Urban Health and Wellbeing: Systems Approaches

Philippa Howden-Chapman
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Cities Under COVID-19: A Systems Perspective

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Urban Health and Wellbeing

Systems Approaches

Series Editor

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The Urban Health and Wellbeing: Systems Approaches series is based on a 10-year global interdisciplinary research program developed by International Council for Science (ICSU), and sponsored by the InterAcademy Partnership (IAP) and the United Nations University (UNU). It addresses up-to-date urban health issues from around the world and provides an appealing integrated urban development approach from a systems perspective. This series aims to propose a new conceptual framework for considering the multi-factorial and cross sectorial nature of both determinants and drivers of health and wellbeing in urban populations and takes a systems approach for improving the understanding of the interconnected nature of health in cities. The systems approach includes an engagement with urban communities in the process of creating and transferring knowledge. Further, it aims at generating knowledge and providing the evidence that is relevant to people and policy-makers for improving integrated decision making and governance for the health and wellbeing of urban dwellers. The methods applied, come from various epistemological domains in order to improve understanding of how the composition and functioning of urban environments impacts physical, mental and social heath and how inequalities can be reduced to improve the overall quality of urban life.

The systems approach is applied to science and society and defined by a deep investigation into disciplinary knowledge domains relevant for urban health and wellbeing, as well as an inter- and transdisciplinary dialogue and shared understanding of the issues between scientific communities, policy makers and societal stakeholders more broadly. It involves one or more of the following elements: 1) the development of new conceptual models that incorporate dynamic relations among variables which define urban health and wellbeing; 2) the use of systems tools, simulation models and collaborative modelling methods; 3) the integration of various sources and types of data including spatial, visual, quantitative and qualitative data.

Like the first book, the coming books will all address the topic of urban health and wellbeing, specifically by taking a systems approach. The topics range across all urban sectors and can, for example, cover the following areas:

(1) transportation, urban planning and housing, urban water, energy and food, communication, resources and energy, urban food systems, public service provision, etc.
(2) the related health disorders in physical, social and mental health
(3) the methods and models used and the type of science applied to understand the complexity of urban health and wellbeing.

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Dedicated to Professor RB Singh and
Professor Juan Vela Valdés

Foreword

This book explores key questions many of us are asking ourselves. Having survived the COVID-19 pandemic, gone through lockdowns, social distancing and isolation, loss of life and livelihoods, how has this collective trauma affected different places and populations? More importantly, will we manage other systemic threats like climate change any better, and what lessons can be drawn to enable effective joined-up action by different sectors in society? Building forward better is a good idea and there is good understanding about what should be done, for example to reduce carbon emissions, but the question still open is how?

Analyses in this book provide insights into how cities in 15 countries, from India, Brazil, China to USA, New Zealand, Europe and Sub-Saharan Africa responded to the problem. It describes differences in how social actors responded to gaps in knowledge and to scientific uncertainty. A picture of solidarity, fast scientific response, commitment of health workers and inter-sectoral cooperation in many places provides hope. The way populists twisted the scientific evidence for personal or political gain spreading misinformation at the expense of people's health shows the ugly challenges that need to be confronted and the urgent need for tools to combat infodemics.

In many places, municipal and regional governments rose above national populist misinformation and inaction and engaged scientists to develop new ventilators, vaccines, masks, IT, communications and to upgrade skills to respond to the need for IT workers. Regions in Brazil and countries like Cuba, China and India developed vaccines independently of multinational laboratories.

In some cities, deaths were not due to lack of access to health care but because the poor had more chronic diseases and could not afford to socially isolate, living in crowded homes and depending on daily wages to survive. Informal settlements were especially at risk, with loss of income and domestic violence among the consequences.

The book also illustrates some of the positive placemaking responses like pop-up cycle lanes and making use of public space for people rather than for cars, or the wide and positive applications of IT. These findings corroborate other reports, but what

makes the book unique is the comparisons of governance mechanisms, including the role of vertical interventions.

In New Zealand, the government used the opportunity to garner public support to pass Fair Pay Agreement legislation, while elsewhere, many abandoned the caring professions and services struggled to find care workers. Canada used a social determinants of health framing to identify vulnerability to infection and target support. China's central measures were useful to control transmission, through IT/social control but became less effective as new waves of infection appeared and caused concerns over privacy. In parts of Europe government responsiveness, reliability, fairness, integrity and openness drove people's trust in government institutions.

The stark contrast in excess mortality between the countries and cities considered here, in the context of wide agreement about the need for vaccination, social distancing and other measures to reduce transmission, speaks of the importance of local analyses, of respect and engagement with different groups in society, of coordinating national and local measures. Fundamental to the population's trust in institutions is the government's ability to respond and adapt to evolving knowledge and risks, with flexibility and transparency. The experiences described here offer good practice examples about how to deal with complex problems requiring systemic and adaptive responses by multiple actors and have implications well beyond epidemics. These analyses also help frame much-needed research about local governance and its unique role in addressing health issues with multiple drivers and connections with planetary boundaries.

New York, USA

Carlos Dora, M.D., Ph.D.
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Franz Wilhelm Gatzweiler is currently Senior Research Advisor at the United Nations University Institute in Macau. Before joining UNU Macau, he was a Professor at the Institute of Urban Environment, Chinese Academy of Science in Xiamen and executive director of the global science programme on Urban Health and Wellbeing: a Systems Approach, which is an affiliated body of the International Science Council (ISC). Franz studied agricultural, resource and institutional economics at the University of Bonn and Berlin and holds a Ph.D. and habilitation in resource economics from the Humboldt University of Berlin, Germany. His current research interests focus on the governance of complex systems and systemic risk.

Rachel Cooper is Distinguished Professor of Design Management and Policy at Lancaster University. She is founding Director of ImaginationLancaster, an open and

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Isaac Luginaah is a Full Professor in the Department of Geography, Western University, London, Ontario, Canada. Dr. Luginaah obtained his B.Sc. from the University of Cape Coast, Ghana, and M.Sc. from the Queen's University of Belfast and an MES from York University, Toronto. He obtained his Ph.D. from McMaster University, Hamilton, Ontario, in 2001 specialising in Health/Medical Geography. In 2011, he was honoured as Paul Harris Fellow by Rotary International in recognition of his "service above self" in his community and globally. He was Canada Research Chair in Health/Medical Geography (2007–2017). Dr. Luginaah's exceptional scholarship and leadership has helped to define the growing field of Health/Medical Geography and has been widely recognised. In 2008, he won the prestigious Julien M. Szeicz Award for Early Career Achievement by the Canadian Association of Geographers, the American Association of Geographers Africa Specialty Group (Kwadwo Konadu-Agyemang Distinguished Scholar Award), the University of Western Ontario (Faculty Scholar for research and teaching excellence) and the University of Windsor (Research Excellence Award). In 2014, Dr. Luginaah was inducted as Member of the College of the Royal Society of Canada. In 2017, he was honoured with the Kwadwo Konadu-Agyemang Distinguished Scholar Award by the American Association of Geographers, and in 2018, he was inducted as Fellow of the African Academy of Sciences.

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Introduction

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The COVID-19 pandemic has understandably been the subject of an extraordinary amount of scientific research since the virus was identified in 2019. Most of this research has focused on virus mutations, their clinical effects, the impacts on different population age groups and international comparisons. Our focus in this edited book is not on these aspects of the virus, but on what impact urban governance can make on the spread of COVID-19. This has received surprisingly little attention.

Most of the authors in this book are, or have been, members of the International Science Council (ISC) Scientific Committee on Urban Wellbeing: A Systems Approach (the Committee), which was established by the ISC in 2012 to increase research on cities from a systems perspective. Due to the systemic nature of health, putting public health and wellbeing into the centre of decision making in urban and territorial planning makes sense. The Committee has promoted and demonstrated systems approaches such as collaborative systems modelling and linking data, knowledge and action to improve systems intelligence and governance for urban health and wellbeing. Good governance takes the complexity and interconnectedness of a system into account and makes intelligent interventions or changes to the system, based on scientific evidence which has established causation, interactions and co-benefits. Particularly during a global health crisis like the COVID-19 pandemic, using a complex systems lens has many advantages (Taylor and Howden-Chapman 2021; Wernli et al. 2021).

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The authors come from 15 different cities in Brazil, Canada, Cameroon, China, Cuba, England, India, Finland, Nepal, United States of America, New Zealand, Nigeria, Sri Lanka and more broadly, the Middle East and Europe. Most authors provided an analysis of impacts of cities in which they lived at the beginning of 2022. They come from a wide variety of disciplinary backgrounds including: public health, clinical medicine, pathology, geography, urban planning as well as other social sciences. Their vivid professional and personal accounts of the responses and impacts of the governments and institutions in their countries vary widely, as do the health outcomes. Yet collectively, the accounts provide a nuanced understanding of the impacts of COVID-19 around the world, and thereby offer important policy lessons for current and future epidemics.

The populations of the different cities we consider here clearly had contrasting patterns and levels of health and wellbeing, linked to their particular political, economic, social and environmental determinants of health. Yet the impact of COVID-19 on urban governance, the economy, the urban environment, urban form, and mobility, show some remarkably similar patterns which we outline below. There is a stark divergence of outcomes in the 15 countries we profile; for example in the cumulative confirmed COVID-19 deaths per million population, as Fig. 1 shows. However, we note the caveat that "for some countries the number of confirmed deaths is much lower than the true number of deaths … because of limited testing and challenges in the attribution of the cause of death." Despite the huge range of outcomes, paradoxically the impact of COVID-19 on urban governance, the economy, the urban environment, urban form and mobility, shows some remarkably similar patterns, which we outline below.

1 Urban Connectivity and the Systems Approach

Systems theory states that properties of a complete system cannot be predicted by disaggregating, analysing and exploring individual constituent parts alone (Bai et al. 2016). The systems approach perceives a city as a complex system with direct and indirect cause-effect chains, best understood as positive and negative feedback loops, which are important drivers of system behaviour and potentially important levers of change (Gatzweiler et al. 2017). According to Gatzweiler et al. (2020), the systems approach requires two strands of action. First, a good scientific understanding of the urban social, ecological and technological infrastructure and the urban system goods and services produced and provided. In case of a global pandemic such as COVID-19, it is key to understand all aspects of the situation, such as how the virus is transmitted and what can be done to prevent transmission. Second, a strategy for political leadership, community involvement, communication, and transfer of knowledge to action must be in place. Invariably, a strategy for regional, national, and global action that promotes and supports effective local initiatives is critical to long-term success.

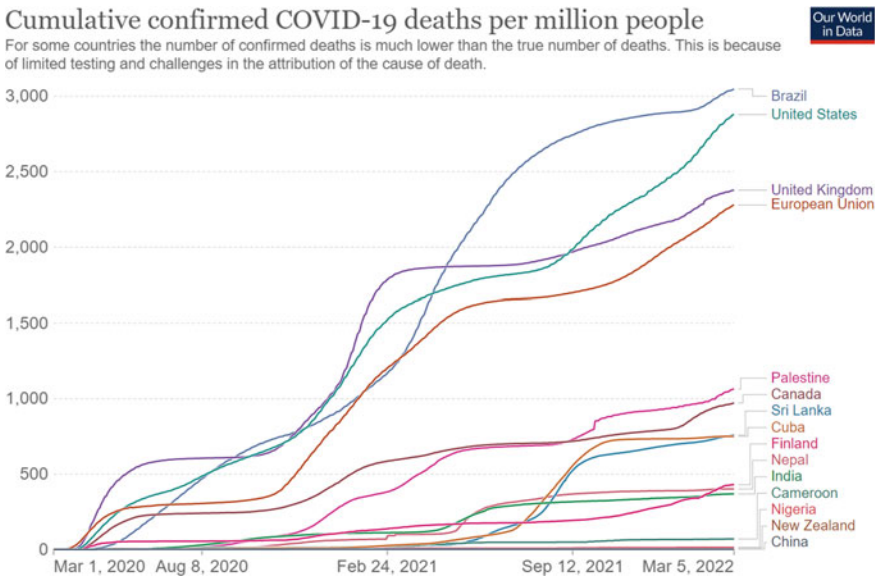

Fig. 1 Cumulative confirmed COVID-19 deaths per million people

Before COVID-19 emerged, the International Council for Science's global, transdisciplinary science programme on Systems Science for Urban Health and Wellbeing (UHWB), in collaboration with Future Earth's Health Knowledge-Action Network (FE Health KAN), in a meeting in Xiamen, China, called for innovative new approaches and a focus on the complexities of urban health problems and how to make urban environments healthier. The Xiamen call to action (Ebikeme et al. 2019) drew attention to the challenges of urban health globally and outlined six principles of building systems governance for urban health:

1. clear leadership and mandate to deal with urban health issues in an integrated manner;
2. inclusiveness—including human rights for all;
3. inter-sectoriality—various urban sectors, such as transportation, energy, housing, including primary health care, work and achieve urban health outcomes together;
4. health and wellbeing as performance indicators which need to be measured centrally and locally;
5. risk sharing—stakeholders investing in and benefiting from cross-sectoral collaboration also share the costs, and
6. the precautionary principle—it is about both the curative and preventive dimensions of health.

These principles cut across domains, expertise, sectors, and actors, and need to be implemented through participation and the understanding that urban health operates within a system of complexity. In relation to public health, a systems approach views

health inequalities as patterns within the larger rubric of other facets of the political, social and physical environmental conditions.

With the emergence of COVID-19, the Committee concluded that 'building the brain of the city' is essential in the context of pandemics (Gatzweiler et al. 2020). The Committee focused on how the six principles outlined in the Xiamen Call for Action could form the basis of intelligent policy response across cities. The key elements would include managing, planning and building cities in ways that prevent the spread of pathogens. But once a disease outbreak is identified, the main priority would be to focus on early emergency response that addresses the outbreak at its origin to reduce the spread of the infectious agent. More generally, there is a need to improve surveillance and monitoring of human pathogens, create mutual learning platforms for cities, and map and model the dynamics of the disease—not only initially, but also as it spreads. Investment in urban infrastructure is also needed to utilise the innovative potential of cities and to build social capital for a collective intelligent response to future health emergencies.

Given the concentrations of people and economic activity in cities, cities have become pandemic hotspots; ninety percent of all reported COVID-19 cases were in cities (UN-Habitat 2020). It is not only the population density and crowded informal settlements but also their interconnected networks which make cities vulnerable to the spread of infectious diseases (UN 2020). Interconnectivity is a double-edged sword: on the one hand it can facilitate sustainable development, but on the other hand it more easily facilitates the transmission of infectious agents. Interconnectivity which concentrates only on economic growth, rather than the broader social, cultural and environmental determinants of health, makes an urban system very vulnerable to a pandemic shock. Understanding the structure of urban interconnectivity—not only for economic growth, but for health and wellbeing—is a key challenge for rebuilding healthy cities in future. "Avoiding a return to the pre-pandemic status quo and transforming cities globally for future resilience, inclusion, green and economic sustainability …" is therefore paramount according to the UN report "COVID-19 in an Urban World" (2020). A high-level integrated governance strategy for cities is needed where the research community works across disciplines and expertise, in direct collaboration with public health and other stakeholders.

Another way of seeing urban interconnectivity is as an enabler of flows of energy, resources and information in the so-called urban metabolism. The urban metabolism is closely related to the health of cities, as these flows occur in interlinked social, ecological, economic and technological and infrastructure systems. Flows are channelled through the city by a complex web of networks and these structures define in part the health of a city and the health and wellbeing of its population (Mehaffy 2019; Seung 2012). Having access to and being part of urban networks enables people's capabilities (Sen 1999), increases their social inclusion and reduces their marginal status (von Braun and Gatzweiler 2014), thereby improving their wellbeing (Benkler 2006).

The International Monetary Fund estimated that on average the global economy contracted three percent in 2020 (IMF 2021). The COVID-19 pandemic affected all sectors of cities by disrupting the flow of resources, energy, information and exchange

of goods and services. During the pandemic, cities had to take drastic measures to protect the health of their citizens by constraining movement and social contacts. Due to mandated lockdowns and social distancing measures, 114 million jobs were lost in 2020 (ILO 2021), leaving those affected unable to pay for housing and food. This has resulted in a sharp increase in COVID-19-induced poverty, especially among the urban poor and those in the bottom 40% of the global income distribution, with roughly 100 million extra people being pushed into extreme poverty (World Bank Blog 2021). Feitelson et al. (2020) took a systems approach to study the impact of COVID-19 on wellbeing and also highlighted that the main impacts have been on the labour market and incomes. One of their policy recommendations was to reduce the size of the informal economy and create more secure jobs.

Our city case studies make clear that unemployment has increased in many cities, especially among workers in the informal economy. There are important ramifications for cities that are fundamentally designed to be engines of the economy. Although more than 80% of global GDP is generated in cities, 75% of global carbon emissions and 75% of the world's natural resources are also consumed in cities (UN Habitat 2020). If cities are built not just to be growth engines of the global economy jeopardising planetary health, but rather as multifunctional systems which regulate and balance planetary health and human wellbeing, a pandemic will have demonstrably less severe effects on cities.

Although some authors have argued that wars and the flu pandemic in 1918–1919 reduced inequality by levelling the playing field, the current pandemic has underlined and reinforced existing inequalities in wealth. For instance, during the COVID-19 pandemic, the stock markets and the assets of the wealthy soared in value (BBC 2021; World Economic Forum 2021; Hill and Narayan 2020). When high levels of inequalities manifest as big gulfs between the rich and the poor, there may be an absence of political will and policy support to redistribute concentrated wealth. Allied with this, there may be a lack of effective welfare policies and support for public good amenities, such as green spaces and public transport, to enhance the health and wellbeing of the less privileged.

2 A Systems Approach for a Systemic Disease

Health has long been understood as a systemic concept. The historically important role of cities in improving the determinants of health and the measures needed to reduce infectious diseases has been clear since the early nineteenth century. There has also been a growing awareness that, rather than a single solution, a systems approach to the urban environment is essential (Rydin et al. 2012). The emerging social, economic and environmental complexities caused by the COVID-19 pandemic in cities can be better understood through a systems perspective (Chapman et al. 2016; McPhearson et al. 2016). The World Health Organization (WHO) advocates systems thinking to understand complex health problems, including taking measures against COVID-19. The pandemic has triggered a more widespread awareness that

the health of people and the health of the planet are closely interlinked and that a systems approach is required to understand the connections.

Further, the complex and systemic nature of health means that protecting the population after disease is identified is often insufficient and needs to be accompanied by preventive measures taken well in advance of an infectious disease outbreak. This approach not only views cities as a key part of the economy and society, but can strengthen the urban immune system by making cities more livable, resilient, sustainable, green, healthy and intelligent. This view also requires a shift from a curative and alleviation approach to a more preventive stance. The Science Plan of the Urban Health and Wellbeing programme (UHWB 2021, p. 18) describes such an approach as addressing the (more complex) upstream root causes of health, which include living conditions, institutions and social inequalities (Coburn 2013; Hassan et al. 2020).

Among others, Bradley et al. (2020) have advocated a systems approach to prevent and respond to the COVID-19 pandemic on the basis that systems thinking can help decision makers to understand the multifaceted consequences of a pandemic beyond the spread of the infection. They proposed causal loop diagrams as tools to understand the complexity and possible consequences of interventions beyond emergency responses, and to "create a system that is intrinsically more resilient to new, and established, infectious agents."

With this understanding, a response to the COVID pandemic should be evident at many different points in a system, requiring a need for multiple and interrelated corrective or preventive actions by multiple actors at appropriate levels. It also highlights the value of a health equity approach to pandemic preparedness, response, and recovery in urban centres.

3 Quick Fixes vs. Systemic Solutions to COVID-19

A pandemic requires rapid responses, but also interventions which take the systemic nature of the disease and urban health into account. It is therefore not always easy to determine which measures need to be taken at which point in time within specific political, social, cultural, economic and geographical contexts. Systems approaches are often not attractive for policy makers, who can receive conflicting advice in all these areas. When urgent policy action is required this can threaten the status quo of power and authoritative decision making. To quote Charlotte Marchandise (2017): "A systems approach is not sexy. It scares policy makers. The system defends itself."

Given the challenges of using the systems approach, some policy makers opt for policies and interventions which promise quick fixes to complex problems, and shy away from a systems approach that may appear complicated and time consuming. There is also a tendency to seek solutions for infectious diseases in biotechnological fixes, like vaccines and protective equipment, while neglecting the socio-economic, cultural and behavioural aspects of the problem.

The success of the measures taken by countries in response to the COVID-19 pandemic has varied and we include a brief report here, but we know of no other urban comparisons. Baum et al. (2021) analysed the effectiveness of national responses and found that the Global Health Security Index, while predicting that the world in general was not well prepared for the pandemic, spectacularly failed to predict individual country preparedness, largely because the Index overlooked the political, economic and social contexts and the role of civil society. The authors concluded that adopting a systems approach which enables a focus on critical system components was necessary. Haug et al. (2020) ranked the effectiveness of different categories of non-pharmaceutical interventions (NPI) to mitigate the spread of the SARS-CoV-2 virus. Their results were based on the Complexity Science Hub COVID-19 Control Strategies List and they confirm the effectiveness of measures which are taken on the basis of a systems approach: curfews, lockdowns and restricting gatherings in public places; closing schools; and individual movement restrictions were amongst the top-ranked measures to bring down the infection rate. Such radical measures, however, can have significant adverse consequences, such as economic disruption, domestic violence, interrupted school learning, mental stress and disrupted nutrition. The Xiamen call to action emphasises the need for a dialogue with all stakeholder groups implicated in urban health issues such as the current COVID-19 pandemic.

4 Case Studies—Cities Under COVID-19

This book presents case studies of how different cities and regions responded to the pandemic around the world. The cases are presented in alphabetical order by country. The chapters were finalised in 2022, but mainly concentrate on the period up to the end of 2021.

São Paulo, Brazil is Latin America's largest city, with a population of 12 million, close to a third of whom live in slum-like conditions. Beyond the biological factors driving the different waves of COVID-19, Paulo Saldiva analyses the lack of economic resilience available to under-privileged social groups, such as their access to health services, where they live in the city and what air and environmental pollutants they are exposed to, to demonstrate the critical importance of the broader physical, economic, social and cultural determinants of disease contagion and severity in the city. As with previous diseases, the risk of dying from COVID-19 was largely dependent on age, comorbidities, genetics and, not surprisingly, Zip code, a widely used proxy variable for socio-economic vulnerability. By early 2022, the city had 1,013,548 confirmed cases and 40,521 deaths. The death rate was 3.2% for females and 4.8% for males, but for Afro-Americans the death rate was 9.4%, twice as high as that for whites (4.5%).

Throughout the pandemic, the Federal Brazilian Government minimised the important risks of contagion, the severity of the disease, and the estimated number of people who were likely to be affected. After the dismissal of two medically trained ministers of health, the policy response centred on supposedly effective drugs.

However, governors and some mayors began to reinforce measures of social isolation and the preventive use of facial masks, which highlighted political divisions that also resulted in street demonstrations fuelled by misinformation on social media. The federal government overrode the agreement between the distinguished local research institute and the Chinese government for vaccine development, so that consequently, Brazil lacks coordinated planning for large scale vaccination against COVID-19. These political decisions were met with a strong response by Brazil's scientific community, which began to collaborate to support health measures through the tax-supported public health system and developed vaccines and distributed personal protective equipment. In addition, there have been major research projects in Brazil on the medical impacts of COVID-19, including long COVID.

Blaise Nguendo-Yongsi analyses the national response strategy taken in **Douala, Cameroon's** largest city, with a population of 3.6 million people. From early 2020, the Ministry of Public Health followed WHO advice and instituted broad measures including contact tracing, surveillance and monitoring measures, public information and awareness-raising campaigns, testing, compulsory mask wearing, and the prohibition of public gatherings. Compliance with social distancing had varied success, understandably given that the majority of Douala's population lives in densely populated informal settlements. The lockdowns caused increases in domestic violence, mental health problems, and increases in other infectious diseases. The COVID crisis made it evident that social protection and welfare systems need urgent strengthening.

Canada has three main levels of government: federal, provincial/territorial and municipal. Conditioned by the 2003 severe acute respiratory syndrome (SARS) outbreak, the federal and provincial governments recognised the threat the COVID pandemic posed and rapidly activated agreed protocols, such as diagnostic capacity, scaled-up measures for preventing community transmission and provided additional resourcing for primary care. At the onset of the pandemic, Isaac Luginaah and colleagues describe how **Middlesex-London, Ontario, Canada**, a city of close to half a million people, adopted a 'social determinants of health' framework to deal with COVID-19. This framework implicitly assumed a community-based systems approach, which recognised how gender, income, employment, working conditions and ethnicity, including Indigenous identity, shaped individuals' experiences of the pandemic. The Middlesex-London Health Unit also issued orders under the provincial Health Promotion and Protection Act which provided additional protection to the county. This approach helped to identify existing inequities and contributed to reducing the number of COVID cases. Consequently, in the provincial COVID-19 response framework the Middlesex-London region was categorised as less restricted. Key features of the response included strong leadership and strategies that worked to ensure an effective, coordinated and inter-sectoral response at the local level.

Lan and colleagues' chapter draws on the effects of control measures in four **Chinese cities: Shanghai, Chengdu, Hangzhou and Zhengzhou**, all of which have populations of over ten million but managed to keep the infection rate below 0.02%, with no more than 10 cumulative deaths. The authors concluded that effective control of transmission in pandemics requires a pre-existing holistic package of governance

strategies that are based on top–down national deployments to ensure that enforcement of lockdowns and social distancing can be implemented by capable and agile local leadership. The aim was to issue appropriately tailored policies which coincide with different periods of the epidemic's development. The rationale is that the population will be reassured by the evidence of control of cases, and consequently, there is less emphasis on differential effects on disadvantaged groups. Where necessary, the central government can mitigate local government caution and delays in seeking approval for action. The authors highlight the different experiences from the four cities: Shanghai as a gateway city concentrated on transmission; Chengdu, led by a governor who was an expert in medicine and health management, had unprecedentedly intense and comprehensive policies; Hangzhou has a high level of technical expertise in mobile apps; and Zhengzhou, with a large rural population, utilised grassroot social mobilisation during its anti-epidemic campaign.

The late Juan Vela Valdés describes the impact of the pandemic in **Havana**, the capital and largest city in **the Republic of Cuba** with a population of just over two million, as a challenge for the entire society. The population was kept informed of likely outcomes even before the first cases appeared and health professionals were given preventive training and were involved in developing intensive preventive strategies and research projects. The Havana strategies were formulated by the leadership of the Communist Party of Cuba in the province and by the Provincial Government and implemented by an intersectoral and collaborative approach. Research institutes, universities, the Ministry of Health, medical companies and policy makers worked together to tackle the crisis, which was exacerbated by the ongoing US economic embargo. Cuba developed three vaccines showing over 90% efficacy in clinical trials, and health services were fully funded by the government. Medical brigades of nearly 5,000 doctors and health specialists were formed as an important force in Cuba and as an example of international health cooperation. Unintended consequences of the lockdowns were a rise in domestic violence and an increase in anxiety and depression, especially in children. While other airborne arboviruses spread by insects increased, childhood infectious disease which had been eliminated in Cuba did not recur and road traffic accidents decreased. Partly because of a decline in tourism, COVID-19 not only caused an overall decline in the economy but also increased existing socioeconomic inequalities.

The **European Union** case study by Monste Daban and colleagues examines how social and interconnected industrial clusters were mobilised quickly and effectively to face COVID-19. Clusters facilitate interconnectivity and are an important tool for economic development and innovation. The networking initiative discussed in this chapter is the European Alliance Against Coronavirus (EAAC), an open exchange group of clusters, associations, institutions, universities, companies, social economy stakeholders and other entities, representing a critical mass of several stakeholders across the 27 EU member states and associated countries. EAAC was brought together at the beginning of 2020 by the European Cluster Alliance (ECA) and the European Commission initially to report disruptions and emerging problems in industrial supplies. EAAC evolved to develop solutions for meeting essential needs for resources and materials during the pandemic, as well as developing strategic

solutions for economic recovery. The aim of the cluster initiative was to create a fast answer platform, which recognised the complex nature of cities and regional ecosystems. A continuous process of tracking, listening, interacting and reporting to the European Commission was made possible by the launch of the COVID-19 Data Platform in early 2020, which allowed member states and network research partners to gain a cross-sectoral perspective and to launch joint actions to address the pandemic and associated socioeconomic disruptions. The cluster approach of cities and regions is fundamentally systemic in the way it involves heterogeneous networks, combining numerous actors at different scales and in all the urban dimensions. This process led to the concept of social reactors, that encouraged collective action, to address the information needs of the general population on social media and to organise co-creation workshops with experts and practitioners. This systems analysis of data compared behavioural, social and economic impacts of the outbreak response across Europe and proposed guidance on best practices, possible responses and mitigation solutions, through the use of interactive dashboards and visual storytelling of population indicators of impact, resilience and social dynamics, intersecting with critical social factors. The governance and impact of response measures and their unintended consequences at various governance levels are also outlined.

Mari Vaattovaara and Henrik Lönnqvist analyse the Capital Region of **Helsinki** in **Finland**, which adopted a hybrid strategy to manage the COVID-19 pandemic after the first cases were identified in early 2020. Using existing emergency powers, Finland, along with other Nordic welfare states which stress social inclusion, has been relatively successful in managing COVID-19. The national government took a strong position and initially closed for three weeks the borders of the Uusimaa region, which has nearly one third of Finland's total population and includes Helsinki. All measures were communicated daily to the public and monitored using epidemiological, medical and functional indicators. A second COVID-19 wave began in September, which led to the setting up of the Corona Coordination Group, a key tool for discussion and joint decision-making in the Helsinki Metropolitan Area involving the top management of Helsinki and the two other cities in the area, Espoo and Vantaa, as well as other key urban and regional agencies. Throughout the pandemic, cities, and municipalities, which are self-governing, have been responsible for implementing most of the practical actions and were encouraged to set their own local rules and practices. This case explores the concrete actions made within the Capital Region of Helsinki, the hybrid strategy and some of the political and regional tensions that have arisen during the epidemic. Social and economic effects of the pandemic in the Capital Region of Helsinki are also explored. Although critical voices have also emerged, citizens' trust in authorities is still high, and among urban residents, the effects on people's daily lives have been reported to be the lowest in Europe.

COVID-19 arrived in the Middle East in February 2020. Abdalhadi Alijla analyses the extreme difficulties of dealing with a pandemic in an area dependent on non-state actors, which nonetheless try to gain legitimacy by behaving like states and engage widely with international NGOs and UN agencies. The Middle East is characterised by long-standing conflicts and large inequalities in health and welfare provisions. The **Gaza Strip**, with a population of two million, has been particularly hard hit by

the pandemic due to its poor humanitarian situation, overcrowded living conditions, poverty and limited access to medical supplies and health facilities. Paradoxically, as Gaza has been under siege since 2006 and has severe movement constraints, it was less likely to have many foreign travellers carrying the virus and infecting the population. The first cases were discovered in March 2020, but since the outbreak of new hostilities between Gaza and Israel in May 2021, health conditions have deteriorated further. Nonetheless, a relatively young population has kept mortality rates comparatively low in relation to other Middle Eastern states. The socio-economic impacts of the pandemic, however, have been serious, increasing unemployment and interrupting education, especially among vulnerable communities. This case study argues that although leadership plays a decisive role in mobilising pandemic response measures, due to their experiences in public service provision and welfare, Hamas acted like a de-facto government, albeit sometimes a coercive one, using the crisis to gain political influence and external legitimacy.

Aakriti Grover and the late R.B. Singh analysed the effect of the pandemic response in **New Delhi**, the capital of **India**, estimated to have a population of 22 million by 2025. The outbreak began at the end of January 2020, but Prime Minister Modi announced (in Hindi only) a national lockdown in late March, along with the introduction of preventive measures to help contain the spread of COVID-19, which included wearing masks, contact tracing, testing and social distancing, causing widespread alarm. Urban workers in the informal economy had to return, often by walking, to their home villages. High population densities in the city and poor housing conditions made it difficult to implement social distancing measures. The health care system and personnel were soon overburdened, and during the lockdowns, there were not only increases in domestic violence, but also violence against doctors, loss of livelihoods and widespread mental health issues. The Delhi State Government moved to introduce welfare schemes and in 2021 began to introduce vaccines that were manufactured in India. With wide rural–urban discrepancies, India is already suffering from a triple burden of diseases, so coping with the pandemic was an overwhelming burden, however there were some wider positive effects. During the lockdown, there was a resurgence of bird life and air and water quality improved. Moreover, non-governmental organisations and student volunteers found many innovative ways to cater to people's needs, especially in rural areas.

