



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

International Journal of Disaster Risk Reduction

journal homepage: www.elsevier.com/locate/ijdrr

Community resilience to pandemics: An assessment framework developed based on the review of COVID-19 literature

Mahdi Suleimany^a, Safoora Mokhtarzadeh^b, Ayyoob Sharifi^{c,d,e,*}

^a Urban Planning and Management, University of Tehran, Tehran, Iran

^b Department of Urbanism, Faculty of Architecture and Urbanism, Daneshpajoohan Pishro Institute, Isfahan, Iran

^c Hiroshima University, Graduate School of Humanities and Social Science, Japan

^d Hiroshima University, Graduate School of Advances Science and Engineering, Japan

^e Network for Education and Research on Peace and Sustainability (NERPS), Japan

ARTICLE INFO

Keywords:

Urban community resilience
Pandemics
COVID-19
Systematic literature review
Assessment framework

ABSTRACT

The COVID-19 outbreak in 2019 and the challenges it posed to communities around the world, demonstrated the necessity of enhancing the resilience of communities to pandemics. In this regard, assessment frameworks can play an essential role and guide resilience-building efforts. However, the lack of a comprehensive assessment framework has led to a focus on sectoral evaluation. This study aims to propose an integrated framework for assessing the pandemic resilience of communities. For this purpose, we rely on a systematic review of literature indexed in major academic databases. We have thoroughly analyzed a total number of 115 related documents to extract relevant criteria. Findings show that many criteria and factors affect community resilience to pandemics. By inductive content coding in MAXQDA software, we have categorized these criteria into five dimensions of Institutional, Social, Economic, Infrastructural, and Demographic. Good leadership and management, insurance and governmental support, planning and preparation, expertise and labor, and available equipment and technologies are the most important institutional criteria. Communication and collective identity, mutual support, public safety and protection, public awareness, and social justice are the influential social criteria. Economic sustainability and resource availability are criteria of economic resilience. Sufficiency of services, public spaces, housing tenure, and transportation system are the main criteria related to the built environment and infrastructural dimension. Finally, demographic resilience includes physical health, psychological well-being, life quality, and hygiene. Based on these criteria, this study develops an integrated evaluation framework that researchers can implement along with conventional assessment and ranking methods to determine the level of community resilience to pandemics.

1. Introduction

The Coronavirus pandemic (COVID-19), first reported in 2019 in Wuhan, China, is a perilous global pandemic in the 21st century that has killed millions of individuals worldwide. This pandemic is caused by acute respiratory syndrome (SARS-CoV-2), which has a variety of symptoms, from mild to deadly. Its high infection rate led the World Health Organization (WHO) to declare it a global

* Corresponding author. 1-3-1 Kagamiyama, Higashi-Hiroshima City, Hiroshima, 739-8530, Japan.

E-mail addresses: mi.suleimany@gmail.com (M. Suleimany), s.mokhtarzadeh@daneshpajoohan.ac.ir (S. Mokhtarzadeh), sharifi@hiroshima-u.ac.jp, sharifgeomatic@gmail.com (A. Sharifi).

<https://doi.org/10.1016/j.ijdrr.2022.103248>

Received 5 June 2022; Received in revised form 25 July 2022; Accepted 9 August 2022

Available online 14 August 2022

2212-4209/© 2022 Elsevier Ltd. All rights reserved.

pandemic in March 2020 [1,2]. The Coronavirus pandemic has swept through many communities, causing widespread socio-economic and psychological impacts. As is the case for any other adverse event, effective dealing with the pandemic depends on taking many pre-and post-event measures to facilitate better coping, response, and recovery processes [3,4].

The pandemic has affected different aspects of human life. In this situation, the greater concern is about communities' social and human capital; if people can exist and cope with this crisis, they can undoubtedly redevelop and compensate for the economic and infrastructural damages [5]. Concerns and anxieties related to the pandemic are driven by the impacts on human health and other socio-economic consequences that may influence community resilience in different countries [6]. In fact, long-lasting lockdowns and social distancing measures that have disrupted daily activities like working and leisure can impose numerous social and economic impacts on communities. School closures, rising unemployment rate, declining face-to-face interactions, forced teleworking, and the like, are more concrete examples of the impacts of this crisis on communities [3]. However, resilient communities can absorb the pandemic impacts more effectively and return to normal conditions rapidly and sustainably [7,8].

In the past few decades, enhancing community resilience, in both geographical and relational notions, has become a significant priority in many parts of the world. This is driven by the fact that there have been upward trends in the frequency and intensity of adverse events and crises in the past, which are projected to continue due to climate change, disasters, wars, and pandemics [9,10]. Resilience literally means "Return to the past," It is originally from the Latin word "Resilio," which dates back to the 17th century. Holling first introduced resilience in the common academic meaning in 1973 as "a measure of a system's ability to absorb shocks while still having previous resistance." Resilience is a buzzword in different fields and has different levels and dimensions [7,10,11]. In urban planning and social sciences, scientific studies investigate resilience at three levels: individual, community (like urban or rural), and national or international resilience [12].

Community resilience indicates the capability of people and communities to retain optimal performance in the event of various natural and anthropogenic crises [13]. In such a way that businesses, infrastructures, and citizens suffer the least damages and casualties and maintain the capacity to recover from damages, adapt, and redevelop [14]. Community resilience includes five dimensions: I- Environmental and Infrastructural, II- Institutional, III- Public Health and Well-being, IV- Social, and V- Economic [7,15]. It is realized through the constant interaction between individuals, social groups, businesses (economic resources), governments (authorities and institutions), and the natural or built environment of settlements [16,17].

Researchers have mentioned five major capacities for resilient communities: I- Having the ability to withstand shocks and minimize potential damages (Mitigation capacity), II- Having the ability to absorb shocks from crises (Absorption capacity), III- Having the ability to redevelop and compensate damages (Recovery capacity), IV- Having the ability to adapt and adjust to changes to moderate future shocks (Adaptation capacity), and V- Having the ability to transform to better status and improve the status quo with regard to the probable shocks (Transformation capacity) [16,18,19]. Also, it is argued that each community needs to enhance its I- Social capacity and social capital, II- Individual capacity and human capital, III- Organizational capacity and institutional capital, IV- Economic capacity and economic capital, and V- Spatial capacity and infrastructural capital to ensure better resilience to shocks and stressors [4].

There is a vast body of literature on community resilience and its determinants. Existing research has mainly focused on resilience to threats such as natural disasters, climate change impacts, and socio-economic difficulties [20–24]. However, resilience to pandemics, specifically before the COVID-19 outbreaks, has been relatively understudied [10]. Also, studies after the COVID-19 outbreak have mostly concentrated on the impacts on communities or the existing capacities to cope with this crisis [4]. This means a limited number of studies have provided a comprehensive assessment framework that contributed to community pandemic resilience [25,26]. Therefore, studying and evaluating community resilience in the face of crises, like the COVID-19 pandemic, that embroils different countries with different social, economic, and infrastructural capital is essential. It also can offer opportunities to advance further our knowledge of community resilience and its determinants [27]. Better knowledge of factors and capacities that contribute to community pandemic resilience may provide opportunities to better plan and prepare for future pandemics and ensure better capacities to cope with, recover from, and adapt to the impacts of future pandemics [28].

This research aims to develop a comprehensive framework for assessing the resilience of communities to pandemics based on existing literature. With this regard, the main questions of this study are I- What are the influential criteria and factors on community resilience to pandemics? Moreover, II- According to the recent pandemic condition, what are the new definition and contributions of these criteria and factors? We have tried to identify the capacities and capital that may affect resilience to answer these questions based on a systematic review of literature published on this topic. In other words, developing a comprehensive pandemic resilience framework for communities alongside reconceiving the criteria considering recent pandemic conditions are the outputs and novelty of this study. Furthermore, it can contribute to evaluating community resilience in different dimensions and inform planners and policymakers of required measures to develop more resilient settlements to pandemics.

1.1. Research background

Before addressing the research methodology and findings, a brief investigation of the study background can determine the general view of the subject and study gaps. A lot of research exists on community resilience. Cutter et al. [29] have provided a place-based model for measuring community resilience considering ecological, social, economic, institutional, and infrastructure dimensions [29]. Cutter and her colleagues further promote their framework by importing spatial dimension and considering urban-rural differences in disaster resilience [30]. Also, other researchers have provided numerous frameworks and methods for assessing community resilience to climate change impacts [31], flooding [32], earthquake [33,34], and the like.

In the field of community pandemic resilience, Massaro et al. [35] have examined the impact of infectious and pandemic diseases on communities' economic and social systems. They stated that preventive measures of governments to control pandemics, such as wide-scale lockdowns and public quarantine, usually cause severe damages to economic and social structures. Therefore, they develop

a framework for optimizing the pandemic control process, emphasizing institutional capacities to make communities more resilient [35]. Moreover, Alonge et al. [5] introduced the level of public knowledge, social networks and communication, public trust, health services, governance and leadership, economic and financial resources, and public preparedness as the key factors in making more resilient communities to pandemics [5].

Cheshmezingi [7] investigated factors affecting community resilience and discussed the role of urban management in controlling the pandemic. He mentioned that resilience to pandemics is based on community-government collaboration and has four dimensions: operational, institutional, services, and supply. This reveals that resilience to pandemics is a multidimensional approach that should be adopted and promoted in a participatory manner [7]. In addition, Xu et al. [4] have studied community resilience to pandemics in Wuhan, the starting point of the coronavirus outbreak. They have evaluated the social, economic, physical, and institutional capital alongside the demographic characteristic of communities in Wuhan to assess their resilience to pandemics. While they have explored different capitals, their study falls short of exploring how each capital and capacity factors could contribute to community pandemic resilience. To the same, Lak et al. [36] have evaluated the pandemic resilience of the Tehran neighborhoods considering physical, demographic, environmental, infrastructural, economic, and social dimensions. This study did not include the institutional aspect of community pandemic resilience. Besides, it is needed to further explore how each evaluation factor affects the community resilience to pandemics [36].

