Urban Resilience: Relation between COVID-19 and Urban Environment in Amman City

Layla Mujahed

Abstract—COVID-19 is an exam for all the city's systems. It shows many gaps in the systems such as healthcare, economic, social, and environment. This pandemic is paving for a new era, an era of technology and it has changed people's lives, such as physical, and emotional changes, and converting communication into digitalized. The effect of COVID-19 has covered all urban city parts. COVID-19 will not be the last pandemic our cities will face. For that, more researches focus on enhancing the quality of the urban environment. This pandemic encourages a rethinking of the environment's role, especially in cities. Cities are trying to provide the best suitable strategies and regulations to prevent the spread of COVID-19, and an example of that is Amman city. Amman has a high increment in the number of COVID-19 infected people, while it has controlled the situation for months. For that, this paper studies the relation between COVID-19 and urban environmental studies cases about cities around the world, and learns from their models to face COVID-19. In Amman, people's behavior has changed towards public transportation and public green spaces. New governmental regulations focus on increasing people's mental awareness, supporting local businesses, and enhancing neighborhood planning that can help Amman to face any future pandemics.

Keywords—COVID-19, urban environment, urban planning, urban resilience.

I. INTRODUCTION

AMMAN is Jordan's capital, and it is located on the Western side of Asia [57]. The country has borders with Syria, Occupied Palestine, Iraq, and Saudi Arabia [57]. Amman is the main economic, and cultural city in Jordan, and it has 42% of its population (2018) [57].

In Jordan, until 7th October 2020, the number of confirmed cases is 19,001, recovered are 5,386, and deaths are 122 [27] (Figs. 1, 2).

Amman can still be considered in the first wave since there is no drop in the number of cases since the first recorded case. The number of COVID-19 cases in the first half of 2020 (2nd of March until 15th of June) is 226 [27], while the number of infected people in the first half of the year (from 16th of June until 6th of October) is 11,047 [27], which shows the high increment in the number of cases. Besides, there was a lockdown and curfew from the mid of March until the end of May. During this time, the ability to contain the pandemic became well comparing with the second half of the year, which became harder, especially with the healthcare staff exhaustion and shortage [59]. Besides, the economy has affected by the curfew, where 51% of enterprises closed tentatively, while 39% of companies continued to work but

Layla Mujahed is with the Beijing JiaoTong University, Beijing, China (e-mail: layla.mujahed12@ gmail.com).

reduced the number of employees [31].

The government has provided new regulations to decrease the crowdedness in Amman city and other Jordanian cities, through controlling the mobility and reduce the crowded spaces such as retails and recreation centers to 89% of its capacity, workspaces were reduced by 81% and grocery stores by 89% [9]. During the lockdown, it is hard to balance between the health and economy. The economic shortage can affect social safety and may take years to rebound [66].

Responding only to COVID-19 will not enhance the city's situation; COVID-19 should be connected to other city challenges and urban area problems, especially that 95% of the population in Jordan live in 5% of the country's land [37]. For that, studying the urban environment can help focus on the right strategies and solutions for this pandemic, and this study works on the relation between COVID-19 and the urban environment to find new ways that are needed to apply to reduce the spread of COVID-19.

II. METHODOLOGY

This paper uses two methods for the research process; the first method is through a questionnaire survey for Amman residents to collect and study the behavior change between before and after the COVID-19 spread in the urban environment. The second method is through focusing on selected cities. These cities were chosen related to their scale or their population the same as Amman. Each city was studied by its density, the number of COVID-19 infected people, percentage of public green spaces, work-life balance, and its model in facing the pandemic. Then we focus on which characteristics are connected more to the spread of COVID-19, and which strategies can be implemented in Amman to help overcome the increment of cases or any future pandemic.

III. LITERATURE REVIEW

A. COVID-19 Pandemic

COVID-19 is a disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [46], transmitted to humans from bats through intermediate host [71]. There is no specific vaccine until now for this disease [10]. COVID-19 is an example of how fast any disease can spread in urban cities and affect all sectors of life [29]. COVID-19 can spread faster and wider in cities with high inequality than cities with less crowded and better resources [40], which shows a relation between the number of the cases and the population [55]. For that, new practices are used to prevent the spread of it, such as "mask-wearing", "physical distancing", and "self-isolation"

World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:15, No:3, 2021

[30]. To face this pandemic, there is an importance of knowing and understanding the distribution of the primary and secondary cases [8].
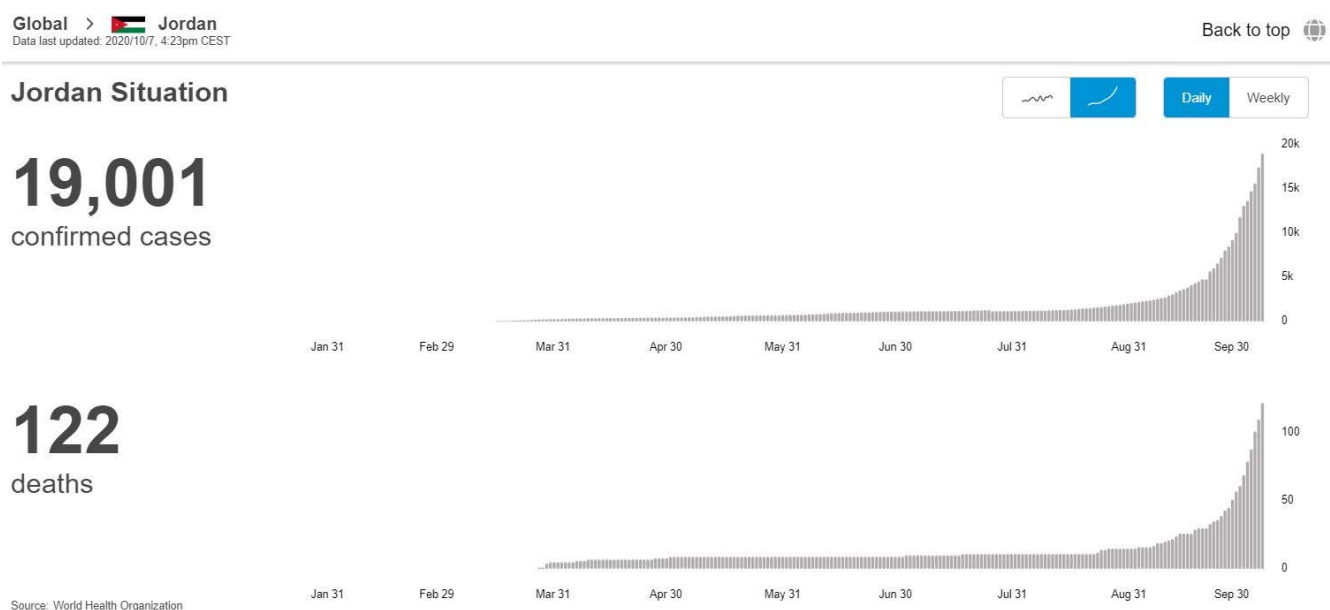