Philippa Howden-Chapman and Libby Grant highlight the relative advantages **New Zealand** had when responding to the COVID-19 pandemic. With a population of 5 million in islands of a similar size to the UK, a diverse but largely cohesive community, low levels of corruption, and a relatively popular government, New Zealand has largely maintained public support for its policies and actions. Every pandemic measure taken was weighed up for the health implications, but also for the social, cultural and environmental consequences. This public support has provided the foundation for the comparatively low social, health and economic impacts of COVID-19 and proportionally low number of cases, hospitalisations and deaths. An elimination strategy, which required quarantine of all incoming citizens and successfully encouraged most of the adult population to be vaccinated, was enforced until the end of 2021. When Omicron began spreading the strategy was abandoned in

favour of suppression. The consensus has been that the country's systems response, heavily informed by epidemiology, has been a success. However, in early 2022 there were several divisive, weeks-long illegal occupations of public space modelled on overseas protests. Despite these, New Zealand still has the lowest case fatality rate of any OECD country.

Suraj Bhattarai and Suman Kumar Karna analyse the city of **Biratnagar**, the second-largest city in **Nepal**, with a population of a quarter of a million. During the first and second waves of the pandemic in 2020 and 2021, Biratnagar designated all public health facilities for COVID-19 services. Holding centres were set up at several border points and 'Participatory Mobility Mapping' was launched with support from the International Organization for Migration (IOM). Rapid antibody testing kits (RAT) and PCR laboratories were soon added in the province and the city's health facilities deployed additional highly skilled health workers. The city set up a risk communication response and community engagement strategy. School teachers were mobilised to deliver awareness messages in the vulnerable, marginalised, and underprivileged communities. Lessons learnt were that formal collaborative studies are required to identify the determinants of COVID-19 burden and to better understand the association between vulnerable populations and the magnitude of COVID-19 impact in the city. Furthermore, health disparities and inequalities can be minimised if the pandemic preparedness and response plans are improved at the city, provincial and national levels taking a systems governance approach as outlined in the Xiamen Call for Action.

Amy Howden-Chapman and Veronica Olivotto analyse the experience of COVID-19 in **New York City**, which has a population of just over eight million and was the first major epicentre of COVID-19 in the **USA**, largely because of its population size, density, and location as a commercial and tourist hub. Discrepancies between the mayoral, state and federal responses defined both public messaging and policy responses aimed at containing infection and preventing deaths. Mayor Bill de Blasio publicly criticised the response at the federal level led by the Trump administration, while ongoing disagreements between de Blasio and New York State Governor Andrew Cuomo contributed to delays in instituting stay-at-home orders, substantially increasing the number of cases and deaths throughout the city. Critically, governance structures mean that the NYC mayor cannot mandate a lockdown in a pandemic without the approval of the state's governor. There were three peaks in COVID-19 cases, in March–April 2020, in December 2020–January 2021 and due to Omicron a much higher peak in December 2021. However, the death rates in the third wave were lower. Overall, the impact of the COVID-19 pandemic in NYC magnified the cumulative health and employment disadvantages already existing for many, especially low-income communities and communities of colour. COVID-19 also reduced the financial and institutional ability of NYC to protect the health and wellbeing of its residents. The impacts of the pandemic in NYC, including effects on housing, particularly for renters, transportation and disparities in job losses, which increased inequality in health and earnings, are analysed. Some innovative policy responses, such as the reallocation of street space for dining and recreation, are also discussed.

Akinyinka Omigbodun describes the COVID-19 response in **Ibadan**, the third largest city in **Nigeria**. It is a conurbation occupying more than 3,000 square kilometres, with an estimated population of six million people. Many of these people live in slums, lack access to potable water, and have poor sanitation and hygiene. A study on access to healthcare in two Ibadan settlements, one nearly 200 years in existence and the other less than 50 years old, began in 2017. There were extensive consultations with community leaders, slum residents, health workers and local government officials. Common illnesses in both places were mosquito-borne diseases, respiratory and gastrointestinal infections, and non-communicable diseases like hypertension. Pre-COVID-19, the inhabitants described fair access to preventive and therapeutic health services, with patent medicine vendors playing a major role in providing medication. With COVID-19, a reduction in access to healthcare and a higher cost of care were reported from both sites, while household income dropped drastically. Fear of being diagnosed with COVID-19 discouraged healthcare seeking. The drastic lockdowns used by authorities to contain the spread of COVID-19 provoked discontent, but the resilience of residents enabled them to cope till these were lifted.

Ruwan Wijayamuni and his colleagues analysed the policy approach taken in the city of **Colombo**, the economic capital of the South-East Asian island state of **Sri Lanka**. Colombo has a multi-ethnic population of over half a million people, as well as additional informal workers. The elected municipal council provides most services including preventive public health, but central ministries provide security services and primary, secondary and tertiary health care. There is also a growing private health sector. As the pandemic emerged in early 2020, the dynamic nature of multiple interacting city systems was recognised. In 2009, Sri Lanka had emerged from a 26-year civil war, so had a recent history of national mobilisation. Consequently the response to the pandemic was initially framed as a law-and-order issue. Public health measures were led by a centralised task force under an army commander and included PCR testing, contact tracing, quarantines, obligation to wear masks and social distancing. Schools were closed, airports were closed to incoming flights, and curfews were enforced. These measures, which were heralded by state and social media, were successful in suppressing the first wave which began in one of the city's overcrowded and underserved low-income areas. Despite these efforts, a second wave followed in September 2020 from clusters originating in a suburban factory and fish market, which then spread to several low-income settlements in Colombo and surrounding areas, and led to a third wave and then a fourth (Omicron) wave at the end of 2021. By then, almost two-thirds of the population were vaccinated.

Rachel Cooper and her colleagues discuss what happened when the city of **Lancaster, England, in the UK** was hit by the pandemic. A tiered system and lockdowns were introduced in October 2020, but the complex ecosystem of regional and local governance in England resulted in a perceived lack of understanding of that ecosystem by civil servants and politicians in central government, and a lack of clarity in the communication of guidelines. At certain stages of the crisis, local leaders would have preferred a more local approach to implement the track and trace system. In the early stage of the pandemic when despite warnings (Morawska and Milton 2020) there was not widespread understanding that the virus was largely

airborne and that outdoor areas were therefore probably safer than indoor areas, COVID-19-prevention measures resulted in a temporary redesign of urban form. To ensure compliance with social distancing in the pedestrianised areas of the city centre, sitting in public places and social gathering was discouraged. Public squares were locked, a market was relocated, roads closed, and buildings were re-used to enable social distancing and gain space for vaccination centres. Large portions of the population were unable to access green space. Overall, the city took a partly systematic and partly emergency-response approach. Within the city council, policies that had been on the agenda for the future were brought forward and essentially prototyped, including working from home, the roll out of digital technologies, active travel and changes to the urban realm. The pandemic offered opportunities for experimentation in policy areas and learning experiences for future health emergencies. Overall, Lancaster took an approach that was partly systematic, but also partly emergent and responsive.

5 Conclusion

The 15 case studies in this book are part of an ongoing story. At the beginning of 2022, the time of writing this book, the epidemic has not yet plateaued in most of the cities, but while the timing and sequencing of the pandemic varied from city to city through 2020 and 2021, the elements of the plot were similar. Gateway cities, such as Auckland, Colombo, Doula, Havana, New Delhi, New York, and Shanghai were the first cities to be affected by the pandemic in their countries. Depending on their borders, most had problems with restricting incoming passengers to slow the spread of COVID-19. In most countries, the pattern of the disease was from cities to small and medium urban centres. Denying citizens the right to return to their own countries raised issues of the balance between public health measures to protect populations and individual rights and liberties.

One of the most challenging issues for governments establishing an action plan in response to an unexpected event like a pandemic is the uncertainty and the speed at which evidence emerges. Hence, the way in which new policies to manage the pandemic are communicated and complex decision-making processes are negotiated among varied stakeholders, are crucial to success. To effectively address the complexities of the COVID-19 pandemic at the intersection of political, social and environmental issues in urban centres, cities need to increase the level of engagement and collaboration across sectors.

Our international case studies illustrate both the commonalities and the differences in the way cities handled the pandemic and highlight the importance of understanding how to approach complex problems in complex environments. Fundamentally, this means understanding key aspects of that specific place; the institutions, governance, economic, environmental and social factors. The latter, especially cultural and behavioural responses in partnership with community groups, have been critical in managing the spread of the virus.

As is indicated from the cities with more positive outcomes, we do have the global knowledge to support a broad, inclusive policy approach to create more healthy cities, which are generally more resilient. Those cities which have weathered the COVID-19 pandemic better than others perform in multifunctional ways by transparently managing flows of information and knowledge, both within different levels of government and in communication with community groups. These information flows inform citizens of the logic of government decisions and reciprocally make city governments more aware of the social and environmental impacts of their policies, and therefore able to act more intelligently to integrate health and wellbeing into all city policies.

A first plan for urban science to achieve this goal of health in all policies was published in 2021 by the Urban Health and Wellbeing Programme (UHWB 2021). It is hoped that the findings of the urban case studies of COVID-19 responses reported in this book will build on the plan for urban science to help inform governments at all levels in their management of future health crises.

References

Bai X, Surveyer A, Elmqvist T, Gatzweiler FW, Güneral F, Parnell S et al (2016) Defining and advancing a systems approach for sustainable cities. Curr Opin Environ Sustain 23:69–78

Baum F, Freeman T, Musolino C, Abramovitz M, Ceukelaire WD, Flavel J, Friel S, Giugliani C, Howden-Chapman P, Huong NT, London L, McKee M, Popay J, Serag H, Villar E (2021) Explaining Covid-19 performance: what factors might predict national responses? BMJ 372. https://doi.org/10.1136/bmj.n91

BBC (2021) Wealth increase of 10 men during pandemic could buy vaccines for all, January 9, 2021. https://www.bbc.com/news/world-55793575

Benkler Y (2006) The wealth of networks how social production transforms markets and freedom.Yale University Press, New Haven and London

Bradley DT, Mansouria MA, Keea F, Garcia LMT (2020) A systems approach to preventing and responding to COVID-19 Commentary. Eclinicalmedicine 21:100325

Chapman R, Howden-Chapman P, Capon A (2016) Understanding the systemic nature of cities to improve health and climate change mitigation. Environ Int 94:380–387

Corburn J (2013) Healthy city planning. From neighbourhood to national health equity. Routledge

COVID-19 in an Urban World. Policy Brief. https://reliefweb.int/sites/reliefweb.int/files/resources/COVIDANDCITIES.pdf. Accessed 10 Jan 2021

Ebikeme C, Gatzweiler F, Oni T et al (2019) Xiamen call for action: Building the brain of the city—universal principles of urban health. J Urban Health 2019(96):507–509. https://doi.org/10.1007/s11524-018-00342-0

Feitelson E, Ilmola-Sheppard L, Rovenskaya E, Strelkovskii N, Rein-Sapir Y (2020) The impact of COVID-19 on well-being: a systems approach. IIASA Working Paper, Laxenburg, Austria: WP-20-019

Gatzweiler FW, Zhu Y-G, Diez Roux AV, Capon A, Donnelly C, Salem G et al (2017) Advancing health and wellbeing in the changing urban environment: implementing a systems approach. Springer, Hangzhou

Gatzweiler F, Fu B, Rozenblat C, Su HJ, Luginaah I, Corburn J, Boufford JI, Valdes JV, Nguendo-Yongsi B, Howden-Chapman P, Singh RB, Cooper R, Oni T, Zhu Y-G (2020) COVID-19 reveals the systemic nature of urban health globally. Cities and Health. https://doi.org/10.1080/23748834.2020.1763761

Hassan I, Obaid F, Ahmed R, Abdelrahman L, Adam S, Adam O, et al (2020) A systems thinking approach for responding to the COVID-19 pandemic. East Mediterr Health J 26(8):872–876. https://doi.org/10.26719/emhj.20.090

Haug N, Geyrhofer L, Londei A, Dervic E, Desvars-Larrive A, Loreto V, Pinior B, Thurner S, Klimek P (2020) Ranking the effectiveness of worldwide COVID-19 government interventions. Nat Hum Behav 4:1303–1312. https://doi.org/10.1038/s41562-020-01009-0

Hill R, Narayan A (2020) Covid-19 and inequality: a review of the evidence on likely impact and policy options. Working paper, Centre for Disaster Protection, London

International Labor Organization (ILO) Monitor (2021) COVID-19 and the world of work. Seventh edition Updated estimates and analysis. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_767028.pdf. Accessed 8 Jan 2021

International Monetary Fund (IMF) (2021) World economic outlook: October 2021. Accessed 16 Dec 2021

Marchandise, Charlotte, Personal interview, 2017

McPhearson T, Haase D, Kabisch N, Gren Å (2016) Advancing understanding of the complex nature of urban systems. Ecol Ind 70:566–573. https://doi.org/10.1016/j.ecolind.2016.03.054

Mehaffy M (2019) Cities are like brains—immense networks of connective tissue. https://www.cnu.org/publicsquare/2019/12/10/wonders-urban-connectome. Accessed 10 Jan 2021

Morawska L, Milton DK (2020) It is time to address airborne transmission of coronavirus disease 2019 (COVID-19). Clin Infect Dis 71(9):2311–2313. https://doi.org/10.1093/cid/ciaa939

Rydin Y, Bleahu A, Davies M, Dávila JD, Friel S, di Grandis G, Groce N, Hallal P, Hamilton I, Howden-Chapman P, Lai KM, Lim CJ, Martins J, Osrin D, Ridley I, Scott I, Taylor M, Wilkinson P, Wilson J (2012) Shaping cities for health: the complexity of planning urban environments in the 21st century. The Lancet 379(9831):2079–2108. https://doi.org/10.1016/S0140-6736(12)60435-8

Sen A (1999) Development as freedom. Oxford University Press, Oxford, UK

Seung S (2012) Connectome. How the brain's wiring makes us who we are. Houghton Mifflin Harcourt, Boston, New York

Taylor JM, Howden-Chapman P (2021) The significance of urban systems on sustainability and health. Buildings and Cities, Special collection: urban systems for sustainability and health 2(1):874–887. https://doi.org/10.5334/bc.181

UHWB (2021) Report of the scientific committee of the international science council's programme on Urban health and wellbeing. An interdisciplinary science-action plan for Urban health and wellbeing in an age of complexity and systemic risks (2021–2025). Urban Health and Wellbeing Programme, Xiamen, China

UN (2020) UN habitat 2020. World cities report 2020. https://unhabitat.org/sites/default/files/2020/10/wcr_2020_report.pdf. Accessed 10 Jan 2021

United Nations Human Settlements Programme (UN-Habitat) (2020). Opinion: COVID-19 demonstrates urgent need for cities to prepare for pandemics, 15 June 2020, available at https://unhabitat.org/opinion-covid-19-demonstrates-urgent-need-for-cities-to-prepare-for-pandemics

von Braun and Gatzweiler (2014) Marginality. Addressing the nexus of poverty, exclusion and ecology. Springer Open, Dordrecht, New York, London

Wernli D, Tediosi F, Blanchet K, et al (2021) A complexity lens on the COVID-19 pandemic. Int J Health Policy Manag x(x):x–x. https://doi.org/10.34172/ijhpm.2021.55 ePublished: 26 May 2021

World Bank Blog. COVID-19 leaves a legacy of rising poverty and widening inequality. https://blogs.worldbank.org/developmenttalk/covid-19-leaves-legacy-rising-poverty-and-widening-inequality. Accessed 8 Jan 2021

World Economic Forum COVID-19 is increasing multiple kinds of inequality. Here's what we can do about it. 2021. https://www.weforum.org/agenda/2020/10/covid-19-is-increasing-multiple-kinds-of-inequality-here-s-what-we-can-do-about-it/

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BRAZIL: COVID-19 in São Paulo

Paulo Saldiva

Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

São Paulo was the epicentre and major focus of SARS-CoV-2 dissemination in Brazil. The first documented case was a senior citizen admitted to a private hospital in São Paulo just after his return from Italy. Less than a week later, the first local infections were documented. The spread of COVID-19 in São Paulo has a vivid and complex plot. Different and sometimes opposing forces emerged, either favouring or reducing the pandemic's spread. Moreover, the pandemic established its route of contagion, dictated not only by the mechanisms that regulate virus–host interaction, but also by the economic resilience of different social sectors, urban morphology and access to health services, all factors that have shown to be important determinants of disease contagion and severity as well. The cartography of cases and deaths disclosed a significant spatial variability, affecting the most severely underprivileged parts of the city. Indeed, in São Paulo, the risk of dying of COVID-19 disease was largely dependent on age, comorbidities, genetics and, not surprisingly, ZIP code, a proxy variable of vulnerability. This chapter presents brief bullets of information about the dialogue between the virus and the city, expressed by the numbers of sick or dead, and interpreted through the lens of a pathologist.

2 The City and COVID-19: General Aspects

São Paulo Metropolitan Area, with 21.5 million inhabitants, is a conglomerate of 39 cities physically and functionally connected with São Paulo, the capital of the state of the same name, which concentrates jobs and opportunities. The city of São Paulo is the residence of 12 million people. From the first case in late February 2020 up until now, the city of São Paulo had 391,917 confirmed cases and 15,463 deaths. Lethality was 3.2% and 4.8% for females and males, respectively. The lethality for Afro-Americans was 9.4%, twice as high as that for whites (4.5%).

The accumulated number of cases and deaths has not shown evidence of any plateauing, as depicted in Figs. 1 and 2.

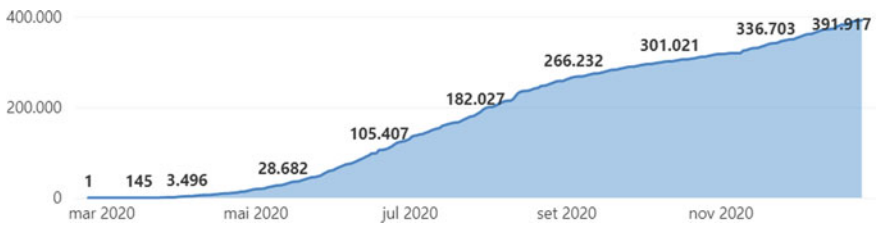

Fig. 1 Accumulated number of COVID-19 diagnosed in São Paulo since the beginning of pandemics (https://www.seade.gov.br/coronavirus/#)

Fig. 2 Accumulated number of deaths due to COVID-19 in the onset of the pandemics (https://www.seade.gov.br/coronavirus/#)

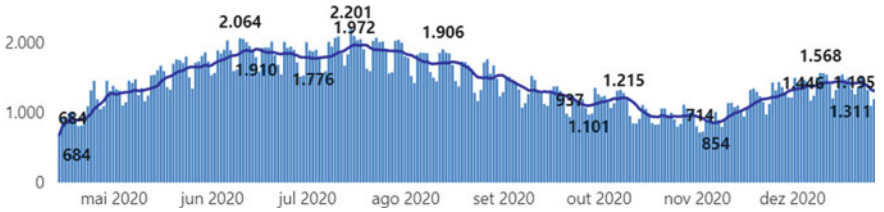

Fig. 3 Daily evolution of new cases of COVID-19 in São Paulo. Bars represent daily counts and the line shows the 15-day moving average (https://www.seade.gov.br/coronavirus/#)

In fact, the city of São Paulo reflects quite well the situation of Brazil, specifically in the distinction between first and second wave of cases. We had a recrudescence of disease when the first wave was still active, as shown in Fig. 3.

3 Social and Economic Vulnerability: The Impact of COVID-19 in the "Different Parallel Cities" Contained in São Paulo

The city of São Paulo is divided into 96 Administrative Districts (AD), with different patterns of settlement and urban development. In São Paulo, the Human Development Index (HDI, a single statistic of reference for both social and economic development, which ranges from 0, no development to 1, maximal development) varies from 0.245 to 0.960. This information points to the significant potential to explore the role of several urban conditions when studying the effects of urbanity on health. In fact, the city has several digital cartographic databases of important environmental and urban features: topography, geology, geomorphology, soil, hydrographic networks, land use and street networks. Moreover, the health authorities have geocoded databases for different health outcomes. The combination of a large number of events and consolidated databases makes São Paulo a natural laboratory for conducting ecological, observational studies to evaluate and explore the role of urbanity on human diseases.

Previous studies have already demonstrated that vulnerability to cardiovascular diseases, a well-known risk factor for COVID-19, is markedly associated with social and economic deprivation in São Paulo. Barrozo et al. (2020) built a georeferenced estimator of socio-economic vulnerability for São Paulo, that explained about 65% of the risk for premature death in our city, as shown in Fig. 4.

Exposure to ambient levels of air pollution has been associated with increased risk of developing COVID-19. Takano et al. (2019) measured the amount of black carbon in human lungs of urban dwellers living in São Paulo and demonstrated that time spent in traffic is an important risk factor for getting a higher dose of air pollution. It is important to note that the cartography of deposited air pollution in the lungs does not correspond to the spatial distribution of ambient concentration of airborne pollutants measured by the fixed air pollution monitoring stations. The monitoring stations show higher levels of pollution in the central part of the city, the area where traffic concentrates from the periphery of the city. On the other hand, carbon measurements in human lungs show a marked peripheral distribution in the less developed parts of the city where the less privileged segments of our population, commuting back and forth from home to work, endure congested traffic on a daily basis (Fig. 5).

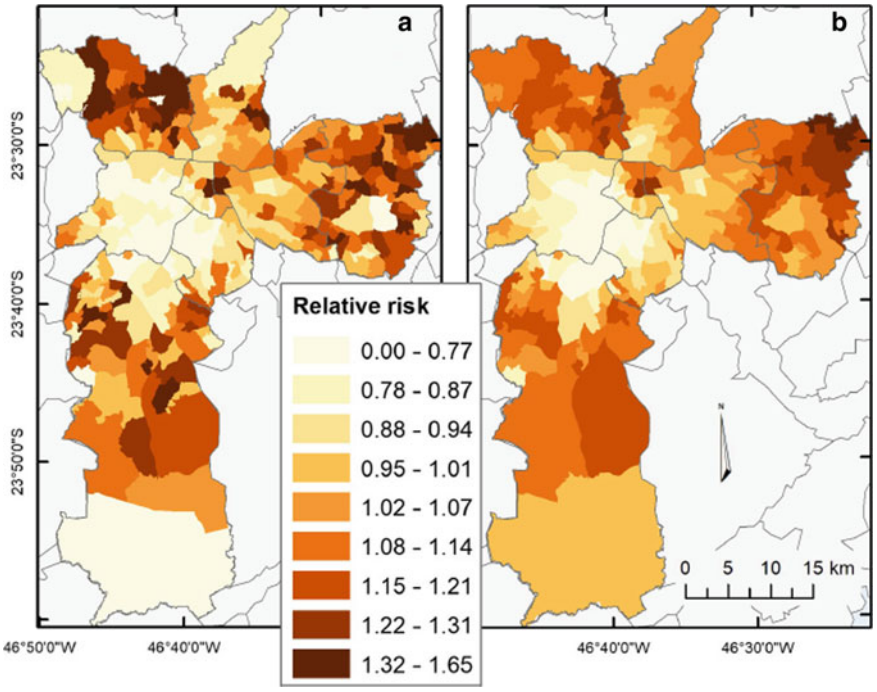

Fig. 4 Panel a shows the marked variation of risk of premature death due to cardiovascular diseases in São Paulo. Panel b shows the prediction of spatial distribution of premature cardiovascular deaths based on socioeconomic indicators (Barrozo et al. 2020)

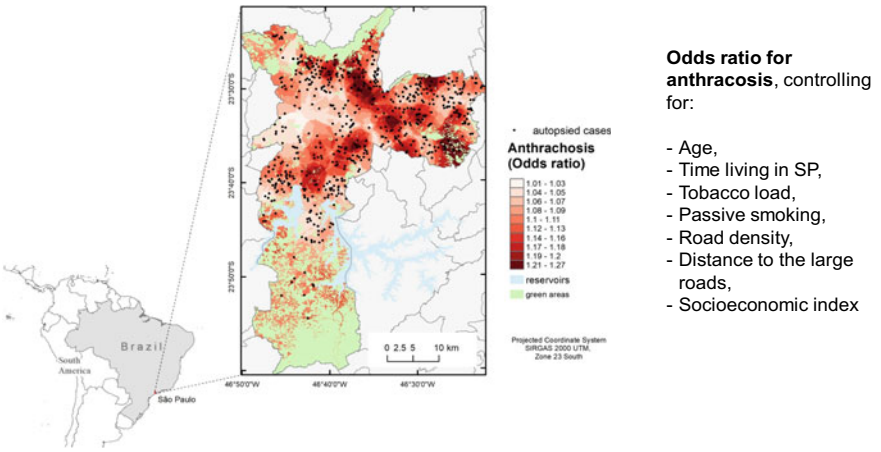

Fig. 5 Spatial variability of the odds ratio for developing significant anthracosis (black carbon deposition into pulmonary parenchyma), adjusted for several confound variables. Dwellers living at the periphery of São Paulo are more exposed to airborne pollutants

Social and economic deprivation and exposure to airborne pollutants are two examples of the complexity of urban characteristics indicative of small-scale variations of susceptibility to health stressors that modify the risk of getting COVID-19 or, even worse, dying of it. At the urban periphery, economic factors impede social isolation, forcing the poorest population segments, who have fewer possibilities of controlling their cardiovascular conditions to work, to use public transportation, where they not only have higher doses of air pollutants but also are exposed to higher contagion risk.

Considering the previous scenario, it was expected that the spread of COVID-19 in São Paulo would be unevenly distributed. Such an assumption was fully confirmed as the pandemic evolved. Bermudi et al. (2020) tracked the spatial variation of confirmed deaths due to COVID-19 in the different epidemiological weeks of pandemics. GeoSES (the index of socioeconomic vulnerability) explained 77% of spatial variability of the lethality risk, indicating that the outcome of COVID-19 is highly influenced by the physical, economic, social and cultural environments of our city (Fig. 6).

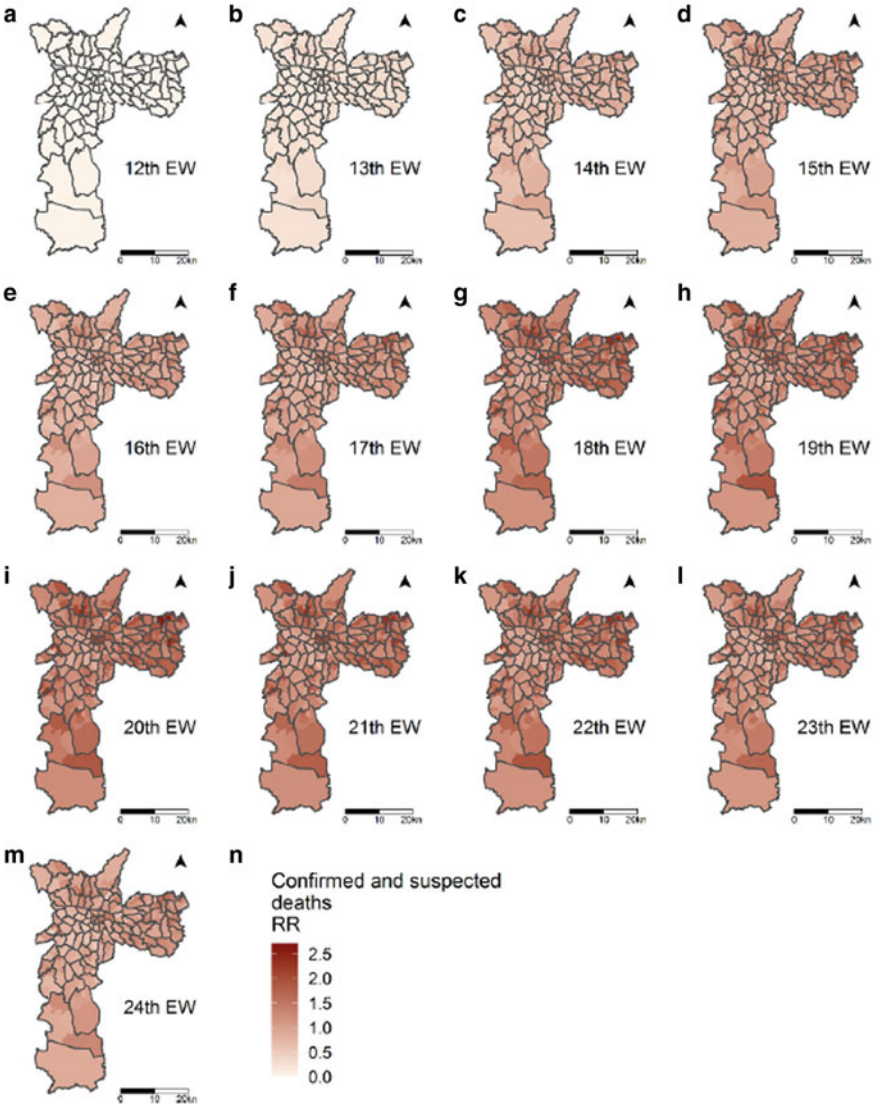

Fig. 6 Spatial variability of lethality risk due to COVID-19 in São Paulo, as measured along different epidemiological weeks (Bermudi et al. 2020)

4 Political Noise in Times of Pandemics

Along the timeline of the pandemic, the political debate in Brazil has reached high temperatures. Since the beginning of the present crisis, the federal government has minimised the risks of contagion, the severity of the disease, and the estimated

number of affected people. Two ministers of health, physicians by training, were dropped from their posts because they refused to endorse such views. Presently, Brazil has a military general as minister of health who follows orders given by the central administration and has consolidated into policy the large-scale distribution of drugs supposedly effective in the early phases of COVID-19, such as ivermectin, chloroquine and vitamin D, which were designated as 'COVID Kits'.

On the other side, governors and some mayors began to reinforce measures of social isolation and the preventive use of facial masks. Because of the political division of the country (supporters vs. non-supporters of the federal government) the debate stretched the limits of political debate and spilled over into social media and the streets, where public manifestations in favour of, or against, the federal government became frequent.

More recently, with the proximity of availability of vaccines, the political temperature has increased even more. The State of São Paulo established an agreement with a Chinese pharmaceutical company to test and produce locally a vaccine based on an attenuated virus. The Brazilian Institution responsible for testing and producing such vaccines is the Butantan Institute, a 120 year-old research facility that produces and exports vaccines against influenza, yellow fever and has developed the most efficient vaccine against dengue. Because of its geopolitical preferences, the federal government initiated a campaign against the "Chinese vaccine", in a rare combination of geopolitics and prejudice, aiming to undermine the intentions of São Paulo's governor to run for the presidential elections in 2022. Currently, Brazil has no definite plan or time schedule for large-scale vaccination against COVID-19.

Thus, it is reasonable to propose that the Brazilian political scenario did not contribute to reducing the magnitude of the pandemic and eventually contributed to increasing its negative impacts.

5 The Response of Scientists

The Brazilian scientific community was highly responsive to the crisis caused by COVID-19. São Paulo has the largest community of scientists in the country, and universities and research institutions collaborated to produce data and instruments to face the challenge. Scientists were called to form advisory boards at municipal and state levels in São Paulo. Geostatistical and advanced forecast models were developed by São Paulo scientists to support health measures. Research institutes and universities began to develop first-generation vaccines, and second-generation locally developed vaccines started phase 1 testing.

Medical equipment was also rapidly developed and produced to overcome shortages because of the large global demand. The School of Engineering of the University of São Paulo (USP) produced a low-cost but highly effective mechanical ventilator. Telemedicine networks were also established by USP's Faculty of Medicine to train non-specialists in intensive-care practices to reduce the mortality of severe patients. Protective masks for health personnel were developed, tested and produced by the

aerosol community. In addition, scientists and institutions engaged in public communication, a great antidote against the proliferation of viral ignorance that infected social media. As a general rule, São Paulo was the Brazilian city that made the best use of science to establish public policies during the pandemics.

6 The Response of the Health Sector

The city of São Paulo is presently the Brazilian reference for advanced medical care. Thus, the city was a pole of attraction for the most complex cases from the state, and to a lesser degree, for cases in other Brazilian states. Brazil has a public health system (Sistema Único de Saúde, SUS) designed to provide all levels of health care for free. Presently, SUS is the only option for about 75% of Brazilians although rates vary amongst different Brazilian states.

The reference hospital for COVID-19 in the city of São Paulo is the teaching hospital of the Faculty of Medicine of the University of São Paulo (Hospital das Clínicas, HC). The HC complex has 2,400 beds (the largest medical centre in Latin America) and has allocated its Central Hospital with 900 beds (300 of them of ICU) exclusively to patients with COVID-19. The entire staff of the Central Institute was designated to support and care for COVID-19 patients and have paid the price of long hours of work, contagion and even death.