These studies have advanced our understanding of different affecting factors in building resilience to pandemics, but there is still a lack of a comprehensive and integrated framework for evaluating community pandemic resilience. In addition, there is a lack of studies that have redefined the community resilience criteria according to the new pandemic. These are the gaps that the present study aims to address by reviewing the literature published on the pandemic resilience.

2. Materials and methods

2.1. Literature selection

Literature used for this review was retrieved from several scientific databases, including Scopus, Web of Science, and PubMed. We have deliberately designed the search string broadly to provide reasonable coverage of the diverse research on communities and their resilience to pandemics. The search string is (“COVID*” OR “Coronavirus” OR “pandemic*” OR “epidem*”) AND (“resilien*”) and we have searched in ‘Title, abstract, and keywords’ of the documents.

We have run the search string on English papers published after 2000. These papers contain research articles, review papers, book chapters, and case reports. Although our research focuses more on evidence from the COVID-19 pandemic, we have also reviewed articles that discussed other pandemics like SARS and Ebola to analyze different dimensions of community pandemic resilience broadly. An initial search in the mentioned databases on November 10, 2021, returned 2169 articles. However, a brief collaborative skimming of the titles of the retrieved papers showed that a high percentage of the articles focused on medical studies examining personal resilience. Therefore, we used the databases’ filtering feature to exclude papers not relevant to community resilience. As a result, articles on pharmaceutical sciences, nursing, medicine, and psychology were omitted (2046 papers excluded). Nevertheless, authors have skimmed the title and abstract of omitted papers to cover the ideas that could contribute to the pandemic resilience of communities. As a result, articles from medicine or psychology fields that discussed community capital like social networks and public behavior were added (21 additional articles).

At the end of this point, 144 papers remained in the database. All three authors first began to screen the abstract of an equal amount of documents separately to assure their relevance. Then they shared the outputs and redecided about them in a participatory manner. After screening the remaining articles, we have excluded 41 more papers. On the other side, after checking the references cited by the selected articles, we added 5 papers, 3 books, and 3 reports to the reviewed sources, based on their relevance, to cover more related topics and empirical evidence. Systematic literature procedures, such as the PRISMA¹ method, allow the use of documents from sources other than database searching [37]. PRISMA is an evidence-based minimum set of elements for reporting systematic reviews and meta-analyses. PRISMA mainly focuses on the reporting of reviews assessing the impacts of interventions but can also be used as a base for reporting systematic reviews with other objectives [37,38]. Fig. 1 represents a more detailed material selection procedure based on PRISMA structure.

It should be noted that we also enabled the notification feature of the academic databases to receive weekly publication updates and, if necessary, add newly published papers to our database during the process. This choice resulted in the inclusion of one additional paper. After identification and screening processes, 115 documents were included in the review study and prepared for analysis.

2.2. Literature analysis procedures

The authors have thoroughly examined the chosen papers to extract the data required for the analysis presented in the following sections. We used Excel and MAXQDA software for the accurate content analysis of the documents. MAXQDA is a professional application for qualitative analysis, and it was used considering its utility for scientific text and content analysis [39]. Before analyzing the contents of the documents, authors have designed a spreadsheet with selected papers on the rows and columns for collecting data on a wide range of items and issues. These items include criteria and factors of community pandemic resilience and their description.

There were three phases of the analysis. First, each author separately read an equal number of papers, gathered the necessary details, and sorted them into the designed spreadsheet in Excel, based on the mentioned factors for community pandemic resilience in

¹ Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

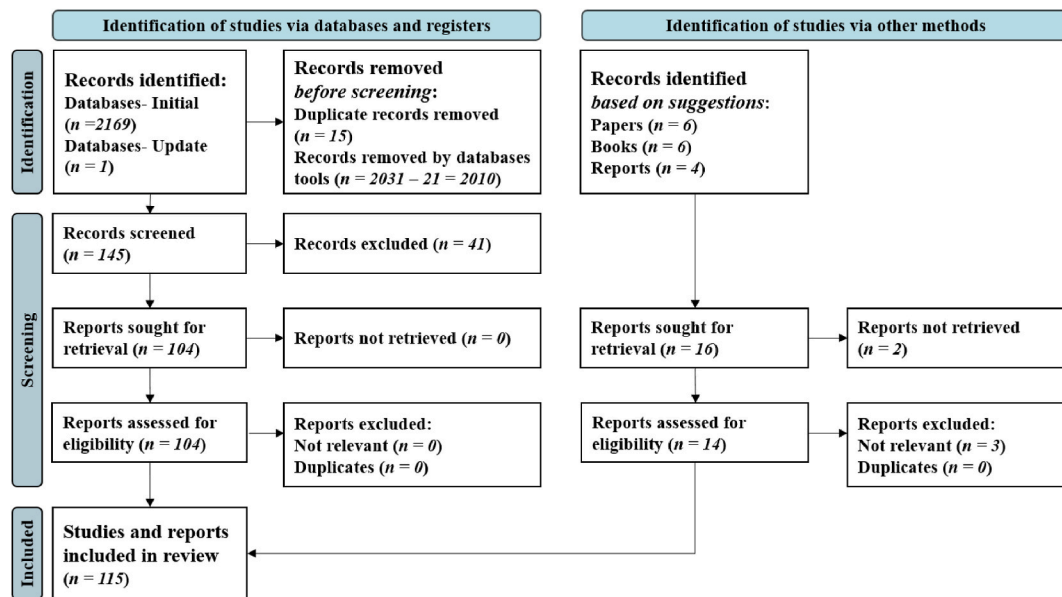


Fig. 1. Process of identification and screening studies for review (PRISMA flowchart).

them (Phase 1). Then the authors independently imported collected information to MAXQDA software and double-checked, categorized, and coded it based on inductive content-coding (Phase 2). Finally, in the third phase, the authors reexamined the coded data collaboratively and used it for writing the article (Phase 3). After coding the data, the authors have classified documents based on their focus on different dimensions of resilience. As a result, the studies were classified into seven categories. This classification helps authors to interpret the different affecting dimensions better. Table 1 provides a quantitative report of studies in these categories.²

3. Results and discussions

Pandemics are one of the most impactful adverse events. They affect different parts of communities [3,40]. Empirical evidence shows that pandemics, due to their lack of geographical limitation, can spread on a much larger scale than any other crisis and inflict heavy damages and casualties on communities. The mortality of more than 5.96 million people due to the Coronavirus infection by the end of February 2022 [41] and a near 5% decline in total world GDP in 2020 [42] obviously demonstrate the impacts of this crisis on the socio-economic structures of communities. In addition, social distancing and long-term lockdown designed for controlling the pandemic might have consequences for cities and diminish the adaptive capacity of citizens [35,43]. These cases and other impacts of this crisis indicate the necessity of building more resilient communities to pandemics. Many studies conclude that the outbreak of Coronavirus, despite all its devastating effects on cities, taught great lessons to policymakers for planning more resilient communities to large-scale pandemics [44,45].

Pandemic resilience of communities, like other forms of resilience, includes five capacities at each level: mitigation, absorption, recovery, adaptation, and transformation [14,19]. Mitigation and absorption are initial capacities of resilience, which take place before and right after the disaster happens. Mitigation is related to the ability of different systems to minimize damages and mitigate casualties. Absorption is the ability of working systems to absorb shocks, and recovery is related to their available resources for compensation and restoring their normal function. Adaptation is the adaptive capacity of a system to adapt and adjust to changes that result from disasters and shocks. Communities that accommodate changes better can redevelop sooner and recover from damages easier. Transformation also depicts the capacity to maintain the development process, and to transform communities into a sustainable situation [6,46–48]. Community resilience to pandemics is a multidimensional term that consists of a vast range of criteria and factors. We have identified different factors contributing to community pandemic resilience and categorized them according to the different dimensions of community resilience. Table 2 represents a summary of dimensions and basic features of the resilient communities to pandemics.

Features provided in Table 2 are the most frequent codes we have detected through the content analysis procedure. Findings indicate that community resilience to pandemics includes Institutional, Social, Economic, Built Environment and Infrastructural, and also Health and Demographic dimensions. This means building a more resilient community to pandemics requires a comprehensive attitude, especially among policymakers, towards the different dimensions of this crisis and various capital of communities [64,66]. Toward building resilient communities to pandemics, institutes, particularly public organizations, are the key actors in planning, preparation, control, and managing efforts in coping with pandemics and their impacts [67–69]. The contribution of social capital in

² All the documents reviewed in this research and their main content codes are categorized in the supplementary appendix.

Table 1
Quantitative report of studies reviewed in this research based on their category.

Categories	Count	Percentage
Institutional Resilience	15	13.0
Social Resilience	18	15.7
Economic Resilience	22	19.1
Built Environment and Infrastructural Resilience	19	16.5
Public Health, Well-being, and Demographic Resilience	10	8.7
Papers focused on multiple dimensions (including urban resilience dimensions)	31	27.0
<i>Total</i>	115	100

Table 2
Dimensions and basic features of resilient communities to pandemics.

