms of coronavirus mortality rate (Table 3).

As shown in Table 3, in some cases statistics related to coronavirus mortality are not available in cities.

Table 2. Coronavirus spread statistics in related cities and countries

Category	City	Country	Coronavirus_Statistics_cities_death	population_city	Coronavirus_Statistics_country_death	population_country
high rate in spanish_flu	London	England	No data	9,304,016	No data	67,886,011
high rate in spanish_flu	Vienna	Austria	No data	1,929,944	708	9,006,398
high rate in spanish_flu	Budapest	Hungary	No data	1,768,073	595	9,660,351
new town	Astana-Nur-Sultan	Kazakhstan	No data	1,165,983	375	18,776,707
new town	Chandigarh	India	No data	1,148,472	24,309	1,380,004,385
Health city	Liverpool	England	No data	901,708	No data	67,886,011
Health city	Copenhagen-Capital Region	Denmark	No data	1,346,485	610	5,792,202
case in china	Shanghai	China	6	27,058,480	No data	1,439,323,776
garden city	Welwyn	England	No data	46,619	No data	67,886,011
sustainable city	British Columbia-Vancouver	Canada	189	5071000	8,798	37,742,154
new town	Brasilia-Federal District	Brazil	960	4,645,843	74,133	212,559,417
sustainable city	Curitiba-State of Paraná	Brazil	1,146	3,678,732	74,133	212,559,417
sustainable city	Seattle-King County-Washington	USA	639	783,137	138,358	331,002,651
high rate in spanish_flu	Pennsylvania	USA	6,973	12,800,000	138,358	331,002,651
Health city	Tokyo	Japan	325	37,393,128	982	126,476,461
new town	Abuja	Nigeria	39	3,277,740	754	206,139,589
high rate in spanish_flu	zamora, Castile and León	Spain	2,787	173,632	28,409	46,754,778
low rate in spanish_flu	New York	USA	32,092	8,323,340	138,358	331,002,651

Ref: <https://news.google.com/covid19/map?hl=en-US&mid=%2Fm%2F059rby&gl=US&ceid=US%3Aen>

<https://worldpopulationreview.com/world-cities>

<https://www.worldometers.info/world-population/population-by-country/>

Date retrieved: Wednesday, July 15, 2020

Whereas the prevalence of the disease in each city must be measured in proportion to the situation in the country in which it is located and its population, using the variables of country status, city population, number of coronavirus deaths in the city and number of coronavirus deaths in the country, the success criteria of cities in face of coronavirus is defined as follows:

Percentage of deaths in the city due to coronavirus to the number of deaths in the country due to coronavirus

Percentage of city population to country population

$C = B - A$. The success criteria of the city in the face of Coronavirus

Accordingly, whatever the C value is higher than zero, the more successful the city has been in the face of Coronavirus; and if the index is less than zero, the city has not been successful against the coronavirus in proportional the population in the country. The results of the surveys are listed in Table 4.

As shown in Table 4, New York City has not been successful against the spread of the Coronavirus virus, despite

the low mortality rate in the Spanish flu, although the impact of urban policy and management is not unrelated. The cities of Vancouver, Brasilia and Curitiba have been successful against Coronavirus, and Tokyo, as a healthy city, has not been successful against Coronavirus. Also, the cities of Abuja (as a new city with a population of over 100,000) and Zamora (a city with a high mortality rate in the Spanish flu) have not been successful in preventing the spread of the Coronavirus virus. Urban management and the physical part of the city are the key factors influencing the spread of epidemics, in cities. It seems that Canada had successful urban management against coronavirus.