Complementing the clinical care of admitted patients, HC invested significant efforts to understand the pathogenesis of the new infectious entity. The Pathology Department of our Institution conducted a minimally invasive autopsy (MIA) procedure, based on imaging guided post-mortem tissue sampling of several organs (Duarte-Neto et al. 2020). MIAs were used to analyse the magnitude of tissue damage in different organs, to explore the mechanisms of disease and to build a tissue repository to study the molecular mechanisms regulating the interaction between the virus and different tissues and cell types. MIAs were the basis for online clinical–pathological discussions attended by more than 100 physicians from different institutions that produced several insights on the magnitude of respiratory damage (Almeida Monteiro et al. 2020), on the vascular-thrombotic events (Dolhnikoff et al. 2020a), on the mechanisms of children's deaths (Dolhnikoff et al. 2020b) and, finally, on the mechanisms underlying the multisystem inflammatory response elicited by SARS-CoV-2 (Veras et al. 2020).

Such efforts imposed a heavy burden on the hospital personnel; not only for the large number of infected members of our staff, but also for the burden of continuous work since early March 2020. Now HC faces the reality of a second wave of infections in the context of an ineffective vaccination plan accompanied by a progressive decrease of social isolation throughout the entire country. We expect new and formidable challenges for health institutions and professionals.

7 Concluding Remarks

This chapter presented a very short description on how São Paulo, one of the largest urban centres in the world, has faced the COVID-19 pandemic. It is a narrative combining scientific data with the qualitative impressions imprinted by the magnitude and intensity of the disease. Indeed, since historical times, it is hard to disentangle science and objective evidence from emotional and spiritual values when describing every epidemic episode.

São Paulo is a good observatory of the complexity that governs pandemic situations. In addition to the challenge of understanding the biology of viral–host interaction and devising new strategies to minimise suffering and reducing lethality, the present pandemic was accompanied by an unprecedented flow of misinformation. The infodemics of the present times have disseminated ignorance, hate, reinforced prejudices and most probably contributed to the dissemination of disease in our city and country. The spread of ignorance is an unpredicted challenge for scientists. Perhaps the moment has arrived when it is necessary to study the epistemology of ignorance and devise systematic methods to counterbalance deliberate misinformation.

São Paulo has also provided a unique and tragic opportunity to evaluate how urban disparities interact with human health. Poor people had significantly higher risk of dying because of COVID-19 in São Paulo. They did not die because of a lack of medical assistance. They died because they are poor, do not have time to control their chronic health conditions, and cannot afford to socially isolate. They die because of bad housing. They die trying to make money to survive. Such a picture is a clear demonstration of the importance of a systemic health approach and the importance of urban health.

References

Almeida Monteiro RA, de Oliveira EP, Saldiva PHN, Dolhnikoff M, Duarte-Neto AN (2020) BIAS—Brazilian Image Autopsy Study Group. Histological-ultrasonographical correlation of pulmonary involvement in severe COVID-19. Int Care Med 46(9):1766–1768. https://doi.org/10.1007/s00134-020-06125-z.Epub. PMID: 32494927; PMCID: PMC7266913

Barrozo LV, Fornaciali M, de Andre CDS, Morais GAZ, Mansur G, Cabral-Miranda W et al (2020) GeoSES: a socioeconomic index for health and social research in Brazil. PLoS One 15(4):e0232074

Bermudi PMM, Lorenz C, Aguiar BS, Failla MA, Barrozo LV, Chiaravalloti-Neto F (2020) Spatiotemporal ecological study of COVID-19 mortality in the city of São Paulo, Brazil: shifting of the high mortality risk from areas with the best to those with the worst socio-economic conditions. Travel Med Infect Dis 2(39):101945. https://doi.org/10.1016/j.tmaid.2020.101945

Dolhnikoff M, Duarte-Neto AN, de Almeida Monteiro RA, da Silva LFF, deOliveira EP, Saldiva PHN et al (2020a) Pathological evidence of pulmonarythrombotic phenomena in severe COVID-19. J Thromb Haemost 18(6):1517–1519. https://doi.org/10.1111/jth.14844. PMID: 32294295; PMCID: PMC7262093

Dolhnikoff M, Ferreira Ferranti J, de Almeida Monteiro RA, Duarte-Neto AN, Soares Gomes-Gouvêa M, Viu Degaspare N et al (2020b) SARS-CoV-2 in cardiac tissue of a child with COVID-19-relatedmultisystem inflammatory syndrome. Lancet Child Adolesc Health 4(10):790–794. https://doi.org/10.1016/S2352-4642(20)30257-1. Epub 2020b Aug 20. Erratum in: Lancet Child and Adolescent Health. 2020b Oct;4(10):e39. PMID: 32828177; PMCID: PMC7440866

Duarte-Neto AN, Monteiro RAA, da Silva LFF, Malheiros DMAC, de Oliveira EP, Theodoro-Filho J et al (2020) Pulmonary and systemic involvement in COVID-19 patients assessed with ultrasound-guided minimally invasive autopsy. Histopathology 77(2):186–197. https://doi.org/10.1111/his.14160. Epub 2020 Jul24. PMID: 32443177; PMCID: PMC7280721

Takano APC, Justo LT, Dos Santos NV, Marquezini MV, de André PA, da Rocha FMM, et al (2019) Pleural anthracosis as an indicator of lifetime exposure to urban air pollution: an autopsy-based study in Sao Paulo. Environ Res 173:23–32. https://doi.org/10.1016/j.envres.2019.03.006

Veras FP, Pontelli MC, Silva CM, Toller-Kawahisa JE, de Lima M, Nascimento DC (2020). SARS-CoV-2-triggered neutrophil extracellular traps mediate COVID-19 pathology. J Exp Med 217(12):e20201129. https://doi.org/10.1084/jem.20201129. PMID: 32926098; PMCID: PMC7488868

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CAMEROON: Epidemiological Insights, Public Health Response, and Potential Psycho-Socio-Economic Impacts of COVID-19 Pandemic in Douala—A Population-Based Study

Blaise Nguendo-Yongsi

Source Jawgmaps/uMap/OpenStreetMaps

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Urban Health and Wellbeing, https://doi.org/10.1007/978-981-19-8163-0_3

1 Introduction

An outbreak of a new coronavirus disease that causes respiratory tract infections and can be lethal in humans began in China in December 2019. On 11 March 2020, the World Health Organization (WHO) announced that the current outbreak of the coronavirus disease 2019 (COVID-19), a respiratory illness caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), is a pandemic (WHO 2020). COVID-19 started spreading rapidly to other countries by the end of December 2019. With the spread of the virus worldwide, global concerns about human pandemics are growing. As of December 2021, the global death toll had passed 5,455,963, with infections rising to more than 289,116,951 (Worldometer 2020). The first case in Africa was identified in Egypt in February 2020. According to the WHO, there have been 9,822,511 confirmed cases and 229,061 deaths registered in Africa by 30 December 2021. South Africa and Morocco have crossed 1,000,000 cases. They are followed by Tunisia (726,706 cases), Ethiopia (420,342 cases) and Egypt (388,734 cases) (WHO 2021).

While some studies have investigated biological and clinical aspects of the disease (Ogen 2020; Wu et al. 2020), others have explored its risk factors and the role of 'space' in cities in the spread of the pandemic. More precisely, an Italian study revealed that population density along with lifestyle in developed countries may partially explain the regional differences regarding the COVID-19 infection between the North and South (Ilardy et al. 2021). Such a link was already reported during the 2003 SARS outbreak in China, where Cui et al. (2003) showed that infected people who lived in densely populated regions were twice as likely to die as those living in regions with low density.

The first case in Cameroon was declared on 6 March 2020. By 30 December 2021, 109,367 confirmed cases and 1,851 deaths had been registered, compared to the 2,069 active cases and 61 deaths registered by December 2020 (MINSANTE 2020). Cameroon is one of the African countries most affected by the pandemic, which is probably due to non-compliance with health measures put in place by the government. The most basic measure to reduce the spread of coronavirus, or to prevent infection, is to follow hygiene rules and physical distancing (Khankeh et al. 2021; Koo et al. 2020). These measures have suddenly changed daily human functioning. Social distancing, self-isolation, loss of freedom, uncertainty, school and business closings, economic vulnerability and job loss have been some results of the lockdown (Nussbaumer-Streit et al. 2020). People worldwide have been told by authorities to stay home to reduce the transmission of coronavirus with the hopeful assurance that social isolation and domestic quarantine can deepen relationships between family members, intensifying intimacy, affective exchanges, personal ties and previous behaviours, thus becoming a period of emotional growth for all involved (Chu et al. 2020).

Despite the measures taken by the government in Cameroon, there has been an increase in cases and deaths by COVID-19, especially in metropolises like Douala. Therefore, the main question addressed here is: as the pandemic transitions to more widespread community transmission, how can the lessons learned thus far be consolidated to effectively curb the spread of COVID-19 while minimising social disruption and the negative social and economic consequences in Douala? The goal of this study is to highlight the epidemiologic features and challenges needed to fight COVID-19 in Douala, Cameroon.

2 Material and Methods

2.1 Study Area

Douala is located between latitude 4°3′53.77″ north of the equator and longitude 9°41′15.41″ east of the Greenwich meridian. It is a coastal city established on the banks of the river Wouri. Located approximately 30 km from the Atlantic Ocean, Douala covers an area of approximately 210 km^2 with roughly 3.6 million inhabitants, giving a population density of 178 inhabitants/km^2. After coming under German rule in 1884, it became known as Kamerunstadt, the capital of German Kamerun. It was later renamed Douala and became part of French Cameroon in 1919 (Fig. 1).

Douala is the largest city in Cameroon and contains a mosaic of ethnic groups. Douala owes its recent growth to the rural exodus that has pushed thousands of Cameroonians to leave the countryside and settle in the city, coupled with the current civil crisis in the north-west and south-west regions of Cameroon.[1] The population

[1] The Anglophone Crisis, also known as the Cameroonian Civil War, is an ongoing war in the Northern and Southern Cameroons regions of Cameroon. The roots of the conflict can be found in the country's colonial history, as Cameroon inherited two distinct traditions in the wake of independence: one French-oriented and the other British-oriented. There were critical differences between the two systems in terms of education, provision of justice, and institutional arrangements for governance (*Anyangwe, Carlson. Betrayal of Too Trusting a People. The UN, the UK and the Trust Territory of the Southern Cameroons: The UN, the UK and the Trust Territory of the Southern Cameroons, pp. 108–111. African Books Collective, 2009*). Objective socioeconomic differences between the English and French-speaking regions do not exactly match up to the Anglophone population's perceptions of inequality and exclusion. Prior to the crisis, the English-speaking Northwest and Southwest regions (NWSW) did not lag behind the rest of the country in terms of economic and social outcomes. Rather, they accounted for a substantial share of Cameroon's limited formal economy and agricultural exports and employment. However, Anglophones appeared to have a harder time entering the public sector, which many Cameroonians regard as a principal path to financial security. The current crisis began with peaceful protests in 2016 and quickly escalated into a full-scale armed conflict with clear secessionist and criminal elements. In fact, following the suppression of 2016 Cameroonian protests, Ambazonian separatists in the Anglophone NWSW territories launched a guerilla campaign against Cameroonian security forces, and later unilaterally proclaimed the restoration of independence. In November 2017, the government of Cameroon declared war on the separatists and sent its army into the Anglophone regions. The conflict has featured repeated and deliberate attacks against symbols of the state and the boycotting of national

of Douala increased from 458,426 in 1976 to 1,907,479 inhabitants in 2005 and in 2020 had an estimated population of 3,663,000 inhabitants, with a growth rate of 3.59%. This increase can also be explained by the presence of numerous industries that serve as a source of job opportunities for the inhabitants. The city of Douala has established itself as the economic capital of the country largely through its seaport, which has allowed the development of nearly 80% of Cameroon's industrial activity. The port serves more than 95% of the country's port traffic. The largest companies in the country have set up their headquarters in Douala rather than in Yaoundé, the capital. This is due to the openness of the coast to other countries for fast distribution of goods and services.

2.2 Study Design and Sampling

This is a cross-sectional study conducted from March 2020 to March 2021, adopting a mixed-research method, that is, both a quantitative and a qualitative approach.

2.3 Method

The target populations included inhabitants living within the urbanised area made up of the five boroughs (Douala I, Douala II, Douala III, Douala IV and Douala V). Douala VI, which is a rural and island area, is excluded. A sample size of 600 households was determined and distributed proportionally to the population size of each borough. In each borough, respondents were selected following a simple random sampling.

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institutions, reflecting a deep rejection of state legitimacy and a sense that the way of life in the NWSW regions is under threat. The impact on human lives and displacement is the most dramatic and visible. The violence has triggered a large and growing humanitarian crisis, while the food situation is alarming. The conflict has also triggered a serious internal displacement crisis: around 680,000 persons, or close to 15% of the pre-crisis population, has been internally displaced from their homes in the NWSW as of December 2019. In addition, the conflict has resulted in the significant destruction of critical assets; schools, health facilities, and productive infrastructure have been deliberately targeted and destroyed. The closure or limited functioning of education services and health facilities has also strained essential health services. Population displacement within NWSW, combined with insecurity and poor living conditions, has increased the risk of disease and rendered difficult management and monitoring of COVID-19 in those areas. Beyond NWSW, the arrival of internally displaced persons in Douala has overstrained a health sector that was already lacking in adequate workforce, supplies, and services.

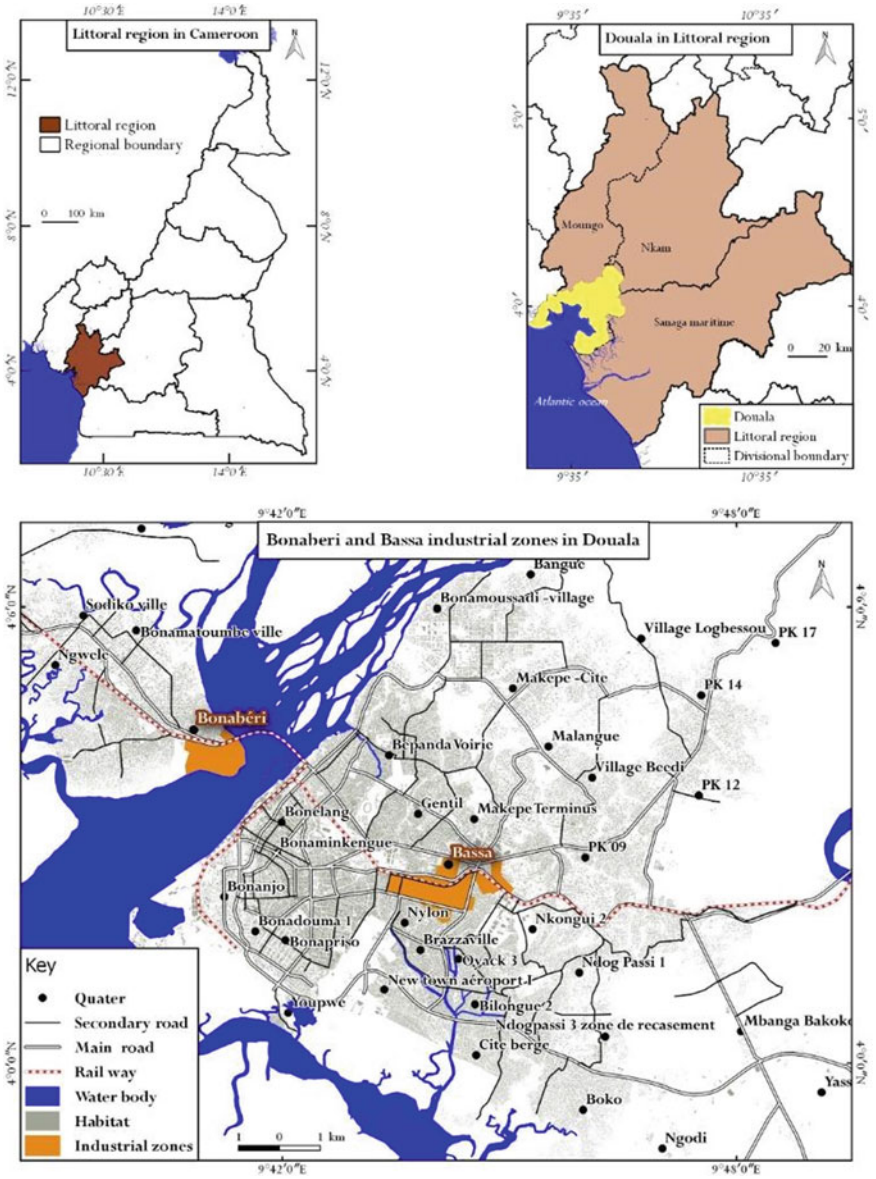

Fig. 1 Location of Douala metropolitan town in Cameroon

2.4 Data Collection and Management

Data used here stem both from secondary and primary sources. Secondary sources are related to data obtained from document reviews (such as web pages/blog reviews dedicated to COVID-19 or newspapers), but are mostly from official health statistics derived from weekly COVID-19 reports produced by the Ministry of Public Health through the National Public Health Emergency Operations Centre (NPHEOC). Primary data were collected through field observations and surveys. Selected participants responded to a structured questionnaire containing the following items: COVID-19 and respect of government measures, preventive behaviours, the effect of the application of measures on respondents' income, gender-based violence or tensions experienced in the household, and household adaptive strategies against the effects of government measures. Qualitative methods included in-depth interviews which aimed to capture people's perception and attitudes towards COVID-19. Due to the restriction on movement and physical distancing policies to reduce the spread of COVID-19, all data collection was conducted by mobile phone and carried out by enumerators trained in conducting mobile phone surveys. Basic respondent characteristics, such as demographics, perceived risk of COVID-19, and social and economic effects of COVID-19, were tabulated using the SPSS® statistical software 20.0 for Microsoft Windows. The open-source software QGIS was used to map COVID-19 cases.

2.5 Ethical Approval

The Regional Delegate of the Ministry of Health provided written approval to conduct the surveys with resource persons. All personally identifiable information was removed to ensure confidentiality. Each household received a coded ID number. Informed consent was obtained from all participants included in the study and they were told they could terminate the survey any time, or refuse to answer specific questions.

3 Results and Comments

3.1 General Epidemiology of the Pandemic

In Cameroon, a French visitor was the first case declared on 6 March 2020, and since then the disease has continued to spread. The time series below shows the increasing spread of active COVID-19 cases in Cameroon, to the point that by March 2021, there were an estimated 109,367 confirmed cases (including 1,466 active cases) and 1,851 registered COVID-19 deaths (Table 1).

Modelling the spread of the pandemic highlights the main hotspots of COVID-19 in Cameroon and shows the spread pattern of the disease from metropolises to small- and medium-urban centres (Fig. 2). We can clearly see that Douala is one of the country's metropolises with high levels of confirmed and active cases of COVID-19.

4 COVID-19 in Douala: A Worrying, but not Alarming Epidemiological and Clinical Situation

The epidemiological summary of COVID-19 cases in Douala shows that the situation, while worrying given the daily increase in the number of cases, is not alarming compared to the world and national situations (Table 1).

Table 1 Epidemiological summary of COVID-19 in Douala (as at December 30, 2021)

	Global world	Africa	Cameroon	Douala
Confirmed cases	290,149,004	9,867,470	109,367	10,082
Recoveries	254,432,850	8,741,105	106,050	8142
Deaths	5,459,478	229,299	1,851	138
Lethality	2.0%	2.3%	1.7%	1.3%

Source Ministère de la santé du Cameroun, 2021, https://www.worldometers.info/coronavirus/

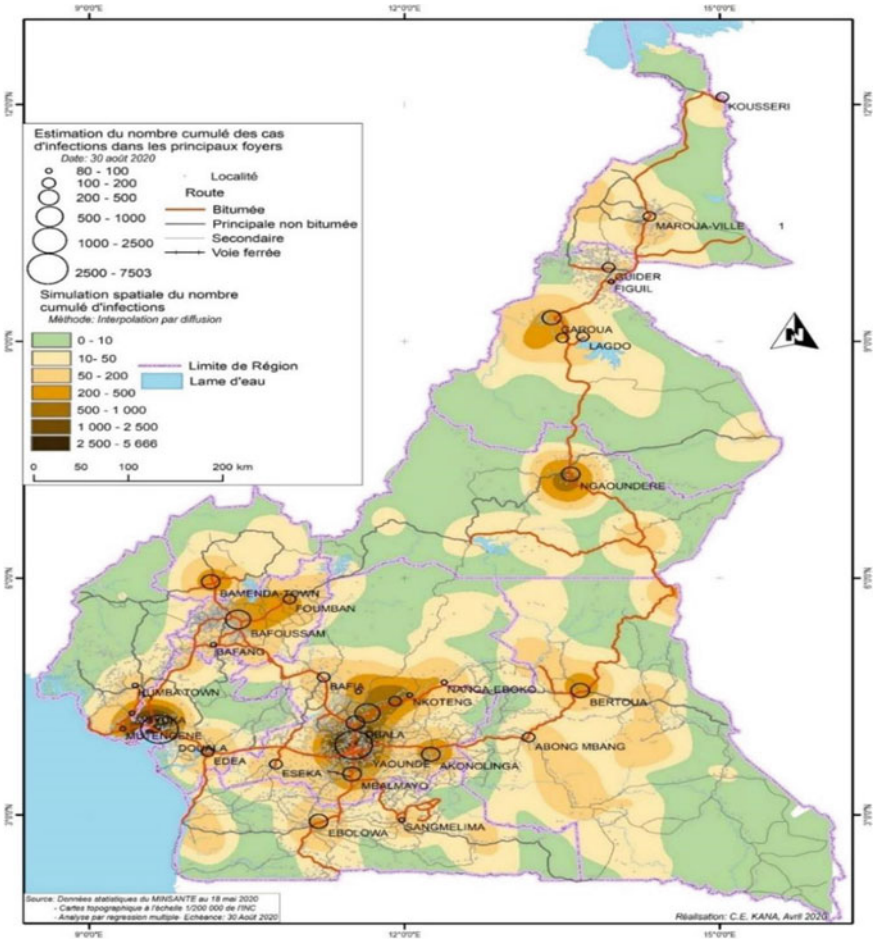

Fig. 2 Spatial diffusion of COVID-19 in Cameroon (*Source* Kana et al. 2020)

The pandemic in Douala as elsewhere is constantly evolving.[2] The distribution has been biphasic with two peaks: the first one in the early stages of epidemic, from May to July 2020; and the second since February 2021. Those two peaks correspond to the two waves of the epidemic that the whole world has experienced by December 2020, and which are related to the South African and British variants of the virus (Harvey et al. 2021). According to Kana et al. (2020), population density (9,251 hab./km^2) and urban mobility of city dwellers are the main explanatory factors of the disease's spread. Taking into account the total number of deaths, the provisional toll for the period amounted to 128 deaths. It is noteworthy that the excess mortality in the period July–August (25.7%) did not take into account the actual impact of COVID-19, and March 2021 data are not consolidated.

From the 1,940 active cases of COVID-19 in 2020, we obtained data regarding clinical symptoms and outcomes for 386 patients (78.4%) out of the 492 patients hospitalised at the three Designated COVID-19 Care Centres. Most patients were adult males (66.5%), 38.4% were informal retailers (street vendors, informal hawkers, workers at local convenience stores, taxi drivers, home-base workers and informal sector farmers) and 29.3% were employed workers. Both latter groups had

[2] This high rate of cases can be explained differently:

(i) by population's perception regarding disease. In fact, disease is not a clinical issue in African societies (Augé 1986). Therefore, perceptions and representations of households in Douala suggest that COVID-19 is not perceived rationally (scientifically), but rather considered to have its source in the invisible world monitored by their dead ancestors. Thus, they identify five different causes of the disease: incorporation of an evil object, loss of the soul, being under the influence of an evil spirit, transgression of a socio-cultural prohibition, assault by a sorcerer. Depending on the supposed cause of the disease, people proceed through rituals and incantations that are supposed to push the evil out of the body or the mind. We can thus understand the statements of a few households surveyed in the city and considered COVID-19 as a violation of a social prohibition;

(ii) by the lack of compliance to health measures, due to COVID-19 symptoms' similarity with those of the seasonal influenza. Dry cough, fever, fatigue and myalgia have been mentioned as the major COVID-19 signs and symptoms; city dwellers in Douala say these symptoms are also those of the flu which is endemic in the city. So, people do not care too much about COVID-19, which they consider to be another European flea/invention. Besides, lack of compliance can be explained by the fact that the majority of households were to have a much harder time putting their economies into the 'medically induced coma' of a full lockdown in response to the COVID-19 pandemic. Most of them work in the informal sector, often for a daily wage, and depend heavily on public services, and have limited savings and no access to credit. For many, compliance with governmental health measures is not a viable option, and not working comes at the expense of food and other necessities;

(iii) by a third avenue of explanation that is of a political and economic nature. Cameroon mainly relies on foreign aid. Thus, the national authorities tend to exaggerate the figures under the assumption that the amount of financial assistance given to fight the pandemic will be proportional to the rate of infection of COVID-19. In this way, they believe they will generate financial surpluses which will be used to remain in power and maintain their anti-democratic political regime. Such an immoral strategy started with the AIDS pandemic in 1980s and 90s. Decision-makers who were managing the pandemic made millions of CFA (the currency of Cameroon) and are currently considered as politically and economically influential men.

a history of contact with infected relatives, friends, or colleagues/customers. The most common symptoms were fever (96.1%) and cough (75.9%), followed by fatigue (72.8%), shortness of breath (78.7%), nausea (59.1%) and nasal congestion (43.5%). Diarrhoea and myalgia or arthralgia were uncommon. Among the 492 patients, 23.7% had at least one co-existing illness (e.g., hypertension, diabetes, chronic obstructive pulmonary disease, or HIV/Aids).

As reported in Italy and France, the ongoing epidemic revealed strong geographical differences in the spread of infection (Deguen and Kihal-Talantikite 2021; Vampa 2021). Figure 3 details the boroughs containing the most likely clusters of high risk of COVID-19. The risk of COVID-19 confirmed cases was 2.13 greater in Douala III than in the rest of the city (p-value = 0.001). The spatial analysis of COVID-19 related deaths revealed the same pattern: clusters were more likely to be located in the eastern part of Douala where there were more densely populated quarters such as Ndogpassi, Dakar, Nylon and Soboum. In these quarters, inhabitants mostly work in the informal sector or are self-employed in small retail businesses–all economic activities where human interaction is essential. However, we found that COVID-19 active cases and intensive care hospitalised cases are located in the north–north-eastern part of the city, that is Douala V (p-value = 0.039). This borough is composed of densely informal settlements (Bepanda, Logbessou, Bangue) and planned quarters (Bonamoussadi, Makepe, Logpom). These results indicate that the percentage of households living in overcrowded housing explained a great part of the excess risk of COVID-19 active case and hospitalisation (Photo 1). Our results are consistent with studies carried out in other countries which suggest that people living in densely populated areas are more at risk of developing severe COVID-19 (Hamidi et al. 2020; Martins-Filho 2021).

This unequal spatial distribution of the infection spread combined with the healthcare capacity of each borough, led the local authority to classify the city in different categories (borough at greater or lesser risk), which from 11 May 2020 guided the lockdown.

5 Learning from Experience: Health-Specific Measures Taken to Address COVID-19 in Douala

As the virus was reported in Douala-Cameroon relatively late compared to Europe and the Americas, the country had extra time to prepare. Based on previous experiences in health crisis management, the Cameroon government seized the window of opportunity to rapidly mobilise a nationwide response. An emergency inter-ministerial meeting held in February 2020 led to the adoption of the Cameroon Strategy for COVID-19. The strategy was approved by the head of state, who underpinned the minister of public health's leadership and ownership of the response to the outbreak. Partnerships with health agencies in sub-regional economic blocs ensured further alignment and synergies. Figure 4 summarises the national COVID-19 Response

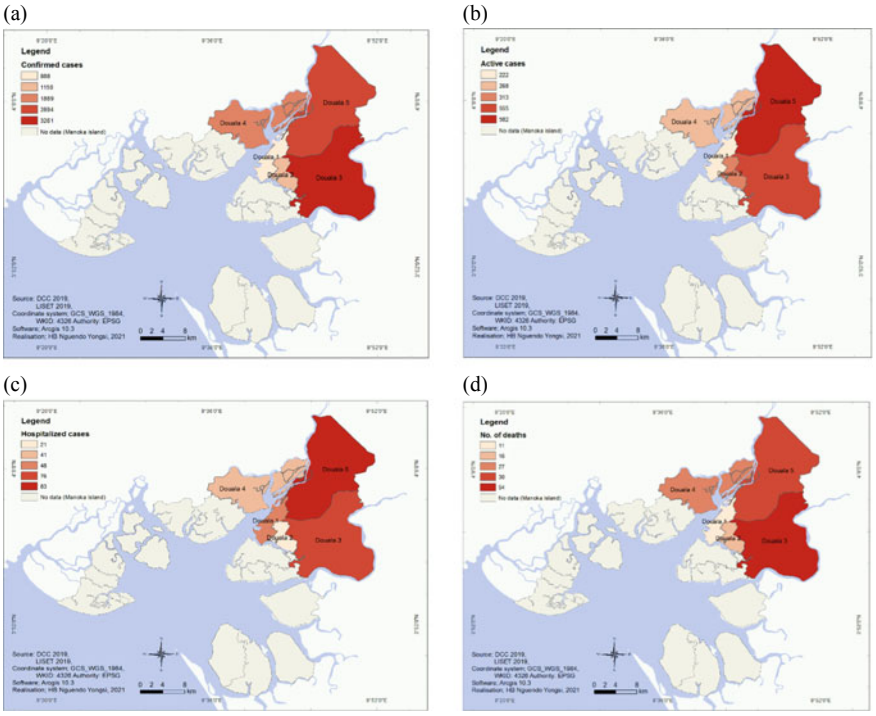

Fig. 3 Spatial distribution of COVID-19-related events in Douala. **a** Confirmed cases of COVID-19. **b** Active cases of COVID-19. **c** Hospitalised cases of COVID-19. **d** COVID-19 deaths

Overcrowding & anarchy | Houses built with unsustainable materials | Lack of utilities and services

Photo 1 Informal settlement of Ndogpassi in the densely populated borough of Douala III

Strategy. The strategy, aiming to curb the exponential increase of coronavirus cases in the country, was to be implemented throughout the country, with the utmost rigour in the main metropolises of Yaounde and Douala.

Implementation of the national strategy was led by the Ministry of Public Health. A collaboration of partners, including the World Health Organization, has harnessed and leveraged existing regional expertise through technical working groups aligned to priority areas. With reference to Douala, the Regional Delegate of Public Health

reviewed the latest evidence and best practices, adapting them into policies and technical recommendations to inform public health action against COVID-19 and to foster coordinated preparedness and response across the city (Gilbert et al. 2020). Hence, early efforts concentrated on ensuring capacity in hospitals and specialised COVID-19 health centres for case detection and containment. Synergies among stakeholders and civil society led to the increase in COVID-19 testing laboratories in the city between mid-March and August 2020. Meanwhile, local workshops were conducted to strengthen the capacity of health staff for enhanced surveillance at points of entry, infection prevention and control, risk communication and clinical case management, with face-to-face workshops transitioning to webinars in April as borders were closed and lockdowns implemented.

Globally, Cameroon and Douala authorities have previously invested in preparedness and response efforts geared toward various outbreaks on the continent (such as cholera, HIV/AIDS, poliomyelitis, measles and tuberculosis). This technical know-how has been swiftly adapted to COVID-19. National and urban-level exchange platforms with an established wide audience have been repurposed for training and providing information on COVID-19 diagnostics. Networks of community health agents that support the response to cholera and other diseases have been leveraged for sensitisation and to raise the alarm about suspected COVID-19 at the subnational level (Photo 2). We believe that such an experience in health crises management has helped to limit the spread of the disease in the city and cases severity, and consequently to avoid the announced health disaster.

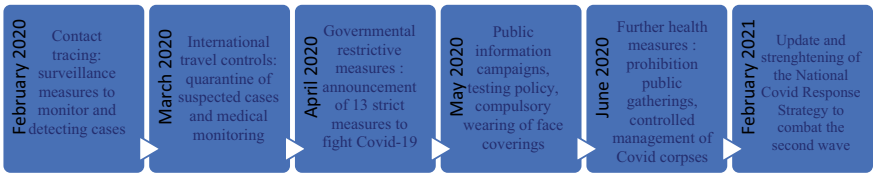

Fig. 4 Timeline of national COVID-19 response strategy

Distribution of facial masks | Distribution of liquid gel | Mobile screening stands

Photo 2 Local authority campaign to raise awareness of city dwellers

6 Douala City Dwellers' Attitudes Towards COVID-19 Health Measures

In April 2020, the government issued 13 strict measures to curb the increase of coronavirus cases in the country.[3] However, compliance with these health measures has been variously observed by Douala inhabitants. For example, only 30.3% of the respondents complied with the measure requiring the systematic washing of hands with soap and water. The same trend is observed regarding face coverings, with only 27.1% of respondents complying in public places; 72.9% were reluctant to do so. This seems an embarrassing policy failure, given the two potential functions of face coverings: they protect the wearer from exposure (personal protective equipment) and protect other individuals from exposure to respiratory aerosols/droplets from the mask wearer. That is why the use of masks for the general public has been recommended as one of several COVID-19 pandemic mitigation strategies (Ebrahim et al. 2020).