Fig. 1 Jordan COVID-19 cases Overview [62]

Fig. 2 The chart of COVID-19 cases and deaths in Jordan [27]

Public authorities see that minimizing the spread of COVID-19 can be through minimizing the physical movement of citizens and avoid crowded and close spaces [23]. The governments can control the number of COVID-19 cases by providing restricted decisions about people's movements. The lack of formal infrastructure can help spread the disease faster. Also, having more open borders can help increase the number of infections. Also, the size of the city can play an important role in spreading the disease. The quality of air enhanced during the time which people spent in the quarantine at home, and it brought the balance for the environment. But the socioeconomic challenges increased at the same time.

B. COVID-19 and Urban Environment

Since 90% of COVID-19 infections are in urban areas [43], some cities encourage the usage of private cars while others encourage sustainable mobility such as bicycles and walk [6]. Globalization, interconnectedness, and shared mobility helped spread the COVID-19 around the world; for that, global communication and corporation are needed to face the pandemic [6].

Cities need to be re-designed to meet the needs of the "social-distance" definition and provide more open and free spaces for pedestrians in the streets, which are already designed for vehicles [6].

The solution to this pandemic can be hard to achieve, but providing the stability of the urban cities, shared responsibilities, and provide healthcare infrastructure for citizens can be the base of the foundation of the solution [15]. The city's parts should be divided in other ways except for incomes, services access, and race [43].

Some works can help overcome the COVID-19 pandemic, such as increasing the digitalizing of the city, which helps reduce greenhouse gas emissions in the city [48].

In the area that has more green spaces, its residents can have better health [4]. People living in the county area have more acceptability to nature but limited access to health centers. Areas that do not have green spaces and their people need to stay in their homes all the time can affect people in a bad way; for example, elders can suffer from anxiety while kids can have post-traumatic stress in the long-term [11].

World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:15, No:3, 2021

Physical activity has a great effect on the human body in the urban spaces. Still, with the COVID-19 regulations and lockdown, a high percentage of people started to do the activities in their homes [34].

C. COVID-19 Regulations

New recommendations were taken for public health and well-being through increasing the amount of visible green spaces in the city, and providing more flexible sharing green areas in the crowded spaces [19]. Also, public green spaces are an important part of the city and its culture [60], but they are separated with limited size and inhospitable in the developed areas. Since the lockdown has increased the percentage of anxiety, depressed and non-communicable diseases for people [19], public green areas can be seen from people flat's window; for that, green spaces distributions in the city are important and can help in enhancing the psychological factors.

The Chinese government contained the pandemic through lockdown of Wuhan city (the city where the COVID-19 started to spread) and gradually closed the surrounding cities. Also, they closed schools, the city's hubs, gyms and all public facilities [30] and many countries follow the same steps to prevent the spread of COVID-19 in their cities. Also, after the infection from the Xinfadi market in Beijing, the government put 11 residential communities under lockdown and provided open-air temporary venues, storage for deliveries, and tests for the residents to curb the spread of the pandemic [65]. The highest number of cases is transmitted through and between family members during January and February. While in March, the highest number of infections came from abroad. On the other side, the public space's number of infections transmitted was not high [65]. The study sees that lockdown is an effective process to stop the spread of COVID-19 because of its high transmissibility [65].

The Jordanian government followed all the regulations and strategies provided by the World Health Organization. Also, they established a multi-discipline national team from different ministries, and sectors to discuss and help in the decision-making process to prevent the spread of COVID-19. Also, the epidemiological investigation teams were distributed around the country to do medical checks for people [5]. Gatherings were reduced to a maximum of 10 people [66].

Jordanian government implemented an early curfew to prevent the spread of COVID-19. Still, the economic situation was affected badly, and in August, when the cases have increased more in the country, it was difficult to lock down the country even the number of the infected people is much higher than the first half of the year [5].

Related to the previous literature review, there is a gap in the research about the relation between the COVID-19 and the urban environment in Amman city. For that, this research will focus on this part.

IV. ANALYSIS

The main reasons for spreading COVID-19 in Jordan can be divided into two parts: the primary reasons were the opening of airports and borders. While the secondary reasons that help to spread COVID-19 in the Amman city related to the resilient city can be divided into:

1. Infrastructure and environment: the lack of long-term infrastructure in the city. In addition, mobility and public services need regular maintenance.
2. Health and wellbeing: the health sector has a shortage in supporting and sufficing the residents, which can help the COVID-19 spread easier and wider. In addition, COVID-19 is considered as a new kind of pandemic, especially for the Jordanian healthcare system.
3. Leadership and strategy: The planning process to face this pandemic is reactive, while it can be proactive. Also, there is a trust gap between the citizen and the government.
4. Economy and Society: the prevalent religious belief of the community that; the God will protect people, and this pandemic is far from affecting them, so they practice their life normally without changing habits, wearing masks or social distancing, especially that the socializing, and religious habits can help spread the pandemic faster. The economic situation cannot afford new obstacles, especially after the shrinkage after the first wave lockdown, which started in March until June.