Table 3. Prioritize selected cities against the spread of coronavirus

Rank	Category	City	Country	A	B	C
1	sustainable city	British Columbia-Vancouver	Canada	2.15	13.44	11.29
2	new town	Brasilia-Federal District	Brazil	1.29	2.19	0.89
3	sustainable city	Curitiba-State of Paraná	Brazil	1.55	1.73	0.18
4	sustainable city	Seattle-King County-Washington	USA	0.46	0.24	-0.23
5	high rate in spanish_flu	Pennsylvania	USA	5.04	3.87	-1.17
6	Health city	Tokyo	Japan	33.10	29.57	-3.53
7	new town	Abuja	Nigeria	5.17	1.59	-3.58
8	high rate in spanish_flu	zamora, Castile and León	Spain	9.81	0.37	-9.44
9	low rate in spanish_flu	New York	USA	23.19	2.51	-20.68

Ref: Authors analysis

Due to the fact that this study sought to investigate the effect of physical part of cities on coronavirus expansion, 9 cities mentioned in the previous table were examined and cities whose physical part (and not urban management) were effective in preventing or expanding coronavirus has been identified.

3. The Physic of the City against the Spread of Infectious Diseases

The physic of cities has been influenced by various factors such as urban theories, natural factors (such as infectious diseases, natural crises), government policies and plans, urban laws and regulations, citizens' actions, and the influence and activity of capitalists and those in power.

According to Paul Davidoff's theory of advocacy planning, one of the goals of urban planning is to protect the public interest and to support the weakest groups and groups who are unable to earn their rights in the urban space. In the field of equality in the use of opportunities and urban services, as well as equality in terms of the risk of coronavirus infection, the public interests and rights of the poor should be considered (Ejlali, 2011). Accordingly, an equal city in the face of the spread of epidemics, including Covid-19, is defined as follows:

"A city that provides its physical facilities to people in order to prevent them equally against the infectious diseases"

As it is clear from the definition provided, a city that is immune from the spread of infectious and contagious diseases is not intended (which, of course, is not realistic) but a city where the risk of infectious diseases is evenly distributed among all.

Urban affairs experts are responsible for the phenomena that affect the urban system and affect the public interests, and if the existing cities cannot adapt to the changes that have taken place, they should provide suggestions and solutions to update the situation of cities. Considering the theory of sustainable development, it can be stated that people, nature and the city must be in balance with each other.

Physical-environmental factors are among the items affecting the citizens present in urban spaces (Khakpour & et al, 2017:43); also, urban infectious diseases are among the natural mutations that affect the city's physical environment. City identity and nature forms the basis of the city's physic. The Covid-19 disease is one of the major pandemics of the last hundred years that has had numerous effects on human life. Due to the prevalence of this disease worldwide, the mission of the authors of this article is to provide practical solutions to achieve a peaceful urban life alongside this disease (Figure 2) (Nikjooy, Khakpour, Ghasemzade, Eghdam, 2021).

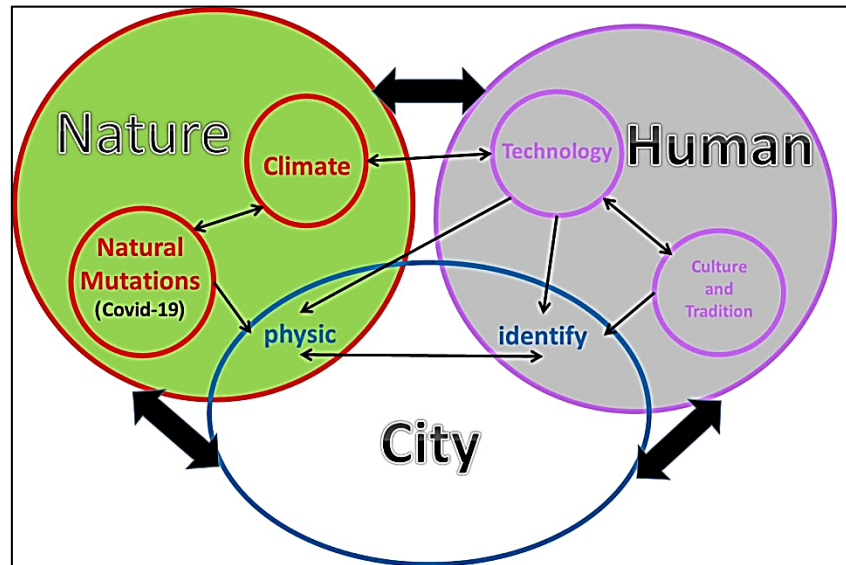


Figure 2. The cycle of nature, human and city

Source: (Nikjooy, Khakpour, Ghasemzade, Eghdam, 2021)