Face mask or nose masks have been used widely all around the world (Gupta et al. 2020; Wang et al. 2020). However, in Douala, the effectiveness of the policy to encourage mask wearing remains problematic. Even social and physical distancing were not followed, only 19.9% complied with the measure. This is not surprising, given the density of the city (about 80% of the city is made up of densely populated informal settlements) and that the majority of inhabitants are involved in the informal sector and survive thanks to retail and self-help. Other measures have also not been complied with (e.g., prohibition of public gatherings, prohibition of overcrowding in public transport, closing of bars, restaurants and entertainment spots).

These results should be set in the socioeconomic context of the country with low recorded unemployment, but very high levels of informal employment. In many cities, self-employment and informal employment absorb the overwhelming majority of the labour force. The poor quality of employment reflects in the low income and those thus employed are classified as 'working poor', who rely on their daily jobs or activities to survive. (Filandri et al. 2020). In this context, compliance with lockdowns

[3] Those 13 measures are as follows: Cameroon's land, air and sea borders closed, with the exception of cargo flights and vessels transporting consumer products and essential goods and materials, whose stopover times will be limited and supervised; issuance of entry visas to Cameroon suspended; all public and private training establishments of the various levels of education, from nursery school to higher education closed; gatherings of more than 50 persons prohibited throughout the national territory; school and university games and attractions suspended; bars, restaurants, theatres and entertainment spots systematically closed from 6 p.m.; regulation of consumer flows in markets and shopping centres; urban and inter-urban travels undertaken only in cases of extreme necessity; drivers of cars, taxis and motorbikes urged to avoid overloading; private health facilities, hotels and other lodging facilities, vehicles and specific equipment necessary for the implementation of the COVID-19 pandemic response plan requisitioned as required by competent authorities; public administration giving preference to electronic communications and digital tools for meetings likely to bring together more than ten people; missions abroad of members of government and public and para-public sector employees suspended; and urging the public to strictly observe hygiene measures recommended by the WHO, including regular hand washing with soap, avoiding close contact such as shaking hands or hugging, and covering the mouth when sneezing.

is a suicidal measure for them economically. That is why places like markets were still crowded, bars and restaurants had the doors closed but had customers inside, taxis were overloaded, inter-urban transports still operated on their frequent schedule, as they depend on these activities as their source of income.

In contrast, most respondents respected the measure of not hand-shaking: 83.8% were compliant, only 16.2% were non-compliant. The reason behind this massive follow-up was not really the fear of COVID-19, but the fact that the population saw in the new way of greetings a fun time, particularly the clapping of the feet, the elbow-to-elbow, the bow, and wrist-to-wrist.

7 Economic Implications and Psychosocial Impact Associated with the COVID-19 Pandemic in Douala

7.1 Economic Implications

The coronavirus disease spread quickly across the city with devastating effects on the national economy, as well as the local socio-economic fabric and the way of life for city dwellers. These implications can be analysed at the micro and macro-economic levels. The microeconomic costs relate to those borne by individuals/households, firms and other establishments, like schools, health facilities, health and workers. With the COVID-19 pandemic, 91% of investigated families have borne costs for diagnosis and treatment, because they are not covered by the government or health insurance schemes. Even where these costs are covered, households have still incurred co-payments, transport costs and other related expenses, including the indirect costs of care.

The COVID-19 pandemic has exacerbated the burden of out-of-pocket health spending on 83% of households in Douala and dampened financial protection for health. Restrictions on, or removal of the ability to work and earn a living, especially for informal workers, who are predominantly women and account for about 89% of all employment in Douala, have put a strain on families. Given the precarious nature of informal work, as evidenced by the absence of a contract or income protection, 63% of respondents stated that their sources of livelihood have been impacted significantly during lockdown. Some firms and establishments have incurred productivity losses from closure of their businesses and from giving employees leave to stay at home to avoid any possible spread of the virus. They have also incurred costs related to keeping their work environments disinfected; shops, including informal grocery stores, bars and restaurants that had to close face a significant decline in demand. Unfortunately, the associated microeconomic costs are difficult to estimate accurately at this moment as the COVID-19 outbreak continues to unfold and costs will depend on the extent of the uncertainty/panic and actual/suspected cases. However, some owners claimed a 40–50% decrease in their turnover. In June–July, an analysis of the socio-economic impacts of the epidemic was carried out under city council leadership. The analysis

showed 82.6% of business leaders reported experiencing a drop in production. The situation was more pronounced in informal sector enterprises than in the formal sector. In terms of impact, almost half of the negatively affected companies said they had recorded a drop of more than 50% in their production.

At the household level, considerable food and economic vulnerability was reported due to COVID-19 control measures. Over 80% of respondents reported a partial or complete loss of income, and 75% reported eating less or skipping meals due to COVID-19. Households reported that they were receiving some assistance, but that their biggest remaining unmet need was food. Although the prevalence of COVID-19 was low, and these factors can largely be attributed to control measures rather than illness from COVID-19 itself, it is important to recognise the counterfactual of no control measures is an unmitigated epidemic, and not an absence of these harms.

The macroeconomic impacts result from a combination of 'demand' and 'supply' shocks in the economy. These impacts can be summed up by looking at, for instance, the effects of the pandemic on macroeconomic aggregates such as the city's GDP, unemployment rate and inflation rate. The macroeconomic impact of the COVID-19 pandemic was the less talked-about economic effect in popular media. However, interviews with economic operators and stakeholders in charge of the city's economic development show that commodity scarcity created by a decline in productivity and by reduction in imports from countries affected by the COVID -19 pandemic has fuelled a rise in general price levels (i.e., inflation). According to the mayor of Douala, decline in economic activity has affected the city's revenue generation by about 35%, especially tax revenue (both direct and indirect taxes). As for the regional delegate in charge of public health, public health spending also increased because they had to manage and treat health service users and contain the spread of the virus. Generally, both local and national governments did incur costs related to building, equipping and maintaining infrastructure to manage, treat and contain the pandemic. The magnitude of public funds incurred went up to 500 million CFA (~USD775,000) for the period from April to July 2020.

7.2 Psychosocial Impacts

Measures taken which have created confinement for part of the population have foreseeable consequences on individual and collective behaviour in Douala. The main social implications related to the health system and domestic violence. As the health system is in a fragile state and has very limited facilities and equipment needed to combat the virus, the healthcare staff have been paying particular attention to COVID-19. Then city dwellers were afraid of going to health facilities for fear of being infected, or saw their associated disease as related to COVID-19, which was a rumour that dominated the whole city. This created an adverse impact on prenatal care, which normally ensures that pregnant women and developing babies get proper care during the pregnancy period. Also, this has contributed to the delay in treatment

of other infectious diseases like tuberculosis, malaria and non-infectious diseases like diabetes and hypertension.

Regarding gender relations and gender-based violence, female respondents reported an increase in sexual and gender-based violence including physical, sexual, emotional and economic violence and its health and psychosocial effects, similarly to what has been reported by Mlambo-Ngcuka (2020) and foretold by the United Nations: "As in past pandemics, there are clear signs women continue to bear the brunt of emergent risks to public health, safety, and human rights" (United Nations 2020). This is because the lockdown has challenged the traditional gender roles in terms of men being the main breadwinners for families. For instance, the closure of markets interrupted the work of males, who previously operated as vendors/small scale retailers. Consequently, such a sudden loss of work has resulted in a lack of income to support their children and women under their care. This causes anger and frustration within families, which aggravates emotional and physical violence (Bradbury-Jones and Isham 2020). Lockdowns amidst economic hardships for families are associated with an increase of violence and abuse, especially for dependents, such as children (Peterman et al. 2020).

Women normally would supplement the family income through regular work in the traditionally female-dominated informal economy, such as braiding hair, washing clothes and tailoring (Macchiavello 2004; Omata and Kaplan 2013). However, these activities have also been closed during the lockdown, but without providing any social protection to mitigate the effects of loss of livelihoods (Mbeutcha Ngueya 2020). Social distancing directives also indicate that such workers are no longer welcome in the places (including households) where they previously worked as casual domestic workers.

This situation has particularly been observed among displaced women, who fled the war zones (north-west and south-west regions) to seek refuge in Douala. With no livelihood options and lack of social support, sexual violence and commercial sexual exploitation of those displaced women and adolescents were almost inevitable (UNFPA 2020; UN Women 2021). In Douala IV borough for example, which is separated from the city centre and other boroughs by the Wouri bridge, closure of informal trade contributed to females taking up survival sex to support their families. This exposed them to HIV/AIDS and other sexually transmitted infections and increased the rates of unwanted pregnancies among them, especially in the context of constrained access to reproductive health services provided by health care centres and humanitarian agencies, due to lockdown measures and banning public transport that would have allowed them to access such services.

We also find that the mental health of two-thirds of the population (67.3%) was affected due to the lockdowns; proportionally fewer men (38.11%) than women (61.89%). The inhabitants of Douala, who were not used to staying in confinement, developed a lot of stress. Self-isolation and lockdown affected mental and physical health significantly because social isolation is adversely related to health (mental and physical). Households were locked down in unfavourable housing conditions (e.g., over-crowded, with poor ventilation) that characterise many informal urban settings and slums (de Figueiredo et al. 2020; Tobias 2020). The impossibility of keeping

recommended social distancing, and the fear of contamination, were sources of stress and anxiety.

According to Peijin et al. (2020), disconnection from the outside world, being away from familiar people, items and routines, generated anxiety related to these uncertainties, as well as the fear of stigmatisation and challenges in communication. Though it is not possible to eliminate these stressors, there are ways to ameliorate them. The use of technology has shown to be particularly useful to enhance communication between individuals and their families as well as providing entertainment and information.

8 Conclusion

Cameroon recorded the first case of the coronavirus on 6 March 2020 and thereafter there was a geometric increase in the number of cases. Our study revealed that all the outcomes related to COVID-19 infection investigated (including active cases, hospitalisations, deaths, intensive health care) were not randomly distributed. The increase in COVID-19-related outcome incidence in Eastern Douala was statistically significant. The spatial distribution of both active cases, deaths and overcrowding housing should be taken into account to fully interpret the spatial distribution of incidence of COVID-19-related outcomes. The current crisis reminds us of how unequal we all are in facing this disease.

In response to the spread of the virus, the government announced 13 firm measures in an effort to curb the exponential increase of COVID-19 in the country. However, it appears that most citizens did not really follow them. Social distance was more a slogan than a practice, as marketplaces remain overcrowded, and bikes, buses and taxis still carry more than the government-prescribed maximums. The number of cases has continued to increase, coupled with another unwanted socio-economic phenomenon, namely the severe impact of COVID-19 on Douala citizens due to the lockdown. Some employers put staff on technical leave and other workers lost their jobs. The informal economy, which has a large number of workers, has been hit hard, leaving a large part of the population in poverty.

During lockdown, the city witnessed increases in domestic violence, in mental health problems, and in other infectious diseases, as well as delays in other treatments. In the absence of adequate social protection and welfare programmes targeting the poor during the pandemic, the local and national authorities need to put in place flexible, but effective policies and legislation approaches that harness and formalise the informal economy. There is an urgent need to strengthen social protection systems to make them responsive to crises and embed them within human rights-based approaches to better support vulnerable populations and enact health and social security benefits.

The COVID-19 response needs to adhere to the well-established ‘do no harm’ principle to prevent further damage, or suffering, as a result of the pandemic. The response can be examined through local lenses to inform peace-building initiatives that may

yield long-term gains in post-COVID-19 recovery efforts. A systems perspective, based on the Xiamen call for action, can also help to overcome the COVID-19 pandemic and global health issues in the city. It is imperative to adopt an intersectoral approach and to integrate health in all policies. In other words, there is a need to set up a comprehensive agenda that supports interaction and collaboration of all the urban actors.

References

Auge M (1986) L'anthropologie de la maladie. L'homme 26(1–2):81–90

Bradbury-Jones C, Isham L (2020) The pandemic paradox: the consequences of COVID-19 on domestic violence. J Clin Nurs. https://doi.org/10.1111/jocn.15296

Chu DK, Akl EA, Duda S, Solo K, Yaacoub S, Schünemann HJ (2020) COVID-19 Systematic Urgent Review Group Effort (SURGE) study authors. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. Lancet 395:1973–1987

Cui Y, Zhang, ZF, Froines J et al (2003) Air pollution and case fatality of SARS in the People's Republic of China: an ecologic study. Environ Health 2, p 15. https://doi.org/10.1186/1476-069X-2-15

Deguen S, Kihal-Talantikite W (2021) Geographical pattern of COVID-19-related outcomes over the pandemic period in France: a nationwide socio-environmental study. Int J Environ Res Public Health 18(4):18–24. https://doi.org/10.3390/ijerph18041824

Ebrahim SH, Ahmed QA, Gozzer E, Schlagenhauf P, Memish ZA (2020) Covid-19 and community mitigation strategies in a pandemic. BMJ 2020:368

(de) Figueiredo AM, Codina AD et al. (2020) Impact of lockdown on COVID-19 incidence and mortality in China: an interrupted time series study. Bull World Health Organ 2020. https://doi.org/10.2471/BLT.20.256701

Filandri M, Pasqua S, Struffolino E (2020) Being working poor or feeling working poor? the role of work intensity and job stability for subjective poverty. Soc Ind Res 147:781–803

Gilbert M, Pullano G, Pinotti F, Valdano E, Poletto C, Boëlle P-Y et al (2020) Preparedness and vulnerability of African countries against importations of COVID-19: a modelling study. The Lancet 395(10227):871–877

Gupta M, Gupta K, Gupta S (2020) The use of facemasks by the general population to prevent transmission of Covid 19 infection: a systematic review. BMJ Yale 1–24. https://doi.org/10.1101/2020.05.01.20087064

Hamidi S, Sabouri S, Ewing R (2020) Does density aggravate the COVID-19 pandemic? J Am Plan Assoc 86:495–509

Harvey WT, Carabelli AM, Jackson B et al (2021) SARS-CoV-2 variants, spike mutations and immune escape. Nat Rev Microbiol 19:409–424

Ilardi A, Chieffi S, Iavarone A, Ilardi CR (2021) SARS-CoV-2 in Italy: population density correlates with morbidity and mortality. Jpn J Infect Dis 74(1):61–64

Kana CE, Joachim E, Nguendo-Yongsi B (2020) Modélisation spatiale de la propagation de l'épidémie à COVID-19 au Cameroun. Revue Espace géographique et Société Marocaine 40:151–171. https://doi.org/10.34874/IMIST.PRSM/EGSM/22848

Khankeh H, Farrokhi M, Roudini J et al (1919) Challenges to manage pandemic of coronavirus disease (COVID-19) in Iran with a special situation: a qualitative multi-method study. BMC Public Health 2021:21. https://doi.org/10.1186/s12889-021-11973-5

Koo JR, Cook AR, Park M et al (2020) Interventions to mitigate early spread of SARS-CoV-2 in Singapore: a modelling study. Lancet Infect Dis 20:678–688. https://doi.org/10.1016/S1473-3099(20)30162-6 pmid. 32213332

Macchiavello R (2004) Public sector motivation and development failures, p 22. Available at SSRN: https://ssrn.com/abstract=780644 or https://doi.org/10.2139/ssrn.780644

Martins-Filho PR (2021) Relationship between population density and COVID-19 incidence and mortality estimates: a county-level analysis. J Infect Public Health 14(8):1087–1088. https://doi.org/10.1016/j.jiph.2021.06.018

Mbeutcha Ngueya AJ (2020) Challenges of the sustainable development goals in informal settlements: the case of the goal 3, 6 and 11 in Douala, Littoral Region of Cameroon, master dissertation, University of Bamenda, p 173

MINSANTE CAMEROUN Rapport de situation COVID-19, N°23, Période du 28 au 30/04/2020, p 4

Mlambo-Ngcuka P Violence against women and girls: the shadow pandemic. Accessed at https://www.unwomen.org/en/news/stories/2020/4/statement-ed-phumzile-violence-against-women-during-pandemic

Nussbaumer-Streit B, Mayr V, Dobrescu AI et al (2020) Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review. Cochrane Database Syst Rev 4:CD013574. https://doi.org/10.1002/14651858.CD013574. pmid:32267544

Ogen Y (2020) Assessing nitrogen dioxide (NO_2) levels as a contributing factor to coronavirus (COVID-19) fatality. Sci Total Environ 726:138605

Omata N, Kaplan J (2013) Refugee livelihoods in Kampala, Nakivale and Kyangwali refugee settlements: patterns of engagement with the private sector. Oxford Universty, Refugee Studies Centre, Working paper 95, p 26

Peijin EM, Fan A, Shu HL, Shin YA, Perera K, Aik HQ et al (2020) Needs and concerns of patients in isolation care units learning from Covid19: a reflection. World J Clin Cases 8(10):12–20

Peterman P, O'Donnell T, Shah O-P, & van Gelder (2020) Pandemics and violence against women and children. CGD Working Paper 528. Center for Global Development, Washington, DC, p 45. Accessed at: https://www.cgdev.org/publication/pandemics-and-violence-against-women-and-children

Tobías A (2020) Evaluation of the lockdowns for the SARS-CoV-2 epidemic in Italy and Spain after one-month follow up. Sci Total Environ 725:138539. https://doi.org/10.1016/j.scitotenv.2020.138539.pmid:32304973

UNFPA (2020) As pandemic rages, women and girls face intensified risks. Available from: https://www.unfpa.org/news/pandemic-rages-women-and-girls-face-intensified-risks

United Nations (2020) COVID-19 and human rights: we are all in this together. Geneva, p 22

UN Women (2021) COVID-19 and violence against women: what the data tells us. Available from: https://www.unwomen.org/en/news-stories/feature-story/2021/11/covid-19-and-violence-against-women-what-the-data-tells-us

Vampa D (2021) COVID-19 and territorial policy dynamics in Western Europe: comparing France, Spain, Italy, Germany, and the United Kingdom. Publius J Fed 51(4):601–626

Wang Y et al (2020) Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. BMJ Global Health 5:e002794

WHO (2019) Coronavirus disease (COVID19) outbreak situation. Geneva. Available from: https://www.who.int/emergencies/diseases/novelcoronavirus 2019 (Consulted on November 28th 2020)

WHO (2021) Coronavirus disease (COVID-2019) situation reports. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports (consulté le 5 juin 2020)

Worldometer (2020) Coronavirus. Available from: https://www.worldometers.info/coronavirus/country/turkey/

Wu X, Nethery RC, Sabath BM, Braun D, Dominici F (2020) Exposure to air pollution and COVID-19 mortality in the United States: a nationwide cross-sectional study. BMJ Yale. https://doi.org/10.1101/2020.04.05.20054502

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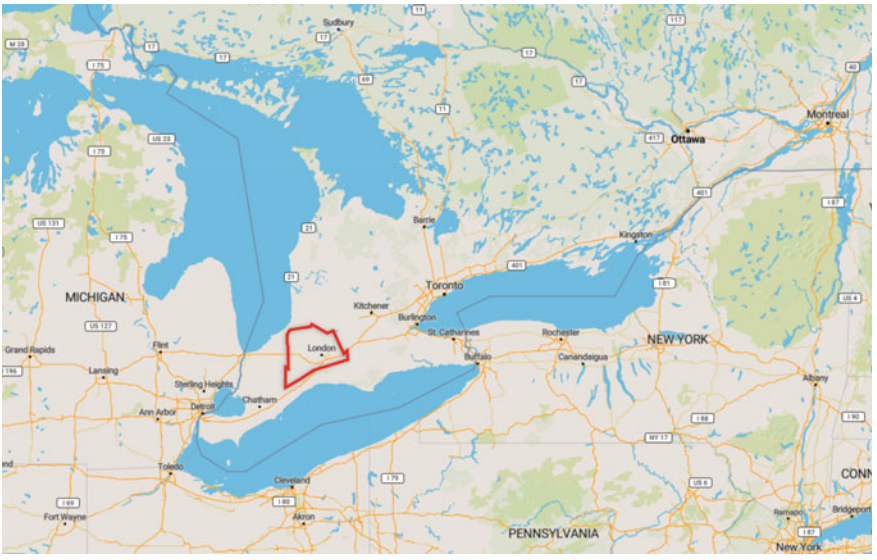
CANADA: Examining the Response to the COVID-19 Pandemic in the City of London and Middlesex County Using a Systems Approach—What Lessons Can We Learn?

Isaac Luginaah, Godwin Arku, and Donna Kosmack



The red outline shows Middlesex County, Ontario.

Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

In Canada, as in many countries, the three levels of government continue to respond decisively to the novel coronavirus crisis (COVID-19) with a focus on increasing the capacity of the health care system and containing the spread of COVID-19 by using public health measures such as hand washing, wearing masks, physical distancing, and a push for vaccination. One of the most challenging issues in establishing an action plan in response to an unexpected event like a pandemic is the uncertainty and speed at which evidence emerges. Hence, the ways in which new policies for managing the pandemic are communicated, mediated among varied stakeholders, and engage all stakeholders in complex decision-making processes are crucial to success. To effectively address the complexities of the COVID-19 pandemic at the intersection of political, social and environmental issues in urban centres, cities are expected to increase the level of engagement and collaboration across sectors.

Canada has three main levels of government: federal, provincial/territorial and municipal. The federal government deals with areas of law listed in the Constitution Act 1867 and issues that affect the whole country. At the next level, each of the ten provincial governments is responsible for areas such as education, some natural resources, and road regulations, although sometimes they share responsibility with the federal government. The three territories have their own governments, with responsibilities as required by the federal government. The municipal governments (usually based in a city, town or district—a municipality) are responsible for areas such as libraries, parks, community water systems, local police, roadways and parking. The municipal government receives authority for these areas from the provincial governments. Across the country, there are also band councils, which govern First Nations communities. These elected councils make decisions that affect their local communities.

The management of health care in Canada is complex, given that it is managed by all three levels of government. Health Canada, a branch of the federal government, is responsible for national health policy and federal agencies such as the Public Health Agency of Canada. Local public health is a shared responsibility of the provincial/territorial and municipal levels of government. Given the multiple levels of government, the Canadian response to the COVID-19 pandemic has been a shared responsibility of all three levels of government. Table 1 presents the timeline of the significant events and responses to the COVID-19 pandemic at the three levels: Canada, Ontario and Middlesex–London.

With the goal of providing recommendations and lessons that other cities may find useful, this chapter will use a systems perspective to examine the COVID response in one jurisdiction in the province of Ontario. Middlesex–London is a region served by the Middlesex–London Board of Health (MLHU) and includes residents of the County of Middlesex and the City of London (Fig. 1). MLHU is located in Southwest Ontario on the traditional lands of the Attawandaron peoples who once settled in this

Table 1 Timeline of COVID-19 and significant responses in Canada, Ontario and Middlesex–London

	Canada	Ontario	Metro Toronto	Middlesex/London
First wave (March–June 2020)				
First case confirmed	27 January 2020	27 January 2020	27 January 2020	31 January 2020
First COVID death	9 March 2020	11 March 2020	21 March 2020	27 March 2020
Request for public to follow public health measures (physical distancing and hand washing)	Since onset	Since onset	Since onset	Since onset
Declaration of state of emergency	Not issued	17 March 2020 by Premier Doug Ford Ended 24 July 2020	23 March 2020 by Mayor John Tory	20 March 2020 by Acting Mayor Jesse Helmer
Closure of bars, restaurants (except takeout), recreational facilitates, libraries, day cares, private schools, movie theatres and concert venues	N/A	17 March 2020	Provincial order applies	Provincial order applies
Closure of all public and schools (elementary and high school)	N/A	12 March 2020—announcement schools would close on 23 March (Originally announced as two weeks, then extended for the remainder of school year)	Provincial order applies	Provincial order applies
Closure of all non-essential workplaces	N/A	23 March 2020 at 11:59 p.m., with further restricted 'non-essential' on 3 April 2020	Provincial order applies	Provincial order applies
Daycares allowed to reopen	N/A	9 June 2020	Provincial order applies	Provincial order applies
Reopening of some places such as places of worship, hairdresser/barber, restaurant patios, malls, day camps	N/A	12 June 2020 (not for all of ON)	24 June 2020	12 June 2020

(continued)

Table 1 (continued)

	Canada	Ontario	Metro Toronto	Middlesex/London
Second wave (September 2020–February 2021)				
Schools reopen (note parents could choose to select online learning or in-class learning for their children)	N/A	Staged reopening plan (since March Break all schools utilised an online learning plan until summer break at the end of June)	14–21 September 2021 (Staggered start depending on grade and virtual or in-class learning)	14 September 2020
Masking legislation (encouraged but not made mandatory by Federal Government)	N/A	3 October 2020 as per *Reopening Ontario [A Flexible Response to COVID-19] Act, 2020*	7 July 2020 as per City of Toronto by-law	6 July 2020 for personal service settings and public transit only as per a Section 22 order by the MLHU Medical Officer of Health (MOH) 16 July 2020 the MLHU MOH issued an instruction for public areas
Declaration of state of emergency	Not Issued	13 January 2021		
Stay-at-home order		14 January 2021	N/A	N/A
Stay-at-home order lifted		Staged reopening	8 March 2021	16 Feb 2021
Reopening of businesses		Staged reopening plan instituted—started 16 Feb 2021	Remains in lock-down to date. All non-essential businesses are closed	16 Feb 2021—moved to 'Red' (strict limits on business i.e. Only 10 people allowed gyms or restaurants) 1 March 2020—Moved to 'Orange'—slightly more lenient limits on businesses—ie. 50 people allowed in a restaurant)
Schools reopen after holiday closure	N/A	Staged reopening plan (since the holiday closure in December all schools utilised an online learning plan until staged reopening)	16 Feb 2021	1 Feb 2021

(continued)

Table 1 (continued)

	Canada	Ontario	Metro Toronto	Middlesex/London
Third wave (March 2021–TBD)				
Closure of all non-essential workplaces	N/A	3 April 2021, 11:59 p.m. 8 April 2020—further restricted 'non-essential'	Provincial order applies	Provincial order applies
Declaration of state of emergency	Not Issued	8 April 2021	Provincial order applies	Provincial order applies
Stay-at-home order		8 April 2021	N/A	N/A
Closure of schools	N/A	N/A	Toronto and Peel MOH Health issue a Section 22 order to close all schools	Schools remain open

Fig. 1 Map of study area

region alongside the Algonquin and Haudenosaunee peoples (Ontario Federation of Labour Aboriginal Cercle and Ontario Federation of Labour Aboriginal Persons Caucus 2017).

During the first wave, there was an early recognition of the threat and rapid activation of response protocols led by federal and provincial governments, rapid establishment of diagnostic capacity, scale-up of measures for preventing community transmission; and mobilising the necessary resources for primary care. Ontario's

public health units are responsible for contact-tracing and case management of all infectious diseases. Because COVID-19 is an infectious disease, the contact-tracing and case management was a responsibility of public health units across Ontario. When COVID-19 cases began to emerge, other infectious diseases did not go away, and therefore health unit staff had to continue to respond to these other cases while their workload was increasing with emerging COVID-19 cases. Health units quickly experienced capacity issues with their regular staffing levels. As a result, the Ontario Ministry of Health, Public Health Ontario and the Government of Canada provided additional assistance to public health units to assist in the case and contact management of COVID-19. Funding was provided to increase staffing complements and staff from other agencies such as Public Health Ontario and Statistics Canada were loaned to local public health units to assist with contact tracing. Effective and efficient case and contact management is vitally important to reduce the spread of infectious diseases.

Canada's response to the COVID-19 outbreak, through a strong national leadership, was due to Canada's experience with the severe acute respiratory syndrome (SARS) outbreak in 2003 (Webster 2020). Yet, within the overall response there were challenges, such as sustaining adequate human resources (e.g. personal support workers and nurses for nursing and retirement homes) and supplies in high caseload areas. Despite coordinated federal and provincial action, there was the recognition that due to Canada's vast geography, there was a need for unique local level responses as well.

2 Social Determinants of Health

From a systems approach, as indicated in the introductory chapter of this book, the social determinants of health (SDOH) are seen as causes as well as outcomes. These would include factors apart from direct medical care that can be influenced by social policies and shape health in powerful ways (Braveman and Gottlieb 2014). This notion is synonymous with Krieger's (1994) spider-web metaphor, which is inclusive of and interwoven with environmental, social, political and economic factors, rather than a linear path of social determinants leading to health outcomes. The feedback loops in the system lead to outcomes influencing their causations. For example, with COVID-19, low-income healthcare workers who are already deprived are likely to experience even poorer health outcomes. This group will also be likely to have more than one job or to seek different types of jobs to make ends meet. Hence, to understand the challenges a pandemic such as COVID-19 has on a particular population requires a community-based system focus that takes into consideration factors that may be collectively contributing to the severe impact on marginalised groups (Gatzweiler et al. 2020). It is imperative that public health professionals consider the SDOH and utilise health equity approaches in the fight against COVID-19.

A community-involved systems science recognises that important population health determinants interact across levels and must be integrated to better understand

health outcomes to design appropriate interventions. The utilisation of the SDOH framework in the context of the COVID-19 pandemic at a regional level can help identify where several factors such as ethnicity, educational attainment, economic well-being, social status and the availability of health and social services come into play.

A SDOH conceptualisation within a systems approach would improve knowledge and capacity of both residents and professionals, including those in the health sector. This can be crucial when fear and misinformation spreads fast during an outbreak. A systems approach to SDOH emphasises the role of the context in determining health inequalities in communities. Responses to the COVID-19 pandemic should be manifest at many different points in a system, indicating a need for multiple corrective or preventive actions by multiple actors at multiple levels. Understanding the dynamic complexity of urban systems can improve the quality of decision-making by illuminating the interconnectedness of system variables and showing options for interventions (Bai et al. 2016). We used the above conceptualisation to examine the response to the COVID-19 pandemic in Middlesex County and the City of London.

3 Middlesex County and the City of London

Middlesex County and the City of London fall under the purview of the MLHU. Middlesex–London has a population of 510,609 (Middlesex county 79,781, City of London 430,828). According to Statistics Canada (2013), the minority ethnic population of Middlesex–London included 76,460 people or 17.0% of the total population in 2016. This was much lower than Ontario overall (29.3%). The five visible minority groups with the largest populations in Middlesex–London in order of size were: Arab, South Asian, Black, Chinese, and Latin American. Middlesex–London had a higher percent of the population identifying themselves as Arab and Latin American than the province overall. The proportion of people identifying themselves as a visible minority has been increasing since 1996 in Middlesex–London, although at a lower rate of change than Ontario overall.

The MLHU is regulated and funded in part by municipal, provincial and federal levels of government. As in many other cities around the globe, the COVID-19 pandemic brought attention to what needs to be done within the city. It should be noted that given Canada's large landscape and health geography (Luginaah 2009), the role of local jurisdictions' responses to the COVID-19 pandemic is important. The broader responses by MLHU against COVID-19 depended on the federal, provincial and municipal governance system, regulations, capacity, the robustness of its health system, and, more importantly, culture and citizen behaviour.

While acting in accordance with federal and provincial regulations and directions, the MLHU, local hospitals and city and municipal governments utilised regional approaches to managing the COVID-19 pandemic based on what was needed in London and Middlesex County. From the onset, collaboration between public health and primary health care was vital to ensure that efficient and effective action was taken

to properly prepare and plan for the COVID-19 pandemic as it unfolded. For example, the London Health Sciences Centre, in consultation with the City of London and the MLHU, established an emergency overflow centre located at London's Western Fair. This was done early in the pandemic response as a backup plan should hospital capacity become an issue. The MLHU hosted daily media briefings in conjunction with the Mayor of London and the Warden of Middlesex County to ensure both that the media was able to obtain timely and accurate information and that the municipal government was acting in conjunction with public health to ensure consistency and avoid duplications of efforts.

The MLHU worked with city and county officials as well as the homeless sector to develop an alternate testing and isolation system that was accessible, safe, and effective for homeless and under-housed individuals in the MLHU community. Additionally, the MLHU also worked with community partners, including the London Intercommunity Health Centre (LIHC) and the Cross-Cultural Learner Centre (CCLC), to develop culturally grounded health promotion campaigns, ensuring populations experiencing outbreaks have access to culturally appropriate information (Fig. 2a, b and c).

The MLHU provided extensive multilingual resources for COVID-19. Resources were provided in the following languages: Algonquin, Amharic, Arabic, Armenian, Bengali, Simplified & Traditional Chinese, Paskwawinimowin (Cree), Creole, Dari, Dënesųłiné (Dene), Nishnaa bemwin (Eastern Ojibwe), English, Farsi, French, German, Greek, Gujarati, Hindi, Innu-Aimun, Inuinnaqtun, Inuktitut, Italian, Japanese, Korean, Kurmanji. Michif, Mi'kmaq, Kanien'kéha (Mohawk), Nepali, Ojibwe Western, Oji-Cree, Pashto, Polish, Portuguese, Punjabi, Romanian, Russian, Somali, Spanish, Tagalog, Tamil, Ukrainian, Urdu, Vietnamese (MLHU 2022a, b).