This research studied the human behavior changes in the urban environment before and after COVID-19 spread in the city. Related to the survey, a high percentage of the people's behavior changed in using open public green spaces before and after the pandemic (Fig. 3). A high percentage of respondents see that these spaces are not safe and can be an epicenter for spreading COVID-19 especially that they are few spaces with a high capacity of users.
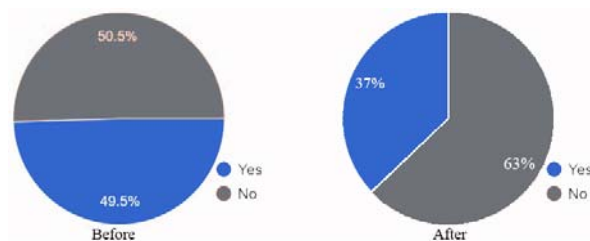

Fig. 3 The percentages of public green spaces users before, and after COVID-19 spread

Related to the same survey of this research, part of the respondents has stopped the usage of public transportation, such as public buses, shared taxis, taxicabs and walking. The use of public transportation dropped from 66.3% before COVID-19, spread to 42.6% after the spread (Fig. 4). Respondents prefer to take private vehicles to reduce the infection spread percentage.

The respondents' behavior in their free time has changed comparing before and after COVID-19 spread. Most people spend their free time at home (Fig. 5), this can create more pressure on the household infrastructure and mental health of people. In addition, it gives importance to rethinking that home spaces as mixed-used spaces for all-aged users.

World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
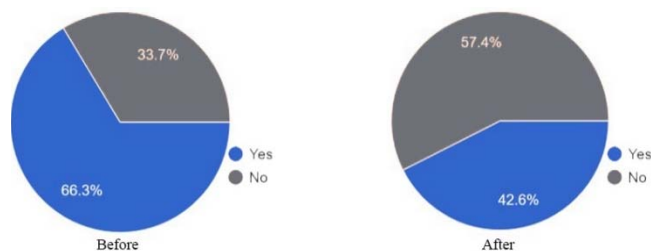Vol:15, No:3, 2021

Fig. 4 The percentages of public transportation users before, and after COVID-19 spread
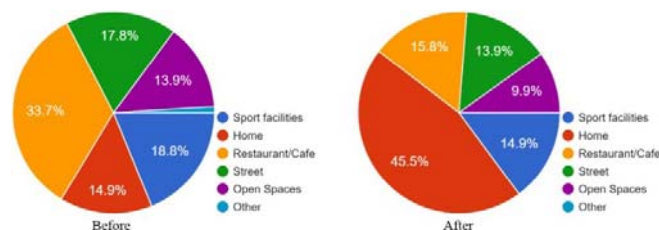

Fig. 5 The percentages of places where people spend their free time before and after COVID-19 spread

The survey has shown that how respondents changed their orientational behavior towards the urban environment and spaces, a high percentage of them started to spend their time in the home, reducing the usage of public green spaces (which cover 2.5% of Amman's area [61]), sports facilities and restaurants. For that, the dwelling design, the facilities for the residents and the quality of the neighborhood plan can take important roles in the future urban planning.

V. CASES

In order to enhance the quality of work to face the COVID-19 in Amman city, some cities were chosen to study their urban characteristics, and model in facing COVID-19. The cities were selected related to their population such as Hong Kong, and Rome while another city was chosen related to its scale comparing to Amman, which is London.

The parameters used to study the cities are density, number of infected, percentage of public green spaces, and work-life balance in each city.

The new shared regulations in cities around the world were about wearing masks; social distancing; washing hands; closing schools, public spaces, and facilities; working from home and quarantine. Besides, governments around the world established websites, and applications to help their citizen to keep in touch with the new information and regulations about COVID-19.

TABLE I
COMPARISON BETWEEN CITIES

City	Population (2019) [53]	Area (km^2) [53]	Density (people/km^2) [53]	Number of infected [46] (1st case recorded date-16th September)	Public Green Space (%)	Work- Life Balance (hr./week) [45]
Rome	4 M	1.28	2,23	13,608	46.5	36
Amman	4 M	1.68	2,38	1,216	2.5	35
Hong Kong	7.5 M	1.10	6,5	4,985	40	50
London	9 M	1.56	4,54	44,175	47	42.5

Hong Kong, London, and Rome had two peak points of daily COVID-19 cases (Fig. 6). From the beginning of March until the end of September, the 2nd peak point of cases was higher than the 1st peak point in Hong Kong [68]. However, the peak points of COVID-19 cases and deaths were in the same period in Hong Kong [47]. In London, the highest peak of cases and deaths was in the same period [2]. Besides, London had two approximate peak points of cases, where the 2nd peak was higher than the 1st peak point [1]. However, the 1st peak point of cases in Rome was higher than the 2nd peak point [51]. In Rome, the highest peak point of deaths was in the same period as the 1st peak point of cases but then the number of deaths started to decrease [52].

In Hong Kong, the distribution of COVID-19 cases is in the center and the western part of the city [54], which has a high population density and water flats [28], [33], (Fig. 7). The usage of public transportation decreased when the number of COVID-19 increased during the study period [32]. London has more distributed cases in the center of the city [58], where it has more population density [39], but the green spaces are widespread inside the city center and its boundary [16]. The usage of public transportation decreased when the number of COVID-19 increased in the first wave of COVID-19, but people continued to use public transportation during the second peak of COVID-19 in London [36]. The green areas in Rome are widespread outside the city center [41], where the population density is at the highest point [42]. The usage of public transportation was affected by the number of daily COVID-19 cases during the study period in Rome [56].

A. Hong Kong

Hong Kong is a city on the southern side of China [24], it was a British colonial city, and now has a unique regime, "One country two systems" [24]. Also, it is considered as low taxation, and has the 7th largest trade economy in the world [24]. The Chinese population in Hong Kong is 92% of the whole population [24]. In Hong Kong, there is a matrix between the built-up areas, and green areas [60]. It has 3 administrative parts: Hong Kong Island, Kowloon, and some small islands. Parks, and natural areas cover 40% of its total area, developed lands are less than 25% [24].

The high density of Hong Kong, which is 6,5 people/km^2, helps the city become more vulnerable to any disease [67], and because of the nature of Hong Kong, it suffers from many natural hazards regularly. But recently, it suffers cities from the COVID-19 pandemic like other worldwide. The

World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:15, No:3, 2021

government's main focus is on local-urban tools such as natural, societal, infrastructure, disaster, and urban development. For that, the government focused on controlling the situation to face the pandemic [12]. It is considered as a good example for facing COVID-19 in its first and second waves, such as the early borders closure, restricted rules of the lockdown, and banned Hubei residents, and non-Hong Kong residents to enter the city, and working on social distance, wearing masks, encouraging people to change their behavior, and increasing their awareness, and concerns, which resulted of weeks of zero-infections of COVID-19 [25].