Urban development is defined as the process of quality of life improvement of all the citizens. To reach to this aim, it is required to consider and respect some principals, rules and norms (Khakpour& Asadi, 2016:1). It must be kept in mind that living conditions and needs and, consequently, human urban identity is changing. In fact, identity is a concept of stability that changes over time. For this reason, the solutions offered for urban life must also be flexible and changeable. According to the identified factors that are extracted from the theoretical and practical foundations of the subject and the issues raised, the principles of Equal city in against infectious diseases are presented as follows:

3.1 *Balanced Building Density*

In recent years, issue of building density has been one of the topics considered by urban planners and designers; what should the building density be in cities? From Frank Lloyd Wright's theory of the broadacre city - this emphasized low building density - to Le Corbusier's radiant city, theory of compact city and new urbanism that emphasized the dense urban fabric. In the meantime, which pattern of building density is less vulnerable to infectious diseases? According to the analysis, it has been found that high population density is directly related to the rate and speed of the spread of infectious diseases, including Covid-19 in the city. It is reasonably expected that areas with higher building densities will accommodate far more populations than areas with lower building densities. High and low building density each have advantages and disadvantages, we are looking for a proposal that has positive consequences for both building density situations and on the other hand, has the least negative consequences; a balanced building density.

3.2 *Observing the Minimum Ratio of Open Space to Urban Residential Space and Balanced Distribution of Open Space in the City*

Urban open space means all non-indoor spaces that can be used by the public in the city. These spaces include sidewalks, squares, pathway, passages, public gathering places in neighbourhood centres, and urban green spaces. Due to the high prevalence of infectious diseases in closed spaces, open spaces have become one of the most important and widely used spaces in the context of infectious disease crisis in the city. Therefore, more open spaces should be provided in cities than in the past. What is important in this is to determine a certain amount of urban open space in each city.

Considering the importance of urban open spaces in relation to infectious diseases and the need to observe a certain amount of urban open space in cities and distance between people, the following ratio is presented as a proposed criterion of the ratio of open spaces to residential space:

$$\frac{S_o}{S_h} = \frac{S_p}{P_h}$$

In this formula:

SO –Urban open space area

Sh – residential space in the city area

Sp – safe area for each person against infectious diseases

Ph – housing land use standard per capita

This formula, while simple, has high efficiency and due to the small number of variables in it, it has a high generalizability among cities around the world; especially in cities where we face a lack of data and statistics. In fact, this formula can be used in cities for which the housing standard per capita has been proposed.

Housing standard per capita is a criterion that in order to determine it in any geographical area, various and multidimensional factors (climatic, cultural, economic and social characteristics) have been considered according to the grounded conditions of that area and according to the use of this variable. In the proposed formula, it can be claimed that the conditions of each range are seen in this formula, and this is another case of the generalizability and high use of this formula. On the other hand, a safe area for each person is considered according to people's minimum confidence distance of each other. For example, for coronavirus, it has been suggested that people be at least two meters apart. Therefore, the safe area of each person will be a circle with a radius of one meter with the person in the center, which is approximately equal to 4 square meters ($s = \pi r^2$).

An example of the application of the formula is provided: The ratio of open space to residential space in one of the cities with a population of more than one million people in Iran and in terms of the prevalence of coronavirus is equal to 12.56%

Hypothesis:

- The housing land use standard per capita according to the criteria of the Supreme Council of Urban Planning and Architecture in Iran (Law on Definitions of Uses approved in 2010) for cities with more than one million people is a maximum of 25 square meters.
- It is recommended that people be at least 2 meters away from each other in relation to Covid-19. A safe area would equal 3.14 square meters.

Therefore, it can be stated that in cities with more than one million people in Iran and in the context of the outbreak of Coronavirus virus, the minimum ratio of open spaces to residential spaces should be equal to 12.56%. Accordingly, if the ratio of open space to residential in such cities is less than 12.56%, it is expected that the city will not well physical performance against the outbreak of Coronavirus virus.