Dimension	Definition and basic factors	Resources
Institutional Resilience	Comprehensive monitoring and risk assessment, self-reliance and independence, government subsidies and support, technologies, expertise and labors, food system security Efficient leadership and management, empowered stakeholders, mixed development planning, equipment, and available tools for controlling the pandemics Risk management and mitigation, equipment and tools, institutional preparedness, doctors and expert labors, planning for development in the pandemics outbreak era	[7,35,49–52]
Social Resilience	Social trust, social solidarity, safety and protection, social justice, distribution equality, social awareness and knowledge about the pandemics Collective identity, social solidarity, social networks, social capital, support and mutual support during the disease's outbreak Social infrastructure, education and public information, public support, law enforcement, social distancing, readiness for quarantine	[7,44,51,53,54]
Economic Resilience	Economic sustainability, GDP, economic development, efficient financial management, supply chain Financial resources, natural resources, basic goods storage, employment and activity, food security Insurance and financial readiness for treatment, care, nursing, and providing required medicine, goods, and services	[55–58]
Built Environment and Infrastructural Resilience	Available welfare services, infrastructures, transportation, and housing status during the pandemics outbreak, hospital capacity Housing and tenure, exposure and vulnerability, basic services provision, transportation, ICTs Sustainable transportation, public open spaces accessibility, residential infrastructures	[59–62]
Health, and Demographic Resilience	Health, life expectancy, quality of life, hygiene, income and purchasing power, attitudes and beliefs Risk understanding, knowledge and habits, personal preparedness, communication, self-care, self-quarantine, social distance observing Human vulnerability, diverse livelihoods and employment, effective devices and measures to maintain people's health and lives	[63–65]

community pandemic resilience is more significant in collective awareness, public mutual support, and the more efficient observance of protective guidelines [28,70].

Resilient economic systems are necessary to compensate for damages caused by pandemics and lockdown policies. Moreover, sufficient financial resources are essential for maintaining food security and supplying medical equipment on a broad scale [68,71]. Services and infrastructures are vital factors in maintaining the quality of life and access to amenities in the pandemic era. Besides, environmental features play an essential role in community mitigation and absorption capacity [61,72]. In addition, demographic resilience can influentially reduce community vulnerability to pandemics by mitigating the infection rate, minimizing death cases, and facilitating the process of recovery and inhibition of disease [36,73]. These dimensions are further discussed in the following sections.

3.1. Institutional resilience

When disasters occur, communities may not be able to function adequately due to the emergency. Accordingly, because of the sudden increase in demands and decline in services, community life may be disrupted, which often cannot return to a stable situation per se [26]. Under such circumstances, actions and strategies of local governments and decision-makers become more critical. By observing common interests and managing interest conflicts, they can minimize possible damages, restore normal function, and maintain the development processes [35,74].

During the Coronavirus outbreak, many essential goods and medical items such as masks and disinfectant gels became scarce in the markets due to increasing demand and individuals' struggle for survival [75]. Also, the growing number of patients and the limited capacities of hospitals and healthcare centers created the need for citywide lockdowns in the communities [76]. This forced governments to adopt strategies and policies to control the pandemic outbreak in communities and distribute basic goods, especially vaccines and required medicines [50,77,78].

Therefore, government institutions and management organizations play a vital role in controlling crises and disaster mitigation. The ability of the government and the agencies to prevent the emergence (before the crisis), control the spread and provide essential services (in the event of a crisis), and facilitate recovery from damages caused by disasters, is called institutional resilience and

organizational capacity. Institutional resilience to pandemics can be redefined as the capability of agencies to provide required goods and equipment and manage large-scale pandemics in order to mitigate the number of infections and facilitate the redevelopment of communities [35,49,51].

The main criteria for institutional resilience to pandemics are good leadership and management, insurance and governmental support (or subsidies), planning and preparation (including supply chain management), expertise and labor, and available equipment and technologies. In this regard, the issues of sufficient health insurance, education and information, and emergency services have been considered more than other factors in relevant studies. In particular, efficient governmental decision making, institutional trust, and coordination have been mentioned as essential institutional factors. These factors play an important role in efficiency and effectiveness of management activities in times of crisis and can affect the sufficiency of other factors such as education and insurance.

It should be noted that all resilience-building efforts in the managerial sector of communities must be through civic participatory approaches to achieve the highest efficiency [16]. Controlling and coping with pandemics, like other crises, requires sufficient interaction between governments, social groups, and businesses. Because in communities with lower participation of individuals, the instructions of management agencies usually have been omitted and the efficiency of government actions to cope with crises reduce [35,50]. Moreover, integrating technologies and smart solutions into community management practices can increase institutional efficiency and resolve limitations caused by large-scale lockdowns [79,80]. Smart governance techniques are capable of attracting public participation in the pandemics era. Therefore, institutes should administer their services through smart portals, such as web-sites, applications, and other online or offline smart manners [81].

3.2. Social resilience

One of the most important dimensions of resilience is social resilience, which is described as the capacity of social groups to cope with probable shocks. Researchers have emphasized social capital and adaptive capacity in defining social resilience [82]. Social capital is about the characteristics that contribute to building up community and the quality of communications between citizens. The benefits of social capital in facing natural disasters, wars, and other crises have been observed [83]. In another definition, social capital refers to the role that trust, norms, and social networks can play in solving communities' problems. In this regard, social capital is influenced by three factors: commitments, solidarity, and communication. Adaptive capacity is also related to the ability of institutions and social groups to learn, gain experience, and resolve conflicts [84,85].

Social groups and networks are the most vulnerable in crises like pandemics. Empirical evidence shows that pandemics have various impacts and consequences for social groups, leading to social segregation and social anomalies. However, social networks play a critical role in absorbing shocks, reducing casualties, and recovering from damages [86,87]. Social resilience complements the community institutional and economic resilience in the face of crises; because in disasters, especially widespread crises like pandemics, available public and economic resources usually cannot meet the costs of mitigation, absorption, and recovery. In other words, administration and economic systems cannot be such efficient in controlling pandemics, if communities do not have sufficient social resilience [54,73].

Social resilience to pandemics can be defined as the capacity of social structures to be aligned with other parts of the community, especially the government, and follow the instructions of the relevant agencies to reduce the infection rate, minimize damages, and restore the community's normal life. It also depends on social capital, social justice, and public support in providing required goods and services [88,89]. Based on what was discussed, criteria of social resilience are communication and collective identity, mutual support, public safety and protection, public awareness and knowledge, and social justice. Social networks and then public readiness are the most recurring factors of social resilience, followed by other factors such as social cooperation and social capital. Analyzing the relationship between the factors shows that social capital and social justice can be more effective in social resilience than other factors. They can be very effective in increasing the capacity of communities to adapt to crises. This also can be strengthened by raising awareness, enhancing education, and emphasizing cultural resources.

Pandemic often struggles communities in a longer period than other crises. As pandemics directly threatens the lives of people, they impose more social and psychological impacts on the communities. They also has significant consequences on public behavior [90]. With this regard, social networks and public awareness are critical factors in a socially resilient community to pandemics. Besides, informal groups and NGOs can highly contribute to both mitigation measures and adaptation procedures [27,91]. These findings reflect the importance of social resilience in the pre-and post-pandemic situation. Hence, planners and policymakers should seek to enrich and employ social capital in their adaptation strategies. This might include public education, participation, and empowerment [28].

3.3. Economic resilience

One of the main characteristics of crises is the embroilment of communities' economic systems and businesses. In other words, economic structures will be disturbed when a disaster occurs due to disruptions in the supply and demand system in local markets [92]. Crises challenge communities' economy through, among other things, demand-driven inflation, job losses, and GDP decline. Also, high recovery costs, supply chain disruption, and food insecurity are other economic impacts of crises such as pandemics [93–95]. It should be noted, however, that some businesses and industries might develop significantly during a disaster, but empirical evidence suggests that crises usually result in a decline in the total economic growth of communities [96,97]. Economic resilience is the economic capacity and commodity capital of a community to meet citizens' basic needs, provide goods and supply tools to minimize casualties, compensate for damages and maintain the development processes during the crises [56].

A 5% decline in total world GDP and 3 to 7% growth in the average nation's unemployment rate in 2020 are the notable impacts of the COVID-19 pandemic on communities' financial and economic systems [42]. Inflation in many goods, especially detergents and

food, and the decline in the purchasing power of the more vulnerable social strata is the other influence of this pandemic on the socio-economic structure of countries [98–100]. Hence, economic resilience to pandemics can be redefined as the ability of economic systems and financial structures to provide medical care and basic needs, ensure supply chain continuity, and support livelihoods during lockdown periods. It is also interpreted as economic flexibility in recovering from damages [101,102]. Key criteria of economic resilience to pandemics are economic sustainability and available resources, such as allocated budget, agriculture, and food security.

Agriculture, food security, and financial resources are the most frequently used factors related to economic resilience in the reviewed literature. This indicates that lack of access to adequate and sustainable supply chain and food resources is one of the most critical concerns of communities during the pandemic. Besides, studies revealed that in many cases COVID-19 was more prevalent in places where poor populations lived [103,104]. Therefore, economic dynamism and justice can affect the supply of required resources. Also dynamism and justice in communities' economy affect other factors such as GDP and job security. Justice in the distribution of resources can play an important role in the access or deprivation of communities to food and health resources, which are essential in coping with pandemics. Studies also suggest that integrating technologies into businesses and some services can contribute to the modification of pandemics' economic impacts and businesses development in the lockdown and closure periods [105].

3.4. Built environment and infrastructural resilience

This dimension of resilience has spatial characteristics and highly depends on the efficiency of public spaces, services, and infrastructures. Public spaces are places for social interactions and meeting the daily needs of citizens. Proper housing is also essential to protect people from many crises. The resilience of built environment and infrastructures refers to the capability of all spaces, buildings, and infrastructures that protect individuals and communities from disaster and include services that meet citizens' basic needs [60, 106]. In some crises, such as floods and earthquakes, the built environment and infrastructures usually suffer various damages. However, in large-scale pandemics, houses and infrastructures are resources that can be used to reduce damages and casualties [61, 107]. Infrastructures, as portals for service provision, also play an essential role in diminishing the side effects of pandemics and long-term lockdowns [108]. Also, adequate provision of public spaces can contribute to pandemic resilience by maintaining social interaction, supplement of required goods and citizens' daily needs [61].