The Hong Kong government encouraged people to stay at home as much as they can and reduce physical socializing. In June, the early reduction of the lockdown restrictions and the opening of public facilities and increasing the number of gathering people increased the percentage of infected people and spread COVID-19 faster and wider [69].

Before the pandemic, the highest percentage of people used to go to malls [70] while, after the spread of the pandemic, people prefer to go to green spaces instead of malls, because of low density, ventilation, lightning, a better quality of air and relaxation [35].

The lessons that can be learned from the Hong Kong model are the importance of early response to the pandemic. Also, working on increasing people's awareness can help reduce the infection in the city.
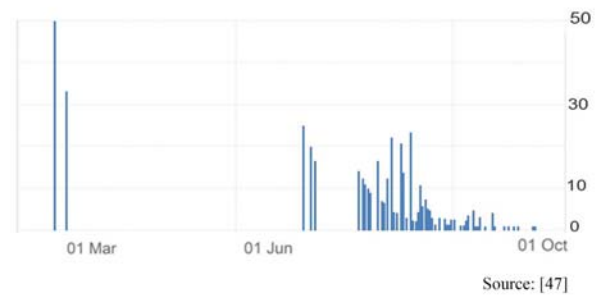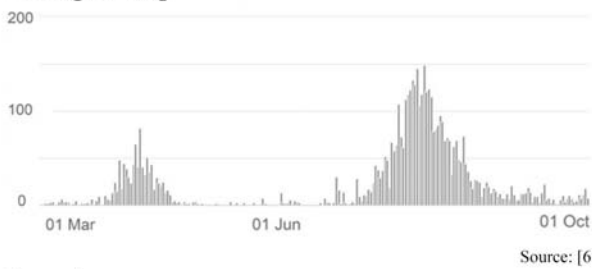
B. London, UK

London is a resilient city with 9 million population within 1,56 km^2 and it is a global trade center [40].

London resilient strategy focuses on resilience for people through supporting communities, places for infrastructure and environment and process to encourage the continuity of building resilience.
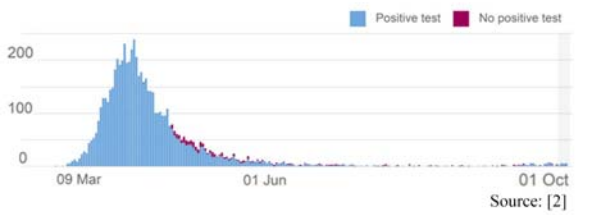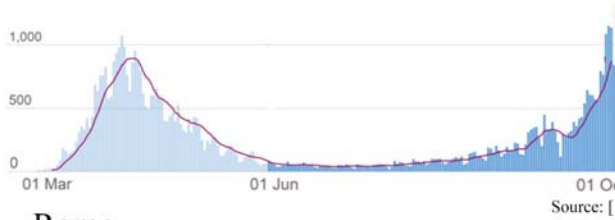
The lockdown decision was too late to reduce the effect of the COVID-19 pandemic. By the end of April 2020, the delay of social distance and the lockdown restrictions increased the total number of patients dramatically [20], [22]. By the end of July 2020, the number of infected people is still increasing, which makes the health situation becomes more worrying. Some scholars see that the response of COVID-19 in London needs to be transparent and open with others to face this pandemic [7]. The recovery plan to face the next months of COVID-19 pandemic focuses on: controlling the limit speed of infection, phasing in and out the lockdown levels and working on the infrastructure and services.

The distribution of the COVID-19 deaths is concentrated in the high-density areas of London (Fig. 8). Also, fewer deaths distributions near public green spaces at the boundary of the city, where 61% of 16+ Londoners go to parks in their free time [8].
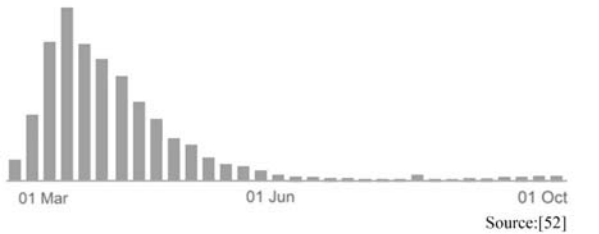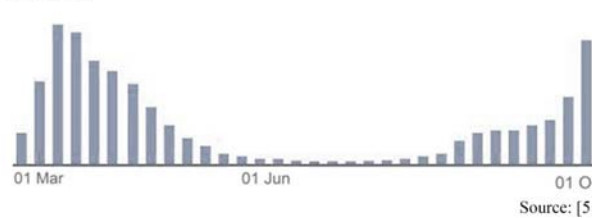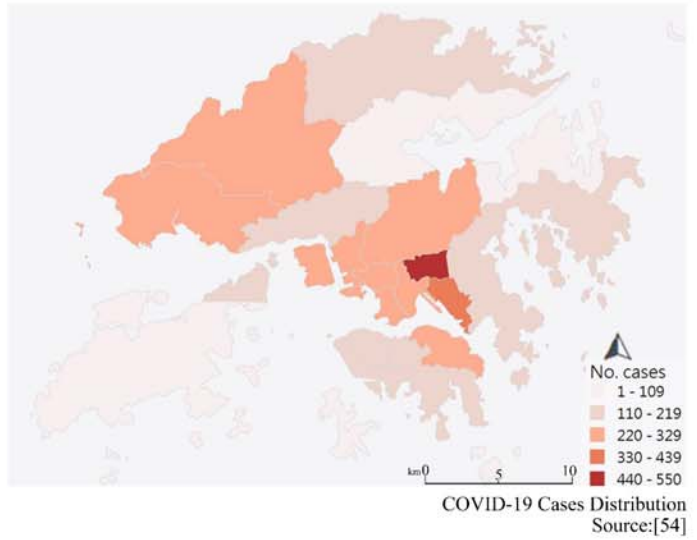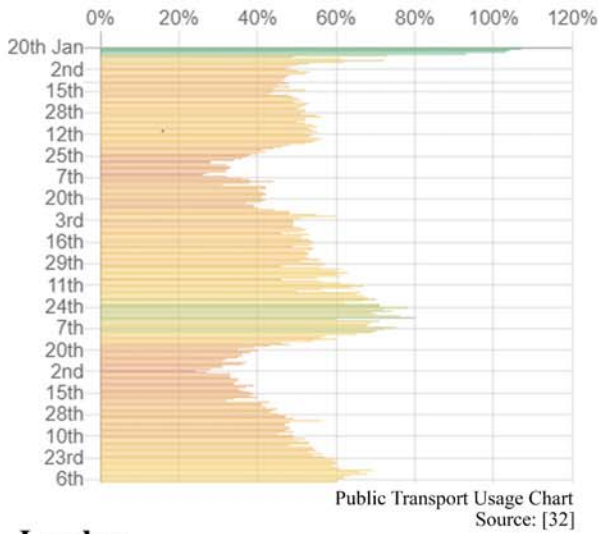

