



Impact Of COVID-19 On The Public Urban Spaces: Rethinking In Designing An Urban Space In Pandemics Era

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ABSTRACT

The paper explores the re-thinking of designing public spaces in a pandemic era. One-half of the world's population has been asked to stay at home and avoid public places as at that time. What effect will the COVID-19 pandemic have on public space in the long run once the restrictions are lifted? From this point of view this research investigates the main aspects forming the future design of public spaces, especially in pandemic era to improve the quality of life of these spaces and their users can use them safe. It focuses on the main aspects that form public space designs, through literature review (Mathew Carmona's book "Public Places-Urban Spaces, The Dimensions of Urban Design" (2003) and Jan Gehl' book "How to Study Public Life"). Several questionnaires are distributed to assess these different aspects and their dimensions and indicators to suggest a model for investigating and quantifying assessment of the main aspects of future public space designs in pandemic disease time and the effect of COVID-19 on public spaces.

KEYWORDS: Quality of Public Spaces, COVID-19, Livability.

تأثير كوفيد-19 على الفراغات العمرانية العامة: إعادة التفكير في تصميم الفراغات العامة في عصر الأوبئة

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الملخص

تستكشف الورقة إعادة التفكير في تصميم الفراغات العامة في عصر الأوبئة. لقد طلب من نصف سكان العالم البقاء في منازلهم وتجنب الأماكن العامة في ذلك الوقت. فما هو تأثير جائحة كوفيد-19 على الأماكن العامة على المدى الطويل بمجرد رفع القيود؟ ومن هذا المنطلق يبحث هذا البحث في الجوانب الرئيسية التي تشكل التصميم المستقبلي للأماكن العامة، خاصة في عصر الأوبئة لتحسين نوعية الحياة في هذه الأماكن ويمكن لمستخدميها استخدامها بشكل آمن. ويركز على الجوانب الرئيسية التي تشكل تصميم الفراغات العامة، من خلال مراجعة الأدبيات (كتاب ماثيو كارمونا "الأماكن العامة - الفضاءات الحضرية، أبعاد التصميم الحضري" (2003) وكتاب جان جيل "كيفية دراسة الحياة العامة"). وقد تم توزيع عدة استبيانات لتقييم هذه الجوانب المختلفة وأبعادها ومؤشراتها لاقتراح نموذج للتحقيق والقياس الكمي للجوانب الرئيسية لتصميمات الأماكن العامة المستقبلية في وقت المرض الوبائي وتأثير كوفيد-19 على الأماكن العامة.
الكلمات المفتاحية: جودة الفراغات العامة، كوفيد-19، الحيوية.

1. INTRODUCTION

The entire world has been overwhelmed by a sense of immobility during the past few months, rushing to stop the spread of COVID-19. Public spaces are places where virus transmission is very easy, therefore, the efforts of governments worldwide to stop the spread have been very strict, ranging from closure of public spaces to complete lockdown, which led to the transformation of public spaces into ghost areas [1]. The current pandemic has presented an opportunity to re-think how cities (especially public spaces) are designed and improve their design to prevent the spread of the disease by approaching a specific model for interpreting and implementing healthy, safe, livable, and functional environment [2]. Thus, achieving healthy livable public spaces has become an important topic and is no more a choice but it is a must because of the spread of pandemics - especially COVID-19 time-which affect some aspects of life, socially, economically, safety, healthy and affect the beauty and aesthetics of urban fabrics [3].

The objective of this study is to offer a paradigm for analyzing and quantifying evaluation of the key elements of future public space designs during pandemic disease times “safety, functionality, public health and liveability” and the effect of COVID-19 on public spaces. The complexity and variety of qualities that can serve as a set of dimensions and indicators that are related to most of these aspects are what makes this discourse problematic. Another significant concern is the idea of measurements and how to fit them observationally with public space future plans. This objective is achieved by discussing the twelve-urban quality by Jan Gehl and the principles of new urbanism by Carmona. This led to the description of a set of dimensions and indicators of public space designs and the relation between them to accomplish an approach for adjusting and consolidating measurements for these aspects, dimensions, and indicators as a model for successful public spaces design specially in pandemic disease time.

The paper is coordinated in two sections:

After review of literature, the proposed aspects and indicators are enlisted, followed by the opinions of relevant specialists (architects, physicians and architectural design specialists and the public) regarding the dimensions and indicators proposed to achieve the 4 aspects: safety, functionality, public health, and livability which are crucial for the design of safer spaces in the COVID era. A questionnaire in google form was distributed among urban design specialists. Next, the results were extracted and analyzed using PYTHON software, followed by the analysis of the strength of the correlation between the specialist’s opinions using PYTHON software and reporting the results in the form of tables and the use of scheme ball to demonstrate correlations in the form of graphs showing the relation between dimensions and relation between indicators.

After the theoretical review of the literature, the research presents the aspects, dimensions, and indicators suggested by the research, followed by taking the opinions of specialists / related to the topic of the research from (architects, citizens, doctors, and urban design specialists), about the proposed dimensions and indicators in achieving the four aspects (safety, functionality, public). Health and livability), which are important in designing safer spaces and reduce the spread of the Corona epidemic.

The following is an analysis of the strength of the relationship between the opinions of specialists through the PEASON program. Displaying his results in the form of tables and also using SCHEME BALL to display relationships in the form of a graph showing the relationships between the dimensions and some of them, as well as indicators and some of them.