During the Coronavirus outbreak, houses were proved to be the most important refuge for people against this virus, and the homeless people, regardless of those with underlying diseases, were identified as the most vulnerable groups [109,110]. Houses and housing infrastructures play an essential role in maintaining citizens' health and hygiene [111]. Also, better access to services, especially hospitals and healthcare centers, and an efficient public transportation system reduce community vulnerability to pandemics [112]. Clean and well-maintained public spaces with mixed-uses as well as sustainable and diverse transportation networks must be added to these criteria [113,114]. Furthermore, some studies have pointed to micro-scale factors such as green infrastructure as a modulating factor of pandemics' psychological impacts [115–117].

Built environment and infrastructural resilience to pandemics can be redefined as the physical-infrastructural capacity of cities to protect citizens from pathogens, increase household hygiene, mitigate exposure and infection rates, provide critical goods and services, and use for emergency utilizations [60,110]. The primary criteria of this dimension of resilience are services (including welfare and infrastructural services), public spaces, housing and tenure, and public transportation system and networks. Also, health and hygiene services, retail and commercial services, public transportation, telephone access, and ICTs,³ are the most frequently mentioned factors in the literature. However, other factors such as housing quality, squares and public centers, local spaces, and commercial streets play an important role in people's access to services. Proper distribution and spatial justice in the distribution of services can highly reduce concerns of vulnerable groups about access to these services in times of crisis.

Few studies have also discussed the natural environment and ecological resilience factors to the pandemics [62,118]. But with concern that pandemics directly impact individuals and are more related to the built environments, in this study it is categorized under the built environment and infrastructural resilience to pandemics. Moreover, some ecological factors have been integrated into the built environment and infrastructural factors.

3.5. Health, quality of life, and demographic resilience

A healthy, educated, and motivated population is essential to increase community resilience [119,120]. The Mental Health Foundation, emphasizing people as the main part of communities, introduced psychological health, physical well-being, and social vitality (social health) as the three main characteristics of citizens in a resilient community [121]. Here, demographic resilience refers to the personal capability, which builds up demographic structures and quality of life in a city. Many studies have integrated factors of demographic resilience into social resilience [122]. However, since demographic resilience is as important as social resilience during pandemics, in this study, demographic resilience is considered a separate dimension.

Studies suggest that in communities with healthier (lower percentage of people with underlying diseases) and younger people, the death rate due to Coronavirus infection is lower [63,65]. Besides, empirical evidence shows that communities are less resilient to this disease in areas with lower public hygiene and access to health infrastructure [89,110,123]. Hence, this type of resilience to pandemics can be redefined as personal capability (including health, well-being, and hygiene) and quality of citizens' life, which immune them to diseases, mitigate death rate and infection rate in the community and increase hopefulness and readiness in patients [124]. It includes physical health, psychological well-being, life quality, and hygiene.

In terms of health and demographic resilience, physical well-being is the most recurring term, but in relation to factors,

³ Information and Communication Technology.

Table 3
Framework for assessing community resilience to pandemics.

Dimension	Criteria	factors	General description of factors according to the literature	Redefinition of factors according to pandemic conditions
Institutional Resilience	Leadership and management	Efficient governmental decision making	The level of governmental control over the emergency situation and the efficiency of management agencies to make timely decisions, which includes planning, adopting the right policies, etc. in the face of disaster.	The efficiency of different governments, agencies and management system in controlling pandemics, such as having a comprehensive action plan, timely action (quarantine, lockdown, public vaccination, etc.)
		Monitoring and risk assessment	Careful monitoring of the community condition and the probable dangers in the face of crises, and having different scenarios to reduce potential damages and casualties	Having an accurate statistic on the people infected, death rate, and recovery rate during the pandemics outbreak, as well as being prepared for the possible increase in the number of patients
		Independency	Independency of an agency or community to produce and provide required goods and services	The level of communities' self-reliance in the preparation and supply of medical goods such as masks, medicines, etc. or other daily needs of citizens during pandemics outbreak
		Institutional trust	The level of citizens' trust in the governmental agencies and following them to mitigate damages during and after the disaster.	The level of people's trust in the government, medical staff, police forces, etc. and following their instructions, orders and guidance in order to cope with pandemics
	Insurance and support	Health insurance	The number of insured citizens and the amount of insurance, which leads to a reduction in the cost of treatment, required medicine and protective equipment for citizens.	The number of treatment costs coverage by health insurance, required medicine and protective equipment for citizens.
		Governmental support (or subsidies)	The sufficiency of governmental supports for vulnerable social groups and businesses to reduce and compensate for damages caused by disasters and crises	The extent and efficiency of governmental supports for patients, low-income groups, closed businesses and vulnerable citizens during large-scale pandemics
	Preparation	Education and information	Adequate and timely education of citizens and informing them about the necessary actions and basic information by relevant institutions	Adequate and timely education of citizens regarding the necessary measures to mitigate the probability of infection (such as observing social distance, wearing masks, etc.) and informing them about possible dangers and threats
		Emergency services Planning for crisis management	The quality and efficiency of the emergency programs and services provided by the related agencies in the event of a disaster	The quality of programs and efficiency of the healthcare and other systems in public informing, providing medicine, and other required goods and equipment
		Expertise and labor	Experiences	The experiences of a community and its citizens in dealing with disasters and similar conditions which makes them more prepared for the emergency situation
	Specialized workforce Support workforce		The range of skilled and educated people (including doctors, nurses, pharmacist, police forces, etc.) available to a community that can use them in the event of disasters (such as pandemics) to cope with the shocks and reduce potential damages and casualties	The quality of programs and efficiency of the healthcare and other systems in public informing, providing medicine, and other required goods and equipment
Equipment	Available required tool	The extent of required tools and technologies (medical and hospital equipment, ICTs, etc) available to a community that can use them in the event of disasters (such as pandemics) to cope with the crises and reduce potential damages and casualties	The quality of programs and efficiency of the healthcare and other systems in public informing, providing medicine, and other required goods and equipment	
Social Resilience	Collective identity	Social reliance	Good supposition and trust in collective relationships with family members, relatives, friends and colleagues, citizens and others with whom the person is dealing during the day.	People's trust in other citizens to take care of each other, collect public donations and control the impacts of the pandemics in the diseases outbreak
		Social solidarity	Unity, harmony and loyalty that result from the shared interests, feelings, empathy and actions.	The level of social solidarity and unity in the face of pandemics and recovery process (volunteering, etc.)
		Social communication Social networks	Interactions and relationships between people that follow a set of norms and values. Networks are the types of communication that are established as a result of citizens' relationships and are responsible for building social interactions.	The level of social communication to help, give each other hope, care, etc. The efficiency of social networks (family networks, friends, etc.) in order to inform, help, give hope, etc. during the outbreak of the diseases
	Mutual support	Social partnership Social collaboration	Active participation of citizens in the political, economic, cultural and generally in all aspects of public life, which includes formal and informal participation, in various forms of governmental and non-governmental associations and organizations.	The level of citizens' participation in programs of controlling and mitigating the pandemics, such as public screening plans, self-quarantine, etc. It also includes their willingness to participate, donate, and work with local agencies to cope with this crisis
		Public protection	Self-quarantine Social distancing	

(continued on next page)

Table 3 (continued)

Dimension	Criteria	factors	General description of factors according to the literature	Redefinition of factors according to pandemic conditions
Economic Resilience	Public awareness	Public awareness	Public compliance with health guidelines and protection instructions such as self-quarantine and social distancing to reduce the risk of infection and ending the disease transmission chain in communities.	The level of citizens' awareness of the symptoms of the pandemics, methods of prevention and care, also information about medical centers, etc.
		Public readiness	Level of public awareness about crises and measures needed to cope with them	
	Social Justice	Public outlook	Citizens' preparedness (financially, physically, and psychologically) to face unexpected events and disasters.	Citizens' perspective about the future of community, and patients hopefulness for recovery
		Social equality	Citizens' equality in access to basic services, basic goods and required equipment to cope with the crisis	
Economic Resilience	Economic Sustainability	GDP	Economic sustainability and stability in order to provide required goods and services, mitigate damages to the citizens' livelihood and businesses due to the various disasters and crises, and to recover from them	Economic sustainability to compensate for damages to businesses and households due to long-term quarantine and lockdowns; Besides, in order to provide or import required medicine, goods and equipment
		Economic dynamism		
	Economic justice			
Infrastructural Resilience	Resources	Jobs security	Necessary resources (natural resources, financial resources, etc.) to reduce potential damages, and provide critical goods and services to citizens in the event of disasters	Available resources to produce and prepare food, medicine, required equipment as well as compensation for financial damages during the pandemics
		Agriculture and food security		
	Services	Financial resources	Residential services such as telephone, drinking water, domestic gas, renewable energy infrastructures, etc. Besides, welfare services that can maintain the quality of citizens life during crises	Welfare services, especially medical services and services that meet the daily needs of people, as well as access to pure drinking water, and sewage and waste disposal system, which helps to maintain citizen health and quality of life
		Natural resources		
		Allocated budget		
		Health and hygiene services		
		Retail and commercial services		
		Official services		
		Educational services		
		Piped purified water		
Public Spaces	Electricity	Urban and public spaces that allow citizens to socialize, have fun and meet their daily needs and buy required goods	Clean and safe public spaces where people can meet their daily needs and buy required goods during the pandemics	
	Heating energy			
Housing	Telephone and ICTs	Adequate housing that can reduce citizen's exposure in crises (especially pandemics) and protect them from many potential dangers. In pandemics, houses are the main refuge for people from pathogens.	Private vehicle and freight services that reduce the exposure rate in the city, also clean and efficient public transportation that allows citizens to travel quickly between the destinations	
	Squares and public centers			
Transportation	Local spaces and commercial streets	Efficient public transportation facilities, especially public transportation, which allows citizens to move between the destinations in times of crisis.		
	Parks, urban garden, green infrastructures			
Health, and Demographic Resilience	Life quality	Housing tenure	The overall level of well-being and life quality of the residents of a neighborhood or community that affects their ability to meet their daily need, care and prevent. Quality of life also affects citizens outlook and social vitality	
		Housing quality		
	Age & Health	Housing per capita	The overall citizens health (physical and psychological) that, in the event of crises, especially pandemics, reduce their vulnerability and lead to a mitigation in potential casualties.	
		Vehicle ownership		
	Hygiene	Public transportation	Appropriate health and sanitary equipment (such as masks, disinfectants, etc.) and the financial ability and willingness of people to use them to prevent infection	
		Freight		

psychological well-being, income and purchasing power also have great importance. The overall level of well-being and quality of residents' life in a neighborhood or community affects their ability to meet their daily needs and protect themselves against the pandemic. Quality of life also affects citizens' outlook and social vitality.