Fig. 6 Comparison between cities daily COVID-19 cases, and deaths

World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:15, No:3, 2021
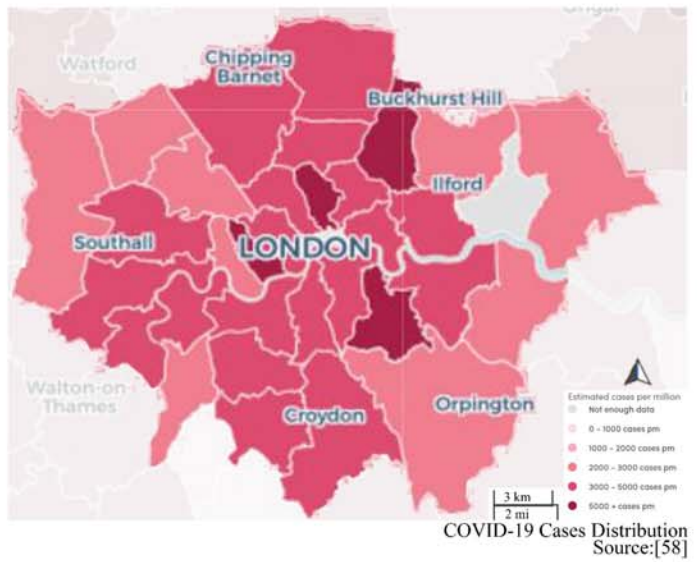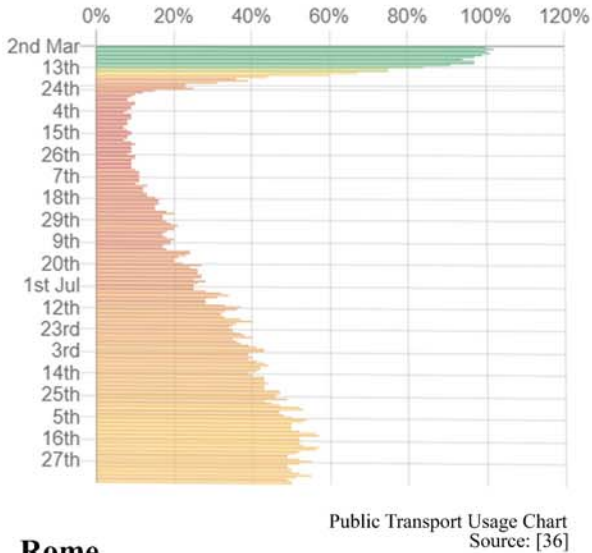
Fig. 7 Urban density, public green spaces, public transportation usage and COVID-19 cases distribution for Hong Kong, London and Rome

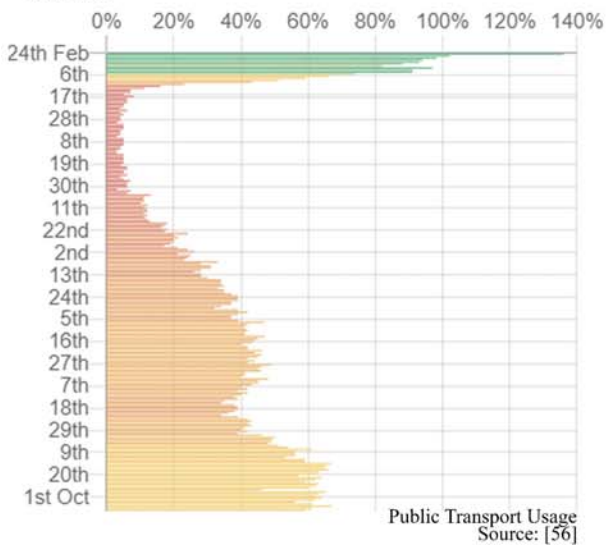World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
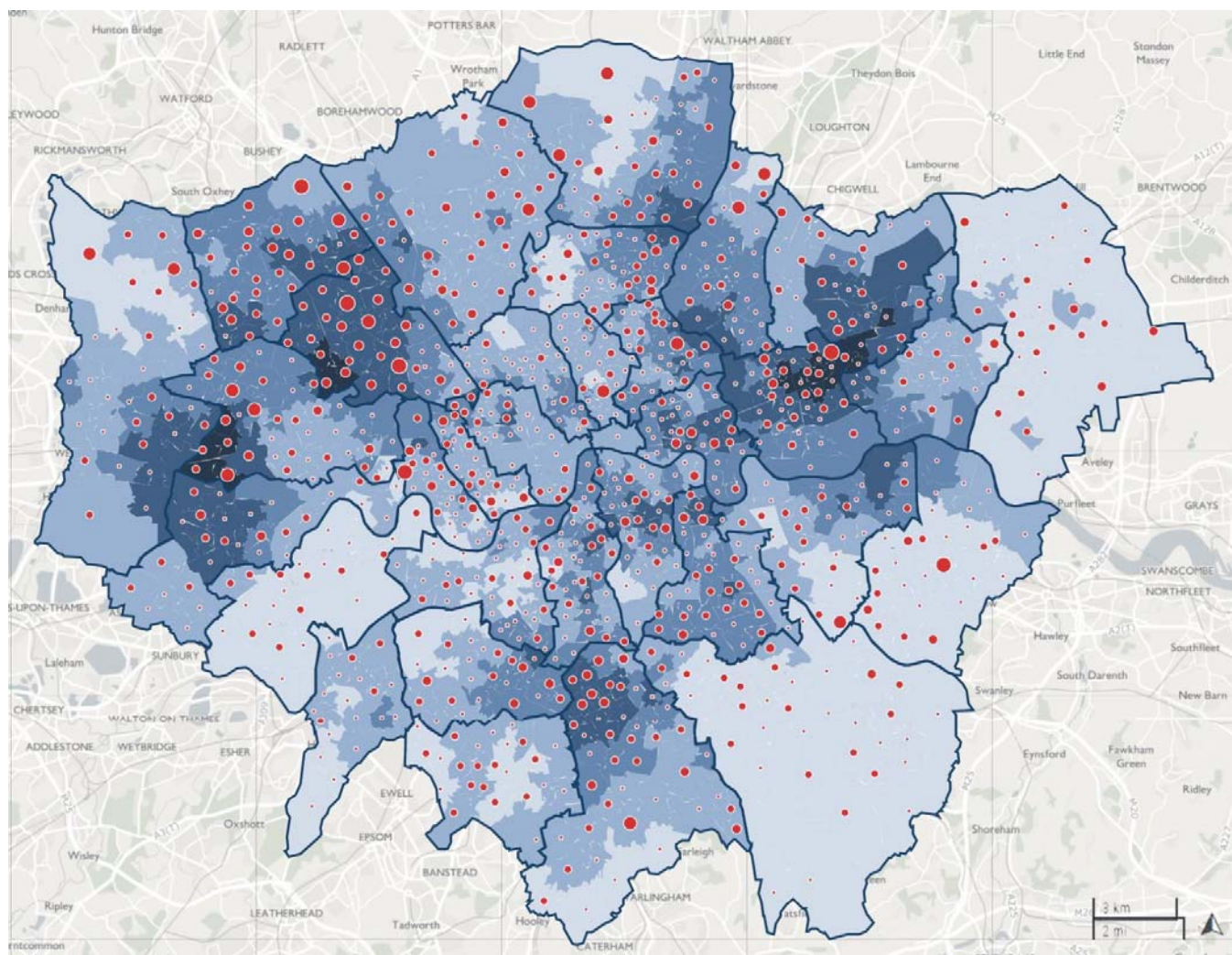Vol:15, No:3, 2021