2. Understanding the quality of public spaces from safe, health, function, and social perspective

Public spaces are an area of the physical world with different events aimed at making social life enjoyable to everyone [4]. All parts of the urban fabric, which are functionally and visually accessible to all, are called public spaces. They are the most important areas of cities and towns in which there is the greatest amount of communication and interaction between individuals. In addition, open spaces give our cities great advantages by providing people with many opportunities to come together and engage within the community and creating a social space for everyone in the society to participate in [5]. Consequently, the design of public spaces ought to be perceived as a multidimensional and a foundation for sustainable living communities. The formation of quality spaces, urban trends and the promotion of a healthy and social atmosphere are thus affected [6]. In order to understand the quality of open spaces from this perspective, the paper will review the principles and qualities of two theorists: Mathew Carmona's book "Public Places-Urban Spaces, The Dimensions of Urban Design" (2003) and Jan Gehl's book "How to Study Public Life"(2013), as these authors explained the relation between open spaces and the social behavior of the users in such healthy areas, and discussed the importance of understanding and considering the health and social dimensions and indicators of the users in these areas when designing open spaces with specific safe, functional, healthy and social patterns. The public space design will make them more conducive to all sorts of social experiences, from large-scale gatherings and parties to low-key humble encounters and everything in between. [7] Space and society are directly related: without social substance, it is difficult to conceive of 'space' and equally difficult to conceive of society without a spatial part [8, 9]. Established a quality criterion from this point of view that represents the social, economic and environmental characteristics of public spaces, such as cleanliness, accessibility, attractiveness, comfort, inclusiveness, vitality, viability, work, distinction, safety, protection, robustness, greenness, doubtlessness and capacity to fulfil. Based on basic knowledge of human senses and needs and what makes people feel relaxed and remain in public space, Jan Gehl created a checklist of quality criteria [10, 11]. These features have been classified by Gehl according to three key themes: security, comfort and enjoyment [12]. The first part deals with the basic defense against traffic, noise, rain, and wind, which usually prevents people from spending time in space. Second, a place usually won't allow someone to spend time there without elements that make walking, standing, sitting, hearing, and conversing relaxed. Play and workout opportunities can also make the space more inviting to individuals of all ages. Finally, public spaces aim to offer meaningful visual and sensory experiences, take advantage of local climatic conditions, and provide elements of human scale so that tourists do not feel lost in their environment [13, 14].

3. Creating public spaces in pandemic disease time: aspects, dimensions and indicators

In the case of a pandemic, the importance of maintaining public health must be stressed upon when planning public spaces, as well as psychological and social needs that have a direct effect on the space's livability. The high level of self-sufficiency represents a well-designed public space [15]. Public space designs should emphasize critical aspects such as:

Safety: It is of profound importance not to underestimate the value of instilling a sense of security among people in public spaces. Failure to have a sense of safety, particularly in public

spaces, can have negative effects such as feelings of fear and fairness, which can contribute to anti-social actions and attitudes to ensure the following aspects of protection in public spaces: Transportation, protection, well lighting system, buffer zone and sense of enclosure [16].

Functionality: The multi-functionality of public spaces creates an atmosphere for all users of the space by attracting people with a range of plans and activities. Functionality dimensions include the following: Size, flexibility, security, sustainability, accessibility, smart open spaces, adaptability, localization, biophilic design and transparency [17].

Public Health: The value of position in one's health cannot be overstated. The built environment has a huge effect on how safe individuals and societies are. Public spaces play an important role in deciding whether some people are better than others, as well as why some people are not as safe as they should be. Essential public spaces are still planned and built without considering all users or a full spectrum of well-being [18]. From this perspective, public space design has an enormous effect on encouraging physical activity and improving social, mental, and physical health. Urban designers, who previously believed that public space design and various aspects of health, such as emissions, emerging needs, content, social distance, green spaces, digital systems, and periodic maintenance to achieve safe public space, particularly during pandemic disease times, are related, are now aware of this connection [19].

Livability: A livable city has public spaces that are clean, inviting, and visually appealing. Many different people use such spaces for fun, to meet friends, or simply to sit. A well-used public space can promote a sense of belonging, identification, and culture [20]. This can happen purely due to the location or natural beauty of a location. In urban or built-up areas, well-designed public space may make people feel like they belong to a group and increase social connections between people. Thus, building public spaces by and for people is the basis for creating livable public spaces. The value of the core dimensions of good livable public spaces in fostering a livable environment for all users has been illustrated in numerous books and studies. Human size, personal space, sense of place, human needs, cultural element, activities, comfort, walkability, and sociability are the dimensions [16]

4. Creating public spaces in pandemic disease time: aspects, dimensions and indicators

Pandemics have been a tragic tragedy in cities for a long time, so this research will concentrate on the most recent pandemic that is currently sweeping the globe, the COVID-19, and how this pandemic will change our relationship with public spaces, as well as what the world might look like after this crisis is over. It is undeniable that coping with pandemics that spread quickly presents a serious challenge for cities. The issue stems primarily from societies' dependency on mass transit, consumption, sports, and luxury in public spaces. Cities are shaped by illness, but they also play a vital role in planning for, preventing, and responding to pandemics [21]. Cities' preparedness varies across the world today, depending on their level of growth and the social determinants of their populations [22].

5. Public space formation as a merger of various qualities

Understanding the quality of public spaces design in times of pandemic disease as a system of different qualities is crucial for defining the relationships between aspects that make up these

spaces, and thus deducing dimensions and metrics for evaluating it. Assessing the main four aspects (public health, functionality, safety, and livability) and their dimensions and indicators become more important when offered to enhance the urban environment [10]. One way of assessing and evaluating the quality of public spaces is identifying dimensions and indicators of the main aspects. The ability to simplify and condense the complexities of a livable environment into a concise amount of useful information is one of their main features [23]. An indicator is something that informs the reader about a main function. [24, 25]. To better inform the public, officials, scientists, and other decision-makers about various aspects of the quality of open spaces, most indicators of that quality take the form of quantitative measurements of critical human characteristics that relate to the long-term viability of human communities. However, indicators are hybrids that combine technical considerations with human values; they are not only technical measurements [25]. Making use of quality of open space indicators requires investing those indicators with meaning to the people who will have to use them, and that means adopting a different approach to creating them in the first place. Seeking indicators quality of open spaces is a complex issue and it falls into the responsibility of several parties. The interest of each category affects the set of indicators represented by them and this may have negative impact upon the holistic concept of the future of open space designs in pandemic disease times. By reviewing literature of designing successful open spaces especially in pandemic disease time, various qualities, and aspects of quality of open spaces are suggested by urban theorists and planners like Jan Gehl and Matthew Carmona that should be taken into consideration when designing open spaces. From this point of view the research will subdivide these aspects into several dimensions, and each dimension has a set of indicators, as shown in table (I), to find the relation between the main aspects like “safety, functionality, public health and liveability” and their dimensions and indicators and the effect of COVID-19 on public space future designs. Based on these aspects, the questionnaire is produced. The conceptual framework of this study is shown in the **Table (1)**.