After identifying the dimensions of community resilience to pandemics, criteria and factors corresponding to each dimension are extracted from the related literature and presented in Table 3 that can form the basis for development of a community resilience assessment framework.

4. Summary and conclusion

In the present research, we found although many studies addressed the issue of community resilience to disasters such as floods and earthquakes, there is a limited number of comprehensive frameworks for evaluating the community resilience to pandemics. Moreover, the existing studies do not clearly discuss how each community' capital can contribute to pandemic resilience. Therefore, based on the related literature, we developed an assessment framework for community resilience to pandemics. Table 3, as the output of this study, is an integrated checklist that includes criteria and factors of a resilient community to pandemics in five dimensions institutional, social, economic, infrastructural, and demographic.

While most of the studies that contributed to this research have focused on urban contexts, the proposed framework could also be relevant to rural communities. However, while the criteria and indicators of community pandemic resilience in cities and villages are similar, they may receive different weight in assessments by decision-makers. For instance, agriculture and food security criteria are more important in rural communities than in urban ones [95]. In contrast, the mass transportation criterion takes on more weight through the assessment of urban community resilience [125].

The literature review also showed that a resilient community is a community in which different sectors, especially managerial institutions, social groups, and businesses, can work well together to minimize the vulnerability of citizens by reducing the potential infection rate at the first step. They must try to maintain and restore communities' normal function by preparing and supplying essential and required goods, especially medicine and healthcare equipment. In addition, components of different community stakeholders need to work jointly to adapt to the new situation and guide the community towards sustainable development.

As presented in Fig. 2, community resilience to the pandemics is a multidimensional approach with multiple criteria and factors. This suggests that government institutions must carefully plan for possible conditions and manage the community by monitoring the situation and potential risks to build a more resilient community to pandemics. These agencies must maintain an acceptable level of required equipment and goods for the pandemic to maintain the supply chain and their citizens' food security in the widespread disease outbreak. Governments must take these steps in partnership with citizens to increase the pace and efficiency of their programs. On the other hand, social groups, businesses, and also individuals must interact in high solidarity to control the situation. They must follow the instructions of experts to reduce the probability of infection and vulnerability. Concerning that "houses are the most immune refuge in the times of pandemics" and "the lower the exposure rate can lead to the lower infection rate," governmental and non-governmental organizations should reduce the presence of people in crowded public places and buildings by providing various services, preferably online or door-to-door. Of course, public spaces and transportation systems must also be adapted to the new conditions in order to be able to respond to the changes in the demand and common interests of the citizens.

Although the authors endeavored to review a wide range of literature to cover the various dimensions of the subject, this study

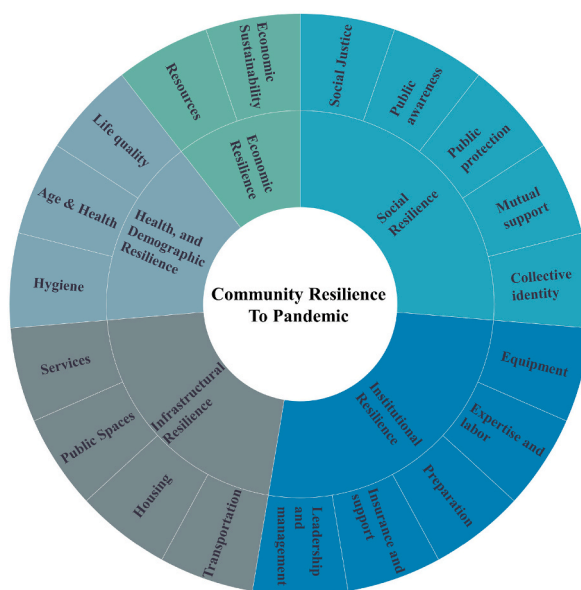


Fig. 2. Dimensions and criteria of community resilience to pandemics.

faced several limitations. The most significant limitation of this study was reviewing only articles and reports in English. However, many countries have prepared numerous reports in their local languages that could help complete this assessment framework. These local reports reflect context-based vulnerabilities that this research may have understudied. Another limitation of this research is the small number of literature that has addressed the resilience of communities in post-pandemic conditions. This limitation made the indicators related to post-pandemic conditions deficient. Therefore, this framework can be promoted in future studies, and its factors can be categorized into three conditions of pre-, during, and post-pandemic.

In conclusion, building resilient communities to pandemics requires an integrated assessment of the existing condition and developing a comprehensive action plan to motivate and control collective effort in different systems of the cities to mitigate probable damages and casualties, absorb shocks, and facilitate the redevelopment processes. Indeed, efforts to create resilient communities are not limited to before or during the outbreak of pandemics, and this needs to be a continuous process. Researchers in future studies can use this framework along with conventional assessment and ranking methods to determine the level of resilience or vulnerability of different communities and cities to pandemics, especially to the coronavirus outbreak. Context-specific empirical studies are needed to apply the proposed framework to different communities and examine possible ways to further improve it. It is also worth noting that investigating the expert opinions can adjust the proposed framework to different characteristics of different communities and lead to strengthening the community resilience assessment.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijdr.2022.103248>.

References

- [1] World Health Organization (WHO), Coronavirus Disease (COVID-19) Advice for the Public, 2020 [Online]. At: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public?gclid=EALaIqobChMI0OrU7rv36gIVygorCh1fNg3UEAAAYASAAEgKNwPD_BwE. (Accessed 10 November 2020). Accessed.
- [2] A. Kumar, R. Singh, J. Kaur, et al., Wuhan to world: the COVID-19 pandemic, *Front. Cell. Infect. Microbiol.* 11 (2021), 596201, <https://doi.org/10.3389/fcimb.2021.596201>.
- [3] A. Sharifi, A.R. Khavarian-Garmsir, The COVID-19 pandemic: impacts on cities and major lessons for urban planning, design, and management, *Sci. Total Environ.* 749 (2020) 1–3, <https://doi.org/10.1016/j.scitotenv.2020.142391>.
- [4] W. Xu, L. Xiang, D. Proverbs, S. Xiong, The influence of COVID-19 on community disaster resilience, *Int. J. Environ. Res. Publ. Health* 18 (1) (2021) 1–18, <https://doi.org/10.3390/ijerph18010088>.
- [5] O. Alonge, S. Sonkarlay, W. Gwaikolo, C. Fahim, J.L. Cooper, D.H. Peters, Understanding the role of community resilience in addressing the Ebola virus disease epidemic in Liberia: a qualitative study (community resilience in Liberia), *Glob. Health Action* 12 (1) (2019), <https://doi.org/10.1080/16549716.2019.1662682>.
- [6] R. Banai, Pandemic and the planning of resilient cities and regions, *Cities* 106 (2020), 102929, <https://doi.org/10.1016/j.cities.2020.102929>. September.
- [7] A. Cheshmezangi, *The city in need: urban resilience and city management in disruptive disease outbreak events*, in: *The City in Need*, 2020.
- [8] S.V. Mishra, A. Gayen, S.M. Haque, COVID-19 and urban vulnerability in India, *Habitat Int.* 103 (2020), 102230, <https://doi.org/10.1016/j.habitatint.2020.102230>. July.
- [9] A. DeWit, R. Shaw, R. Djalante, An integrated approach to sustainable development, National Resilience, and COVID-19 responses: the case of Japan, *Int. J. Disaster Risk Reduc.* 51 (2020), 101808, <https://doi.org/10.1016/j.ijdr.2020.101808>. July.
- [10] A. Sharifi, Urban resilience assessment: mapping knowledge structure and trends, *Sustainability* 12 (15) (2020) 1–18, <https://doi.org/10.3390/SU12155918>.
- [11] C.S. Holling, Resilience and stability of ecological systems, *Annu. Rev. Ecol. Evol. Syst.* 4 (1973) 1–23.
- [12] A. Santos, N. Sousa, H. Kremers, J.L. Bucho, Building resilient urban communities: the case study of setubal municipality, Portugal, *Geosciences* 10 (6) (2020) 1–13, <https://doi.org/10.3390/geosciences10060243>.
- [13] A. Sharifi, A critical review of selected tools for assessing community resilience, *Ecol. Indic.* 69 (2016) 629–647, <https://doi.org/10.1016/j.ecolind.2016.05.023>.
- [14] F. Moraci, M.F. Errigo, C. Fazio, T. Campisi, F. Castelli, Cities under pressure: strategies and tools to face climate change and pandemic, *Sustainability* 12 (18) (2020) 1–31, <https://doi.org/10.3390/su12187743>.
- [15] A. Jovanović, P. Klimek, O. Renn, R. Schneider, K. Øien, J. Brown, M. DiGennaro, Y. Liu, V. Pfau, M. Jelić, T. Rosen, B. Caillard, S. Chakravarty, P. Chhantyal, Assessing resilience of healthcare infrastructure exposed to COVID-19: emerging risks, resilience indicators, interdependencies and international standards, *Environ. Syst. Decis.* 40 (Issue 2) (2020) 252–286, <https://doi.org/10.1007/s10669-020-09779-8>.
- [16] M. Sakurai, H. Chughtai, Resilience against crises: COVID-19 and lessons from natural disasters, *Eur. J. Inf. Syst.* 29 (5) (2020) 585–594, <https://doi.org/10.1080/0960085X.2020.1814171>.
- [17] J. Haldon, M. Eisenberg, L. Mordechai, A. Izdebski, S. White, Lessons from the past, policies for the future: resilience and sustainability in past crises, *Environ. Syst. Decis.* 40 (2) (2020) 287–297, <https://doi.org/10.1007/s10669-020-09778-9>.
- [18] OECD, *Resilience Systems Analysis: Eastern DRC, Final Report*, 2014.
- [19] B. Manyena, F. Machingura, P. O'Keefe, Disaster Resilience Integrated Framework for Transformation (DRIFT): a new approach to theorising and operationalising resilience, *World Dev.* 123 (2019), 104587, <https://doi.org/10.1016/j.worlddev.2019.06.011>.
- [20] B. Borskova, P. Nijkamp, P. Guevara, Urban resilience patterns after an external shock: an exploratory study, *Int. J. Disaster Risk Reduc.* 31 (2018) 381–392, <https://doi.org/10.1016/j.ijdr.2018.05.012>. ISSN 2212-4209.