Fig. 8 Distribution of COVID-19 deaths in London City [9]

The government worked on launching a public health campaign to provide health information for people and slow the spread of the pandemic. But not all the plans which the government put in February were active and the restrictions began very late which started in late March. Also, the protest which supported Black Lives Matter in June has helped increase the spread of COVID-19. In September, the number of cases increased, and the government provided new restricted rules to face COVID-19. It is also important to know how citizens believe in their government because that will encourage them to follow the rules more. 48% of people said that the government is trustworthy [21].

The lessons that were learned from the London model for facing COVID-19 are it is not enough if the country has a strong medical and healthcare system because having a pandemic needs an organized crisis management team to provide the compass to overcome and pandemic and more coordination's between local government is needed.

C. Rome, Italy

Rome is a resilient city and the capital of Italy. It is located in the central-western side of the country with 4 million population in 1,28 km^2 [51]. It is considered a successful connection between the city, and the environment [17]. The public green spaces in Rome cover 46.5% [26]. The highest distribution of green spaces in Rome is a natural reserve with 30% then forests and woodland with 7.04% [64]. Also, it is considered as one of the best cities in Europe in work-life balance, which is 36 hour/week (Table I) [13], [18].

The number of infected people between 31st January and 16th September is 13,608 patients [25]. Many reasons helped spread COVID-19 in Italy, such as the aging population, health system, lockdown delay, no disaster response plan, and air pollution increment [14]. The government tried to reconfigure many sectors such as economic, education, and industry [44].

The government response approach to face COVID-19 was by cooperation between the different levels of the governments even some governs in the country did not take the virus spread seriously, and using a decentralized working system to learn from the different experiences, and outcomes that were applied [50]. These approaches helped achieve the needed health measures but the implementation of the

World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:15, No:3, 2021

regulations was too late, and the virus was already spread.

In March, 32% of people said that they trust the government but it increased to 43% in April [49], which means people trust in the government, and this can encourage them to follow the rules more.

The lessons that were learned from the Italian model for facing COVID-19 are: preventing the spread of COVID-19 should be through an ineligible system with effective implementation with fast, and cleaver learning from the surrounding models to implement a better right regulation through gathering the needed information, and enhance the community awareness.

The current pandemic highlights new concepts in the urban city, such as the need for globalization to corporate, share information to face the pandemic, encourage the community to participate in the planning process, give the environment challenges more interest, and effort to solve them. The resilient framework can focus on more levels in the city such as neighborhoods, and buildings. Buildings should have enough ventilation, lighting, and spacing for their residents.

Digitalizing the city can help allocate the COVID-19 patients or alert people around them, increase remote service, and organize all the open and green spaces at the neighborhood level. Also, we can provide a resilient and flexible design for public spaces so they have other usages in the needed time such as hospitals in parks, and high-speed trains can be used as medical transport since the recovery from the COVID-19 pandemic may take years [40]. Also, houses and living spaces can be reformed to become useful for many mixed-used spaces. Green spaces in the environment have a positive effect on mental, physical and mental health [38]. The green spaces can help enhance and improve social interaction and communication for children [3].

VI. RESULTS

This research studies many cities that worked on reducing the infection through lockdown, increasing the capacity of health services, and providing social and economic recovery plans at the national and community level. Also, from the results of the study, the density can be a primary reason to spread COVID-19 if the regulations to face the pandemic were not taken seriously from earlier stages, which can be seen from the Hong Kong case study. The city worked on overcoming the first, and second waves even it has a high density. On the other side, London which has one of the best healthcare systems in the world [63] faced a high number and increment in the number of infections related to the late implementation of the regulations.

The high-density areas in the center of the cities have less public green spaces with high COVID-19 cases; while around the green areas at the boundary of the cities have fewer cases. In Hong Kong, more cases are distributed near the seaside.

This research studied how the respondent's behaviors have changed towards public transportation during the increment of COVID-19 cases. In Hong Kong, there was a decrease with 60% of the usage of public transport during the first wave of COVID-19, while in the second wave; the decrement of public transportation usage was 20%-40%. In London and Rome, the usage of public transportation was at the lowest point during the lockdown period but after that, the usage of public transportation has increased even the number of cases has increased.