Table 1. Aspects, dimensions and indicators effecting quality of open spaces in pandemic disease time

Aspect	Dimensions	Indicators
Safety	Trans portat ion	- Providing safe walkways and bicycle lanes, Providing convenient and hygiene transportation - Multiple transportation options, Adequate parking spaces - Reject public transportation in favor of private motor vehicles.
	Protection	- Protection against traffic, Protection against crime and violence (feeling secure) - Protecting the space from weather conditions
	Well Lighting System	- Provide plenty of suitable light sources, Protect the space against crime and violence - Distributing the light sources on fixed suitable intervals
	Buffer Zone	- Create a landscaped area between the different activities - Create a landscaped area between users and vehicles movements
	Sense of Enclosure	- The degree to which the urban space is visually surrounded by buildings or landscape elements
	security	- Presence of design features for safety & security - Lighting system, especially at night
Functionality	Size	- Widen sidewalks - Demand for curb space (free space for pedestrians)
	Flexibility	- Ability to be transformed for emergency health purposes - Enhancing mobility - Transform streets into open air restaurants
	Sustainability	- Sustainable infrastructure - Car-free zones to support a low-carbon and sustainable recovery - Self-sufficient
	Accessibility	- Bicycle and pedestrian paths
Functionality	Accessibility	- Connectivity - Connected system of open spaces
	Smart Open Spaces	- Digital technology and innovation to help to maintain social distance - Adoption of automatic doors.
	Adaptability	- Adaptive reuse to create emergency facilities - Adaptability is an essential capacity of both physical public spaces and of communities.
	Localization	- Less use of mass public transport - In access to day-to-day amenities
	Biophilic Design	- The incorporation of nature into the built environment - Design with natural features
	Transparency	- Ground-floor facades are an attractive place for urban users - Good view of the space - Provide psychological and practical physical support - Link the functions inside the building with open space life
Public Health	Pollution	- Reducing environmental pollution - Road closure
	Emerging needs	- Standalone care units - Creating a huge demand for drop off and delivery space. - Providing hand washing facilities
	Material	- Type of the used materials
	Social (Safe) Distance	- Adding more space to accommodate for new queuing norms at the entrances of shops, services and public facilities, A series of painted social distancing circles - Redesign pedestrian crossings in order to meet social distancing recommendations
	Green Spaces	- Provide more spaces for pedestrians and cyclists, Provisions for cycling - Continuous networks of green spaces will be more valuable than isolated patches, Visual access to nature - Therapeutic gardens to boost the mental and emotional well-being of citizens
	Digital Systems	- Used to track and contain the virus - Monitor health status to solve community health problems
Public Health	Periodic Maintenance	- Lack of periodic maintenance leads to increasing the rate of damaging and distortions - Creating partnerships with organizations or volunteers' people to sponsor and maintain urban spaces is a good idea to keep the space clean. - Presence of funding channels for public space maintenance
	Weather Comfort	- Opportunities to enjoy the positive aspects of climate
Public Health	community health context	- Environmental conditional related to physical space
	Inform, educate, empower	- Inform, Educate, and Empower covers the development and dissemination of information that educates and promotes, Activities to reduce health risks associated with vector-borne diseases.
Livability	Human Scale	- Buildings and spaces designed to human scale. - Sense of enclosure with their buildings
	Personal Space	- Sense of their locations without feeling lost
	Sense of Place	- Lively Public Realm - Place identity - Provide high Image-ability
	Human needs	- Ability to meet the social demands. - Opportunity to hear, vision and talking. - Good design to meet the psychological needs
	Cultural Factor	- Reflect the community identity
	Activities	- Opportunity for play and exercise - Invitations for physical activities - Street furniture provides talk spaces - Ability of the space to accommodate diverse activities
	Comfort	- Opportunity to sit (good places to sit), Low noise levels, Opportunity to enjoy the positive aspects of climate (sun/shade)
	Walkability	- No obstacles, Good surface, Safe distance, Providing attractive, comfortable and safe walkways
Social Interaction		- Provide physical space. - Ability to attract people to come to the space. - Provide a degree of comfort. - Image of the open space
		- Good access, connect and linkage of the open space.

6. Methods

The research methodology is divided into two main stages as follows:

Stage (1):

- Identify the main aspects that form public space design through literature review [27].
- By distributing several questionnaires to citizen, urban designers and human doctors, the following is determined:
 - a. Accessing the most important aspects of designing future open spaces, especially in COVID-19 era.
 - b. The relative importance of each aspect (safety, functionality, public health, and livability).
 - c. Compare between choices of citizen, urban designers, and physicians to identify the difference and agreement between them.

Through the outputs of the first stage the paper will answer the research question: “How to makes public spaces a healthy environment safe from the pandemic and improve the quality of life for its users?”

Stage (2):

- By distributing several questionnaires to citizen, urban designers and physicians, the following is determined:
 - a. The different dimensions and indicators of the main aspects that form the future urban space designs.
 - b. Accessing the relative importance of the relationships between the dimensions, as well as the indicators.

Through the outputs of the second stage, the paper will access a form of an index for successful open spaces design especially in pandemic disease time.

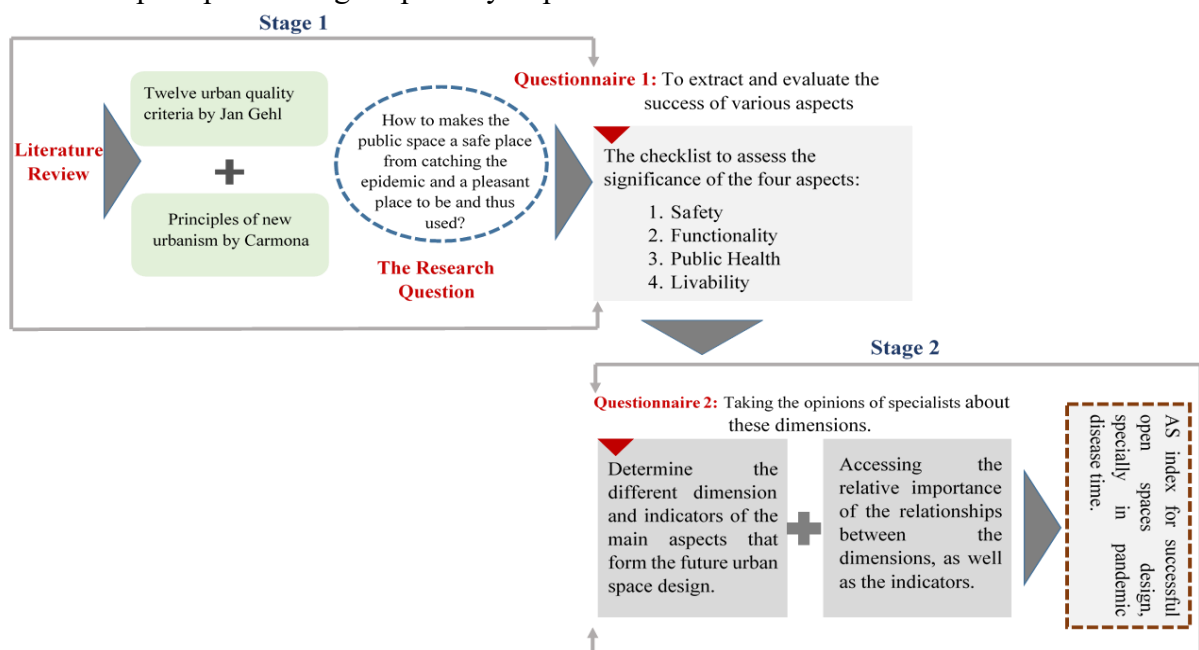


Fig. 1. Formation of the research methodology.