A significant action in MLHU's response was how it issued Section 22 orders under the Health Promotion and Protection Act which implemented restrictions over and above provincial legislation to provide further protection to Middlesex–London (MLHU 2020). Three Section 22 orders and one instruction were issued by the medical officer of health at the MLHU. The first order ensured that face coverings were required to be worn in all personal service settings such as hair salons and barbershops, aesthetician services, piercing services, tanning salons and tattoo studios. Next, an order was issued requiring masks to be worn by individuals accessing all forms of public transit. An instruction was then issued which required operators of all enclosed public spaces to ensure face coverings were always worn in their establishments. The orders and instructions were issued approximately three months before the provincial government legislated the use of face covering. Additionally, an order was issued during the second wave placing more stringent regulations on sport and recreational facilities as it became apparent that transmission of COVID-19 was happening in this type of environment. The masking orders were rescinded when provincial regulations came into force, however, the sports and recreational facilities order remains in effect as it is more restrictive than current provincial legislation, and thus continues to provide enhanced protection to residents of London and Middlesex County.

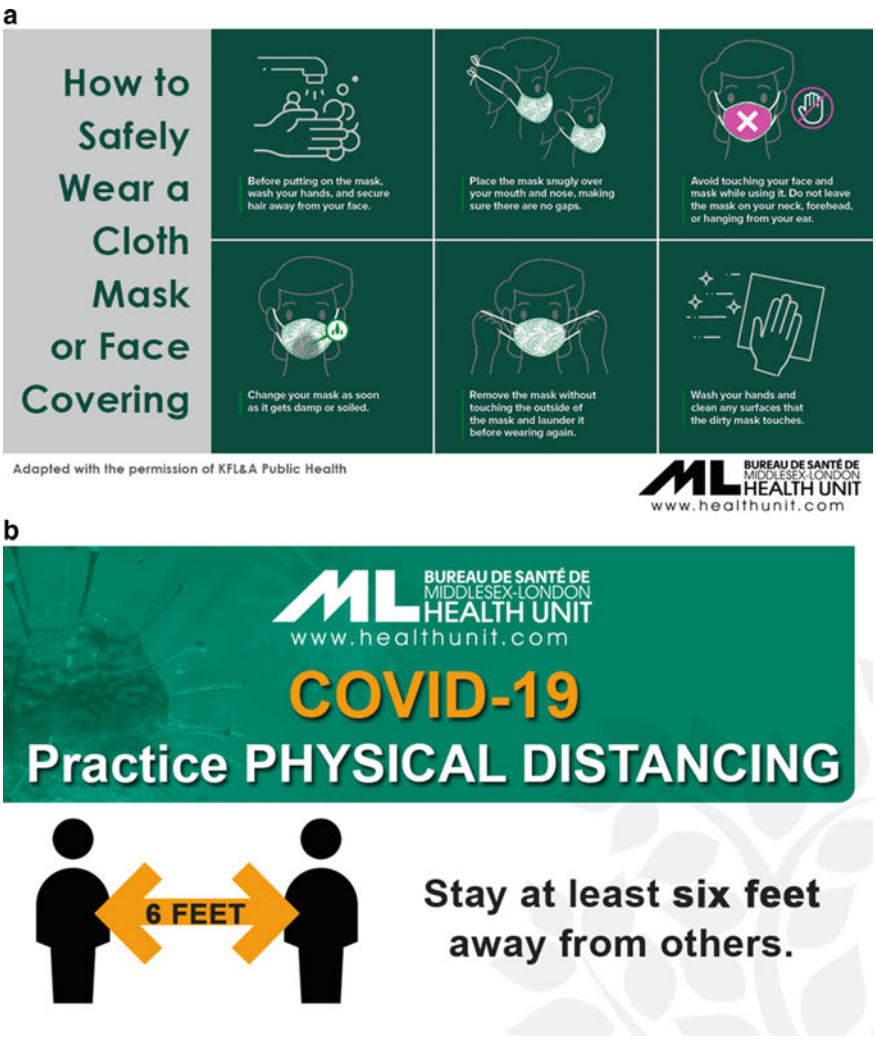

Fig. 2 **a** How to wear a mask. **b** Practise physical distancing. **c** MLHU COVID-19 information sources

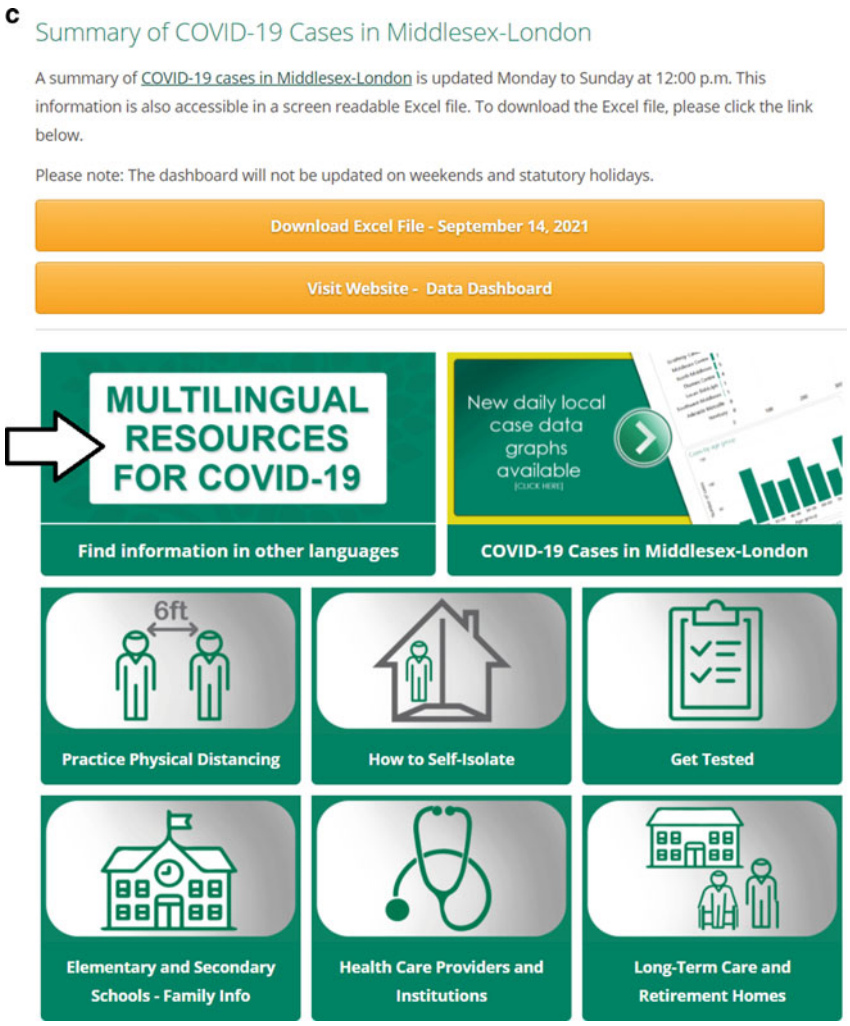

Fig. 2 (continued)

As cases increased, the MLHU recognised the importance of a multi-disciplinary approach to the COVID-19 response. Consequently, the MLHU adopted a SDOH approach to their response to the pandemic (MLHU 2020). The incorporation of SDOH into a pandemic response helped to identify existing inequities and allowed for a better understanding of those at heightened risk of becoming infected with COVID-19 and experiencing severe outcomes associated with COVID-19 infection. Additionally, once inequities were identified, the MLHU acted to reduce the disproportionate impact of the pandemic on various populations. For example, MLHU provided food and personal care items to individuals who were in quarantine or

isolation and did not have the means to obtain these required items. MLHU also offered cell phones with data to a few individuals who were experiencing problems remaining in quarantine and communicating with the health unit case and contact staff. Importantly, throughout the course of the COVID-19 pandemic, MLHU has utilised health equity interventions that are in line with the concept of community-involved system science aimed at supporting various at-risk groups in the community with their responses. Table 2 summarises the key features as they relate to the guidelines as stipulated in the Xiamen call to action (Fig. 3).

In recognition of the systemic nature of the pandemic, in April 2020, the Middlesex–London Health Unit (MLHU 2020) was one of the first public health agencies in Canada to initiate the voluntary collection of race and socio-economic data from laboratory confirmed COVID-19 cases. At the end of June 2020, the Ministry of Health required the collection of information on race, income level, language, and household size for all individuals who test positive for COVID-19. As part of follow-up with confirmed COVID-19 cases, MLHU staff continue to collect information for the following indicators: race, total family income, household size, language, occupation, homeless/under-housed, and Indigenous identity. The health equity data were identified as necessary as the evidence began to emerge showing the disparities in COVID-19 cases in the populations.

4 Discussion and Conclusions

The data collected by the MLHU help identify where inequities exist and further inform MLHU's response to the COVID-19 pandemic. This highlights the need to incorporate a health-equity approach to pandemic preparedness, response, and recovery in urban centres. The collection, analysis and dissemination of data on the social determinants of health, especially throughout the course of a pandemic, can influence and inform actions to address and potentially mitigate health inequities. Under the guidance of the MLHU, the London Health Sciences Centre (made up of four tertiary hospitals) set up an overflow centre in anticipation of a surge. Although this overflow centre was not utilised for patients during the first or second waves of the pandemic, it was subsequently repurposed into the first COVID-19 mass vaccination centre for the region. The federal and provincial governments are putting a strong focus on getting vaccines for the Canadian population. Provincially, the government of Ontario has sent high-level prioritisation guidelines for vaccine eligibility and has directed local public health units to prioritise further at the local level. In Middlesex–London long-term care home and retirement residents and staff were vaccinated first. Adults over 80 years of age and high-priority health care workers and first responders such as police, paramedics and fire were then vaccinated, followed by the remaining health care workers and adults aged 75+, and so forth. The vaccine roll-out has been on-going, and according to Public Health Ontario as of 29 January 2022, MLHU ranked fourth in the province of Ontario for the percentage of the population who had completed the primary series (vaccine doses 1 and 2) of the COVID-19 vaccine.

Table 2 MLHU COVID-19 mapped onto the six principles of building systems governance for urban health

Principle	MLHU/London COVID response
• Clear leadership and mandate to deal with urban health issues in an integrated manner	• MLHU worked with municipal partners and community organisations to lead the region through the pandemic response • MLHU issued Section 22 orders and an instruction under the provincial *Health Promotion and Protection Act*
• Inclusiveness: including human rights, mutually beneficial for sectors	• Developed an alternate testing and isolation system that was accessible, safe, and effective for homeless and underhoused individuals in the MLHU community • Developed culturally grounded health promotion campaigns, ensuring populations experiencing outbreaks have access to culturally appropriate information • Ensured interpretation services were always available for case and contact tracing
• Inter-sectoriality: various urban sectors, such as transportation, energy, housing, including primary health care, work and achieve urban health outcomes together	• Established a priority population liaison team to support pandemic planning alongside agencies and organisations that work with populations such as the homeless and underhoused, developmentally delayed, and individuals living in other group living settings • Supporting Indigenous partners, including the Oneida Nation of the Thames Health Centre, Chippewa of the Thames First Nation Health Centre, and Southwest Ontario Aboriginal Health Access Centre (SOAHAC) to conduct their own testing, including providing medical directives, swab training, and providing swabs • Working with the City of London, London InterCommunity Health Centre, and other partners, e.g., in the homeless sector • Working with community partners including the Cross-Cultural Learner Centre and the London InterCommunity Health Centre
• Health and well-being as performance indicators which need to be measured centrally and locally	• Collection of race data given the racialised nature of pandemic that was reported in other cities
• Risk sharing: stakeholders investing in and benefiting from cross-sectoral collaboration also share the costs	• Collaborations with other organisations in the city and county to enforce the Reopening Ontario Act 2020, such as local police, by-law enforcement, the Ministry of Labour, and the Alcohol and Gaming Commission of Ontario • MLHU participated in weekly calls with these agencies to share information and reduce duplication of efforts. Together joint initiatives were planned around key dates such as St. Patrick's Day to ensure community compliance

(continued)

Table 2 (continued)

Principle	MLHU/London COVID response
• Precautionary principle: it is about both the curative and preventive dimensions of health	• MLHU worked to not only prevent the spread of COVID-19 but has now begun a large-scale operation to vaccinate all members of the public starting with those most at risk

Fig. 3 Banner celebrating the one million doses of vaccine administered by MLHU

As of 5 February 2022, 1,087,630 doses had been administered in the Middlesex–London region; with 90.7% of the population 12 years and over have been fully vaccinated (2 doses) and 51.9% have received three doses (MHLU 2022a, b).

Throughout, the pandemic measures were enacted to keep health at the forefront, but also to recognise that other issues such as economic considerations, social connectedness and mental health were also important as they too affect the overall health of a population. Key features informing the response to date include strong leadership and specific strategies that work to ensure effective coordinated and intersectoral response at the local level. By using the SDOH as a framework, the MLHU was able to reveal how the COVID-19 pandemic has exposed and exacerbated existing health inequities, highlighting the need to prioritise the collection of health equity information to assess and modify our response to health crises and protect the health of all individuals (MLHU 2020). The findings showed which groups in the City of London and the MLHU were likely to be infected and experience severe outcomes related to COVID-19. These findings informed MLHU's response and the strategic priorities for implementation as the pandemic continues.

Overall, the example of the City of London and Middlesex County clearly shows that health equity considerations should be included in pandemic planning, response, recovery, and beyond. Although the approach adopted by MLHU may not be generalisable across different cities in Canada and elsewhere, it does provide lessons for other cities. Key recommendations include:

(1) Recognise the racialised nature of the pandemic,
(2) Establish appropriate diagnostic capacity,
(3) Reinforce aggressive measures to prevent community transmission,

(4) Work with local community groups to develop culturally-grounded health promotion campaigns, to ensure populations experiencing outbreaks have access to culturally appropriate information, and
(5) Limit economic impact through and while prioritising controlling the spread and impact of COVID-19.

The MLHU's response to the pandemic has provided learnings that can be adopted by other Canadian jurisdictions and the global community facing the enormous COVID-19 challenges and any future pandemics ahead.

References

Bai X, Surveyer A, Elmqvist T, Gatzweiler FW, Güneral F, Parnell S et al (2016) Defining and advancing a systems approach for sustainable cities. Current Opinion Environmental Sustainability 23:69–78

Braveman P, Gottlieb L (2014) The social determinants of health: it's time to consider the causes of the causes. Public Health Rep 129(1_suppl 2):19–31

Gatzweiler F, Fu B, Rozenblat C, Jenny Su H-J, Luginaah I, Corburn J, Boufford JI, Valdes JV, Nguendo-Yongsi B, Howden-Chapman P, Singh RB, Cooper R, Oni T, Zhu Y-G (2020) COVID-19 reveals the systemic nature of urban health globally. Cities & Health 5:S32–S36

Krieger N (1994) Epidemiology and the web of causation: has anyone seen the spider? Soc Sci Med 39(7):887–903

Luginaah I (2009) Health geography in Canada: where are we headed? The Canadian Geographer 53(1):91–99

MLHU (2020) Social determinants of health during the COVID-19 pandemic. Middlesex-London Health Unit, London, Ontario

MLHU (2022a) Multilingual resources for COVID-19. https://www.healthunit.com/covid-19-multilingual-resources. Accessed 2 September 2022

MLHU (2022b) Summary of COVID cases in Midddlesex-London. https://app.powerbi.com/view?r=eyJrIjoiMzE5MzJlOTItOWE2ZS00MDNlLTlkNDEtMTcyYTg5OGFhMTFiIiwidCI6ImRjNTYxMjk1LTdjYTktNDFhOS04M2JmLTUwODM0ZDZhOWQwZiJ9. Accessed 14 February 2022

Ontario Federation of Labour Aboriginal Circle and Ontario Federation of Labour Aboriginal Persons Caucus (2017) Traditional territory acknowledgements in ontario [Internet]. Ontario Federation of Labour, Toronto ON [cited 2018 Nov 22]. www.ofl.ca/wp-content/uploads/2017.05.31-Traditional-Territory-Acknowledgement-in-Ont.pdf

Statistics Canada (2013) Middlesex-London Health Unit, Ontario (Code 3544) (table). National Household Survey (NHS) Profile. 2011 National Household Survey. Statistics Canada Catalogue no. 99-004-XWE. Statistics Canada, Ottawa, ON [updated 2013 Sep 11; cited 2018 Dec 3]. https://www12.statcan.gc.ca

Webster P (2020) Canada and COVID-19: learning from SARS. The Lancet 395(10228):936–937

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Canada Research Chair in Health/Medical Geography (2007–2017). Dr. Luginaah's exceptional scholarship and leadership has helped to define the growing field of Health/Medical Geography and has been widely recognized. In 2008 he won the prestigious Julien M. Szeicz Award for Early Career Achievement by the Canadian Association of Geographers, the American Association of Geographers Africa Specialty Group (Kwadwo Konadu-Agyemang Distinguished Scholar Award), the University of Western Ontario (Faculty Scholar for research and teaching excellence), and the University of Windsor (Research Excellence Award). In 2014, Dr. Luginaah was inducted as a member of the College of the Royal Society of Canada. In 2017, he was honoured with the Kwadwo Konadu-Agyemang Distinguished Scholar Award by the American Association of Geographers, and in 2018 he was inducted as a Fellow of the African Academy of Sciences.

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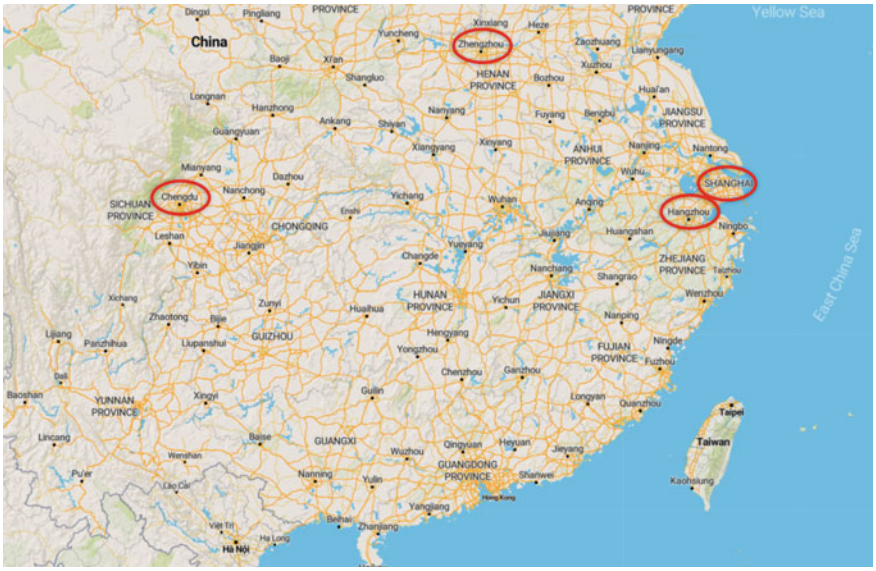
CHINA: Urban Factors Influencing COVID-19 Incidence Under Central-Local Interaction

Lan Wang, Lingyue Li, and Surong Zhang



People's Republic of China
Source Jawgmaps/uMap/OpenStreetMaps

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The rapid spread and continuous mutation of SARS-CoV-2 virus threatened global public health systems, challenging the established leadership models (Catalyst 2020), depressing economies, and stagnating people's daily lives. Densely populated cities where person-to-person transmission occurs easily are particularly vulnerable to epidemics (Kapiriri and Ross 2020), and thus should not be ignored in research on epidemics like COVID-19 (Ali and Keil 2006; Alirol et al. 2011; Liu 2020; Neiderud 2015). Where people live and how those places are governed determine whether and when they get sick, receive medical treatment, and die (Corburn 2013). Appropriate spatial interventions and policy measures can be effective in controlling the pandemic. Given China's fairly effective control of COVID-19, research into lessons and experiences resulting from its anti-epidemic actions is necessary and contributes to global public health emergency (PHE) responses. Drawing on experiences from anti-pandemic actions in four Chinese cities, Shanghai, Chengdu, Hangzhou and Zhengzhou (See the Map above), this chapter argues that effective control of pandemics such as COVID-19 requires both a holistic package of governance strategies and locally adaptive governance measures/processes (Li et al., 2021).

1 Powerful Unified Deployment of the Central Government

1.1 Coordination Between Central and Local Governments

The fight against the COVID-19 pandemic is enabled by an efficient, top-down command transmission and execution system as well as capable local leadership. Leadership agility is needed to address the epidemic crisis, as well as a well-coordinated governance structure that trickles down to the grassroots level to coordinate societal responses. In the case of the four Chinese cities identified here, unified national deployment ensured that the composition and structure of holistic policy packages were similar. Appropriate policies were issued and then improved to respond to different periods of the epidemic's development.

Scholars have often characterised the post-1980 Chinese state as an omnipotent government that embraces open-door policies and globalisation while retaining a centralised, hierarchical power structure (Lin et al. 2015; Chan and Li 2017; Wu and Wang 2017; He et al. 2018). With administrative power, governments that monopolise resources can establish an efficient administrative structure at national, regional and local levels to implement unified deployment. This specific pre-existing mode of governance shapes Chinese cities' responses to public health emergencies (PHE) with whole-of-government responses, supported by multi-sectoral cooperation platforms and quickly scaling-up PHE capacity (Dodds et al. 2020; Ning et al. 2020; Shaw et al. 2020).

In the initial period of the outbreak in December 2019, a few local governments (e.g., Wuhan) took time to seek approval from the central government before taking

any action, leading to the lapse of the golden time needed to contain the outbreak. However, the initial hysteria was soon calmed by the central government, which took drastic remedial measures and provided necessary personnel and material assistance. The whole-of-government response and accountability systems have been rapidly developed by organising cooperative platforms for multiple ministries at the central level. Policies essential to China's effective control of COVID-19 transmission include enforcement of lockdown, social distancing and mobility control. Concerns over the passive results of the top-down strategies such as societal instability and worsening of infection for disadvantaged groups (Corburn et al. 2020; Kapiriri and Ross 2020; Sharifi and Khavarian-Garmsir 2020) are countered by the visibility and effectiveness of disease control.

Although the initial response was criticised for revealing the disadvantages of a less liberal political system, the relatively effective control of the epidemic shows the advantages of it. Frequent policy mobilisation due to an efficient top-down governance approach and administrative transmission system enabled valid control measures to spread and benefit all cities, as illustrated in the convergent pattern of policy evolution in Zhengzhou, Shanghai, Hangzhou, and Chengdu. Specifically, the powerful unified deployment of the central government, along with concerted but also adaptive specific measures of local governments, and a professionally guided health system, have helped to achieve the control of COVID-19 in China. This well-coordinated whole-of-society action differs from some other countries where national leadership might not be strong enough to coordinate, and thus local governments' responses are fragmented (Renda and Castro 2020; Science News Staff 2020). In some places, politics and pervasive instability threaten disease control (Henry 2020). The formation of coordinated central–local governance should therefore be strongly advocated to assist epidemic control.

1.2 Government Credibility and Social Cohesion

Apart from coordination between different levels of governments, the effectiveness of PHE governance also depends on social cohesion and social trust. Social cohesion and broad conformity with strict disease prevention policies are vital for epidemic control, for which public trust in government leaders is essential (Gerwin 2011). Social isolation and lockdown were implemented almost everywhere, but were not always effective. Social cohesion and rigorous implementation of these policies were crucial for ensuring effectiveness, as demonstrated by China's anti-epidemic experience. This is also observed in Germany and the Netherlands, where individuals' sense of responsibility and self-discipline in implementing lockdown policies is emphasised (Kuiper et al. 2020; Lu et al. 2021).

In China, social cohesion helped enact governance measures, given citizens' determination and consensus to conquer COVID-19. Such cohesion, however, develops during a crisis when government and society share a common objective—the fight against the epidemic—and is consolidated by the temporary PHE regime. High levels

of cohesion allow PHE governance to operate in a more challenging manner; for example, individual interests such as privacy are less of a concern than public health security. The public complained that community lockdown and the closure of shops and general outpatient clinics made it too difficult for those in need. Low-income households received few financial subsidies, or even no subsidies at all. Although some top-down policy actions are not welcomed by vulnerable groups initially, life improves as the disease becomes more controllable. The central government was responsive to public demands and made more humane policies to balance social needs and epidemic control, e.g., allowing one person to go out every two days to buy supplies for ordinary families, and community volunteers to deliver supplies for families and elderly people living alone during the quarantine period. The government also stockpiled food, masks, and medicine to ensure adequate supplies and stable prices, and set up a hotline for medical services.

2 Adaptive Specific Measures of Local Governments

2.1 Strict Control of Infection Sources

As a global gateway city with a high inbound passenger volume, Shanghai is especially influenced by global conditions, thus having stricter border controls than other cities. By identifying foreign entrants as a source of infection, Shanghai took a series of strict and targeted measures to cut off transmission passages importing the epidemic from abroad, effectively preventing a large-scale local outbreak.

Resilience to global pressures played an extremely important role in Shanghai's fight against COVID-19. To prevent importing the virus from abroad, Shanghai issued intensive immigration-related health-risk monitoring policies and strengthened the health management of immigrants entering Shanghai (centralised isolation) as its top priority in the later stage of the anti-epidemic campaign. According to the development trend of the global epidemic situation, the Shanghai Leading Group for Epidemic Prevention and Control determined a list of key countries (and regions) for epidemic prevention and control and adjusted the list in a timely manner considering the changing trends of the epidemic in each country. Shanghai implemented strict border control, using the list to respond to the high risk of importing epidemics. Shanghai Customs, Shanghai Entry–Exit Administration, and Shanghai Entry–Exit Border Inspection Station worked closely with the Shanghai Municipal Health Committee to enable airports and other entry ports to implement quarantine, epidemiological investigation, closed-loop trans-shipment, and nucleic acid tests for all immigrants. For immigrants from or passing through key countries and regions, an additional 14-day centralised isolation was also implemented. These stringent measures fully reflect Shanghai's emphasis on the prevention and control of epidemics imported from abroad.

2.2 Expertise-Dominated Leadership

Chengdu benefits from a science-minded governance and expertise-dominated leadership as its governor is an expert in medicine and health management. The intensity and comprehensiveness of the policies in Chengdu were unprecedented, and many measures reflected the forward-looking and scientific nature of the anti-epidemic campaign.

Serving as a group leader, the governor structured the Chengdu Municipal Epidemic Response Leading Group with comprehensive responsibilities and a detailed division of labour. This group comprised six sub-groups: epidemic control; medical treatment; scientific research; information promotion and public opinion; logistics support; and comprehensive working groups. The sub-groups worked together to guide health departments, including Chengdu Municipal Health Committee, Chengdu Municipal Disease Control Centre, and People's Hospital Infection Control Centre, to put science-minded leadership and expert advice into practice as soon as possible. Within three days of the first case of COVID-19 being reported in Wuhan, under the leadership of the governor, the list of designated hospitals for COVID-19 treatment and the epidemic supervision hotline were announced, road traffic to Wuhan was blocked, disinfection and temperature monitoring for passengers at the airport were carried out, and people entering from Wuhan were thoroughly investigated. A PHE response plan for the education system was introduced, supplies of anti-epidemic supplies were prepared, and large-scale public gatherings were suspended. After all the deployments were completed, the governor officially announced that Sichuan had launched the highest-level response for PHE, effectively avoiding panic among the masses and confusion in the anti-epidemic campaign.

2.3 Utilisation of Technological Force

Hangzhou is known for being an advanced digital economy. With technical support from local high-tech enterprises, Hangzhou had the advantages of techno-driven governance during the epidemic.

Market forces played an important role in Hangzhou's anti-epidemic campaign; one of the first to bear the brunt of this was the Alibaba Group. Because of the industry-leading AI algorithm and data architecture capability of the Alibaba Cloud platform, Hangzhou took the lead in proposing health codes, a mobile application for monitoring the population's movement and health status with big data. Public health departments could quickly identify potentially at-risk populations and control the spread of the virus. The Hangzhou government strongly supported the development of health codes. The Zhejiang Big Data Development Administration Bureau and Hangzhou City Data Resources Bureau provided real-time data cleansing and sharing services for the Alibaba Group. Alibaba's DingDing and Alipay, which have large user bases, enabled the health code to spread rapidly. In addition to the health

code, the Alibaba Group also provided strong support in terms of COVID-19 diagnosis. Alibaba Dharma Hospital developed a set of AI diagnostic technology for the clinical diagnosis of COVID-19. This AI algorithm is based on the learning and training of the CT image sample data of more than 5,000 cases. It can interpret CT images of suspected COVID-19 cases within 20s, greatly improving the diagnostic efficiency of doctors. Other high-tech and manufacturing companies also contributed to developing medical equipment and producing anti-epidemic materials. Owing to the technical support of local high-tech enterprises, smart solutions, typified by health codes, were widely used to improve the efficiency and speed of anti-epidemic responses.

2.4 Mobilisation of Grassroots Power

With a considerable rural population, Zhengzhou made the best use of social mobilisation at the grassroots level during its anti-epidemic campaign.

The geographical proximity and high rates of mobility between Wuhan and Zhengzhou prompted Zhengzhou to start screening people with a travel history of visiting Wuhan as early as possible, especially at the grassroots level. During this critical period, residents' committees and other grassroots social organisations played an important role in disease prevention and control. In urban areas, residents' committees, community police and citizen volunteers built anti-epidemic networks. In rural areas, anti-epidemic fights were carried out mainly by villagers' committees and volunteers. Having no surveillance cameras, village volunteers cordoned quarantined areas and took turns keeping watch to ensure that migrants from Wuhan were quarantined at home. To raise awareness of epidemic prevention, village committees compiled hilarious slogans in folk languages that were popular and easy to understand (Sohu News 2020). These were broadcast in a loop, with an electric car towing the stereo and distributing epidemic-prevention leaflets to every household. However, the grassroots campaign sometimes lacked scientific guidance. To implement closure, some radical villagers cut off the only access roads with excavators, making villages inaccessible for supplies and emergency vehicles.

The Henan Provincial Department of Agriculture and Rural Affairs and Zhengzhou Municipal Agricultural and Rural Work Committee closely monitored the grassroots situation, and quickly stopped this practice. Zhengzhou's PHE governance is moderately characterised by bottom-up actions, as grassroots management led epidemic prevention. In many villages and communities, grassroots management played a fundamental role in epidemic control and signified the emergence of social forces in China's urban development, although such participation continues to insufficiently alter the key decision-making process. However, such public security-oriented governance does not necessarily indicate a complete anti-growth logic in Chinese society. Instead, it stabilises epidemic control for better economic recovery and regrowth.

3 Conclusion

During the two and a half years of the COVID-19 pandemic transmission from late 2019 to February 2022, all four Chinese cities, with populations of more than 10 million, managed to keep the infection rate below 0.02% with no more than ten deaths in total (statistics include the initial Delta and Omicron strains). While fighting COVID-19, the four cities worked to minimise the socio-economic impact of the pandemic and ensure normal production and life. Although specific local governance measures were varied and led to dissimilar epidemic control policy pathways, the outcomes of the four cities are positive so far. The successful experience of these four Chinese cities in responding to the COVID-19 pandemic reveals that effective control of pandemics such as COVID-19 requires both a holistic package of governance strategies and locally adaptive governance measures/processes. The holistic policy package showed overall similarities across the four cities, while locally adaptive governance measures specifically tailored to the different economic, social, geographic and political contexts in each city also play important roles in the anti-epidemic fight.

To ensure a better response to COVID-19 control and future pandemics at a local level, the following four lessons are worth replicating within diverse subnational institutional contexts. First, sources of infection should be identified and targeted policies should be developed to cut off transmission passages. Shanghai provides a good example of this. By identifying foreign entrants as a source of infection, Shanghai took a series of strict and targeted measures to cut off transmission passages importing the epidemic from abroad, effectively preventing a large-scale local outbreak. Second, timely and science-minded leadership should be valued in anti-epidemic campaigns. As a medical professional, the governor of Sichuan Province led Chengdu's anti-epidemic campaign and gave full play to his medical expertise, helping the city develop a series of comprehensive, professional, and intensive anti-epidemic policies. Third, techno-driven approaches and smart solutions should be encouraged when designing effective response and recovery measures, but attention should be paid to privacy protection. The health codes introduced in Hangzhou have been useful for monitoring the population's movement and health conditions but requiring such monitoring measures runs the risk of violating users' data privacy. A trade-off between technological anti-epidemic measures and privacy protection is necessary. Fourth, emphasis should be placed on the guidance of social anti-epidemic forces. Full grassroots mobilisation to consciously comply with epidemic-prevention measures and report high-risk individuals allowed Zhengzhou, bordering Wuhan, to cut off potentially widespread transmission.