In Amman, people's behavior has changed towards public transportation and public green spaces. People preferred not to use public transportation, and reduce their visits to public green spaces and stay more at home as the government advised.

Related to the previous conclusion, the future Amman resilient planning should be designed for people and the city can be divided into decentralized areas and neighborhoods, each area is built using its main health, economic social, and environmental sector with its resilience emergency, recovery areas, and public green mixed-used spaces. The shared area between all the decentralized areas can have the operation, and management center for all the areas.

Applying new strategies using the dimensions of the Amman resilience framework can be embodied into:

- Infrastructure and environment dimension: provide long-term emergency infrastructure, work on mixed-used public green spaces, and its distribution in the areas, and neighborhoods to make people's lifestyles integrated with nature especially with an increment of the digital lifestyle. Encourage shared street zones, and wider mixed-used street design including walking, biking, and convert car lanes in some parts of the city into pedestrian, and bikes only.
- Economy and Society: Support and empower the local business, and work on self-sufficiency strategy. Encourage the change and update of old legacies and traditions and encourage new definitions that are suitable to the current health situation such as wearing a mask and social distance.
- Health and Wellbeing: Enhance the citizen's awareness and reduce the gap between people and the government through engaging citizens in decision making and keep them updated with all the information and situations. Encourage domestic tourism especially green open spaces and cultural spaces.
- Leadership and Strategy: Encourage the local and international corporations between governments and organizations to enhance the decision-making process and upgrade the city to face multi-hazards proacting system instead of a single hazard reacting system.

VII. CONCLUSION

Many factors can play important roles in spreading COVID-19, such as density, distribution of open and green areas. However, the early restricted rules, the lockdown, and protective strategies can help control the COVID-19 spread.

comments and suggestions during the whole research work.