- [21] L. Chelleri, A. Baravikova, Understandings of urban resilience meanings and principles across Europe, *Cities* 108 (2021), 102985, <https://doi.org/10.1016/j.cities.2020.102985>, 0264-2751.
- [22] G. Datola, M. Bottero, E. De Angelis, F. Romagnoli, Operationalising resilience: a methodological framework for assessing urban resilience through System Dynamics Model, *Ecol. Model.* 465 (2022), 109851, <https://doi.org/10.1016/j.ecolmodel.2021.109851>. ISSN 0304-3800.
- [23] D. Feldmeyer, D. Wilden, C. Kind, T. Kaiser, R. Goldschmidt, C. Diller, J. Birkmann, Indicators for monitoring urban climate change resilience and adaptation, *Sustainability* 11 (2019) 2931, <https://doi.org/10.3390/su11102931>.
- [24] L. Figueiredo, T. Honiden, A. Schumann, Indicators for Resilient Cities[®], OECD Regional Development Working Papers, No. 2018/02, OECD Publishing, Paris, 2018, <https://doi.org/10.1787/6f1f6065-en>.
- [25] S. Afrin, F.J. Chowdhury, M. Rahman, COVID-19 pandemic: rethinking strategies for resilient urban design, perceptions and planning, *Front. Sustain. Cities* 3 (2021) 32, <https://doi.org/10.3389/frsc.2021.668263>.
- [26] G. Büyükoçkan, Ö. Ilıcak, O. Feyzioğlu, A review of urban resilience literature, *Sustain. Cities Soc.* 77 (2022), 103579, <https://doi.org/10.1016/j.scs.2021.103579>.
- [27] H. Alizadeh, A. Sharifi, Social resilience promotion factors during the COVID-19 pandemic: insights from Urmia, Iran, *Urban Sci.* 6 (1) (2022) 14, <https://doi.org/10.3390/urbansci6010014>.
- [28] C. Wang, T. Zhang, W. Xu, H. Ruan, J. Tang, Social capital, technological empowerment, and resilience in rural China, *Int. J. Environ. Res. Publ. Health* 18 (22) (2021), 11883, <https://doi.org/10.3390/ijerph182211883>.
- [29] S.L. Cutter, L. Barnes, M. Berry, C. Burton, E. Evans, E. Tate, J. Webb, A place-based model for understanding community resilience to natural disasters, *Global Environ. Change* 18 (4) (2008) 598–606, <https://doi.org/10.1016/j.gloenvcha.2008.07.6>.
- [30] S.L. Cutter, K.D. Ash, C.T. Emrich, The geographies of community disaster resilience, *Global Environ. Change* 29 (2014) 65–77, <https://doi.org/10.1016/j.gloenvcha.2014.08>.
- [31] J. Joerin, R. Shaw, Y. Takeuchi, R. Krishnamurthy, Assessing community resilience to climate-related disasters in Chennai, India, *Int. J. Disaster Risk Reduc.* 1 (2012) 44–54, <https://doi.org/10.1016/j.ijdr.2012.05.006>.
- [32] M. Zhong, K. Lin, G. Tang, Q. Zhang, Y. Hong, X. Chen, A framework to evaluate community resilience to urban floods: a case study in three communities, *Sustainability* 12 (4) (2020) 1521, <https://doi.org/10.3390/su12041521>.
- [33] M. Bruneau, S.E. Chang, R.T. Eguchi, G.C. Lee, T.D. O'Rourke, A.M. Reinhorn, D. von Winterfeldt, A framework to quantitatively assess and enhance the seismic resilience of communities, *Earthq. Spectra* 19 (4) (2003) 733–752, <https://doi.org/10.1193/1.1623497>.
- [34] S. Ainuddin, J.K. Routray, Earthquake hazards and community resilience in Baluchistan, *Nat. Hazards* 63 (2) (2012) 909–937, <https://doi.org/10.1007/s11069-012-0201-x>.
- [35] E. Massaro, A. Ganin, N. Perra, I. Linkov, A. Vespignani, Resilience management during large-scale epidemic outbreaks, *Sci. Rep.* 8 (1) (2018) 1–9, <https://doi.org/10.1038/s41598-018-19706-2>.
- [36] A. Lak, P. Hakimian, A. Sharifi, An evaluative model for assessing pandemic resilience at the neighborhood level: the case of Tehran, *Sustain. Cities Soc.* 75 (2021), 103410, <https://doi.org/10.1016/j.scs.2021.103410>.
- [37] A. Liberati, D.G. Altman, J. Tetzlaff, C. Mulrow, P.C. Gøtzsche, J.P.A. Ioannidis, M. Clarke, P.J. Devereaux, J. Kleijnen, D. Moher, The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration, *J. Clin. Epidemiol.* 62 (Issue 10) (2009), <https://doi.org/10.1016/j.jclinepi.2009.06.006>.
- [38] M.J. Page, J.E. McKenzie, P.M. Bossuyt, et al., The PRISMA 2020 statement: an updated guideline for reporting systematic reviews, *BMJ* (2021), <https://doi.org/10.1136/bmj.n71>.
- [39] U. Kuckartz, S. Rädiker, Working with bibliographic information and creating literature reviews, in: *Analyzing Qualitative Data with MAXQDA*, Springer, Cham, 2019, https://doi.org/10.1007/978-3-030-15671-8_14.
- [40] H. Gong, R. Hassink, J. Tan, D. Huang, Regional resilience in times of a pandemic crisis: the case of COVID-19 in China, *Tijdschr. Econ. Soc. Geogr.* 111 (3) (2020) 497–512, <https://doi.org/10.1111/tesg.12447>.
- [41] World Health Organization (WHO), *Weekly Epidemiological and Operational Updates*, 2022. March 2022.
- [42] World Bank, The Potential Impact of COVID-19 on GDP and Trade: A Preliminary Assessment. April, 2020, <https://doi.org/10.1596/1813-9450-9211>.
- [43] J. Mikolaj, K. Keenan, H. Kulu, Intersecting household-level health and socio-economic vulnerabilities and the COVID-19 crisis: an analysis from the UK, *SSM - Populat. Health* 12 (2020), 100628, <https://doi.org/10.1016/j.ssmph.2020.100628>.
- [44] G. Elcherth, J. Drury, Collective resilience in times of crisis: lessons from the literature for socially effective responses to the pandemic, *Br. J. Soc. Psychol.* 59 (3) (2020) 703–713, <https://doi.org/10.1111/bjso.12403>.
- [45] A. Kiaghadi, H.S. Rifai, W. Liaw, Assessing COVID-19 risk, vulnerability and infection prevalence in communities, *PLoS One* 15 (10) (2020) 1–21, <https://doi.org/10.1371/journal.pone.0241166>. October.
- [46] S. Kimhi, H. Marciano, Y. Eshel, B. Adini, Recovery from the COVID-19 pandemic: distress and resilience, *Int. J. Disaster Risk Reduc.* 50 (2020), 101843, <https://doi.org/10.1016/j.ijdr.2020.101843>. June.
- [47] X. Chen, R. Quan, A spatiotemporal analysis of urban resilience to the COVID-19 pandemic in the Yangtze River Delta, *Nat. Hazards* 555 (2021), <https://doi.org/10.1007/s11069-020-04493-9>.
- [48] A. Asadzadeh, T. Kötter, A. Fekete, et al., Urbanization, migration, and the challenges of resilience thinking in urban planning: insights from two contrasting planning systems in Germany and Iran, *Cities* 125 (2022), <https://doi.org/10.1016/j.cities.2022.103642>.
- [49] C. Bryce, P. Ring, S. Ashby, J.K. Wardman, Resilience in the face of uncertainty: early lessons from the COVID-19 pandemic, *J. Risk Res.* 23 (7–8) (2020) 880–887, <https://doi.org/10.1080/13669877.2020.1756379>.
- [50] R.B. Duffey, E. Zio, COVID-19 pandemic trend modeling and analysis to support resilience decision-making, *Biology* 9 (7) (2020) 1–13, <https://doi.org/10.3390/biology9070156>.
- [51] S. Hezer, E. Gelmez, E. Özceylan, Comparative analysis of TOPSIS, VIKOR and COPRAS methods for the COVID-19 regional safety assessment, *J. Infect. Publ. Health* (2021) 775–786, <https://doi.org/10.1016/j.jiph.2021.03.003>.
- [52] M. Acuto, COVID-19: Lessons for an Urban(izing) World, *One Earth* (2020), <https://doi.org/10.1016/j.oneear.2020.04.004>.
- [53] L.S. Lau, G. Samari, R.T. Moresky, S.E. Casey, S.P. Kachur, L.F. Roberts, M. Zard, COVID-19 in humanitarian settings and lessons learned from past epidemics, *Nat. Med.* 26 (5) (2020) 647–648, <https://doi.org/10.1038/s41591-020-0851-2>.
- [54] S.J. Kim, W. Bostwick, Social vulnerability and racial inequality in COVID-19 deaths in Chicago, *Health Educ. Behav.* 47 (4) (2020) 509–513, <https://doi.org/10.1177/1090198120929677>.
- [55] M.S. Golan, L.H. Jernegan, I. Linkov, Trends and applications of resilience analytics in supply chain modeling: systematic literature review in the context of the COVID-19 pandemic, *Environ. Syst. Decis.* 40 (2) (2020) 222–243, <https://doi.org/10.1007/s10669-020-09777-7>.
- [56] M.F. Rahmadana, G.H. Sagala, Economic resilience dataset in facing physical distancing during COVID-19 global pandemic, *Data Brief* 32 (2020), 106069, <https://doi.org/10.1016/j.dib.2020.106069>.
- [57] W. Hynes, B. Trump, P. Love, I. Linkov, Bouncing forward: a resilience approach to dealing with COVID-19 and future systemic shocks, *Environ. Syst. Decis.* 40 (2) (2020) 174–184, <https://doi.org/10.1007/s10669-020-09776-x>.
- [58] I. Noy, N. Doan, B. Ferrarini, D. Park, Measuring the economic risk of COVID-19, *Global Pol.* 11 (4) (2020) 413–423, <https://doi.org/10.1111/1758-5899.12851>.
- [59] T. Campisi, S. Basbas, A. Skoufias, N. Akgün, D. Ticali, G. Tesoriere, The impact of COVID-19 pandemic on the resilience of sustainable mobility in Sicily, *Sustainability* 12 (21) (2020), <https://doi.org/10.3390/su12218829>.
- [60] J.M. Keenan, COVID, resilience, and the built environment, *Environ. Syst. Decis.* 40 (2) (2020) 216–221, <https://doi.org/10.1007/s10669-020-09773-0>.
- [61] A. Lak, S.S. Asl, A. Maher, Resilient urban form to pandemics: lessons from COVID-19, *Med. J. Islam. Repub. Iran* 34 (1) (2020) 1–9, <https://doi.org/10.34171/mjiri.34.71>.