6.1 Participants

To maintain the representativeness of the research sample, the population sample under study should be selected to infer statistically valid generalizations about a particular characteristic of this population. The sample was oriented to target population of 25 participants in each study subgroup according to the job title “Physician, urban design specialist, architect and citizen “. The final sample consisted of 100 participants, as shown in table (II), of which 43 were males and 57 were females. Some of sample participants have architecture and urban design background, "n=25". The sample represented 5 age groups: from 20 -35 years “n= 42”, from 36-45 years “n= 37”, from 46-55 years “n= 11”, from 55-65 years “n= 4”, and more than 65 years “n= 6”. The sample fulfilled several criteria including fitting in range of age groups with different marital status, working conditions and educational backgrounds and understanding of the urban valuable physical and non-physical qualities.

Table 2. Descriptive background parameters of the questionnaire.

Position Title		Architect	Citizen	Physician	urban designer	Total
Gender	Male	9	14	10	12	43
	Female	16	13	15	13	57
Age group	20 – 35 years	17	14	5	10	42
	36 – 45 years	4	7	15	10	37
	46 – 55 years	2	0	4	4	11
	55 – 65 years	2	1	1	0	4
	More than 65 years	0	4	0	2	6

6.2 Stimuli

In light of the information gathered during the theoretical stage, the initial opinion poll form was drafted, and it was first tested on a limited sample that included 10 cases of specialists to initially take an opinion on the content of the questionnaire, then it was modified accordingly and formulated into its final form, then it was distributed randomly, through correspondence through social information networks (Social Media) with some researchers and specialists inside and outside Egypt, as well as distributing it to some citizens of different age groups. The data collection form was designed based on the logical sequence of questions. As for the general content of the form, it was divided into 3 sections. Sequentially, it covered the following aspects:

Section One: General Data: includes the main features / background of the questionnaire sample (gender, age, profession / field of work).

Section Two: This section has been divided into two successive parts.

The first part: the analysis and evaluation of specialists of the main aspects, which were identified through the literature review mentioned in the theoretical part (Section 3), as we mentioned earlier, it is divided into 4 aspects, which are respectively (safety, functionality, public health, coexistence), as they are considered needs The basic material and moral of the human being, taking the extent of satisfaction of the questionnaire sample on the aspects from the point of view of each participant, a matrix table was used to determine the impact and importance of the proposed aspects, and each participant should determine the range of importance from 1: 5, where 1 is the least important and 5 is the most important - importance It expresses the extent to which these aspects have been achieved in making public spaces safer, healthier, functional and livable.

The second part: Determine the dimensions for each of the four main aspects (see Table 1), which express and clarify each aspect, and their number is 34 after a section into (6 dimensions of safety, 9 dimensions of functionality, 10 dimensions of public health, 9 dimensions of livability). These dimensions were evaluated by the criteria in the first part, by taking the opinions of the questionnaire sample on the sub-dimensions of these aspects by specifying a range of importance from 1: 5, where 1 is the least important and 5 is the most important.

The third part: Researchers have identified several indicators that achieve each of the proposed dimensions. They are considered indicators that clarify and achieve the main aspects desired to be achieved in the design of the public space. Each of the specialists in the questionnaire sample must prioritize the importance of each indicator separately by placing a degree of importance from 1: 5.

6. 3 Procedures

A structured interview method was applied to collect reference data. All participants were individually interviewed by research. The data collection sheet consisted of a table - questionnaire. The questionnaire assured the respondents of confidentiality. In the first page, participants were requested to specify their background, age, gender, positions, and the frequency of visiting public spaces in his / her neighborhood. The respondents were asked to answer several of questions about each aspect which divided into dimensions. A full list of questions is shown in Table II. 5 points rating scale was used to answer each of the questions. The rating scale ranged from 1 "not at all" to 5 "very much". This rating scale was used in several preference studies. Next the respondents were asked to determine the importance of different indicators to each dimension to achieve a model for successful open spaces design especially in pandemic disease time. A full list of questions is shown in **Table (1)**. 5 points rating scale was used to answer each of the questions. The rating scale ranged from 1 "not at all" to 5 "very much". This rating scale was used in several preference studies.

7. Results and discussion

7.1 Data Handling and Processing

This part is divided into two phases: the first phase of sorting the questionnaire results, each specialty separately, and the second phase to verify the choices of specialists by comparing the choices of specialists with each other.

The first phase: sort the survey results

Raw data obtained from the questionnaire were entered into an excel file. The data included opinions taken from Architects, Citizens, physicians, and specialized urban designers. A total of 100 samples were taken, divided equally between each specialization: 25 for Architects, 25 for Citizens, 25 for physicians, and 25 for specialized Urban Designers. Descriptive background parameters in this questionnaire are shown in the following table (2). It is expected that opinions captured from each category of people will differ according to their specializations. To rearrange the obtained data in a form that could be easily analyzed, a simple computer program was written by Python 3 programming language. The computer program read the raw data from the excel file, read data was rearranged and processed, then was written in another excel file in a completely reorganized manner. The processed data was written in an-easy to analyze form. Data was arranged according to the dimension, aspect, number of votes for every item. Data was also captured for each specialization to achieve a main idea about the importance of every dimension based on the specialization. An average value of votes for each dimension and for each specialization was also obtained, as shown in Figure 3.

The reason of using python language in data rearrangement is that it was a simple and powerful language in data treatment, it was in a general-purpose language and contained a collection of libraries that can easily deal with excel files.

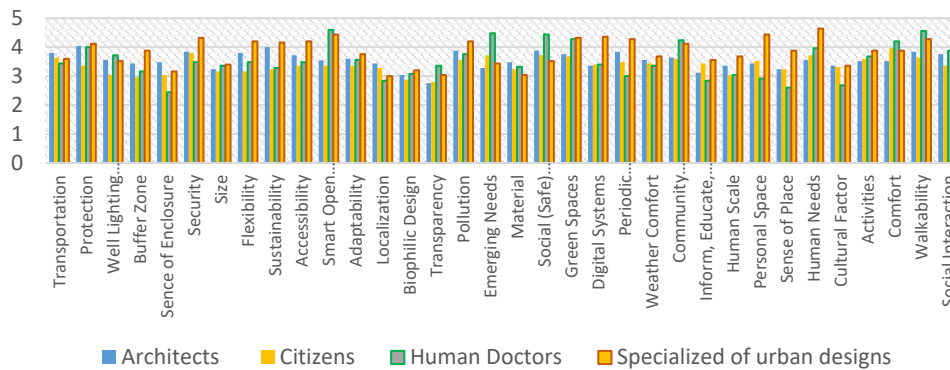


Fig. 2. Details the results of the questionnaire to evaluate the proposed dimensions by Python 3.