References

Ali SH, Keil R (2006) Global cities and the spread of infectious disease: The case of severe acute respiratory syndrome (SARS) in Toronto Canada. Urban Studies 43(3):491–509

Alirol E, Getaz L, Stoll B, Chappuis F, Loutan L (2011) Urbanisation and infectious diseases in a globalised world. Lancet Infect Dis 11(2):131–141
Catalyst NEJM (2020) What health care leaders and clinicians say about the covid-19 pandemic. New England Journal of Medicine, Catalyst Innovations in Care Delivery 1(2)
Chan RCK, Li L (2017) Entrepreneurial city and the restructuring of urban space in Shanghai Expo. Urban Geogr 38(5):666–686
Corburn J (2013) Healthy city planning: from neighbourhood to national health equity. Routledge, London
Corburn J, Vlahov D, Mberu B, Riley L, Caiaffa WT, Rashid SF, Ko A, Patel S, Jukur S, Martínez-Herrera E, Jayasinghe S, Agarwal S, Nguendo-Yongsi B, Weru J, Ouma S, Edmundo K, Oni T, Ayad H (2020) Slum health: arresting COVID-19 and improving well-being in urban informal settlements. Journal of Urban Health 97(3):348–357
Dodds K, Broto VC, Detterbeck K, Jones M, Mamadouh V, Ramutsindela M, Varsanyi M, Wachsmuth D, Woon CY (2020) The COVID-19 pandemic: territorial, political and governance dimensions of the crisis. Territory Politics Governance 8(3):289–298
Gerwin LE (2011) Planning for pandemic: A new model for governing public health emergencies. Am J Law Med 37(1):128–171
He S, Li L, Zhang Y et al (2018) A small entrepreneurial city in action: policy mobility, urban entrepreneurialism, and politics of scale in Jiyuan, China. Int J Urban Reg Res 42(4):684–702
Henry R (2020) COVID-19 in Latin America: a humanitarian crisis. Lancet 396(10261):1463
Kapiriri L, Ross A (2020) The politics of disease epidemics: a comparative analysis of the Sars, Zika, and Ebola outbreaks. Glob Soc Welf Res Policy Pract 7(1):33–45
Kuiper ME, de Bruijn AL, Folmer CR, Olthuis E, Brownlee M, Kooistra EB, Fine A, van Rooij B (2020) The intelligent lockdown: compliance with COVID-19 mitigation measures in the Netherlands. Amsterdam Law School Research Paper No. 2020-20. https://doi.org/10.2139/ssrn.3598215. Accessed 4 August 2021
Lin GC, Li X, Yang FF et al (2015) Strategizing urbanism in the era of neoliberalization: state power reshuffling, land development and municipal finance in urbanizing China. Urban Studies 52(11):1962–1982
Liu L (2020) Emerging study on the transmission of the Novel coronavirus (COVID-19) from urban perspective: evidence from China. Cities 103:102759
Lu G, Razum O, Jahn A et al (2021) COVID-19 in Germany and China: mitigation versus elimination strategy. Glob Health Action 14(1):1875601
Neiderud CJ (2015) How urbanization affects the epidemiology of emerging infectious diseases. Infect Ecol Epidemiol 5(1):27060
Ning Y, Ren R, Nkengurutse G (2020) China's model to combat the COVID-19 epidemic: a public health emergency governance approach. Glob Health Res Policy 5(5):34
Renda A, Castro R (2020) Towards stronger EU governance of health threats after the COVID-19 pandemic. Eur J Risk Regul 11(2):273–282
Science News Staff (2020) United States strains to act as cases set record. Science 368(6486):17–18
Sharifi A, Khavarian-Garmsir AR (2020) The COVID-19 pandemic: impacts on cities and major lessons for urban planning, design, and management. Sci Total Environ 749, 142391
Shaw R, Kim YK, Hua J (2020) Governance, technology and citizen behavior in pandemic: lessons from COVID-19 in East Asia. Prog Disaster Sci 6, 100090
Sohu News (2020) Anti-epidemic slogans battle. https://www.sohu.com/a/369446192_784306
Wu W, Wang J (2017) Gentrification effects of China's urban village renewals. Urban Stud 54(1):214–229

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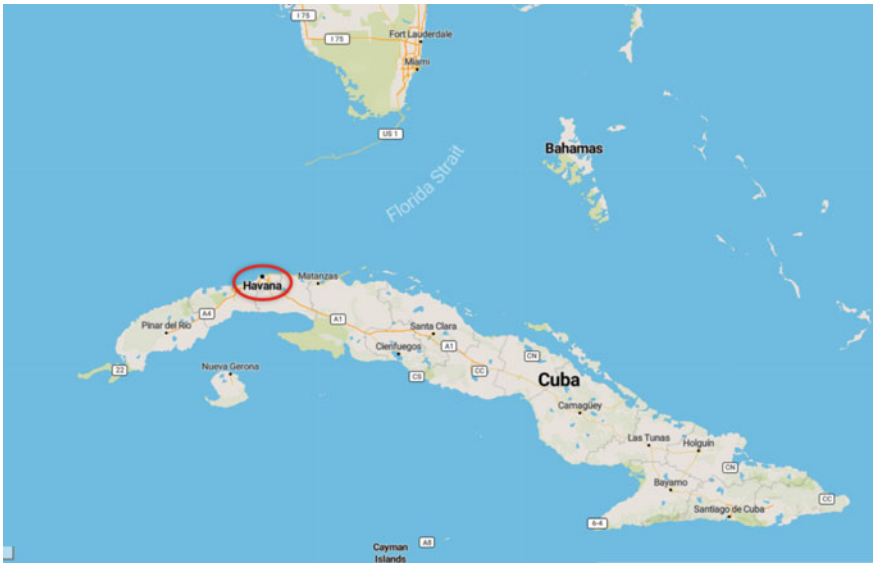
CUBA: COVID-19 in Havana, Cuba 2020

Juan Vela Valdés



Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

Havana, capital of the Republic of Cuba, is also La Habana, one of the 15 provinces in the country and the city with the largest population, with an area of 727 km. It was founded in 1519 by the Spanish conquerors. It has a roughly trapezoidal shape and has grown over the years from the main road axes. Havana is the main centre for spatial, economic, service, cultural and scientific organisations, as well as the main node for transport and communications. It has 15 municipalities and is considered a single territorial unit (Remond Noa and Rodríguez Pérez 2020).

Havana is predominantly flat, with seven types of plains that are distributed parallel to the coastline. Its tropical climate is seasonally humid, with a dry season from November to April, and a wet season from May to October (Remond Noa and Rodríguez Pérez 2020).

Havana in 2020 had a population of 2,132,289 inhabitants, 47.7% men and 52.2% women. Its population density is 2,927.8 inhabitants per km^2 and 21.9% of the population is over 60 years of age. It has one of the lowest fertility levels of the Cuban Provinces (Ministry of Public Health 2021a).

The budget of the province in 2020 was 7,187.1 billion pesos (~USD300 m). The province is governed by a Provincial Government of the People's Power made up of a governor and a provincial council. This represents the state, and its fundamental mission is the economic and social development of its territory, in accordance with the general objectives of the country. It coordinates between the central structures of the state and the municipalities, contributing to the harmonisation of the interests of the province and its municipalities. Above the provincial government is the National Assembly of the People's Power, which elects the president and vice president of the republic, the state council and appoints the Prime Minister and the council of ministers.

2 Timeline of COVID-19 Response

2.1 How Were Citizens Informed?

Before the first cases appeared in Havana, the population had already been informed in many ways through: the media, social networks, civil society organisations, talks by primary care doctors to their patients, and speeches by state and political leaders at all levels of the country. Information to citizens has been regular and constant with a solid scientific basis. In the city, local television and radio stations, the city newspapers and civil society organisations keep the population informed. The Ministry of Public Health (MINSAP) holds a daily television conference reporting the number, ages and comorbidities of people who have died, and the daily incidence by age groups of those admitted to hospitals and isolation centres. In Havana in 2020, all cases positive by PCR and antigen tests were admitted to hospitals, as well as contacts and suspected cases.

2.2 How Was the Problem Framed?

The problem was clearly presented as a serious global disease for the world. The population was informed of the need to comply with biosecurity measures, the use of masks, physical distance of at least 1.5m, frequent handwashing and not going into closed spaces. All educational facilities were closed, and schooling continued at home, through tele-classes on two television channels, both with national reach.

Since the first cases appeared in Wuhan, People's Republic of China, Army General Raúl Castro Ruz, then First Secretary of the Party Central Committee, publicly indicated the need to have a strategy in the face of this danger. On 29 January 2020, the Council of Ministers approved the National Plan for the Prevention and Control of Coronavirus in Cuba. On 3 February, the training of health professionals and workers of the Central State Administration agencies began on biosafety issues and on 12 February, the Science Group for Coping with COVID-19 was created. On the 17th and 26th of the same month, the COVID-19 Health Observatory and the Innovation Committee were established, respectively. On 28 February, the first five research projects for COVID-19 were approved (Portal Miranda 2020).

The management model for the control of COVID-19 has three fundamental components: epidemiological, healthcare and scientific. This strategy is also based on a rigorous statistical information system, on the political will of our government, and on the support of political and mass organisations, as well as the support of all our people (Portal Miranda 2020).

As part of the science-led fight against the pandemic, a strategy was designed to obtain and produce drugs and immunogens, which led to five major research projects of anti-COVID vaccine candidates. As a result of this effort, the Centre of Genetic Engineering and Biotechnology was able to obtain the *Abdala* anti-COVID vaccine and the *Mambisa* vaccine candidate, this latter will be applied through the nasal route. Finlay Vaccine Institute obtained and produced the anti-COVID vaccines *Soberana 02* and Soberana Plus and the vaccine candidate *Soberana 01*. All these products underwent the corresponding clinical trials and prior approval by the national regulatory authority of the Centre for State Control of Medicines, Equipment and Medical Devices (CECMED) and have been integrated into Cuban protocols to confront the pandemic (Cuba already has three vaccines against COVID-19 2021).

As a result of this intense scientific activity, in December 2020 there were 869 research and innovation projects, of which 189 are national (Portal Miranda 2020). The importance that the country gave to science at the forefront of the epidemic control strategy is evidenced by the 38 occasions during 2020 in which the President and Prime Minister held meetings with scientists who provided them detailed information on the course of their investigations (Portal Miranda 2020).

All health services are free, and access is guaranteed to the entire population regardless of political ideas, religion, race, legal status and sex. The health system in Havana has 22,827 doctors, which means 106.9 doctors per 10,000 inhabitants or 94 inhabitants per doctor. There are 34 hospitals with 13,454 beds for medical assistance,

which means 6.3 beds per 1,000 inhabitants. In them, there are 20 intensive therapy services (Ministry of Public Health 2021a).

The primary health care system has been the key to the successful performance of the pandemic prevention and care plan. Primary care in Havana is organised into 82 health areas. On average, the population served at this level is 27,013 inhabitants. Each area has a polyclinic and several family doctors' offices. In Havana there are 3,617 family doctors in the community in 2,012 family doctors' offices, and they deal with the health problems of individuals, the community and the environment (Ministry of Public Health 2021a).

The pandemic prevention plan includes: the immediate admission of patients with new coronavirus to hospital facilities for their treatment, according to the protocols established by MINSAP; the isolation and admission to state institutions of all contacts and suspects according to epidemiological surveys; quarantine to control outbreaks and events; special attention given to vulnerable groups such as the elderly, pregnant women, the disabled and children; health promotion actions and mandatory use of masks; physical and social distancing; frequent hand washing; and the application of preventive drugs to increase the immunity of the entire population.

2.3 Balance of Encouragement and Trust vs Penalties

To manage the pandemic, there was a balance between educational, encouragement and trust measures, and financial fines and penalties. Considerable emphasis had to be placed on the population's perception of risk for contracting the disease, but this objective was sometimes not realised in some population groups. Overall, correct actions were highly encouraged and incorrect actions were criticised. The MINSAP prepared the National Action Protocol for COVID-19 Version 1.4 (Ministry of Public Health 2020a) and Ministerial Resolution 128/2020, published in the Extraordinary Official Gazette Number 25 of 12 May 2020, where it issued the specific complementary health provisions for the stage of prevention and control of the spread of COVID-19 in the national territory (Ministry of Public Health 2020b). Decree Law 14 was issued by the Prime Minister on infractions against communal hygiene and sanitary measures for confronting COVID-19 in the province of La Habana.

2.4 Who Took Charge?

In Cuba, the first cases of COVID-19, were diagnosed on 11 March, 2020 and the Cuban government immediately created the Temporary Working Group, chaired by the president of the republic, the vice president and Prime Minister, deputy Prime Ministers and ministers, including public health. They have met daily since March 2020 to analyse the epidemiological situation in the country and to give instructions. In these daily meetings, the authorities of the 15 Cuban provinces and the special municipality of Isla de la Juventud participate by videoconference (Díaz-Canel and Núñez 2020).

In the province-city of Havana, a temporary working group was created with the same composition as at the national level, which meets daily, and analyses the epidemiological situation of the city, outbreaks and events, quarantine measures, internal order, work activity, the progress of investigations or active searches for patients and their isolation and immediate treatment. This group, chaired by the general secretary of the Communist Party of Cuba in the city and the governor, is made up of the heads of the municipal administrations and provincial administrative leaders, as well as political and social organisations. This group took charge.

2.5 Did Lockdown Occur and When? Who Monitored It and How?

A first lockdown occurred from 10 May to 3 July. A second confinement was put in place from 7 August to 1 October 2020 (Cubadebate 2020a). The confinement was monitored by local administrative and political authorities. The forces of public order, mass organisations, trade unions, professional and community organisations also participated. They observed in the community whether the measures were accomplished and the overall discipline of the population.

3 Timeline of Effects

3.1 Number of Cases

Havana reported its first case on 16 March 2020 and closed the year with 4,924 cases, a rate of 230.6 per 100,000 inhabitants. Most of the cases (81.8%) were 4,026 community-acquired (autochthonous), only (18.2%) of the cases were people (898) returning from other cities or countries (Ministry of Public Health 2020a, b).

3.2 Number of Deaths

There were 76 deaths in 2020, a rate of 3.5 per 100,000 inhabitants. Most people who died (80.9%) suffered from underlying non-communicable diseases (Ministry of Public Health 2020a, b).

3.3 Demographic Groups Particularly Affected

In nine of the 15 municipalities in the province, the pattern of incidence rate by age groups was concentrated in the 20–24 age group. Incidence rates by sex showed higher rates among women in the provinces, with the highest incidence among women in 8 of 15 municipalities. The mortality rate was highest for males of advanced ages. There is a significant correlation between the mortality rate and the age rates of 60 and over (Centre for Demographic Studies 2020).

3.4 Super-Spreading Events or Settings

Super-spreading events or settings in Havana are classified according to where they occur. If the event takes place in a workplace, student centre or military base, it is classified as an institutional event. If it occurs in a house, which spreads to other homes and families in the community, it is called a community event.

There were two notable institutional events: in the Pharmaceutical Laboratories, Playa municipality (109 cases); and the Provincial Centre for social protection, Cotorro municipality (92 cases) and two notable community events: Popular Council Dragones, Centro Habana municipality (89 cases); and the Popular Council Los Sitios, Centro Habana municipality (61 cases).

4 Consequences

4.1 Political Consequences

The response to COVID-19 was a political process, with evident consequences. A systemic and intersectoral vision to confront the pandemic in the country and in Havana city was articulated. It was not considered that this was just a problem that concerned the National Health System. All the effort in Havana was articulated by the leadership of the Communist Party of Cuba and the province by the provincial

government, as well as by professional, community and representative organisations, all the administrative sectors, communities, and municipalities. A true integration of organisational efforts was achieved.

4.2 Role of Media

A health crisis such as the one caused by the COVID-19 pandemic must be faced with the full participation of individuals and communities and for that effective communication is essential. All the media were focused on the pandemic. Several informative proposals were launched:

- There was balanced information with valid arguments, supported by scientific sources; it did not promote fear or sensationalism.
- Official statistics from the Ministry of Public Health and the Provincial Health Office were used and showed the real epidemiological situation of the province; truthful information was provided on the extent and severity of cases, mortality was disaggregated by gender and age groups, and organised by municipalities and popular councils. Inequalities were visible in most vulnerable people, due to their age, comorbidities, or their social situation, sex, and age. The highest mortality rate was evidenced in the older adult populations.
- A number of polls and surveys were carried out by the Centre for Demographic Studies (CEDEM) of the University of Havana, looking at specific concerns, such as multi-generational families and demographic factors (Centre for Demographic Studies 2020).
- Approach to the behaviour of co-residing families, taking into account the positive cases of COVID-19 that belong to the same family network. A survey was applied that made it possible to obtain information on 224 families of positive cases.
- Analysis by age and sex of COVID-19 positive patients in Havana, from 11 March 2020 to 19 April 2021. The highest concentration of those infected was reported in young ages, whereas the highest death rate prevailed in old people.

4.3 Social Consequences

Along with Cuban traditions of solidarity, professors and students of health sciences participated in daily visits to the houses to know the health of people; also, students and teachers supported health services in hospitals, including red zones. They also participated in isolation centres and in the health intervention with the Cuban vaccine candidates (Jiménez Rodríguez et al. 2021).

5 Unintended Consequences of Lockdowns

5.1 Domestic Violence

According to the 2016 survey on gender equality, undertaken before the pandemic, 26.7% of women between 15 and 74 years old had been victims of some manifestation of violence in their relationship in the previous 12 months (National Survey on Gender Equality 2020). The prevailing variant was psychological, and secondly economic, two elements that are currently being put to the test (Newspaper Juventud Rebelde 2020). As in the rest of the world, isolation conditions can cause an increase in domestic violence and remain invisible as we all look elsewhere (Cubadebate 2021b).

5.2 Mental Health

Among the most frequently reported manifestations in the studies consulted were: emotional disorders, depression, stress, apathy, irritability, insomnia, post-traumatic stress disorder, anger and emotional exhaustion. In tests to check the presence of symptoms of post-traumatic stress, quarantined children and adolescents on average show scores three times higher compared to children who have not experienced quarantine.

The existence of a recurrent fear of death, fear of separation from the family, insomnia, nightmares, symptoms of generalised anxiety, depressive symptoms, obsessive symptoms, post-traumatic stress and increased use of substances, especially alcohol, are reported in older adults, especially increased consumption of alcohol (Brooch Pérez et al. 2020).

5.3 Impact on Other Infectious Diseases

Many infectious diseases which are common in other countries, such as poliomyelitis, diphtheria, newborn tetanus, pertussis, rubella and mumps, have been eliminated in Cuba, and did not reoccur. There was a decrease in the medical attention required for acute diarrheal diseases and acute respiratory infections decreases. Similarly, indicators showed that the mother-to-child transmission of HIV and congenital syphilis had been eliminated and did not reoccur. However other airborne arboviruses increased (Ministry of Public Health 2021a).

5.4 Delays in Other Medical Treatments

There did not appear to be delays in other medical treatments. There were indications that the number of medical and stomatological consultations decreased compared to 2019. The indicators of surgical activity and hospital admissions also decreased compared to 2019 (Ministry of Public Health 2021a).

5.5 Decrease in Injuries Caused by Traffic Accidents

Also positively, mortality from traffic accidents decreased from a rate of 6.4 per 100,000 inhabitants in 2019 to 4.6 per 100,000 inhabitants in 2020 (Ministry of Public Health 2021a).

5.6 Economic Consequences

Cuba has an open economy, dependent on the external sector, tourism, commerce, etc. The gross domestic product (GDP) of Cuba in 2020, according to estimates valued at constant prices, decreased 11% due to the severe contraction in foreign trade, the reduction in international tourism and in foreign exchange earnings, due to COVID-19. These pandemic-related factors were exacerbated by the tightening of the economic, commercial and financial blockade of the government of the United States of America (Cubadebate 2020b).

5.7 Unemployment

There was wage protection in the state sector, which employs the majority of workers (67%) in the country. In centres that remained open, those workers who could start telecommuting and remote work were kept working and they received 100% of their salary. In the centres that closed, the workers in the first month of the pandemic received their salary at 100% and thereafter at 60%. In the non-state sector, cooperative members, shop owners of hostels, restaurants, etc., and self-employed workers, were exempted from paying taxes, while the effects of the pandemic lasted (National Office of Statistics and Information 2021).

Twenty-two percent of the city's health areas show some degree of socioeconomic vulnerability. In these areas, conditions of greater economic dependence coexist with lower indices of economic activity. These neighbourhoods are more economically and environmentally precarious, for example, they have less availability of water service inside homes (Remond Noa and Rodríguez Pérez 2020). COVID-19 has led to an increase in existing socioeconomic inequalities.

6 Conclusion

6.1 Impact of Taking a Systems Approach

This pandemic represents a challenge for society as a whole. It was necessary to establish in some cases, and strengthen in others, the coordination of all sectors of society. Intersectorality and a systems approach were fundamental. In the fight against the pandemic, the National Health System and its research institutes had the support and integration of research centres of the Cuban Academy of Sciences, other institutions, universities, the medical-pharmaceutical biotechnology industry and the political, professional and social organisations that promote popular participation. From the beginning of the pandemic, the President and the government were at the forefront of the national effort, along with the local authorities in the city, to link and inform government management with scientific and technological management. This integrated system promoted inter-institutional, intersectoral and interdisciplinary collaboration, an accelerated search for answers, overcoming potential obstacles and inconveniences and an active public communication campaign to improve the information and response of the population.

Today Cuba has three vaccines approved by the National Regulatory Authority for emergency use—Soberana 02, Soberana Plus and Abdala—which, in the studies carried out, have shown an efficacy higher than 90% (Cuban scientists present to WHO the results of anti-Covid-19 vaccines 2021). By the end of October 2021, more than 25 million doses of the three Cuban vaccines were administered in the country. At least one dose has been administered to 9.8 million people. Of these, 7.8 million have had a second dose and 6.4 million have received a third dose. Overall, 62.7% of the whole Cuban population have received a double vaccination (Ministry of Health 2021b). The government's aim is for more than 90% of the population by the end of November 2021 to have a complete vaccination (Ministry of Public Health 2021c). Before 15 November, 100% of the vaccinable population in Havana must be vaccinated (Cubadebate 2021a).

A key indication of Cuban international solidarity in the pandemic was the setting up of 57 brigades of health personnel, made up of 4,982 people, who worked in 41 countries. All this effort has taken place in a very difficult economic context, accentuated by the strong economic, financial and commercial blockade and the ongoing political harassment by the government of the United States of America.

References

Brooch Pérez Y, Fernández Castillo E, Reyes Luzardo DA (2020) Psychological consequences of quarantine and social isolation during the COVID-19 pandemic. Rev Cub Salud Pública [Internet] [cited 15 Oct 2021] 46(0). http://www.revsaludpublica.sld.cu/index.php/spu/article/view/2488

Centre for Demographic Studies (CEDEM) (2020) Demography and COVID 19: social and epidemiological differentials of a pandemic, University of Havana. UNFPA, Havana (Internet). ISBN 9-789597, ISBN (collection) 9-789597-253204. https://cuba.unfpa.org/sites/default/files/pub-pdf/demografia_y_covid-19.pdf

Cuba already has three vaccines against COVID-19 (2021) (+ Video) (Internet). https://www.granma.cu/cuba/2021-08-20/soberana-02-soberana-plus-ya-son-vacunas-20-08-2021-12-08-53. Accessed 24 October 2021

Cubadebate (2020a) COVID-19: new restrictive measures to reinforce physical isolation in Havana. Havana. (Internet). http://www.cubadebate.cu/noticias/2020/08/27/covid-19-nuevas-medidas-restrictivas-para-reforzar-el-aislación-fisico-en-Havana/. Accessed 21 October 2021

Cubadebate (2020b) Cuban economy falls 11% this year and should grow around 7% in 2021. Havana (Internet). http://www.cubadebate.cu/noticias/2020/12/17/economia-cubana-cae-11-este-ano-y-estima-crecer-alrededor-del-7-en-2021/. Accessed 20 October 2021

Cubadebate (2021a) Reopening and easing of measures in Havana: what should you know? (Internet) Havana. http://www.cubadebate.cu/noticias/2021/10/20/reapertura-y-flexibilizacion-de-medidas-en-la-habana-que-debe-saber/. Accessed 20 October 2021

Cubadebate (2021b) Violence does not go into quarantine. Havana (Internet). http://www.cubadebate.cu/especiales/2020/04/16/la-violencia-no-entra-en-cuarentena/. Accessed 10 September 2021

Cuban scientists present to WHO the results of anti-Covid-19 vaccines (2021) Workers Newspaper, Havana (Internet). http://www.trabajadores.cu/20210916/cientificos-de-cuba-presentan-a-oms-resultado-de-vacunas-anticovid-19/. Accessed 8 September 2021

Díaz-Canel Bermúdez M, Núñez Jover J (2020) Government management and Cuban science in the confrontation with COVID-19 [Internet]. Ann Sci [cited 25 Oct 2021] 10(2). http://revistaccuba.sld.cu/index.php/revacc/article/view/881

Jiménez Rodríguez D, Ramos Leliebre O, Sardiñas Valdivia G, Oramas Hernández L, Álvarez Sánchez M, Mena Madrazo DR, García García I et al (2021) Integrated community work of medical sciences students facing COVID-19, Rampa Polyclinic, 2020. Rev Cubana Salud Pública [Internet] 47(3). http://www.revsaludpublica.sld.cu/index.php/spu/article/view/3120. Accessed 15 October 2021

Ministry of Public Health (2020a) National action protocol for COVID 19. Version 1.4 (Internet). https://files.sld.cu/editorhome/files/2020/05/MINSAP_Protocolo-de-Actuaci%c3%b3nNacional-para-la-COVID-19_versi%c3%b3n-1.4_mayo-2020a.pdf. Accessed 28 July 2020

Ministry of Public Health (2020b) Resolution 128/2020b. Published in the Official Gazette of the Republic of Cuba, Extraordinary Edition (Internet) May 12, 2020; Year CXVIII. Number 25. pp 295–298. http://www.gacetaoficial.gob.cu/. Accessed 28 July 2020

Ministry of Public Health (2021a) Statistical yearbook of health. Information as of December 31, 2020. Minsap, Havana (Internet). https://files.sld.cu/bvscuba/files/2021/08/Anuario-Estadistico-Espa%c3%b1ol-2020-Definitivo.pdf. Accessed 12 September 2021

Ministry of Public Health (2021b) Updating of the strategy for the development of Cuban vaccines. Havana (Internet). https://salud.msp.gob.cu/actualizacion-de-la-vacunacion-en-el-marco-de-los-estudios-de-los-candidatos-vacunales-cubanos-y-la-intervencion-health/. Accessed 18 October 2021

Ministry of Public Health (2021c) More than 90% of the Cuban population will have completed their vaccination schedule in November and booster doses are being studied. Havana (Internet). https://temas.sld.cu/coronavirus/2021/10/12/mas-del-90-de-la-poblacion-cubana-tendra-completo-su-vaccination-scheme-in-November-and-booster-doses-are-studied/. Accessed 18 October 2021c

National Office of Statistics and Information (2021) Statistical yearbook of Cuba. Information as of December 31, 2020. ONEI, Havana (Internet). http://www.onei.gob.cu/sites/default/files/aec_2020_anuario_0.pdf. Accessed 20 October 2021

National Survey on Gender Equality (2020) ENIG-2016 results report December. Havana (Internet). http://www.onei.gob.cu/node/14271. Accessed 21 October 2021

Newspaper Juventud Rebelde (2020) Violence and COVID-19: scourges in dispute in Havana (Internet). http://www.juventudrebelde.cu/suplementos/sexo-sentido/2020-04-14/violencia-y-covid-19-flagelos-en-disputa. Accessed 12 October 2021

Portal Miranda J (2020) Intervention in the National Assembly of People's Power. Science and technological innovation in the face of COVID-19. J Sci Inf Health Direct. INFODIR [Internet]. http://www.revinfodir.sld.cu/index.php/infodir/article/view/1047. Accessed 24 October 2021

Remond Noa R, Rodríguez Pérez MN de las (coords) (2020) La Habana: atlas of COVID-19. Editorial UH, Havana. 216p:152 ils.:86 map. ISBN: 978-959-7251-90-3, ISBN-e: 978-959-7251-91-0. Published virtually 03/2021. https://www.ipf.gob.cu/es/content/habana-atlas-covid-19

Juan Vela Valdés (1946–2022) was a medical Doctor from University of Habana. He had a 1968 Bachelor of Social Sciences, a Masters in Medical Education from Habana Medical Sciences University and a Ph.D. in Health Sciences. He was a full Professor of Public Health Sciences at the National School of Public Health of Cuba and a Doctor Honoris Causa of five foreign universities. He was a former President of Latin America Universities Union 2004–2006 and a former member of the Council of United Nations University (UNU) (2001–2007). Since 2016, he had been Editor-in-Chief of the Cuban Journal of Public Health and in 2017 he was awarded the National Prize of the Academy of Sciences of Cuba. He had published numerous scientific papers in national and international journals and been a guest professor at several universities. From 1972 to 1975 he was Provincial Director of Public Health in the province of Camaguey, Cuba and President of the University of Camagüey from 1975 to 1982. From 1982 to 1994 he was President of the Habana Medical Sciences University and from 1994 to 2006 President of the University of Habana. He was Minister of Higher Education from 2006 to 2009. He was a member of the scientific committee of the 'Urban Health and Wellbeing: a Systems Approach' global science programme from 2016 to 2022.

Europe Social and Industrial Clusters to Support European Cities Under COVID-19: The Impact of the European Alliance on Coronavirus Actions

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Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

It has never been more evident that close collaboration and coordination both between sectors and across scales is an essential strategy for cities to face global challenges (Cervantes and Keenan 2021). The European Union and Commission have understood this for some time, but a practical solution has not been obvious. The unprecedented impact of the COVID-19 crisis has undoubtedly accelerated possible actions.[1]

The dynamic nature of social innovation and industrial clusters or ecosystems respond to triggering events in business, value chains, healthcare services, economic urban and rural landscapes, human behaviour, mental health and social aspects. Thus, social and industrial clusters provide unique insights into the impact of the outbreak and responses across European jurisdictions and cities. They address complexity because they involve actors between different sectors and across different scales from local to continental and global. These complex systems of players are instrumental in creating new diagnoses that will lead to future holistic, evidence-based mitigation strategies.

Clusters and innovation ecosystems bring robust and resilient networks of different players that can cooperate with each other across company and industry boundaries (Wilson 2021). Such innovative ecosystems facilitate collaborative spaces (Granstrand and Holgersson 2020). Their main activity is to create solid, trust-based collaborative relationships between companies and all types of organisations and players, especially scientific and research institutions, hospitals, technology and service providers and talent resources, as well as public administrations. The proactive development of clusters during the COVID-19 crisis indicates that they are potentially important actors on which regional, national and European preparedness strategies could rely, to ensure a complex perspective to better understand societal and economic impacts, to better tailor initiatives to test actions to be implemented, and overall to provide evidence-based policy support.

Recovery is inherently linked to resilience, the ability of a system to react to changes, failures, events and disturbances, and maintain or adapt its function. The literature provides a large body of knowledge conceptualising resilience as a dynamic and adaptive property of systems with multiple stable states that evolve over time (Meerow and Newel 2015). Resilience is also an inherent property of complex networks (Fraccascia et al. 2018). Clusters, by their very nature, are complex network constructions that foster—through interactions among their members—knowledge, technology and economic fluxes, with their very complexity endowing the clusters with resilience. It follows then that the presence of clusters in a region/metropolitan area is expected to enhance overall economic resilience and higher employment renewal (Smart Guide to Cluster Policy 2016) through direct (cluster-confined) and indirect (spill-over) effects.

[1] https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/timeline-eu-action_en.

The proliferation in usage of the terms *cluster* and *value network*, and the rapid adoption of the *ecosystem* concept in industrial, social or innovation constellations of players brings about the need for clarification of these—often overlapping—concepts. These intend to reflect the participant interdependencies and coopetition[2] within specific geographic regions (either urban or regional). Autio and Thomas (2021) differentiate these collective constructs by their system-level outcomes, participants' heterogeneity, the nature of the interdependencies and coordination mechanisms. On the other hand, Peltoniemi (2004) differentiates these terms according to the competitive vs cooperative structure, with ecosystems inducing both elements.[3] For our purposes, these terms are sometimes used interchangeably.

How can the cluster-collaborative approach contribute to the preparedness and the recovery of our societies? Clusters, as engines of growth, are an essential part of the contemporary economic development of most countries and regions and have become a popular policy tool for boosting economic growth and innovation. EU policymakers are aware of the role of clusters in sustainable development and cluster policies are widely encouraged by international authorities, such as the EU and OECD (Derlukiewicz et al. 2020).