- [62] R. Acharya, A. Porwal, A vulnerability index for the management of and response to the COVID-19 epidemic in India: an ecological study, *Lancet Global Health* 8 (9) (2020) e1142–e1151, [https://doi.org/10.1016/S2214-109X\(20\)30300-4](https://doi.org/10.1016/S2214-109X(20)30300-4).
- [63] A.H. Aghapour, M. Yazdani, F. Jolai, M. Mojtahedi, Capacity planning and reconfiguration for disaster-resilient health infrastructure, *J. Build. Eng.* 26 (2019), 100853, <https://doi.org/10.1016/j.jobe.2019.100853>. June.
- [64] R. Djalante, R. Shaw, A. DeWit, Building resilience against biological hazards and pandemics: COVID-19 and its implications for the Sendai Framework, *Progr. Disas. Sci.* 6 (2020), 100080, <https://doi.org/10.1016/j.pdisas.2020.100080>.
- [65] Z. Austin, P. Gregory, Resilience in the time of pandemic: the experience of community pharmacists during COVID-19, *Res. Soc. Adm. Pharm.* 17 (1) (2021) 1867–1875, <https://doi.org/10.1016/j.sapharm.2020.05.027>.
- [66] OECD, *Building Resilience to the COVID-19 Pandemic: the Role of Centers of Government. OECD Policy Responses to Coronavirus (COVID-19)*, 2020.
- [67] S. Bindal, P. Acharya, A.K. Gupta, J. Kishore, Enhancing epidemic resilience: planning and institutional resilience, Indian Institute of Technology, National Institute of Disaster Management, in: *Integrated Risk of Pandemic: COVID-19 Impacts, Resilience and Recommendations. Disaster Resilience and Green Growth*, Springer, Singapore, 2020, https://doi.org/10.1007/978-981-15-7679-9_23.
- [68] OECD, *The Territorial Impact of COVID-19: Managing the Crisis across Levels of Government. OECD Policy Responses to Coronavirus (COVID-19)*, 2020.
- [69] S. Akter, S.S. Hakim, M.S. Rahman, Planning for pandemic resilience: COVID-19 experience from urban slums in Khulna, Bangladesh, *J. Urban Manag.* (2021), <https://doi.org/10.1016/j.jum.2021.08.003>.
- [70] C. Stevenson, J.R. Wakefield, I. Felsner, J. Drury, S. Costa, Collectively coping with coronavirus: local community identification predicts giving support and lockdown adherence during the COVID-19 pandemic, *Br. J. Soc. Psychol.* 60 (4) (2021) 1403–1418, <https://doi.org/10.1111/bjso.12457>.
- [71] D. Ozdemir, M. Sharma, A. Dhir, T. Daim, Supply chain resilience during the COVID-19 pandemic, *Technol. Soc.* 68 (2022), 101847, <https://doi.org/10.1016/j.techsoc.2021.101847>.
- [72] M. Everard, P. Johnston, D. Santillo, C. Staddon, The role of ecosystems in mitigation and management of Covid-19 and other zoonoses, *Environ. Sci. Pol.* 111 (2020) 7–17, <https://doi.org/10.1016/j.envsci.2020.05.017>.
- [73] S. Kimhi, H. Marciano, Y. Eshel, B. Adini, Resilience and demographic characteristics predicting distress during the COVID-19 crisis, *Soc. Sci. Med.* 265 (2020), 113389, <https://doi.org/10.1016/j.socscimed.2020.113389>.
- [74] S. Moloney, A. Doyon, The Resilient Melbourne experiment: analyzing the conditions for transformative urban resilience implementation, *Cities* 110 (2021), 103017, <https://doi.org/10.1016/j.cities.2020.103017>.
- [75] M. Loxton, R. Trusket, B. Scarf, L. Sindone, G. Baldry, Y. Zhao, Consumer behavior during crises: preliminary research on how coronavirus has manifested consumer panic buying, herd mentality, changing discretionary spending and the role of the media in influencing behavior, *J. Risk Financ. Manag.* 13 (8) (2020) 166, <https://doi.org/10.3390/jrfm13080166>.
- [76] S. Ahmed, M. Ajisola, K. Azeem, et al., Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements, *BMJ Global Health* 5 (8) (2020), e003042, <https://doi.org/10.1136/bmjgh-2020-003042>.
- [77] D. Thilmany, E. Canales, S.A. Low, K. Boys, Local food supply chain dynamics and resilience during COVID-19, *Appl. Econ. Perspect. Pol.* (2020) 1–34, <https://doi.org/10.1002/aep.13121>.
- [78] Z. Chu, M. Cheng, M. Song, What determines urban resilience against COVID-19: city size or governance capacity? *Sustain. Cities Soc.* 75 (2021), 103304 <https://doi.org/10.1016/j.scs.2021.103304>.
- [79] A. Sharifi, A.R. Khavarian-Garmsir, R.K.R. Kummitha, Contributions of smart city solutions and technologies to resilience against the COVID-19 pandemic: a literature review, *Sustainability* 13 (14) (2021) 8018, <https://doi.org/10.3390/su13148018>.
- [80] A. Abu-Rayash, I. Dincer, Development of integrated sustainability performance indicators for better management of smart cities, *Sustain. Cities Soc.* 67 (2021), 102704, <https://doi.org/10.1016/j.scs.2020.102704>.
- [81] C. Kim, K. Kim, The institutional change from e-government toward smarter city; comparative analysis between Royal Borough of Greenwich, UK, and Seongdong-gu, South Korea, *J. Open Innov. Technol. Mark. Compl.* 7 (1) (2021) 42, <https://doi.org/10.3390/joitmc7010042>.
- [82] J.S. Fernández-Prados, A. Lozano-Díaz, J. Muyor-Rodríguez, Factors explaining social resilience against COVID-19: the case of Spain, *Eur. Soc.* (2020) 1–11, <https://doi.org/10.1080/14616696.2020.1818113>, 0(0).
- [83] C.D. Butler, Pandemics: the limits to growth and environmental health research, *Curr. Opin. Environ. Sustain.* 46 (2020) 3–5, <https://doi.org/10.1016/j.cosust.2020.10.005>.
- [84] N. Pitas, C. Ehmer, Social capital in the response to COVID-19, *Am. J. Health Promot.* 34 (8) (2020) 942–944, <https://doi.org/10.1177/0890117120924531>.
- [85] G.I. Bhaskara, V. Filimonau, The COVID-19 pandemic and organizational learning for disaster planning and management: a perspective of tourism businesses from a destination prone to consecutive disasters, *J. Hospit. Tourism Manag.* 46 (2021) 364–375, <https://doi.org/10.1016/j.jhtm.2021.01.011>. November 2020.
- [86] S. Michel, K. Megerdumian, *Modeling Community Resilience for a Post-epidemic Society*, Computational Social Science Society of the Americas, 2015, pp. 1–21. October.
- [87] P. Bukuluki, H. Mwenyango, S.P. Katongole, D. Sidhva, G. Palattiyil, The socio-economic and psychosocial impact of COVID-19 pandemic on urban refugees in Uganda, *Soc. Sci. Hum. Open* 2 (1) (2020), 100045, <https://doi.org/10.1016/j.ssaho.2020.100045>.
- [88] T.S. Gaynor, M.E. Wilson, Social vulnerability and equity: the disproportionate impact of COVID-19, *Publ. Adm. Rev.* 80 (5) (2020) 832–838, <https://doi.org/10.1111/puar.13264>.
- [89] F.F. Tavares, G. Betti, The pandemic of poverty, vulnerability, and COVID-19: evidence from a fuzzy multidimensional analysis of deprivations in Brazil, *World Dev.* 139 (2021), <https://doi.org/10.1016/j.worlddev.2020.105307>.
- [90] D. Maison, D. Jaworska, D. Adamczyk, D. Affeltowicz, The challenges arising from the COVID-19 pandemic and the way people deal with them. A qualitative longitudinal study, *PLoS One* 16 (10) (2021), e0258133, <https://doi.org/10.1371/journal.pone.0258133>.
- [91] K. Sato, N. Kondo, K. Kondo, Pre-pandemic individual- and community-level social capital and depressive symptoms during COVID-19: a longitudinal study of Japanese older adults in 2019–21, *Health Place* (2022), <https://doi.org/10.1016/j.healthplace.2022.102772>.
- [92] H.R. Bassett, J. Lau, C. Giordano, S.K. Suri, S. Advani, S. Sharan, Preliminary lessons from COVID-19 disruptions of small-scale fishery supply chains, *World Dev.* 143 (2021), 105473, <https://doi.org/10.1016/j.worlddev.2021.105473>.
- [93] R.F. Ceylan, B. Ozkan, E. Mulazimgullari, Historical evidence for economic effects of COVID-19, *Eur. J. Health Econ.* 21 (6) (2020) 817–823, <https://doi.org/10.1007/s10198-020-01206-8>.
- [94] L.A. Duguma, M. van Noordwijk, P.A. Minang, K. Muthee, COVID-19 pandemic and agroecosystem resilience: early insights for building better futures, *Sustainability* 13 (3) (2021) 1–22, <https://doi.org/10.3390/su13031278>.
- [95] S. Fan, P. Teng, P. Chew, G. Smith, L. Copeland, Food system resilience and COVID-19 – lessons from the Asian experience, *Global Food Secur.* 28 (2021), 100501, <https://doi.org/10.1016/j.gfs.2021.100501>.
- [96] Y. Qian, W. Fan, Who loses income during the COVID-19 outbreak? Evidence from China, *Res. Soc. Stratif. Mobil.* 68 (2020), 100522, <https://doi.org/10.1016/j.rssm.2020.100522>. June.
- [97] R. Dai, D. Mookherjee, Y. Qian, X. Zhang, Industrial clusters, networks and resilience to the COVID-19 shock in China, *J. Econ. Behav. Organ.* 183 (2021) 433–455, <https://doi.org/10.1016/j.jebo.2021.01.017>.
- [98] F. Ceballos, S. Kannan, B. Kramer, Impacts of a national lockdown on smallholder farmers' income and food security: empirical evidence from two states in India, *World Dev.* 136 (2020), 105069, <https://doi.org/10.1016/j.worlddev.2020.105069>.
- [99] M.K. Kansime, J.A. Tambo, I. Mugambi, M. Bundi, A. Kara, C. Owuor, COVID-19 implications on household income and food security in Kenya and Uganda: findings from a rapid assessment, *World Dev.* 137 (2021), 105199, <https://doi.org/10.1016/j.worlddev.2020.105199>.
- [100] X. Wu, X. Li, Y. Lu, M. Hout, Two tales of one city: unequal vulnerability and resilience to COVID-19 by socioeconomic status in Wuhan, China, *Res. Soc. Stratif. Mobil.* 72 (2021), 100584, <https://doi.org/10.1016/j.rssm.2021.100584>. August 2020.