It is clear from the chart above that after classifying the dimensions according to predetermined criteria; they found that some of the 25 dimensions after scored 75% or more of a total of 34 dimensions. Note that the doctors' expert choices of the proposed dimensions are consistent with the choices of the rest of the experts (architect, citizens, specialists in urban design), which means the success of the proposed dimensions and their importance in improving the quality of public spaces and rehabilitating them in line with the circumstances of the Covid 19 epidemic.

Table 3. The dimensions, which got on average vote of 75% or more (3.75 out of 5 or more). dimensions, which got on average vote of 75% or more (3.75 out of 5 or more).

Aspect	Dimension		Job title			
			Architects	Citizens	Human Doctors	specialized of urban design
Safety	D1	Transportation	3.8	3.64	3.44	3.60
	D2	Protection	4.04	3.36	4	4.12
	D3	Well Lighting System	3.56	3.04	3.75	3.52
	D4	Buffer Zone	3.44	2.96	3.16	3.88
	D5	Sense of Enclosure	3.75	3.04	2.44	3.16
	D6	Security	3.84	3.80	3.48	4.32
Functionality	D7	Size	3.24	3.16	3.87	3.42
	D8	Flexibility	3.8	3.16	3.48	4.2
	D9	Sustainability	4	3.24	3.28	4.16
	D10	Accessibility	3.75	3.36	3.48	4.2
	D11	Smart Open Spaces	3.54	3.36	4.60	4.44
	D12	Adaptability	3.60	3.36	3.56	3.76
	D13	Localization	3.44	3.28	2.84	3
	D14	Biophilic Design	3.04	2.88	3.08	3.20
	D15	Transparency	2.76	2.80	3.36	3.04
Public Health	D16	Pollution	3.88	3.56	3.76	4.2
	D17	Emerging needs	3.28	3.75	4.48	3.44
	D18	Material	3.48	3.24	3.32	3.04
	D19	Social (Safe) Distance	3.88	3.76	4.44	3.52
	D20	Green Spaces	3.76	3.68	4.28	4.32
	D21	Digital Systems	3.36	3.4	3.40	4.36
	D22	Periodic Maintenance	3.84	3.48	3	4.28
	D23	Weather Comfort	3.56	3.44	3.36	3.68
	D24	Community Health Context	3.64	3.6	4.24	4.12
	D25	Inform, Educate, and Empower	3.12	3.44	2.84	3.56
Liveability	D26	Human Scale	3.36	3.04	3.04	3.68
	D27	Personal Space	3.44	3.52	2.92	4.44
	D28	Sense of Place	3.24	3.24	2.60	3.88
	D29	Human Needs	3.56	3.75	3.96	4.64
	D30	Cultural Factor	3.36	3.32	2.68	3.36
	D31	Activities	3.52	3.6	3.68	3.88
	D32	Comfort	3.52	3.96	4.21	3.88
	D33	Walkability	3.84	3.64	4.56	4.28
	D34	Social Interaction	3.76	3.36	3.88	3.16

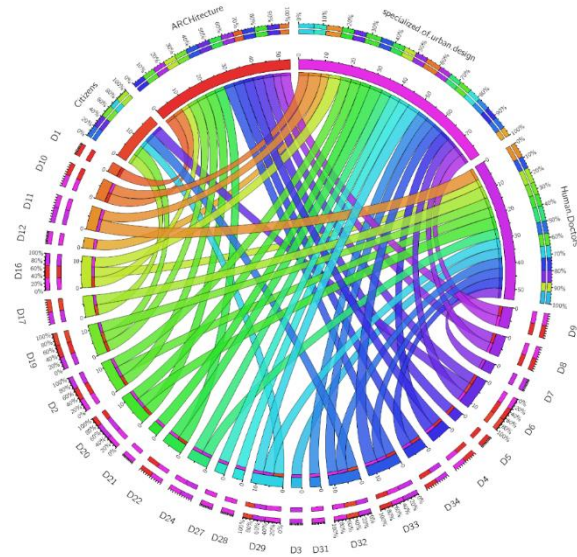


Fig. 3. Graphic representation for the dimensions, which got on average vote of 75% or more (3.75 out of 5 or more) schema-ball.

To gain a deeper insight into the perspectives of specialists in highly weighted dimensions and the degree of convergence of the opinions of specialists whether the different dimension options are related to each other or not, the focus on all dimensions achieved will be an average vote of 75% or more (3.75 out of 5 or more), which were filtered and defined by the Python 3 programming language (Table 2). The obtained number of close to one which indicated a strong relation between Architects and physicians in their opinions and points of view at different levels of voting for the dimension of “Green Spaces” in the aspect of “Public Health”

Table 4. Outputs verify the strength of the relationship between the remaining dimensions by the Pearson program.

Aspects	Dimension		Architect & Citizen	Architect & Human Doctor	Architect & Urban Designer	Citizen & Human Doctor	Citizen & Urban Designer	Human Doctor & Urban Designer
	Safety	D2	Protection		0.991	0.957		
D6		Security	0.873		0.973		0.956	
Functionality	D8	Flexibility			0.642			
	D9	Sustainability			0.996			
	D11	Smart Open Spaces						0.943
Public Health	D16	Pollution	0.553	0.943	0.881	0.722	0.568	0.752
	D19	Social (Safe) Distance		0.752				
	D20	Green Spaces		0.977	0.679			0.791
	D22	Periodic Maintenance			0.882			
	D24	Community Health Context						0.760
Livability	D29	Human Needs						0.423
	D32	Comfort				0.929	0.821	0.925
	D33	Walkability		0.986	0.895			0.941
	D34	Social Interaction		0.899				