The European Alliance Against Coronavirus (EAAC) is an open exchange group consisting of clusters, associations, institutions, universities, companies, social economy stakeholders and other entities, that emerged in early 2020 as an informal group searching for 3D printing capacities to respond to the COVID-19 crisis. Fostered by the European Clusters Alliance (ECA), it turned some weeks later into a group of industry experts collaborating with the European Commission to tackle production and value chain disruptions for protection materials (PPEs, masks and plexiglass) and for healthcare products (therapeutics and vaccines). The goal of the new alliance was to foster a collaborative scheme, and to gather social and industrial clusters and regional innovation ecosystems, higher education institutions, research organisations, technology providers and specialists in global business intelligence, and even beyond (research units, hospitals, healthcare professionals, socioeconomic actors and mental health experts). The network now represents a critical mass of thousands of stakeholders across the 27 EU member states and associated countries.

This chapter introduces what social and industrial clusters and innovative ecosystems are (Sect. 1) and how the EAAC used their properties to get ahead of European policies to coordinate and find solutions to every national and local lack or bottleneck (Sect. 2). We illustrate the benefits of this kind of coordination with some concrete examples and explain how discussions developed by the EAAC during the crisis activated policy-making. This EAAC initiative also supported and disseminated the emergence of the new European vision for the future of its territories and cities based on three pillars—the Green Economy, Digitisation and Resilience—that are largely expected to be developed by clusters (as expressed in the European Expert Group

[2] https://www.sciencedirect.com/science/article/abs/pii/S0148296319306745.

[3] http://www.cse.tkk.fi/fi/opinnot/T-109.4300/2014/luennot-files/Peltoniemi.pdf.

on Clusters Recommendation Report, December 2020)[4] (Sect. 3). We finally discuss the potential of clusters and innovation ecosystems to trigger social transformation (Sect. 4).

2 Social and Industrial Clusters to Support Cities and Regions Facing COVID-19

Based on Marshall's (1919) observation of the concentration of specialised industries in local territories which create emerging systems with properties of productiveness, consistency and flexibility, the notion of an "industrial district" was introduced for the specific context of the textile and furniture industry in Northern Italy (Bagnasco 1977; Becattini 1979). The cluster concept was developed on the Silicon Valley model of innovation, with a wider view of the involved actors and specifically a growing role for universities in the creation of knowledge in the economy (Etzkowitz 2008), and later the importance of the regional context (Porter 1998), institutional organisations and social networks (Padgett and Powell 2012). Cities and regions nurture the emergence of synergistic innovative communities where the density of infrastructure and the culture of the city support the interaction among the components vital to an innovation cluster.

The first part of the twenty-first century witnessed a rebirth of cities as engines of innovation, as an organic response to technological and societal pressures, opportunities, and norms (Engel et al. 2018). Both terms, innovative clusters and ecosystems have roots in industry and business clusters (Porter 1998; Estrin 2008) and are interchangeable when referring to interactive value networks consisting of local or regional actors and dynamic processes that breed economic and social innovation. Such ecosystems are built on trust and social capital, facilitate collaborative spaces and instruments, and their main activity is to create solid and effective partnerships and relationships between companies and all types of sectoral organisations, especially scientific and research institutions, and with public administrations (Granstrand and Holgersson 2020). "Cities and regions have become the new powerhouses for progress and societal innovation: they can and must benefit greatly from open innovation ecosystems and they need to take a new orchestrator role in this field. … Regions and cities are the closest entities to citizens: they know best the specific needs on the ground".[5]

Whereas the past strategy of clusters and innovation ecosystems typically had a business focus and a competitiveness strategy, linking academia and research

[4] https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3636.

[5] Quotes from the forewords by Markku Markkula and Corina Creţu for the Committee of the Regions guide "Regional Innovation Ecosystems: Learning from the EU's cities and regions". https://s3platform.jrc.ec.europa.eu/documents/20182/84453/Regional+Innovation+Ecosystems/48ab5553-489b-4c41-89b4-5c897e3ef066.

organisations with administration and companies and providing proximity between key actors to facilitate knowledge transfer and industrial growth, current innovation ecosystems integrate the societal impact perspective. Adding a fourth member, society (including media and culture), to the concept of triple helix introduced to represent the synergies between different kinds of actors (Etzkowitz and Leydesdorff 1995; Hasche et al. 2020), and even a fifth—a common challenge—yields a quintuple helix (Carayannis et al. 2018). Under this framework, clusters and their networks play key roles as enablers of rapid solutions connecting main actors such as hospitals, public buyers, health equipment providers, individuals, public authorities, and so on.

- We can provide good examples of this through the activities carried out by the Spanish Federation of Clusters, and their immediate collaboration with key international players like the European Clusters Alliance (ECA),[6] that has more than 800 associated clusters throughout Europe). The prompt and dynamic cooperation on COVID-19 via international clusters included actions such as: In March 2020 reporting on capacities in 3D printing, delivered to the European Commission (EC) with full details of more than 1,300 companies and institutions putting their resources at the disposal of the EC and member states' governments.
- Immediate communication with members to detect needs and offer support, regular updates on developments and important information from regional, national and European level from other clusters and entities.
- Detection of societal needs through fluid communication with representatives from civic movements, leading to adjusting production lines to help with the production of masks, PPE and other equipment experiencing shortages, and to comply with new safety measures for employees.
- Organisation of webinars, hackathons, brokerage events and other supporting events with awareness and resource-raising purposes.
- Participation in national and European virtual exchanges, connecting on various levels with other clusters and entities to coordinate activities, share information and best practices.
- Reporting disruptions in EC industrial supply and value chains to work on solutions for the economic recovery and future strategic measures for Europe's economy.

All these activities provided clusters with direct insights into the impact "on the ground". Multi-stakeholder, multilateral and bilateral communication enabled rapid responses to constantly changing threats to the ecosystem posed by the pandemic.

[6] https://clustersalliance.eu/.

3 Achievements of the European Alliance Against Coronavirus (EAAC)

The ECA brought cluster cooperation to the next level and offered the EC full cooperation in March 2020. The immediate request received was to map industrial resources related to 3D capabilities and advanced textiles. In just four days ECA was able, through its network, to compile and send a complete and detailed database (including number of devices, their characteristics, supplies and raw materials available, etc.). More than 1,300 companies offered their resources in that field, most of them without economic interests. Coordinating their activities, the logistics processes, the urgent certification of new designs, the quick search for missing materials, became a challenge. Agile communication and coordination were needed.

ECA created a high-level expert group, the European Alliance Against Coronavirus (EAAC), to coordinate the actions of industrial and social clusters, networks (like the Council for European BioRegions, CEBR[7]), civil associations, universities, companies, and social economy stakeholders, and organisations with close links to the EC and the European Economic and Social Committee (EESC). To date, there have been 218 videoconferences joining over 9,300 experts who have discussed a wide range of COVID-19-related topics, including: prototyping of respirators and 3D printing; protective equipment and furniture; increasing production of vaccines; public procurement; economic and social impacts; exit strategy; the social economy; ICT solutions, and so forth. Its strength is the gathering of multi-level competences and knowledge from members all over Europe.

When the focus turned to economic recovery in Europe, the group shifted the topics of their meetings to the identification of disrupted value and supply chains. The ECA was contracted by the EC to report detected disruptions and identify possible solutions for 14 ecosystems. These were specified in the EC´s recovery plan *"Europe's moment: Repair and Prepare for the Next Generation"*[8] (European Commission 2020). See Fig. 1 for the industrial ecosystems identified.[9]

The group collected information on the situations in their ecosystems and discussed actions to be taken for a quick recovery and to prepare the economy for the expected rebound, delivering to the EC the outcomes of their analysis. The group analysed the presence and weight of interdependencies between the 14 sectors, the clusters that already combined different sectors and the density of actors already involved between sectors (Fig. 2)

Industrial ecosystems appear as yellow stars in Fig. 2. Orange nodes indicate clusters (hundreds of them). Green boxes refer to emerging industries. Purple signs indicate emerging technologies. Blue dots refer to the different sectors involved. The size of the signs is proportional to the number of links to the other elements.

[7] https://www.cebr.net/.

[8] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_940.

[9] https://data.europa.eu/doi/10.2873/491386.

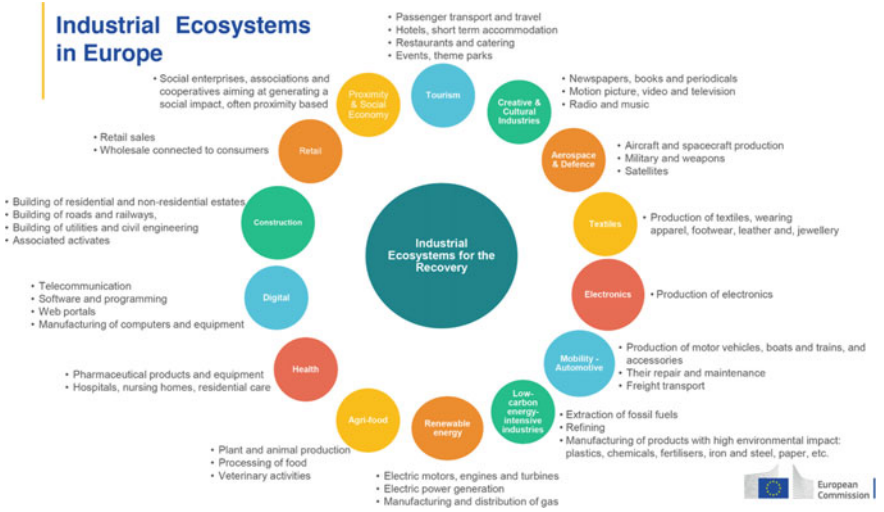

Fig. 1 The 14 ecosystems of the EU recovery plan[10]

EAAC worked in an open scheme in which everyone from industrial clusters, social economy actors, companies, and public authorities was invited to join the discussions and share contacts and solutions to face the challenges in their ecosystems across Europe. With COVID-19 redefining the agenda of research and innovation, the EC and many EU countries have redirected funding programmes and have dedicated calls to find solutions to the pandemic emergency and subsequent crisis. EAAC discussed these funding opportunities in June 2020, shared experiences with the different types of programmes, and contributed to coordinate the participation in calls among this community.[11] This discussion helped identify the need for a strategic approach to generate consortia to apply for funding more actively and maximise the impact of the instruments launched, by filling dissemination gaps and addressing calls across Europe as a cluster community. The strategic position of the EAAC and the participation of Commission (DG GROW) officials contributed the advisory role adopted by the alliance, involving:

- screening the 2014–2020 EU budget for remaining funding opportunities and the MFF2021-2027 Recovery Package for future instruments;
- informing all clusters and their members across EU about funding opportunities and instruments;
- elaborating ideas for topics, programmes and calls to better fit the innovative ecosystems needs; and

[10] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en.

[11] https://clustercollaboration.eu/news/review-funding-opportunities-innovative-projects-across-europe.

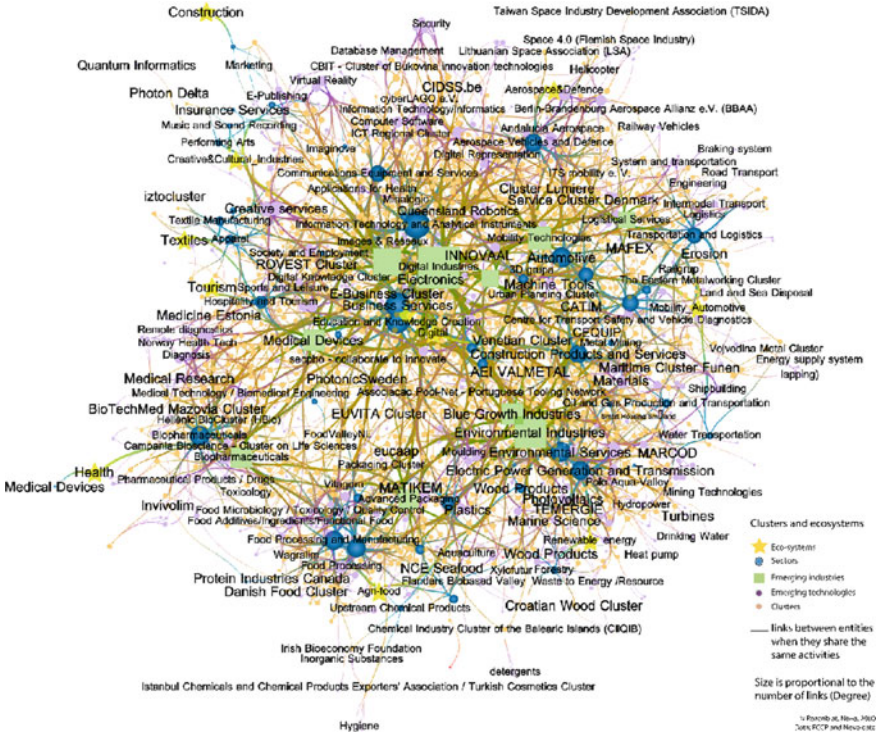

Fig. 2 Clusters' and firms' activities according to the 14 ecosystems (*Source* Rozenblat and Novo 2020 ECCP)

- generating critical mass (cohesive, excellence-driven) to create competitive consortia across sectors and effectively build solid proposals.

4 Role and Initiatives of the European Cluster Alliance

4.1 Fast and Coordinated Reaction

In the case of EAAC, the collaborative process helped to: (i) understand the problems, (ii) identify needs, (iii) find solutions, and (iv) deploy a cross-sectoral collaborative scheme all across the EU. A total of 218 sessions and 11 weekly reports to the European Commission were delivered over 23 months (and continue). A continuous process of tracking, listening, interacting and reporting to the EC allowed EAAC to gain a cross-sectorial perspective and to launch joint actions to fight the pandemic and the socioeconomic disruption created. Antonio Novo (president of ECA and one of the authors of this chapter) stressed that reporting all connections and opportunities

was the key of this process's success and ensured its continuity up until the present. EAAC provided a platform publishing suggestions and solutions for concrete lacks and bottlenecks, helping connect different players in the industrial chains at European scale.[12]

During February 2021, both the European Clusters Alliance (ECA) and the Council of European BioRegions (CEBR) were supporting the task force on vaccines of the European Commission to locate and map all the possible resources available in Europe to produce vaccines for COVID-19. This included mapping the possible manufacturing facilities themselves, but also all related aspects of vaccine production, including raw materials, vials, syringes, storage and distribution, etc. They surveyed and reported data from 231 European companies working in this field, reporting with full details to the Commission about their capacities, needs, bottlenecks and ways to speed up their production capacities.[13] Three matchmaking events were organised during 2021 in close collaboration with the Commission in order to increase the European capacity for production of COVID-19 vaccines and therapeutics, with participation of 817 attendants. Based on that work, both ECA and CEBR developed a proof of concept for the European Health Emergency Preparedness and Response Authority (HERA) titled "Model prototype of a smart, dynamic map for detection of disruptions in the supply chains and rapid mobilisation of the EU vaccines and therapeutics community". They also performed a detailed analysis of results of the EU Survey and matchmaking event on COVID-19 therapeutics production.

5 Spurring Solutions

One of the main lessons learnt from the crisis was that the connection among stakeholders was a catalyst for novel solutions that responded to societal challenges and new demands. Other good practices implemented at regional and national level, are listed as examples in Table 1. They are a fraction of the huge number of actions taken by clusters, networks and alliances to activate responses. We want to stress that they all were connected at a supra-cluster level to concertedly fight the crisis, either through networks as the Council of European BioRegions (CEBR), the European Cluster Alliance (ECA), the European Cluster Collaboration Platform (ECCP) or academic networks.

[12] https://clustercollaboration.eu/tags/european-cluster-alliance.

[13] https://ec.europa.eu/eusurvey/runner/COVID19_vaccine.

Table 1 Examples of initiatives launched in 2020 and 2021 by European regional and national clusters addressed to fight the COVID-19 crisis in a coordinated form

Action	Description	Clusters involved
REDEN SIE MIT! WAS MACHT CORONA MIT UNSERER PSYCHISCHEN GESUNDHEIT?	This project created a broad dialogue and awareness for mental health under COVID-19 in Austria	LBG
DOT Projekt	Pathways through the COVID-19 crisis for staff in psychosocial services for children and families in Lower Austria and Vienna, Austria	LBG
Village Projekt	Responding to COVID-19 measures and enhancing reach for particularly vulnerable families	LBG
Chasing COVID	Monitoring the advancement of COVID-19 research projects in the BioRegion of Catalonia, funded by different agencies, promoting a collaborative scheme to share samples, resources, data and critical equipment. Included a large event in October 2020	Biocat
d-HEALTH Barcelona	Postgraduate design thinking programme on healthcare innovation. The 2020 edition "The stressed healthcare system due to COVID-19 pandemic" (online) actively involved hospitals, patients, health professionals and care associations to find disruptions and unmet needs in the health system response to COVID-19. d-Health is an EIT-Health project	Biocat

(continued)

Table 1 (continued)

Action	Description	Clusters involved
Reports on "Disruptions in the European value chains and industrial ecosystem, solutions and setting up of an EU Rapid Alert Function"[14]	Under the contract GRO/SME/20/F/205B-2 IdiA elaborated weekly reports to the European Commission on the development of an EU Rapid Alert Function	IdiA
BioM-COVID-19 exchange platform and survey	BioM offered an exchange platform to companies, research institutions and clinics, to find partners, technologies and expertise in the context of COVID-19 research projects. This cluster also surveyed Bavarian biotech companies about the challenges they had to deal with as a result of the pandemic, and measures taken	BioM
COVID19 Forum for Industrial Cluster Actors	Between March and June 2020, the European Cluster Collaboration Platform (ECCP) community, closely connected to the EAAC, devoted a forum to exchange views, demands for materials, regulatory issues, and solutions for the economic shock caused by the COVID-19 pandemic and consequent health and safety measures. It was identified as one of the European Commission's eight key response measures for industry and the Single Market	ECCP

(continued)

[14] https://op.europa.eu/es/publication-detail/-/publication/b0d3bf9a-3061-11eb-b27b-01aa75ed71a1

Table 1 (continued)

Action	Description	Clusters involved
Search for COVID-19 vaccine production and support capacities	In coordination with the task force on vaccines of the European Commission, the European Clusters Alliance (ECA) and the Council of European BioRegions (CEBR) worked to locate and map all possible resources available in Europe for the production of vaccines for COVID-19. This includes mapping the possible manufacturing facilities themselves, but also all related aspects of vaccine production, including raw materials, vials, syringes, storage and distribution etc. Furthermore, the initiative compiles any difficulties and bottlenecks one could identify about the production of vaccines, e.g. regulations, certification and distribution	ECA, CEBR, Task Force on Vaccines (EC)
EUvsVirus Pan-European Matchathon	Massive action to scale up creative solutions to coronavirus challenges took place from 21 to 28 May under the patronage of Commissioner Mariya Gabriel and the European Innovation Council (EIC). It brought together the 120 winning solutions from the hackathon with over 458 partners, including investors, corporates, public authorities, academia and research institutions from 40 countries	EC, clusters and innovation players across Europe

(continued)

Table 1 (continued)

Action	Description	Clusters involved
Coordinated action to provide Plexiglas	After the first containment, there was a need for transparent screens to be placed in different kinds of workstations to protect employees and customers/clients from COVID-19. These screens also had a psychological benefit. After increased anxiety and concern about the risk of infection, both clients and employees felt more secure and protected. The lack of Plexiglas in numerous European countries was noted on April 26 2020 during one of the EAAC's daily meetings. A few days later (28 April) they announced that they could design and start producing Plexiglas clear screens immediately	EAAC and The Bulgarian Furniture Cluster

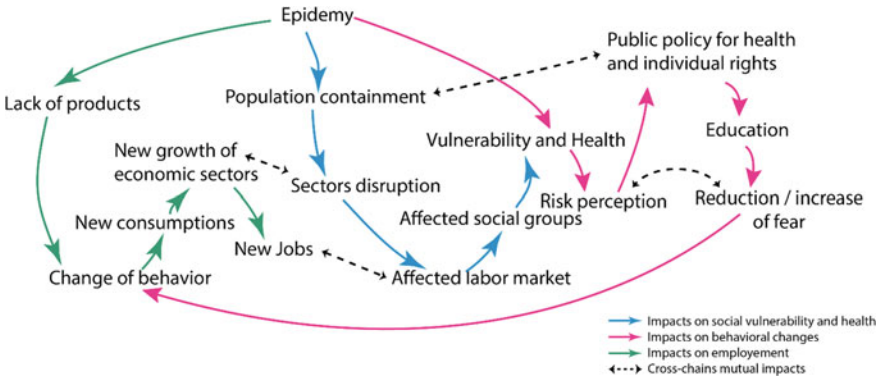

Fig. 3 Multi-dimensional impacts of COVID-19 (*Source* Rozenblat, Social Reactor 2020)

6 Going Beyond the EAAC Industrial Initiative: A Social Reactor

There is a large volume of literature about the benefits of adopting industrial clustering models for social clustering and considering how much societies might gain if the idea of seeing each other as potential partners was adopted (Bembenek and Kowalska 2015; Odongo 2019). Social economy entities in the third sector can increase efficiency and overcome barriers when they build in grassroots social cluster initiatives. The cluster approach helps to understand the needs and behaviours entangled in the economic and social scenarios and map the dynamics.

The intense activity deployed in the first six months of the COVID-19 crisis, addressing multi-scale and multidisciplinary aspects within and among clusters and innovative ecosystems, offered deep insights into the needs and demands arising from the unprecedented socioeconomic and health impact of the pandemics. A team of cluster experts collaborating within the EAAC, including the authors, explored options beyond emergency activation, taking inspiration from multi-scale reactor engineering (Konstandopoulos et al. 2006). We proposed a 'social reactor', collective action which could exploit the complex nature of cities and regional ecosystems.[15] The overarching aim of this social reactor was to provide evidence on the many different impacts of the COVID-19 crisis and guidance for the best 'next practices', supported with data to underpin the implementation of further public health interventions and actions, with a special focus on mental health, for its significance and the future issues we might face in that area. The societal impacts included were key interconnections between a variety of sectors (See Fig. 3).

Considering these interconnections, this social reactor scheme could contribute to:

[15] https://www.sciencedaily.com/releases/2013/06/130620142925.htm

1. Creating comprehensive frameworks to gather, analyse and compare the multitude of data available in the cluster ecosystems, databases, the evolving archival and grey literature, and other unsystematic sources.
2. Delivering an explorative and innovative dashboard to support interactive exploration and visual storytelling of indicators of impact and resilience of the population, and social dynamics, which intersect with critical social factors.
3. Analysing the governance and impact of response measures and identifying unintended consequences, to bridge gaps in our understanding of the effects of specific measures taken at different governance levels with respect to the resulting impacts on the public health ecosystem (patients, health workers and communities at large).
4. Providing analysis of the immediate and long-term mental health impacts on specific groups (frontline healthcare workers and vulnerable collectives) as well as society at large, including (a) the workplace, (b) the education system and (c) social isolation while also investigating the public expression of communal loss and grief.
5. Assessing various policy scenarios with respect to their social, economic and public health outcomes, contributing to technical and policy-related mitigation strategies.
6. Offering guidance for further interventions towards fast recovery and fast response, identifying critical factors and actors ('keystone species') that enable resilience of the society–economy continuum (Konstandopoulos et al. 2017).

To be better prepared for future pandemics, our societies need to work towards better, more sustainable, greener and fairer societies, and should re-assess health systems, education and work, and move towards more sustainable industries. This pandemic may have hidden other big challenges, but complying with previous commitments (2030 Agenda SDGs, European Green Deal) and the new ones (Twin Transformation, Recovery and Resilience Member State Plans, S3 and S4) will help preserve societal well-being and environmental sustainability.[16]

7 Clusters are Key Players for Sustainable Transformation

A recent Recommendation Report prepared for the EC by the Expert Group on Clusters (coordinated by Marek Przeor, DG GROW) contains 15 recommendations with examples of using clusters to lead green transition, accelerate digital transition and build resilience. Some examples are to use clusters as: drivers of change, accelerators and enablers of the green transition through mobilising and facilitating cooperation among stakeholders in industrial ecosystems; collective intelligence to make value/supply chains more resilient, thereby creating synergies and cooperation

[16] https://www.sdgwatcheurope.org/documents/2020/06/covid-19-statement-sdg-we-final_accessible.pdf/.

with SME and employer organisations to anticipate risks and prepare for new opportunities and challenge; taking an active role in local labour markets through building their capacities for reskilling and upskilling and participating in the implementation of the Pact for Skills; a way of identifying and implementing shared value initiatives to address societal challenges at a community level.

Aligned with these recommendations, we develop below some relevant traits and aspects of the proposed social reactor-innovative ecosystem social cluster approach, contributing to mitigation of the COVID-19 outbreak and responses, and supporting sustainable transformation and resilient recovery and preparedness. As stated by de Géry and Glaser (2020), COVID-19 has reshuffled the European innovation ecosystem. The cluster ecosystem makes gathering crucial information quicker and easier, be it about governmental aid programmes, funding for urgently needed innovations, or how to be useful for disrupted European value chains. By involving actors in such collaborative clusters, each individual institution or company can gain the advantages of being integrated into a large project, like meeting numerous and various actors that can bring new opportunities, accessing diverse information. But in the opposite direction, the institutions or companies can see the risks of sharing their data and being confronted too early in their own innovation cycle by local or international competitors.

8 Data Sharing

One of the biggest challenges in the fast-moving field of COVID-19 research is to share data and findings in a rapid and coordinated way. The EC launched the COVID-19 Data Platform[17] in April 2020, operated by the Commission, EMBL's European Bioinformatics Institute (EMBL-EBI), EU Member States and research partners such as ELIXIR. This shares available research data from different sources for the European and global research communities. Large datasets have been generated involving labour, finances, trade, mobility and education. In addition, the EC dedicated one section of Eurostat to gathering all datasets related to COVID-19 in one place, with statistics that provide a baseline against which the impact of the crisis can be measured to see its evolution.[18]

A social reactor enables the development of an innovative explorative dashboard, to help society, stakeholders and policymakers monitor a selection of relevant indicators, which link them to policy responses and allows them to make a fine-grained exploration of research results and a fast analysis of different scenarios. Friendly data visualisation offers an effective communication channel to disseminate COVID-19 information to citizenship and society. For example, the expression "flattening

[17] https://www.covid19dataportal.org/.

[18] https://ec.europa.eu/eurostat/web/covid-19/data.

the curve" went viral more than a decade before COVID-19 in a simulation about arresting a novel strain of influenza (Kelso et al. 2009) and was heavily promoted by on-line initiatives like Our World in Data.[19]

9 Testbeds, an Evidence-Based Approach

The exploratory work of EAAC underlined how testbeds can be important modelling tools (Fortier and Michel 2003) that provide a realistic environment in which to improve understanding of the system, facilitate measurements and evaluate solutions. The alliance provided the opportunity to test existing ideas and new solutions, and thanks to the networks, connect and scale-up interventions. The umbrella organisations participating in the EAAC ensured the involvement of a diverse set of stakeholders from key industrial and social sectors and offered broad European geographical coverage and international connections to analyse cases and mobilise solutions in record time. The analysis of the results of those actions, for example, the one developed for matchmaking events on vaccines and therapeutics, returned positive feedback. Of the companies who answered the follow-up survey, 75.5% identified potential business partners during the meetings, and 42% had already planned follow-up meetings.

The European Commission, and in particular DG Research and Innovation, launched testbed programmes in key industrial areas such as nanotechnologies. The Safe-N-Medtech project funded by the EC H2020 programme is an example, in which clusters and the Council of European Bioregions (CEBR), use a methodology based on test cases and needs-driven interventions.[20] This open-access platform activated new calls for projects in the first wave of the pandemic, to support nano-enabled medical technologies for COVID-19-related projects.

The authors identify three main features of testbeds for the purposes of this paper:

- They provide an environment close to real-world conditions in which design decisions can be based on both theoretical and empirical studies.
- They offer an opportunity to incentivise and coordinate the ecosystem's stakeholders (public and private) to work together in solving specific challenges.
- They are a recognised and trusted methodology to test needs-driven interventions and achieve the aims of national, regional and local industrial and societal strategies.

Applying lessons from the first waves of the pandemics and the actions taken at the industrial ecosystems level, a social reactor concept could trigger change at the following levels:

[19] https://ourworldindata.org/.

[20] http://www.safenmt.eu/.

9.1 Employment

Workers during COVID-19 have had to operate in difficult circumstances (such as health and food sector professionals), work from home, simply not work for long periods (restaurants and bars) or even become unemployed. Precarious workers, with a low socioeconomic position, have been particularly affected across Europe and globally. Thousands of businesses have significant concerns about the economic loss suffered and whether they will be able to bounce back to the economically stable companies they managed before the pandemic.

9.2 Workers' Health

Employers have a responsibility to manage occupational risks of COVID-19 for their workers. They have to control exposure to the virus to a level that is reasonably practicable, taking into account the possibility that some workers will be more vulnerable than others if they contract the disease. Different measures of support from public and occupational health services have been implemented in each case (depending on the national health services, the social security system, national policies and COVID restrictions).

9.3 Mental Health

Measures to prevent further contamination (lockdown, working from home, social distancing policies) have had consequences for workers in other sectors. In countries where schools were closed, working parents were suddenly confronted with the care and education of their children. These sudden developments have led to stress, putting all workers, albeit in different ways, at risk of further health problems. A recent study (Cénat et al. 2020) states that independently of the gender, group or region, the pandemic has affected the population's mental health, with a high prevalence of depression, anxiety, insomnia and PTS symptoms, to a great extent due to the public health measures adopted. Health inequalities in general, and in particular mental health, must be considered according to the activity sector and to the social and family status.

9.4 Frontline Healthcare Workers (HCW)

The COVID-19 crisis had a huge impact on healthcare workers, particularly those vulnerable to disorders and adverse effects, especially in the first wave. Over the course of the outbreak, these professionals have been regularly exposed to hazards that put them at risk, including pathogen exposure, long working hours, psychological distress, fatigue and occupational burnout, leading to stress responses and new behavioural patterns. Specifically, young healthcare workers have been especially susceptible to these, which may have triggered adaptive but also maladaptive professional behaviour. Many studies have reported this impact during the first wave of COVID-19 (Alonso et al. 2020; Mortier et al. 2020), serving to develop recommendations to optimise healthcare delivery in response to future potential crises.

9.5 Vulnerable Families

The health crisis has led to a situation where the wellbeing of families has been severely challenged, especially families with pre-existing vulnerabilities. Using Open Innovation in Science (OIS) methods, the social reactor designers envisaged co-design training and online activities to foster engagement and trust-building between practitioners, parents and children. Having the ability to co-design these approaches with people with lived experience enables the development of a feasible and safe approach to address the dilemmas faced by practitioners and families where a member has a mental illness.

9.6 Pandemic Grief

Media, public, and expert responses to the SARS-CoV-2 pandemic can be read as verbal practices that rely on established cultural patterns of discourse. Linking literary and cultural studies of different languages, media studies, theatre studies, philosophy, theology, and psychology can inquire into how pandemic grief and communal loss elicited by COVID-19 can be connected to the notion of crisis and catastrophe, in view of its underpinnings in the ecological crisis. The analysis requires a methodological plurality, combining close reading with discourse analysis, an understanding of language as a performative act, and actor–network theory, so far discussed mainly in ecocriticism, as a novel approach to relationality without the vantage point of

individuality. This approach could allow us to explore opportunities for symbolic frameworks for the public negotiation of communal loss and grief in the wake of the SARS-CoV-2 pandemic.

9.7 Societal Impact on Education and Social Isolation

The health crisis provoked radical changes in the population's lifestyle. It is particularly relevant to analyse the effects that social isolation, as well as the rearrangement of working and educational habits, have had on the health of the population. For that, a Social Reactor intended to address the general population on social media and organise co-creation workshops with experts and practitioners. Groups of people especially affected by the restrictions (e.g. school children or elderly people) would be invited to anonymously report their personal experience, and four online workshops with experts and practitioners would be held with the objective to develop proposals for new evidence-based measures related to the abovementioned key topics.

9.8 Mental Health Impact Influencers

A social reactor could analyse the ways in which selected influencers affected people's mental health during the COVID-19 pandemic: media, healthcare system, education and childcare, local government and social care system. This would include both negative and positive outcomes. A social reactor could create and conduct a survey in selected European countries that had different lockdown measures and economic impacts, infection and mortality rates. Once the survey results had been analysed, focus groups could be organised to present the findings, flesh out emergent themes and discuss elements where improvements should be made.

9.9 A Cross-Border and Cross-Sectoral Participatory Approach

The social reactor would offer a cross-border, cross-sectoral collaborative approach including social and behavioural sciences into the innovative ecosystems framework to support local, national and EU public policies and help mitigate the impact of the pandemic.

The huge socioeconomic impact that the COVID-19 health crisis has brought may vary between countries, cities and regions depending on the differences in the

productive structure and their cross-sectoral connections. For example, it has been particularly damaging to those sectors where interaction with the end-consumer is more important (Prades and Tello 2020). A cross-sectoral approach is therefore indispensable to understand the crisis's impact on our interconnected world. Clusters have been applying this approach, connecting within and among sectors, across borders, since the beginning of the pandemic. While most of them represent members of a certain sector or industry, they have naturally reached out to each other to work on solutions together, combining their knowledge to better understand the dynamics of the crisis and possible actions.