- [101] M. Leach, H. MacGregor, I. Scoones, A. Wilkinson, Post-pandemic transformations: how and why COVID-19 requires us to rethink development, *World Dev.* 138 (2021), 105233, <https://doi.org/10.1016/j.worlddev.2020.105233>.
- [102] S. Beninger, J.N.P. Francis, Resources for business resilience in a COVID-19 world: a community-centric approach, *Bus. Horiz.* (2021), <https://doi.org/10.1016/j.bushor.2021.02.048>.
- [103] W.H. Finch, M.E. Hernández Finch, Poverty and Covid-19: Rates of Incidence and Deaths in the United States During the First 10 Weeks of the Pandemic, *Front. Sociol.* (2020), <https://doi.org/10.3389/fsoc.2020.00047>.
- [104] J. Jung, J. Manley, V. Shrestha, Coronavirus infections and deaths by poverty status: The effects of social distancing, *Journal of Economic Behavior & Organization* (2021), <https://doi.org/10.1016/j.jebo.2020.12.019>.
- [105] A. Kumar, S. Luthra, S.K. Mangla, Y. Kazançoğlu, COVID-19 impact on sustainable production and operations management, *Sustain. Oper. Comput.* 1 (2020) 1–7, <https://doi.org/10.1016/j.susoc.2020.06.001>.
- [106] J. Wang, Y. Yang, J. Peng, L. Yang, Z. Gou, Y. Lu, Moderation effect of urban density on changes in physical activity during the coronavirus disease 2019 pandemic, *Sustain. Cities Soc.* 72 (2021), 103058, <https://doi.org/10.1016/j.scs.2021.103058>.
- [107] Z. Allam, D.S. Jones, Pandemic stricken cities on lockdown. Where are our planning and design professionals [now, then and into the future]? *Land Use Pol.* 97 (2020), 104805 <https://doi.org/10.1016/j.landusepol.2020.104805>. May.
- [108] L. Seidlein, G. Alabaster, J. Deen, J. Knudsen, Crowding has consequences: prevention and management of COVID-19 in informal urban settlements, *Build. Environ.* 188 (2021), 107472, <https://doi.org/10.1016/j.buildenv.2020.107472>. November 2020.
- [109] K. Imdad, M. Sahana, M.J. Rana, I. Haque, P.P. Patel, M. Pramanik, A district-level susceptibility and vulnerability assessment of the COVID-19 pandemic's footprint in India, *Spat. Spat.-Temp. Epidemiol.* 36 (2021), 100390, <https://doi.org/10.1016/j.sste.2020.100390>.
- [110] UN-Habitat, *Cities and Pandemics: towards a More Just, Green and Healthy Future*, 2021.
- [111] B. Li, Y. Peng, H. He, M. Wang, T. Feng, Built environment and early infection of COVID-19 in urban districts: a case study of Huangzhou, *Sustain. Cities Soc.* 66 (2021) 1–10, <https://doi.org/10.1016/j.scs.2020.102685>. August 2020.
- [112] J. Chen, X. Guo, H. Pan, S. Zhong, What determines city's resilience against epidemic outbreak: evidence from China's COVID-19 experience, *Sustain. Cities Soc.* 70 (2021), 102892, <https://doi.org/10.1016/j.scs.2021.102892>.
- [113] M. Sasidharan, A. Singh, M.E. Torbaghan, A.K. Parlikad, A vulnerability-based approach to human-mobility reduction for countering COVID-19 transmission in London while considering local air quality, *Sci. Total Environ.* 741 (2020), 140515, <https://doi.org/10.1016/j.scitotenv.2020.140515>.
- [114] H. Ghasemi, H. Yazdani, E.H. Fini, Y. Mansourpanah, Interactions of SARS-CoV-2 with inanimate surfaces in built and transportation environments, *Sustain. Cities Soc.* 72 (2021), 103031, <https://doi.org/10.1016/j.scs.2021.103031>.
- [115] M. Hanzl, Urban forms and green infrastructure – the implications for public health during the COVID-19 pandemic, *Cities Health* (2020) 1–5, <https://doi.org/10.1080/23748834.2020.1791441>, 00(00).
- [116] C.M. Huerta, A. Utomo, Evaluating the association between urban green spaces and subjective well-being in Mexico City during the COVID-19 pandemic, *Health Place* (2021), <https://doi.org/10.1016/j.healthplace.2021.102606>.
- [117] L. McGuire, S.L. Morris, T.M. Pollard, Community gardening and wellbeing: the understandings of organizers and their implications for gardening for health, *Health Place* (2022), <https://doi.org/10.1016/j.healthplace.2022.102773>.
- [118] B. Snyder, V. Parks, Spatial variation in socio-ecological vulnerability to Covid-19 in the contiguous United States, *Health Place* (2020), <https://doi.org/10.1016/j.healthplace.2020.102471>.
- [119] A. Aitsi-Selmi, S. Egawa, H. Sasaki, C. Wannous, V. Murray, The sendai framework for disaster risk reduction: renewing the global commitment to people's resilience, health, and well-being, *Int. J. Disas. Risk Sci.* 6 (2) (2015) 164–176, <https://doi.org/10.1007/s13753-015-0050-9>.
- [120] C. Machado, D. Melina Nassif Mantovani Ribeiro, A. Backx Noronha Viana, Public health in times of crisis: an overlooked variable in city management theories? *Sustain. Cities Soc.* 66 (2021), 102671 <https://doi.org/10.1016/j.scs.2020.102671>.
- [121] Mental Health Foundation (MHF), *Building Resilient Communities*, 2013.
- [122] T. Saghapour, B. Giles-Corti, A. Jafari, A. Qaisrani, G. Turrell, Supporting pandemic disease preparedness: development of a composite index of area vulnerability, *Health Place* (2021), <https://doi.org/10.1016/j.healthplace.2021.102629>.
- [123] F.D. Algahtani, S.-N. Hassan, B. Alsaif, R. Zrieq, Assessment of the quality of life during COVID-19 pandemic: a cross-sectional survey from the Kingdom of Saudi Arabia, *Int. Environ. Res. Publ. Health* 18 (3) (2021), <https://doi.org/10.3390/ijerph18030847>.
- [124] R.J. Ferreira, F. Buttell, C. Cannon, COVID-19: immediate predictors of individual resilience, *Sustainability* 12 (16) (2020), <https://doi.org/10.3390/su12166495>.
- [125] A. Majewska, M. Denis, E. Jarecka-Bidzińska, J. Jaroszewicz, W. Krupowicz, Pandemic resilient cities: possibilities of repairing Polish towns and cities during COVID-19 pandemic, *Land Use Pol.* 113 (2022), 105904, <https://doi.org/10.1016/j.landusepol.2021.105904>.