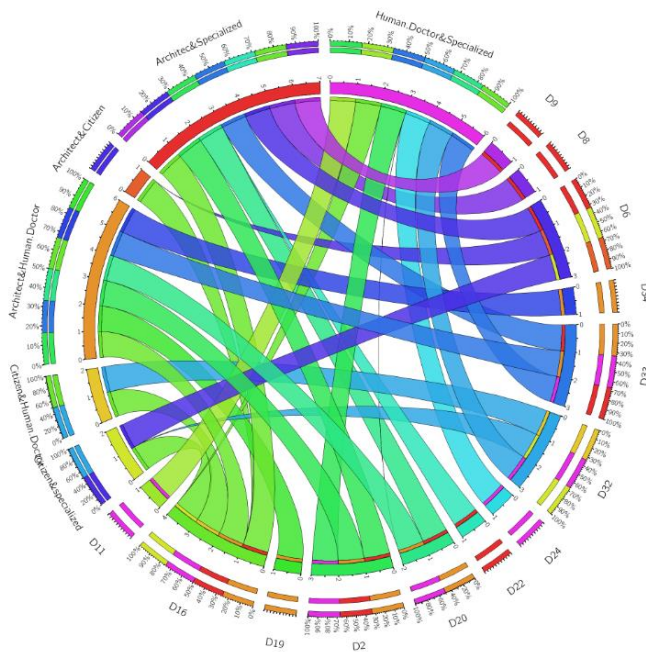


Fig. 4. Achieving the outputs from the strength of the relationship between the opinions of specialists and the questionnaire sample in the remaining dimensions in the outputs of Table 3.

As mentioned previously, the value obtained for r determined how two different dimensions are related to each other, that is, to what extent the two specified dimensions are similar in importance. A value of one implies an ideal or ideal relationship between the two dimensions. The value minus one (-1) means a perfect inverse correlation. A value of zero indicates that the two dimensions are incoherent and completely independent. Getting a value between 0.5 and 1 means that the two dimensions are correlated, change with each other, are closely related and have approximately the same importance or weight. It is clear from the outputs of the Pearson program that all dimensions achieved values ranging from zero to approximately one, as shown in a Table 4, which indicates the convergence of views of specialists about options for the proposed dimensions that help to make the public spaces viable during crises and epidemics. Like what was done in the analysis of the survey results for the proposed dimensions, the results of the specialists' choices of the proposed indicators were extracted in the same way using the Pythum program, and the indicators that were not selected were deleted and results were extracted as shown in Table 5, after which the results of each specialist were compared to each other using the suggested rate. After deleting the indicators that were not selected to prove the convergence of views of the accuracy and success of their selection.

Table 4. The indicators, which got on average vote of 75% or more (3.75 out of 5 or more).

Dimensions	Indicators		Job title			
			Architects	Citizens	Human Doctors	specialized of urban design
Transportation	I1	Providing safe walkways and bicycle lanes	3.96	3.4	4.36	4.76
	I2	Providing convenient and hygiene transportation	3.96	3.56	4.8	4.12
Protection	I3	Protection against traffic	3.68	3.64	3.64	4.32
	I4	Protection against crime and violence	3.88	3.56	3.56	3.6
	I5	Protecting the space from weather conditions	3.6	3.4	4.2	3.96
Well Lighting	I6	Protect the space against crime and violence	3.64	3.44	3.2	4.04
Buffer Zone	I7	Create a landscaped area between the different activities	3.24	3.32	3.4	4.36
	I8	Create a landscaped area between users and vehicles movements	3.8	3.48	3.32	4.28
Security	I9	presence of design features for safety & security	3.48	3.44	3.36	4.16
	I10	Lighting system, especially at night	3.72	3.64	3.4	3.8
Size	I11	widen sidewalks	3.75	3.52	3.6	3.88
	I12	Demand for curb space	3.84	3.44	3.36	3.76
Flexibility	I13	Ability to be transformed for emergency health purposes	3.68	3.6	3.76	3.8
	I14	Enhancing mobility	3.76	3.12	3.28	3.96
	I15	Transform streets into open air restaurants	3.12	3.2	3.64	3.68
Sustainability	I16	Sustainable infrastructure	3.88	3.4	3.16	4.36
	I17	Car-free zones to support a low-carbon and sustainable recovery	3.68	3.52	4	3.88
	I18	Self Sufficient	3.36	3.32	3.96	3.96
Accessibility	I19	Bicycle and pedestrian paths	4.08	3.64	3.75	4.4
	I20	Connectivity	3.68	3.48	2.8	3.8
	I21	Connected system of open spaces	3.56	3.24	4.08	4.2
Smart Open Spaces	I22	Digital technology and innovation to help to maintain social distance	3.64	3.2	3.36	4.24
Adaptability	I23	Adaptive reuse to create emergency facilities	3.52	3.4	3.6	3.8
Transparency	I24	Good view of the space	3.88	3.44	3.4	3.88
	I25	Provide psychological and practical physical support	3.56	3.36	3.92	3.75
	I26	Link the functions inside the building with open space life	3.64	3.32	3.8	4.24
Pollution	I27	Reducing environmental pollution	4.04	3.44	3.72	4.44
Emerging needs	I28	Providing hand washing facilities	3.88	3.72	4.4	4.12
Material	I29	Type of the used materials	3.88	3.32	3.666	3.84
Social (Safe) Distance	I30	A series of painted social distancing circles	4.04	3.36	3.96	4
Green Spaces	I31	Provide more spaces for pedestrians and cyclists	3.56	3.52	4.04	4.2
	I32	Continuous networks of green spaces will be more valuable than isolated patches	3.6	3.44	4.24	4
	I33	Visual access to nature	3.56	3.28	3.4	3.92
	I34	Therapeutic gardens to boost the mental and emotional well-being of citizens	3.64	3.28	3.75	3.8
	I35	Provisions for cycling	3.68	3.36	3.04	4.08
Digital Systems	I36	Used to track and contain the virus	3.52	3.56	3.12	4
	I37	Monitor health status to identify and solve community health problems	3.8	3.32	3.2	4
Periodic Maintenance	I38	Lack of periodic maintenance leads to increasing the rate of damaging and distortions	3.92	3.48	3.08	4.12
	I39	Creating partnerships with organizations or volunteers' people to sponsor and maintain urban spaces is a good idea to keep the space clean	3.76	3.24	3.16	3.88
	I40	Presence of funding channels for public space maintenance or improvements	4.04	3.12	3.04	3.96
Weather Comfort	I41	Opportunities to enjoy the positive aspects of climate	3.52	3.12	3.28	4.12
community health context	I42	Environmental conditional related to physical space	3.68	3.44	3.90	4.12
Human needs	I43	Ability to meet the social demands	3.36	3.36	3.36	3.76
	I44	Opportunity to hear, vision and talking	3.64	3.76	3.6	3.52
	I45	Good design to meet the psychological needs	3.72	3.28	3.84	3.92
Activities	I46	Street furniture provides talk spaces	3.8	3.08	3.8	4.08
	I47	Ability of the space to accommodate diverse activities	3.76	3.12	2.92	4.28
Comfort	I48	Opportunity to enjoy the positive aspects of climate	3.68	2.96	3.96	4.08
	I49	Low noise levels	4	3.04	4.12	3.72
Walkability	I50	Good surface	3.76	3.36	3.52	3.72
	I51	Safe distance	3.72	3.44	4.28	3.96
	I52	Providing attractive, comfortable and safe walkways	3.84	3.64	4.24	4.04
Social Interaction	I53	Provide physical space	3.84	3.28	3.36	3.68
	I54	ability to attract people to come to the space	3.48	3.28	2.84	3.88
	I55	Provide a degree of comfort	3.64	3.32	3.8	4.04
	I56	Image of the open space				
	I57	Good access, connect and linkage	3.92	3.08	3.52	4.2
	I58	Administration and maintenance of the open place	3.88	3.32	2.48	4.16