REFERENCES

[1] (GLA), G. L. A. (2020a). Coronavirus (COVID-19) Cases.
[2] (GLA), G. L. A. (2020b). Coronavirus (COVID-19) Deaths.
[3] A, C., A, T., & H, G. (2004). The impact on mental wellbeing of the urban and physical environment: an assessment of the evidence. *J Mental Health Promot, 3*(2), 17-32.
[4] AE, V. d. B., J, M., & al, V. R. e. (2010). Green space as a buffer between stressful life events and health. *Soc Sci Med, 70*(8), 1203-1210.
[5] Al-Tammemi*, A. a. B. (2020). The Battle against COVID-19 in Jordan: An Early Overview of the Jordanian Experience. *Frontiers in Public Health*.
[6] Alcantud, A., Badia, M., & Santamaria, M. (2020). *Covid-19 and the future of cities: 5 keys to keep moving towards local sustainability.* CitiesToBe.
[7] Alwan, N., Bhopal, R. S., Burgess, R., Colbourn, T. E., Cuevas, L. E., Smith, G. D., . . . Smith, J. (2020). Evidence informing the UK's COVID-19 public health response must be transparent. *The Lancet Journal*.
[8] Anderson, R. M., Hollingsworth, T. D., Baggaley, R. F., Maddren, R., & Vegvari, C. (2020). COVID-19 spread in the UK: the end of the beginning? *The Lancet Journal, 20*.
[9] Authority, G. L. (2020). COVID-19 Deaths Mapping Tool. *London Data Store*.
[10] Authority, G. L. (2020). COVID-19: socio-economic risk factors briefing. *London Data Store*.
[11] Barthel, S., & Andersson, E. (2020). What cities need to learn from Covid-19. *Stockholm Resilience Centre*.
[12] Boseley, S. (2020). Test and trace: lessons from Hong Kong on avoiding a coronavirus lockdown. *The guardian*.
[13] Buchholz, K. (2019). The Countries With the Best Work-Life Balance.
[14] Buono, M. G. D., Iannaccone, G., Camilli, M., Buono, R. D., & Aspromonte, N. (2020). The Italian Outbreak of COVID-19: Conditions, Contributors, and Concerns. *Mayo Clinic Proceedings, 95*(6).
[15] Chong, B. (2020). 5 must-do's on urban resilience. *The Resilience Shift*.
[16] CIC, G. I. f. G. L. (2018). London's Open Spaces. Retrieved from https://www.gigl.org.uk/londons-open-spaces/
[17] Cities, B. a. g. i. E. o. f. (2011). Rome, a green city, the example of Appia Antica Regional Park. *Cerema*.
[18] Cities for the Best Work-Life Balance 2019. (2019). *Kisi*.
[19] D'Alessandro, D., Gola, M., Appolloni, L., Dettori, M., Fara, G. M., Rebecchi, A., . . . Capolongo, S. (2020). COVID-19 and Living Spaces challenge. Well-being and Public Health recommendations for a healthy, safe, and sustainable housing. *Acta bio-medica: Atenei Parmensis*.
[20] Dashboard, P. C.-. (2020). London COVID-19 Cases.
[21] El-Bar, K. (2020). Public trust in UK government crashes in new poll. *AA*.
[22] England, N. (2020). London COVID-19 Daily Deaths.
[23] Forum, I. T. (2020). Re-spacing Our Cities For Resilience. *OECD*.
[24] Government, H. K. (2020). Hong Kong – the Facts.
[25] Government, I. (2020). Covid-19, situation in Italy.
[26] Gratani, L. (2020). Understanding the Benefits from Green Areas in Rome: The Role of Evergreen and Deciduous Species in Carbon Dioxide Sequestration Capability. *American Journal of Plant Sciences, 11*(8), 1307-1318.
[27] Health, M. o. (2020). Daily COVID-19 Cases, Deaths and Recovered in Jordan. Retrieved from https://corona.moh.gov.jo/en
[28] HGSARG, H. K. P. d. (2016). Green and Blue Space Conceptual Framework. *Planning department HGSARG*.
[29] Hon, K. L., Leung, K. K., Leung, A. K., Qian, S. Y., Chan, V. P., Ip, P., & Wong, I. C. K. (2020). Coronavirus disease 2019 (COVID-19): latest developments in potential treatments. *Drugs in Context, 9*, 1-14.
[30] K, N., & S, L. (2020). What does the global pandemic COVID-19 teach us? Some reflections. *Journal of Urban Management*.
[31] Kebede, T. A., Stave, S. E., Kattaa, M., & Prokop, M. (2020). Impact of the COVID-19 pandemic on enterprises in Jordan. *UNDP*.
[32] Kong, C. H. (2020). Citymapper index Hong Kong Retrieved from Source: Citymapper.com/cmi/hong kong
[33] Kong, E. C. H. (2020). Hong Kong Mid-Year Population Density in 2018. Retrieved from https://opendata.esrichina.hk/datasets/hong-kong-mid-year-population-density-in-2018
[34] Lawanson, T., Foley, L., Assah, F., Mogo, E., Mapa-Tassou, C., Ogunro, T., … Oni, T. (2020). The urban environment and leisure physical activity during the COVID-19 pandemic: a view from Lagos. *Cities & Health*.
[35] Lee, C. (2020). Hong Kong's public space problem. *BBC*.
[36] London, C. (2020). Citymapper Index London. Retrieved from Source: Citymapper.com/cmi/london
[37] Luck, T. (2020). How Jordan crushed the curve and halted Coronavirus in its tracks. *The National*.
[38] Maas, J., Verheij, R. A., Groenewegen, P., Vries, S. d., & Spreeuwenberg, P. (2006). Green space, urbanity, and health: How strong is the relation? *Journal of Epidemiology & Community Health, 60*(7), 587-592.
[39] Mangomap. (2020). London Population. Retrieved from https://mangomap.com/demographics/maps/50232/population#
[40] Ministry of Housing, C. L. G., Department for Business, Energy & Industrial Strategy, Paul Scully MP, and The Rt Hon Robert Jenrick MP. (2020). Plans announced for London's COVID-19 recovery.
[41] Monni, S., Lelo, K., & Tomassi, F. (2019). Le mappe della disuguaglianza. *Donzelli*.
[42] Monni, S., Tomassi, F., & Lelo, K. (2018). Urban Inequalities in Italy: A comparison between Rome, Milan and Naples. *Entrepreneurship and Sustainability Issues, 6*(2), 939-957.
[43] Nations, U. (2020). Policy Brief: COVID-19 in an Urban World. *United Nations*.
[44] Nicola, F. G. (2020). Exporting the Italian Model to Fight COVID-19. *The Regulatory Review*.
[45] OECD. (2019). Work-Life Balance. *OECD Better Life Index*.
[46] Organizatioin, W. H. (2020). Q&A on coronaviruses (COVID-19).
[47] Organization, W. H. (2020). Hong Kong COVID-19 Deaths *Trading economics*. Retrieved from https://tradingeconomics.com/hong-kong/coronavirus-deaths
[48] Phathanothai, L. H. (2020). Towards More Equal and Resilient Cities Post-COVID-19. *Global Dashboard*.
[49] PIANTONI, V. (2020). Trust in government increases as the number of new Covid-19 cases slows down in Italy. *La Stampa*.
[50] Pisano, G. P., Sadun, R., & Zanini, M. (2020). Lessons from Italy's Response to Coronavirus. *Harvard Business Review*
[51] Population, C. (2020a). City Population Rome Cases. Retrieved from citypopulation.de/en/italy/covid/lazio/058__roma/
[52] Population, C. (2020b). City Population Rome COVID-19 Deaths. Retrieved from citypopulation.de/en/italy/covid/lazio/058__roma/
[53] Prospects, W. U. (2019). World City Population.
[54] Region, T. G. o. t. H. K. S. A. (2020). Corona Virus Index. Retrieved from https://www.coronavirus.gov.hk/eng/index.html
[55] Ribeiro, H. V., Sunahara, A. S., Sutton, J., Perc, M., & Hanley, Q. (2020). City size and the spreading of COVID-19 in Brazil. *PLoS ONE, 15*(9).
[56] Rome, C. (2020). Citymapper Index Rome. Retrieved from Source: Citymapper.com/cmi/rome
[57] Statistic, D. o. (2018). Population of the kingdom by city.
[58] Study, C. S. (2020). COVID Symptom Study in UK. Retrieved from https://covid.joinzoe.com/data#interactive-map
[59] Suleiman, A., Bsisu, I., Guzu, H., Santarisi, A., Alsatari, M., Abbad, A., . . . Almustafa, M. (2020). Preparedness of Frontline Doctors in Jordan Healthcare Facilities to COVID-19 Outbreak. *Int. J. Environ. Res. Public Health, 17*(9).
[60] Tian, Y., Jim, C. Y., & Wang, H. (2013). Assessing the landscape and ecological quality of urban green spaces in a compact city. *Landscape and Urban Planning, 121*(121), 97-108.
[61] Times, T. J. (2015). For a greener Amman. *The Jordan Times*.
[62] Tracker, C. (2020). Corona Tracker in Jordan. Retrieved from https://www.coronatracker.com/country/jordan/
[63] Triggle, N. (2017). NHS ranked 'number one' health system. *BBC News*.
[64] Varrella, S. (2020). Distribution of green spaces in the city of Rome in Italy in 2018, by category.
[65] Wang, X., Pan, Y., Zhang, D., Chen, L., Jia, L., Li, X., . . . Macintyre, C. R. (2020). Basic epidemiological parameter values from data of real-world in mega-cities: the characteristics of COVID-19 in Beijing, China. *BMC Infectious Diseases, 20*.
[66] Werman, A. (2020). Jordan's rising economic challenges in the time of COVID-19. *Middle East Institute*.
[67] Wong, S. Y. S., Kwok, K. O., & Chan, F. K. L. (2020). What can countries learn from Hong Kong's response to the COVID-19 pandemic? *CMAJ, 192*(19), E511-E515.
[68] Worldometer. (2020). Hong Kong Corona Virus Cases and Deaths.

[69] Yeung, J. (2020). Two weeks of zero local infections: How Hong Kong contained its second wave of Covid-19. *CNN*.

[70] Zordan, M., & Tsou, J. Y. (2020). Urban Transitions in Pandemic Scenarios: Insights from Hong Kong. *Journal of ASIAN Behavioural Studies, 5*(17).

[71] Zowalaty, M. E., & Järhult, J. D. (2020). From SARS to COVID-19: A previously unknown SARS-CoV-2 virus of pandemic potential infecting humans – Call for a One Health approach. *One Health, 9*.