3.3 Reducing of per Capita Office Land Use

Office land use is one of the population-absorbing uses, which we see the density and concentration of the population in these uses during the day. Office use can be divided into 3 categories with low, medium and high referrals in terms of the number of citizens and employees. We define the high referral as “the number of referrals per day is so high that in part or all hours of the day, the area of the office land use is not enough to maintain a distance of two meters between people.” Similarly, the medium referral is such that “the number of referrals and the number of employees of the office land use is such that the distance between people is about two meters.” In the low referral, distance between employees and customers, is more than 2 meters throughout the day.

In relation to office land use with high population density, it is proposed that offices with a high percentage of citizen visits be identified and, as far as possible, virtual services are presented to citizens. It is suggested that a list of services that can be provided virtually and services that require the presence of people be identified and as far as possible the departments and employees related to these two items be separated and employees related to services that can be provided virtually, provide these services remotely and from home.

It should be kept in mind that providing services in absentia requires conditions and prerequisites, such as strengthening the bandwidth of internet services networks and providing incentive offers to use internet services against face-to-face use.

3.4 Increasing Residential Use per Capita

Given the advances in telecommunications services and the expansion of smart and virtual cities, it seems that in the near future, part of the residential uses will need to create a space or room for work. On the other hand, due to the growing trend of infectious diseases in the last 50 years and the lack of remedial spaces in cities, the existence of space in a residential unit in order to isolate persons with infectious diseases is necessary. Accordingly, at least two new spaces in the residential unit will be needed, which should be considered in the rules and regulations of future plans. These spaces will inevitably be effective in increasing the residential use per capita.

3.5 Establish a Crisis Center with Isolated Conditions in Each Neighborhood

Due to the limited capacity of medical centers in cities in the face of infectious diseases that are not actually suitable for epidemics and global crises, it is necessary to anticipate crisis centers with isolated conditions as a new use in urban infrastructure. In non-crisis situations, such spaces can have uses compatible with a crisis center, but it should be kept in mind that the main use of these centers as crisis centers.

These centers are essential because they can provide immediate relief and first aid in the neighbourhood. On the other hand, these centers must be able to measure the amount of different viruses in persons. In fact, these centers can be named as passive bio-defense centers in urban neighbourhoods. In order to observe the flexibility of the proposals, it is necessary that the distance of these centers from each other and the population covered by each of these centers be considered in accordance with the rules and regulations of health organizations and taking into account the local conditions of each region.

3.6 Increasing per Capita Urban Equipment and Facilities

Urban equipment as service uses in the city can be divided into two types of hazardous and non-hazardous.

- Hazardous land use: There are cases that can be problematic for the surrounding area if they encounter problems, such as fire stations, gas pressure regulating stations. Hazardous land uses must be specified in a color different from the color of other urban land uses and equipment in the land use map. Such land uses should be distributed evenly throughout the city.
- Non-hazardous uses: There are non-hazardous urban equipment that are also attractive to the population, such as permanent exhibitions, fruit and vegetable markets, etc. In the meantime, special attention should be paid to fuel stations from the perspective that they are both part of hazardous uses and are among the centers of population attraction.

According to the proposal to establish crisis management centers in each neighbourhood, neighbourhood crisis management centers should be added to the definitions of land uses in the urban equipment sector, and while considering the increase in the required area for these centers in the city, the urban equipment per capita should be increased. For example, according to Iran's urban planning laws, for cities with more than one million people, the urban equipment land use per capita is between 0.5 and one square meter. The rate of increase per capita by considering the variables of the maximum number of clients at a time and the space required for each person, which is equal to a circular area with a radius of one meter, the number of urban equipment land uses required in the city, proposed. In terms of site selection, in general, urban facilities and equipment should be considered in places with low building density and population.

3.7 Balanced Distribution of Neighborhood Services

Due to the popularization of neighbourhood service centers, these centers should be evenly distributed in the neighbourhood and located within the urban green space. In fact, they must not be aligned and scattered.