In the next part, the outputs (Table 5), are verified, comparing the remaining dimensions that obtained on average 75% or more (3.75 out of 5 or more), and avoiding those who got less than the required percentage, to verify the strength of the relationship between the opinions of the specialists / sample questionnaire by Pearson. The results and their outputs are presented in the following table.

Table 5. Outputs verify the strength of the relationship between the remaining dimensions by the Pearson program.

Aspect	Dimension	Architect & Human Doctor	Architect & Urban Designer	Human Doctor & Urban Designer	
Transportation	I1	Providing safe walkways and bicycle lanes (pedestrian- and cycle-friendly streets)	0.673	0.966	0.788
	I2	Providing convenient and hygiene transportation	0.851	0.942	0.708
Protection	I5	Protecting the space from weather conditions			0.793
	I7	Create a landscaped area between users and vehicles movements		0.947	
Size	I11	widen sidewalks		0.357	
	I12	Demand for curb space (free space for pedestrians)		0.474	
Flexibility	I13	Ability to be transformed for emergency health purposes			0.990
	I14	Enhancing mobility		0.819	
Sustainability	I16	Sustainable infrastructure		0.746	
	I17	Car-free zones to support a low-carbon and sustainable recovery			0.746
Accessibility	I19	Bicycle and pedestrian paths		0.883	
	I21	Connected system of open spaces			0.845
Transparency	I29	Type of the used materials		0.627	
	I26	Link the functions inside the building with open space life			0.779
Pollution	I27	Reducing environmental pollution		0.893	
	I28	Providing hand washing facilities	0.909	0.889	0.959
Material	I29	Type of the used materials		0.787	
Social (Safe) Distance	I30	A series of painted social distancing circles	0.924	0.924	0.894
Green Spaces	I31	Provide more spaces for pedestrians and cyclists			0.837
	I32	Continuous networks of green spaces will be more valuable than isolated patches			0.893
Digital Systems	I37	Monitor health status to identify and solve community health problems		0.815	
Periodic Maintenance	I38	Lack of periodic maintenance leads to increasing the rate of damaging and distortions		0.826	
	I39	Creating partnerships with organizations or volunteers' people to sponsor and maintain urban spaces is a good idea to keep the space clean		0.973	
	I40	Presence of funding channels for public space maintenance or improvements		0.767	
Human Need	I45	Good design to meet the psychological needs			0.983
Activities	I46	Street furniture provides talk spaces	0.854	0.807	0.570
	I47	Ability of the space to accommodate diverse activities		0.360	
Comfort	I48	Opportunity to enjoy the positive aspects of climate (sun/shade)			0.843
	I49	Low noise levels	0.674		
Walkability	I51	Safe distance			0.802
	I52	Providing attractive, comfortable, and safe walkways	0.807	0.683	0.754
Social Interaction	I55	Provide a degree of comfort			0.430
	I56	Image of the open space	0.374		
	I57	Good access, connect and linkage of the open space		0.819	
	I58	Administration and maintenance of the open place		0.767	

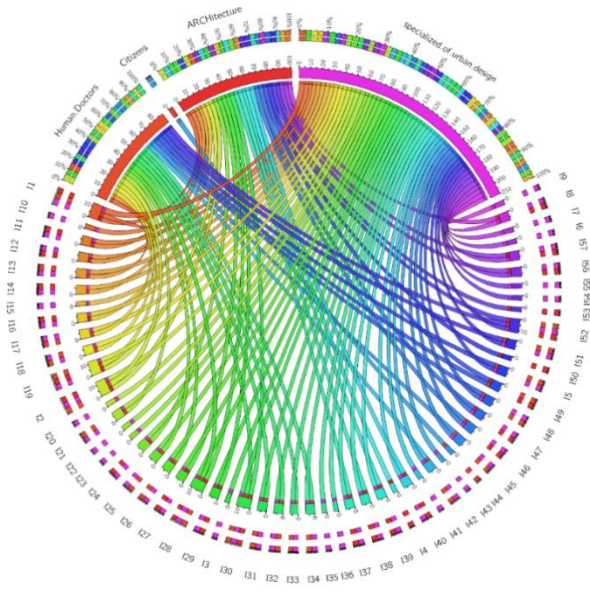


Fig. 5. Graphic representation for the indicators, which got on average vote of 75% or more (3.75 out of 5 or more) schema-ball in the outputs of Table III.

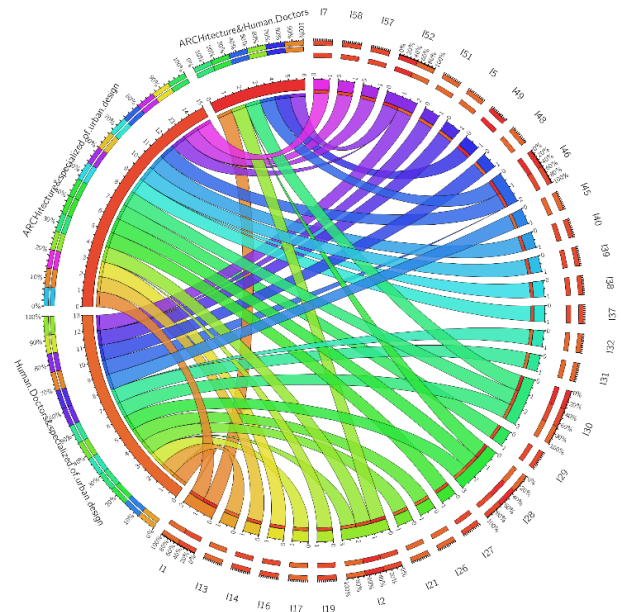
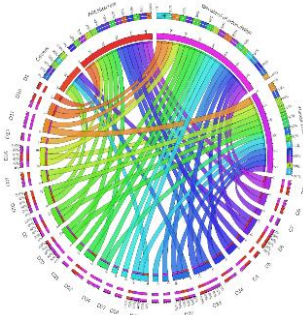
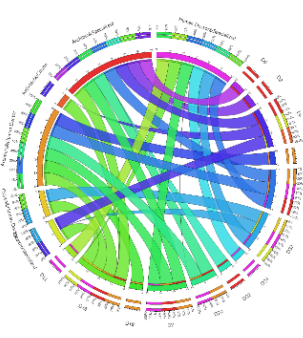
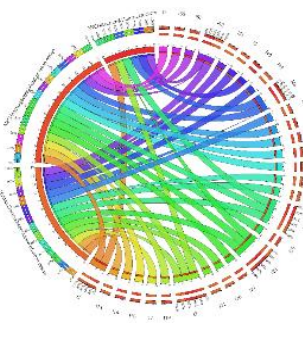