Table 4. Neighborhood service distributed pattern positive and negative consequences analysis

Type of Service distribution	Positive consequences	Negative consequences
Focused and directional	+ Access to all services in one place	- Overcrowding in neighbourhood centers
	+ Determining the neighbourhood center	- High probability of creating traffic jams
	+ Possibility of higher social interactions	- In the event of a crisis in this model, the neighbourhood will face problems in terms of access to urban services
	+ Create a higher sense of belonging than the distributed service mode	- High probability of face-to-face contact and the spread of airborne diseases
	+ Possibility of strengthening spatial identity among people living in the neighbourhood	- Unfavorable access to urban services
Scattered and unbalanced	+ People are less likely to face and less likely to spread infectious diseases	- Need to create more than one type of service at the neighbourhood level to cover the neighbourhood
	+ Balanced distribution of traffic load in neighbourhood passages	- Probability of a low level of social interactions
	+ Less population density in neighbourhood service centers than in centralized and straightforward distribution	- Uncertainty of neighbourhood center

Ref: Researchers

Considering the positive and negative consequences of the two models (table 4), the model of balanced and scattered distribution of urban services in the neighbourhood is proposed. In this model, services are distributed in the neighbourhood in such a way that all residents have good access to services and also people are less likely to face each other. Also, urban service centers should be located within urban green spaces as much as possible.

3.8 Moving to Multi-Center Cities and Reducing Concentration in City Centers

In general, anything that reduces the concentration and density of the population in the urban environment is effective in combating epidemics. Therefore, in order to disperse the population in the city, it is suggested that urban centers be proportional to the urban population and be distributed evenly in the urban level so that there is at least one weekly service center in each urban area.

3.9 Using Multifunctional Urban Spaces

Due to the limitations of development and creation of all necessary spaces in times of crisis, it is recommended to use urban spaces for multiple purposes, which one of the areas is infectious diseases crisis management. Among the land uses that can be used multifunctional are educational use, higher education use, transportation and warehouse use (specifically, multi-story car parks that can be turned into health centers) and use of urban equipment (specifically, this refers to fire stations, which can be used for both firefighting and detoxification in areas with a high degree of virus spread). It is expected that the preconditions for the conversion of these uses will be provided in order to be able to exploit the use in times of crisis.

It is suggested to use multi-purpose spaces in urban development to be used in crisis situations to reduce the effects of the crisis. The following can be mentioned as samples of can be used as multifunctional spaces:

- Fire stations
- Schools
- Urban green spaces
- Unused office space (Due to the virtualization of office services, areas remain unused in office applications that can be used as relief and treatment centers and other functions considered in times of crisis.)

- Libraries

3.10 Increase Pedestrian Crossing Area

One of the main reasons for the spread of infectious diseases is the accumulation in public spaces and the close distance of people to each other in these spaces. To improve the situation, the area of the pedestrian crossing on the streets should be increased. Due to the need to observe a minimum distance of 2 meters of citizens in urban spaces, including urban sidewalks to prevent infectious diseases such as Covid-19, proposed 4 meters for minimum sidewalk width (Figure 3).

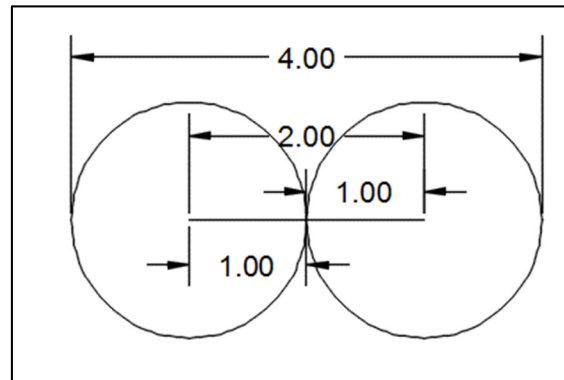


Figure 3. Minimum useful sidewalk width

Source: (Nikjooy, Khakpour, Ghasemzade, Eghdam, 2021)

3.11 Flexible Design of Road Network to Use in Crisis Situation

In some cases, an area or urban area is identified as a center for the spread of infectious diseases. If the system of the road network is such that it is possible to isolate and quarantine that urban area, it is possible to prevent the spread of the disease to other adjacent urban areas.