Fig. 6. Achieving the outputs from the strength of the relationship between the opinions of specialists and the questionnaire sample in the remaining indicators in the outputs of Table V.

According to **Table (6)** and Figure (4), some of the four pink-colored indicators achieved a value of less than 0.5, which means that these indicators have a weak relationship, while the rest of the indicators achieved a value higher than 0.5, which means the strength of the relationship and affinity for the experts in choosing indicators.

Table 6. Describes findings from dimensions and indicators from section (6).

Diagram illustration using SCHEMA BALL	The results
<p>Figure 3:</p> 	<p>Each of the dimensions (D2, D6, D15, D19, D20, D29, D32 and D33), are the dimensions agreed upon by the respondents in the questionnaire of those involved in the research, and also obtained a high value of more than 75% - importance High in the range of impact. As for the dimensions (D8, D9, D10, D11, D17, D22, D24 and D34), they achieved average importance, while the dimensions (D3, D5, D7andD12) were the least important, while the rest were of weak importance because they obtained values less than 50% which indicates that it is useless in improving the public space.</p>
<p>Figure 4:</p> 	<p>Each of the dimensions (D2, D6, D8, D9, D11, D16, D19, D20, D22 and D24) is the one that achieved a value between (0.5 - 1), which means that the opinions of specialists about the two dimensions are related. Where the opinion of the strength of the relationship approximates the extent to which the two specific dimensions are similar in importance to each of (Architects, Human Doctors, and Specialized Urban Designers) on the dimensions (D2, D6, D20, D16 and D33), while (Architects and Specialized Urban Designers) (D8) agreed. (D9, and D22), while (Human Doctors, and Specialized Urban Designers) agreed on the dimensions (D11, D24, and D29), as for the dimension D34, it was agreed upon by (Architects, and Human Doctors) only.</p>
<p>Figure 6:</p> 	<p>Each of the index numbers shaded in grey are the ones that achieved a value between (0.5-1), while the numbers shaded in pink achieved a value less than (0.5), which indicates that the strength of the relationship between the opinions of specialists in choosing Indicators and their correlation with some are not strong. They are not considered in the design of the public space due to their lack of influence on the design. The highlighted with grey achieved a value (0.5-1) while the numbers highlighted with pink achieved a value less than 0.5 which indicated the correlation between the expert opinions is not strong enough to be considered when planning general spaces due to its little impact on the design</p>

Analysis of the proposed dimensions

The following is an illustrative picture of what was extracted from the dimensions and indicators that achieved a rate higher than 75%. In the following **Table (6)**, the authors briefly review the findings of the applied study represented in the results of the questionnaire screening, which they dealt with in the form of tables in section (Section 6.) In the following table the authors review a summary of the results and relationships between the opinions of specialists about the dimensions and indicators proposed in the research.

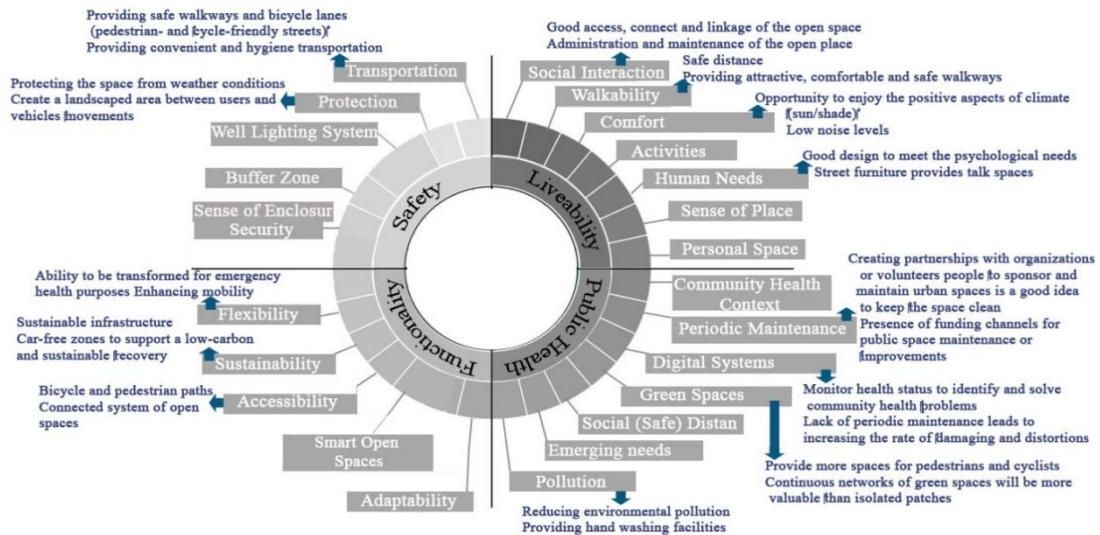


Fig. 7. Sincerely for the dimensions of the general messages that were sent from specialists to improve the public spaces.

Conclusions

The paper explores the re-thinking of designing public spaces in a pandemic era to improve the public space through suggesting a model for investigating and quantifying assessment of the main aspects of future public space designs in pandemic disease time and the effect of COVID-19 on public spaces. After the theoretical review, the research determine the aspects, dimensions, and indicators suggested by the research, and through an online questionnaire, a group of experts, human doctors and users are distributed to assess these different aspects and their dimensions and indicators to suggest a model for investigating and quantifying assessment of the main aspects of future public space designs in pandemic disease time and the effect of COVID-19 on public spaces. A SCHEME BALL is used to display relationships in the form of a graph showing the relationships between the dimensions and some of them, as well as indicators and some of them.

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