4. Conclusion

The city is a living and dynamic creature that is constantly evolving. Based on this, we certainly face different identities and cultures in the city. For example, culture and identity are not the same in the decades 1930 to 2020. Cities are constantly affected by different factors, but the impact of different parts of each city is different from these factors. For example, the effect that technological progress has on architecture and urban planning and the identity of the historical context of Bushehr (Note 2) is very different from the effect it has on the new fabric of this city. Thus, in relation to the influence of factors on the city, the identity of different parts of the city also changes in different ways; a change that makes more difference between parts of the city and is constantly repeated.

Public and governmental institutions and non-governmental organizations and citizens are forces influencing the urban environment. Each of these forces has specific mechanisms for influencing the urban environment. Government and public institutions use the tools of law and policy and NGOs and citizens according to their culture, traditions and customs influence the urban environment. Currently, we are encountering the existence of changing and fluid urban identities in cities. Accordingly, policies and laws related to the urban environment - which are actually used by citizens - should commensurate with the changes and fluidity of identity and have the necessary flexibility. In terms of content, the outputs of urban plans and programs can be made flexible by using flexible rules and regulations and by using flexible forms and procedurally, using the feedback phase in the urban planning and development process, flexible, lively and dynamic programs can be prepared for cities (Figure 4).

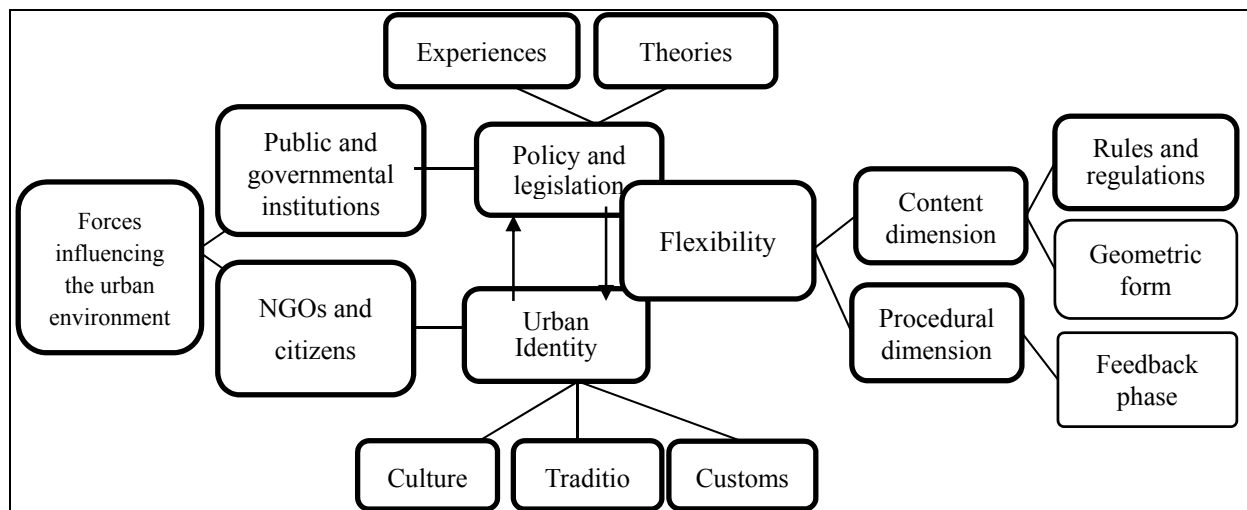


Figure 4. Urban environment influenced forces conceptual model

Source: (Nikjooy, Khakpour, Ghasemzade, Eghdam, 2021)

Accordingly, it should be noted that the proposed principles that have been submitted should be amended and updated over time. Due to the change and updating of culture, city officials and managers should always try to guide urban identity based on culture. Any of the principles of indigenous architecture and urban planning that can be adapted and updated with the culture of the day, can remain and help guide the path of identity change. Therefore, what is important in the design and planning of new cities and new urban developments, and has been neglected in recent years, is to consider the concept of urban identity and its flexibility, and along with these changes, architectural and urban planning systems need to be updated to balance the existing urban system.

References

- Ahmadi, H. (1999). The roots of arising Healthy city idea. *International Journal of Sakhte-Shahr*, (6&7), 1-9.
- Azad (Armaki), G., & Abdolreza, R. E. (2010). *The economics of sustainable development*, Commercial Print and Publications Company, Tehran.
- Bahrainy, H. (1999). *Modernism, postmodernism, and after in urban design and planning*. University of Tehran Press.
- Ejlali, P. (2011). Advocacy Planning Theory: Revised. *Social Development and Welfare Planning*, 2(5), 1-14. Retrieved from <https://www.sid.ir/en/journal/ViewPaper.aspx?id=208468>
- <https://news.google.com/covid19/map?hl=en-US&mid=%2Fm%2F059rby&gl=US&ceid=US%3Aen>. Date retrieved: Wednesday, July 15, 2020.
- <https://worldpopulationreview.com/world-cities>. Date retrieved: Wednesday, July 15, 2020.
- <https://www.livescience.com/worst-epidemics-and-pandemics-in-history.html>. Date retrieved: Wednesday, July 15, 2020.
- <https://www.worldometers.info/world-population/population-by-country/>. Date retrieved: Wednesday, July 15, 2020.
- Johnson, N. P., & Mueller, J. (2002). Updating the accounts: Global mortality of the 1918–1920 “Spanish” influenza pandemic. *Bull Hist Med.*, 76, 105–115. <https://doi.org/10.1353/bhm.2002.0022>
- Jordi, H.-R., Isabelle, A., Josep, B., Vincent, C., Carolyn, D., Cecil, K., ... Mark, N. (2020, April 21). *The Impact of COVID-19 on Public Space: A Review of the Emerging Questions*. <https://doi.org/10.31219/osf.io/rf7xa>
- Khakpour, A., & Asadi, R. (2016). Analyzing Associations between the Price of Urban Properties and Population Size with City Development Index in a Selected Cities of Iran (Esfahan, Tabriz, Qazvin, Zanjan and Ilam). *Indian Journal of Science and Technology*, 9(20). <https://doi.org/10.17485/ijst/2016/v9i20/84697>
- Khakpour, A., Sabouri, S., & Harirehian, M. (2017). Analysis of Effective Factors on Presence of Citizens in Urban Spaces, Case Study: Towhid Square in Tehran. *Journal of Sustainable Development*, 10(3).

<https://doi.org/10.5539/jsd.v10n3p35>

- Lai, Y., Yeun, W., & Celi, L. A. (2020). Urban Intelligence for Pandemic Response: Viewpoint. *JMIR Public Health Surveill*, 6(2), e18873. <https://doi.org/10.2196/18873>
- Liu, L. (2020). Emerging study on the transmission of the Novel Coronavirus (COVID-19) from urban perspective: Evidence from China. *Cities*, 103. <https://doi.org/10.1016/j.cities.2020.102759>
- Spreeuwenberg, P., Kroneman, M., & Paget, J. (2018). Reassessing the Global Mortality Burden of the 1918 Influenza Pandemic. *American Journal of Epidemiology*, 187(12), 2561–2567. <https://doi.org/10.1093/aje/kwy191>
- Turner, T. (2007). Translated by Farshad Nourian, *City as landscape: a post - post modern view of design and planning*. Tehran: Urban Planning and Processing Company.
- Whittingham, N. (2013). Towards the healthy city: An urban planner's reflection on health, and wellbeing. *Global Built Environment Review*, 8(2), 61-87.
- Zaheer, A., & David, S. J. (2020). Pandemic stricken cities on lockdown. Where are our planning and design professionals [now, then and into the future]?. *Land Use Policy*, 97, 104805. <https://doi.org/10.1016/j.landusepol.2020.104805>

Notes

Note 1. Habitat II, the Second United Nations Conference on Human Settlements was held in Istanbul, Turkey from June 3–14, 1996, twenty years after Habitat I held in Vancouver in 1976. See this site for more information: <https://www.un.org/en/development/devagenda/habitat.shtml>

Note 2. A city in Iran.

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).