9.10 An Evolutionary Approach of Urban Health

There is also another very interesting and naturally occurring phenomenon between sectors and activities: ecosystems might co-evolve.[21] Due to the inherent complex links between sectors and activities, changes in one of them could significantly affect two or more ecosystems at once. They can be seen to co-evolve. Interactive ecosystemic evolution is compatible with a holistic view, embracing both industrial and social spheres (Russell and Smorodinskaya 2018). A good example of this interactive co-evolving layers in the COVID-19 pandemic would be the effect of the closure of schools (the education ecosystem) co-evolving with the labour ecosystem, causing major obstacles for the return to work as the children need to be looked after at home. This is only one of many examples, and by using a cluster approach we can offer a 'capture all' approach to the problem, helping harmonise the different policies and social and/or cooperation policies between the different actors, and setting forth a common effort for the benefit of the community, mitigating risks and offering resilience.

10 Conclusion

COVID-19 has brought about a massive disruption at many levels. In the first weeks after the outbreak, collaborative dynamics generated from an alliance of industrial clusters, the ECA, resulted in system-level improvements. The creation of a fast-answer platform, in coordination with the European Commission and the Council of European BioRegions, effectively created different ecosystems and industry value chains. Intermediary roles played by cluster organisations (like IDiA or Biocat) were

[21] https://clustercollaboration.eu/sites/default/files/WYSIWYG_uploads/20200630_dialogue_commissioner_breton_eca.pdf.
https://clustercollaboration.eu/sites/default/files/WYSIWYG_uploads/videoconference_commissioner_breton_eca_presentation.pdf.

amplified and helped turn the crisis into an opportunity to address societal challenges. As stated in a report from the Inter-American Development Bank, countries with more mature innovation ecosystems and developed institutional capacities can respond more quickly and decisively, so investing in these capacities and in regional collaboration is key to value-added solutions.[22]

According to our findings, European industry was able to better reorganise its capacities, quickly creating new linkages, through the cluster and ecosystem-based collaborations and matchmaking events. The cluster approach of cities and regions is fundamentally systemic in the way it involves heterogeneous networks, combining numerous actors at different scales and in all urban dimensions. Most urban health issues would benefit from such clusters that can support the implementation of intersectoral policies leading to urban transitions and better practices for economic, social, and cultural aspects of urban societies. The flexible properties of such clusters are also suitable for adapting to the structure of local conditions, but necessitate some strong managing capacities.

Several social factors intersect with the effect of the pandemics and the measures to contain it. Applying a cluster approach at all socioeconomic levels (extended in the whole urban field with the social reactor methodology) ensures full stakeholder involvement and provides the perfect opportunity for citizens to get involved. Building more resilient societies and preparedness measures must include citizens' perspectives, experience and matters of concern, as critical factors for the shaping and implementation of sustainable recovery strategies.

The cluster approach can focus ideas responding to the widespread disruption created by COVID. As an example, we mentioned the task force on vaccines allowing their fast implementation by their production in different places in Europe, coordinated with the distribution and the medical organisation of vaccinations involving numerous social actors, together with some national and regional laws and political revisions. As emphasised in this chapter, this approach permits both the awareness of the possible local emergence of new needs, as well as the stimulation of adequate multi-level governance allowing close proximity solutions, or if it does not exist there, to build the long linkage capabilities to build supply chains. Cities and clusters can better achieve this multi-scale rapid building between local communities scattered all over Europe, or all over the world.

References

Alonso J, Vilagut G, Mortier P et al (2020) MINDCOVID working group. Mental health impact of the first wave of COVID-19 pandemic on Spanish healthcare workers: a large cross-sectional survey. Review Psiq. Salud Mental. https://doi.org/10.1016/j.rpsm.2020.12.001

Autio E, Thomas L (2021) Researching ecosystems in innovation contexts. Innov & Manag Rev 2515–8961. Emerald Publishing Limited. https://doi.org/10.1108/INMR-08-2021-015

[22] https://publications.iadb.org/publications/english/document/Responding-to-COVID-19-with-Science-Innovation-and-Productive-Development.pdf.

Bagnasco A (1977) Tre italie: La problematica territoriale dello sviluppo italiano Il Mulino, p 255
Becattini G (1979) Dal settore industriale al distretto industriale. Alcune considerazioni sull'unità di indagine dell'economia industriale. In Rivista di economia e politica industrial (5, 1) pp 7–21.
Bembenek B, Kowalska K (2015) Social clusters—open space for social innovations development. Humanit and Soc Sci Quart. https://doi.org/10.7862/rz.2015.hss.45
Carayannis EG, Grigoroudis E, Campbell DF, Meissner D, Stamati D (2018) The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. R&D Manag 48(1):148–162
Cénat JM, Blais-Rochette C, Kokou-Kpolou CK, Noorishad PG, Mukunzi JN, McIntee SE, Labelle P (2020) Prevalence of symptoms of depression, anxiety, insomnia, posttraumatic stress disorder, and psychological distress among populations affected by the COVID-19 pandemic: a systematic review and meta-analysis. Psychiatry Res 113599
Cervantes M, Keenan M (2021) Resolving global challenges and crises through international collaboration. In OECD science, technology and innovation outlook 2021: times of crisis and opportunity, Chapter 5. OECD Publishing, Paris
De Géry C, Glaser A (2020) How COVID-19 reshuffles the European innovation ecosystem, ESCP Impact Paper No. 2020–52-EN. E. Europe and Eco & Bus Pol
Derlukiewicz N, Mempel-Śnieżyk A, Mankowska D, Dyjakon A, Minta S, Pilawka T (2020) How do clusters foster sustainable development? an analysis of EU policies. Sustainability, MDPI, Open Access Journal 12, 4, pp 1–15
Engel JS, Berbegal-Mirabent J, Pique JM (2018) The renaissance of the city as a cluster of innovation. Cogent Bus & Manag 5. https://doi.org/10.1080/23311975.2018.1532777
Estrin J (2008) Closing theiInnovation gap: reigniting the spark of creativity in a global economy. McGraw-Hill, New York
Etzkowitz H, Leydesdorff L (1995) The triple helix–university-industry-government relations: a laboratory for knowledge based economic development. EASST Rev 14(1):14–19
Etzkowitz H (2008) The triple helix: university-industry-government innovation in action 15. Routledge London
European Commission (2020) Directorate-general for internal market, industry, entrepreneurship and SMEs, Report on disruptions in the European value chains and industrial ecosystems, solutions and setting up of EU rapid alert function. Publications Office
Fortier PJ, Michel HE (eds) (2003) Introduction, computer systems performance evaluation and prediction. Digital Press, p 1–38, ISBN 9781555582609. https://doi.org/10.1016/B978-155558260-9/50001-1
Fraccascia L, Giannoccaro I, Albino V (2018) Resilience of complex systems: state of the art and directions for future research. Complexity, ID 3421529, 44 p
Granstrand O, Holgersson M (2018) Innovation ecosystems: a conceptual review and a new definition. Technovation 90: 102098
Hasche N, Höglund L, Linton G (2020) Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system. J of Small Bus & Entrep 32(6):523–544
Kelso JK, Milne GJ, Kelly H (2009) Simulation suggests that rapid activation of social distancing can arrest epidemic development due to a novel strain of influenza. BMC Public Health 9:117
Konstandopoulos AG, Kostoglou M, Vlachos N (2006) The multiscale nature of diesel particulate filter simulation. International J of Veh Des 41(1–4):256–284
Konstandopoulos AG, Metallinou R, Drosos G (2017) The challenge of resilience for European defence energy critical infrastructures. In 5th International exergy, life cycle assessment, and sustainability workshop & symposium (ELCAS5), 09–11 July 2017
Marshall A (1919) Industry and trade. Macmillan and Co., London, 879 p
Meerow S. Newell JP (2015) Resilience and complexity: a bibliometric review and prospects for industrial ecology. J of Ind Ecology. https://doi.org/10.1111/jiec.12252
Mortier P, Vilagut G, Ferrer M et al (2020) Thirty-day suicidal thoughts and behaviors among hospital workers during the first wave of the Spain COVID-19 outbreak. Depression and Anxiety 1–17

Odongo JO (2019) The theory of social clustering and the reorganization of human society. https://doi.org/10.13140/RG.2.2.21414.37446
Padgett JF, Powell WW (2012) The emergence of organizations and markets. Princeton University Press
Peltoniemi M (2004) Cluster, value network and business ecosystem: knowledge and innovation approach. http://www.cse.tkk.fi/fi/opinnot/T-109.4300/2014/luennot-files/Peltoniemi.pdf
Porter ME (1998) Clusters and the new economics of competition. Harv Bus Rev 76(6):77–90
Prades Illanes E, Tello Casas P (2020) Heterogeneidad en el impacto económico del Covid-19 entre regiones y países del área del euro. Boletín Económico (2):18
Russell MG, Smorodinskaya NV (2018) Leveraging complexity for ecosystemic innovation. Technol Forecast and Soc Change 136:114–131
The European expert group on clusters recommendation report (2020) Published for the directorate-general for internal market, industry, entrepreneurship and SMEs. Publications Office of the European Union, Luxembourg, 15 December 2021 ISBN 978–92–76–30280–3
Wilson J (2021) Supporting skills for industry through clusters European cluster collaboration platform. Discussion Paper 1. https://www.clustercentre.ie/wp-content/uploads/2021/02/discussion_paper_skills_final_2.pdf

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FINLAND: How Bright Are the Northern Lights—Finnish Welfare State and Local Responses to COVID-19

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Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

The first case of the coronavirus was diagnosed in Finland in a Chinese tourist in a holiday resort in Lapland on 29 January 2020. Within two weeks, COVID-19 was included in the list of generally hazardous communicable diseases in the Government Decree on Communicable Diseases. The number of cases in Finland stayed at one until cases started to increase at the end of February and early March, as travel from the Alps during the winter holidays occurred. On 16 March, the Finnish government, jointly with the president of Finland, declared a state of emergency. Implementing the Emergency Powers Act, the government issued several measures. At the end of March, parliament voted unanimously to temporarily close the borders of the Uusimaa region, which had the most confirmed cases, to try and slow down the epidemic in the rest of the country. This restriction for Uusimaa, which has nearly one third of Finland's population of 5.5 million and the capital city Helsinki (650,000), lasted for three weeks.

The growth in COVID-19 cases and deaths was reversed in the summer of 2020, but from September onwards, the number of new cases has risen again. By 26 February 2021, the number of confirmed cases in the country reached a total of 56,407 and the number of COVID-19-related deaths reached 742. The number of cases by early February 2022 increased to over 540,000, with deaths at 2,100.

This paper provides a brief overview of Finland's healthcare system and COVID-19 trends with specific focus on urban actions and outcomes. It refers to the principles in the Xiamen Call to Action (Ebikeme et al. 2019) and the recommendations suggested as critical elements for systematic urban health action during COVID-19 and discusses their usefulness in facing the pandemic.

2 Inclusive Cities Within the Welfare State

Inclusiveness, as stressed by Ebikeme et al. (2019), has been the founding principle of the so-called Nordic welfare state. Finland has been one of the strongholds of the Nordic welfare regime, a system based on progressive taxation, universal social benefits, high-quality public services and a strong redistribution of market incomes by the state. The result is evident in Finland, which has one of the most equal income distributions in the Western world and a relatively low poverty rate (Vaattovaara and Kortteinen 2003). The social trajectories of the Finnish welfare model have been strongly built upon educational institutions (Castells and Himanen 2002; Esping-Andersen 1999; Kautto 2001). The outcome is a highly educated population, with national and local policies reflecting experiences and ideals of an egalitarian society. Equality has also been pursued in urban housing policy. The development of the

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standard of living has been guided by legislation and other normative guidance. Urban housing policy and residential planning have also aimed at a socially balanced, mixed structure.

Although all the above also applies to twenty-first century Finland, Finnish society is changing in many ways. There has been a relatively late, but now rapid, urbanisation. The population is ageing and at the national level, population growth in recent years has been entirely dependent on immigration. New divisions have emerged, both between regions and within urban areas. In the largest urban areas, socioeconomic segregation has intensified.

The number of immigrant youths who are not in education, employment or training is also many times higher than the native population. Integrating the immigrant population into the labour market is associated with significant challenges. Although Finland is still doing quite well in the PISA survey of educational achievement, the differences in skills between the sexes in Finland are the largest in the OECD countries. The impact of family background on children's skill levels has strengthened and differences in health between socio-economic groups are comparatively large in Finland (Kangas and Blomgren 2014).

3 Roles and Responsibilities Between Cities and the State

Finland is divided into municipalities, 309 in 2021 (of which 107 are cities), whose administration is based on self-government. The principle of municipal self-government is strong and municipal councils are elected every four years; the traditional role of municipalities in providing basic services to citizens is extensive. There are also regional administrative authorities, but until 2022 there were no regional governments with political organs. From the beginning of 2023, the health care system has been decentralised, and the responsibility for organising healthcare, social welfare and rescue services transferred from municipalities and joint municipal authorities to wellbeing services counties. Municipalities were and still are responsible for organising many services including child daycare, education, sports and cultural services, as well as public transport. To provide these services, municipalities collect taxes and receive state grants based on demographics and circumstance factors. Differences in municipal tax bases are levelled by an inter-municipal equalisation system and subsidies paid by the state.

Finland does not have a separate agency tasked with managing and coordinating actions during exceptional circumstances, such as a pandemic, but at the very beginning of the pandemic the government took a strong national position. Ministers appeared almost daily on the nationally broadcasted news, reporting epidemiological, medical and functional indicators, which was followed by national media on their front pages. However, after the March 2020 declaration of the state of emergency over the coronavirus outbreak, the government replaced the Emergency Act on 16 June 2020 with restrictive measures taken under existing legislation. For example schools, educational institutions, universities, and universities of applied sciences

were closed, as well as museums, theatres, libraries, public leisure, and sport facilities. The number of customers and opening hours of restaurants were also limited. There have been several reopenings and lockdowns during the last two years. The implementation of many of these measures and the day-to-day management of the crisis is now largely the responsibility of municipalities.

As the responsibilities of municipalities for services are wide-ranging, it is possible for municipalities to coordinate the activities of different sectors. Already in the very early stages of the pandemic, cities activated their own emergency organisations. In accordance with government decisions, several services were completely shut down and staff relocated where possible to support the healthcare sector. Regional cooperation, e.g., between mayors and key authorities, was further intensified. In the Helsinki Metropolitan Area, the key decisions were made jointly, and these decisions were also communicated together. Nationwide, the exchange of information between the leaders of the largest cities has also been extensive during the pandemic.

The pandemic has also revealed some 'organisational leakages' in the response to the pandemic, which still cause friction between the state and the major urban areas when formulating the best judgements of and solutions to the situation. Voices from the main cities have become more and more critical during the prolonging of pandemic measures. Issues such as school lockdowns, lockdowns of some facilities while keeping other amenities, such as shopping malls, open has led to heated debates. Yet, one could clearly state that in the moments of crisis, there is clear leadership and a mandate to deal with urban health issues in an integrated manner as stated by Ebikeme and colleagues. Also, the condition of inter-sectoriality has been fulfilled. Various urban sectors, such as transportation, energy, housing, including primary health care, work and achieve urban health outcomes together.

4 Health and Wellbeing Under COVID-19

At the national level, following the onset of COVID-19, monitoring and reporting on the progress of the pandemic was launched. The first comprehensive national report of the Finnish Institute for Health and Welfare (THL) was published online on 15 May 2020. This comprehensive report is updated weekly, and includes detailed information on the progress of the pandemic and scenarios for its development. At the local level, Helsinki University Hospital (HUS), Finland's largest hospital district and also responsible for specialist care in the Helsinki metropolitan area, launched its own COVID-19 monitoring.

Cities also organised their own monitoring and reporting. This was done at an early stage of the pandemic. For example, in Helsinki, a special operations group was formed that collects data through various digital technology platforms and runs scenario analysis to inform decision-making. The knowledge base is compiled and updated in this way to support the city's crisis management. The mayor leads a special coordination group that has met daily since 1 March to monitor progress of

the crisis management systems, prepare for recovery, and make timely decisions. There is daily streaming of the mayor's information sessions to citizens and staff. Similar groups also operate, for example, in Espoo and Vantaa, two other large cities in the Helsinki metropolitan area.

A key tool for discussion and joint decision-making in the Helsinki Metropolitan Area has been the so-called corona coordination group, involving the top management of each city (Helsinki, Espoo and Vantaa) as well as THL, HUS and Regional State Administrative Agency (AVI), which was established on the 9 October 2020. This group is responsible for the preparation and coordination of decision-making, based on common interpretations of the situation and expected developments. The actual decisions are made separately in each city.

Citizens' well-being and satisfaction with the treatment of the crisis have been separately surveyed. For example, in 2020 the City of Espoo twice surveyed their residents' sense of security, their views on their daily lives and views on the city's activities during the exceptional period caused by the epidemic. In each city a separate telephone counselling service was also set up for those in need. In addition, efforts have also been made to reach the elderly and those directly at risk.

5 Sharing the Risk

Although the corona shock experienced by the Finnish economy is smaller than in many other countries, the economic impact of the pandemic has been significant and unevenly distributed across regions and sectors. Adverse effects are the result of measures taken to curb the pandemic, as well as consumers' reactions to the pandemic. The crisis has primarily weakened the service sector—the accommodation and food service activities, arts, entertainment and recreation, and transport sectors have been hit hardest by the pandemic. Large cities, in which the service sector is in the most dominant position, and areas dependent on the tourism industry, have suffered the most. Unemployment rose rapidly in the spring of 2020 as layoffs increased. By the summer of 2020, the rise in unemployment was reversed and unemployment began to decline slightly. During 2021 unemployment decreased, but at the beginning of 2022 is still at a higher level than before the pandemic. There are concerns about the increase in long-term unemployment and the effects of unemployment on well-being and subsequent access to employment. Concerns about the well-being of the youth have also increased.

From the beginning of the COVID pandemic, it was clear that the public authorities, especially the state, would have to bear the immediate costs of the crisis. The financial problems caused to households and the unemployed have been addressed largely through existing support schemes. Economic policy measures in Finland, as in many other European countries, focused on the business sector. Direct support was granted through Business Finland, the ELY Centres (Centre for Economic Development, Transport and the Environment) and the municipalities. The support instrument

for one-person enterprises was the responsibility of the municipalities, although the costs were borne by the state. In addition, for the most affected companies, municipal business services have provided individual non-monetary support measures. Corporate bankruptcy protection legislation was also temporarily amended to restrict creditors' ability to file for bankruptcy based on insolvency.

6 Conclusions

Despite the prolongation of the pandemic, both the number of infections and the number of deaths related to COVID-19 in Finland are still comparatively low compared to other countries. However, regional differences within the country are large. In the Helsinki metropolitan area, the situation most of the time has been significantly worse than in the rest of the country. Due to new virus variants, there have been new lockdowns and the total number of cases and deaths has increased. The adequacy of hospital capacity, particularly intensive care capacity, has been carefully monitored and preventive policy measures have been in use. Large-scale vaccination programmes have had significant impacts, even if they have not prevented new cases from emerging. The third round of vaccinations began in Autumn 2021. By early February 2022, 86% of adults had had two vaccinations and 58% had had three.

Why is the situation in Finland better than in most other European countries? According to our interpretation, there are several reasons for this. First, the rapid and rather strong restrictive measures in the spring of 2020 effectively curbed the first wave of the pandemic in Finland. Second, regulatory guidance was and continues to be reasonably well trusted. Third, the universal healthcare system, available to all, has functioned well under the crisis. Fourth, the remote work recommendation was duly followed and the technical infrastructure and possibilities for doing remote working, in those professions where it is possible, are exceptional. And finally, outside the core areas of major cities, Finland is quite a sparsely populated country. This and Finns' fascination with summer cottages and outdoor activities further contributed to reducing the risk of infection.

The prolongation of the pandemic has however raised significant concerns. School closures, even partial ones, have led to an increase in inequality among students. The ability of families to support distance/remote learning vary greatly. According to school authorities, some students have disappeared, i.e., they do not participate in distance learning. Distance/remote learning has also proved difficult in vocational secondary education. The number of dropouts in vocational training is also alarmingly high. Restrictions on recreational opportunities for young people have been seen to have similar effects on exclusion. Overall, signs of youths' mental distress have become more common.

There are a significant number of COVID-19 cases in areas inhabited by foreign-born populations. Cultural factors, living conditions, and the language barrier can explain the differences. The cramped living conditions of migrant workers are also

a particular risk factor. Political decisions on forced testing and quarantine of cross-border passengers have also been difficult to make.

The strong financial support of the state in the early stages (2020) of the pandemic saved the municipal economy from immediate crisis. However, in the longer term, municipalities will face the consequences of a prolonged pandemic, most likely unevenly. At the same time, the government is preparing a major, historic reform to move social and health responsibilities away from municipalities from the beginning of 2023. The economic impact of the pandemic, together with the upward pressure on public spending created by an ageing demographic, will pose a significant economic challenge in the coming years.

Citizens' trust in authorities is still high, even if the prolonged pandemic has lowered it. Critical voices have also emerged alleging unclear roles and leadership of the pandemic, including lockdowns. However, a recent European survey highlighted that Finnish residents' concerns about the effects of the pandemic on their daily lives have been the lowest in Europe. So far coping with COVID-19 has been relatively successful in Finland. Even if there are ongoing political debates, the pandemic has proven the strength of the welfare state. As the Finnish Nobel prize winner Bengt Holmström described the situation in his speech in Finland recently:

We are a village, and in a village, everyone is helped at the moment of misery.

References

Castells M, Himanen P (2002) The information society and the welfare state: The Finnish model. Oxford University Press, Oxford

Ebikeme C, Gatzweiler F, Oni T et al (2019) Xiamen call for action: building the brain of the city—universal principles of urban health. J Urban Health 96:507–509. https://doi.org/10.1007/s11524-018-00342-0

Esping-Andersen G (1999) Social foundations of postindustrial economies. Oxford University Press, Oxford

Holmström B (2020) A post-pandemic path to success: what can Denmark and Finland learn from each other? Webinar with the Finnish Nobel laureate and Paul A. Samuelson Professor of Economics, emeritus, MIT Bengt Holmström and the professor of economics at Århus University Torben M. Andersen, today on October 26, 2020 at 16.00–17.00 Hanasaari

Kangas O, Blomgren J (2014) Socio-economic differences in health, income inequality, unequal access to care and spending on health: a country-level comparison of Finland and 16 other European countries. Res Finn Soc 7:51–63

Kautto M (2001) Diversity among welfare states: comparative studies on welfare state adjustment in Nordic countries, Research reports 118. National Research and Development Centre for Welfare and Health, Helsinki

Keskimaki I, Tynkkynen LK, Reissell E, Koivusalo M, Syrja V, Vuorenkoski L, Rechel B, Karanikolos M (2019) Finland: Health system review. Health Syst Transit 21(2):1–166

Vaattovaara M, Kortteinen M (2003) Beyond polarisation versus professionalisation? A case study of the development of the Helsinki region, Finland. Urb Stud 40(11):2127–2145

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Photos

BRAZIL

São Paulo skyline.
Paulo Saldiva

Underground station in São Paulo. Fourteen million people commute daily in the city. Transportation was an important infective force during pandemics.
Paulo Saldiva

Street vending and commerce were hot spots for infection.
Paulo Saldiva

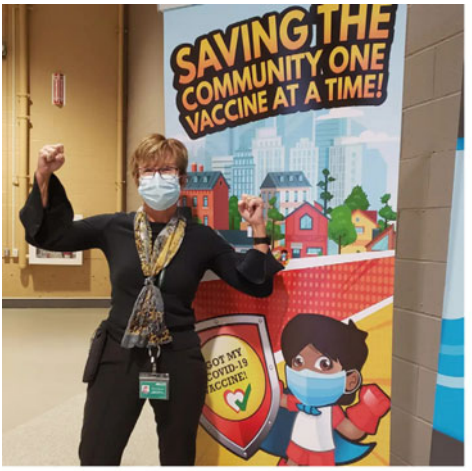
Slums and streets house about two million people in São Paulo. People living in vulnerable areas paid a heavy load during pandemics, expressed in terms of cases and lethality. The number of people living in the streets increased 35% during pandemics, meaning that forty thousand souls densely concentrated in an area of 3.5 square kilometres in the central part. This population in fact lives in another city embodied within São Paulo, whose name is Misery.
Paulo Saldiva

CAMEROON

Douala is the economic capital of Cameroon and known for its wholesale and retail markets, as here in the Sandaga retail market.

Ryan Brown

CANADA



Tracey Gordon, Manager of Vaccine Preventable Disease at the Middlesex London Health Unit with the Middlesex-London Super Hero display.
Alex Tyml, Middlesex London Health Unit

Superhero display at the Agriplex vaccine site.
Alex Tyml, Middlesex London Health Unit

Vaccine center at the Caradoc Community Centre.
Alex Tyml, Middlesex London Health Unit

Vaccination center at Earl Nichols Area London, Ontario.
Alex Tyml, Middlesex London Health Unit

CHINA

CUBA

Yander Zamora/EPA

A nurse asks a family to go to a vaccination center amid concerns about the spread of Covid-19 in Havana, Cuba, 17 June 2021.

Alexandre Meneghini / Reuters

The European Alliance Against Coronavirus was a collective effort with the leadership of the European Clusters Alliance and the contribution of a number of experts and organisations. On the image, the authors of this chapter.
ECCP

Catalonia ensured COVID-19 vaccine interventions left no community behind. Early on, public health officials noted that low vaccination coverage coincided with areas of greater social disadvantage. By mapping vaccine rates geographically, officials identified who needed the most targeted interventions, as well as the social determinants which affected access to or uptake of the COVID-19 vaccine. The strategy was recognised by WHO.
WHO. Image by Albert Mulero

Medical teams at the Hospital del Mar in Barcelona photographed while wheeling people to the beach as part of a programme designed to humanise intensive care units.
BBC / Getty Images

INDIA

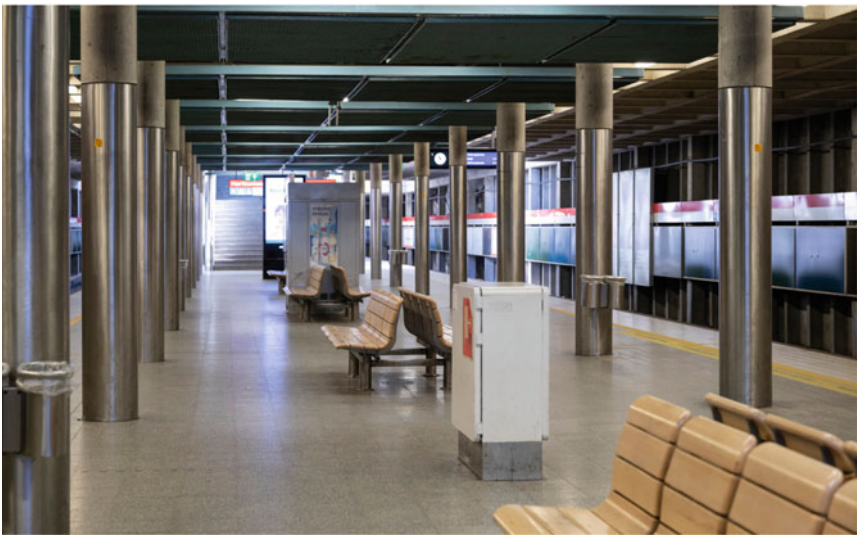
Active participation of Gurudwara during COVID-19 relief measures.
The Indian Express, 11 May 2021

Medical supplies being exported from India.
Meenakshi Kandwal, 2021

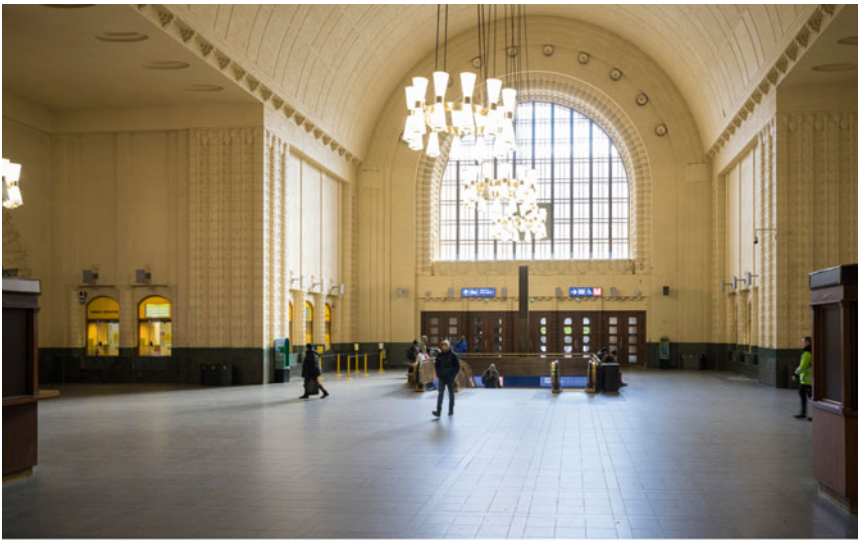
Social distancing being practised in public places, Kerala.
Ashique V.V., Department of Geography, Central University of Tamil Nadu, India, 2020

Installation of hand wash corner in Kodiyathur village, Kerala by regional political parties.
Ashique V.V., Department of Geography, Central University of Tamil Nadu, India, 2020

FINLAND



Great hall of the Central Station in Helsinki, Finland during the COVID-19 pandemic, April 2020.
Wikimedia Commons



Herttoniemi metro station in Helsinki, Finland during the COVID-19 pandemic, April 2020.
Wikimedia Commons

GAZA STRIP

Hamas Policeman wearing a mask guarding an empty street after a curfew imposed by Hamas de-facto police and security forces after discovering the first case of COVID-19, 25 August 2020.
Khalil Hamra / AP

Hamas soldiers wearing protective gear in a drill simulating a wide spread of COVID-19 virus in Gaza (18 July 2020).
Khalil Hamra / AP

NEPAL

The city of Biratnagar Submetropolitan during COVID-19 lockdown.
Hamro Biratnagar Group

Silent street of Biratnagar Submetropolitan during COVID-19 pandemic.
RBB Group, Biratnagar

Mobile van to collect swabs from people for COVID-19 PCR testing.

Biratnagar Metropolitan City team handing over COVID-19 response logistics to Koshi Hospital.

NEW ZEALAND

Capital Coast District Board

Philippa Howden-Chapman

Philippa Howden-Chapman

Philippa Howden-Chapman

Death and the plague doctor going walkabout.
Philippa Howden-Chapman

Street grafitti.
Philippa Howden-Chapman

SRI LANKA

A medicinal bath carved from granite used in an ancient hospital in Sri Lanka.
Dr Dinil Abeygunawardane

Colombo city: old and new.
Dr Dinil Abeygunawardane

Busy intersection in the city.
Dr Dinil Abeygunawardane

Street protests in Colombo.
Dr Dinil Abeygunawardane

UNITED STATES OF AMERICA

An elaborate 'Open Restaurant' eating area straddles two sides of a bike lane in Manhattan NYC.
Amy Howden-Chapman

An ‘Open Street’ in Brooklyn NYC. With the street closed daily to through traffic it is used for walking and exercise.
Amy Howden-Chapman

A social distancing sign that appeared throughout NYC Parks during the early part of the pandemic.
Veronica Oilvotto

An ‘Open Street’ in Brooklyn NYC. Blue police barricades being used to close the street to through traffic allow children to use the space for play.
Amy Howden-Chapman

An ‘Open Restaurant’ eating area sited in a former parking space in Brooklyn NYC.
Amy Howden-Chapman

GAZA STRIP: Non-State Actors and COVID-19—Hamas as a Case Study

Abdalhadi Alijla

Source Jawgmaps/uMap/OpenStreetMaps

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Urban Health and Wellbeing, https://doi.org/10.1007/978-981-19-8163-0_9

1 Introduction

In late 2019, the novel coronavirus appeared in Wuhan province in China, resulting in thousands of deaths. Because of the public health emergency, China took unprecedented measures by locking down millions of people in the Hubei areas (BBC 2020). The crisis tested the preparedness of various societies and states as countries sought to prevent deaths and overloading of their health care systems. According to the World Health Organization (WHO), as of January 10, 2022, there were around 300 million confirmed cases and more than 5.5 million deaths, and more than 9 billion vaccines administered (WHO 2022). The crisis forced many governments to respond quickly, including closing economies, shutting down countries, and forcing citizens to adhere to new measures for many months.

In just a few weeks, international and multinational organisations, governments, non-state actors, research centres and universities were mobilised to trace the virus and minimise its impact on society. The urgency of the situation created a state of exception, where governments, non-state actors, research centres, scientists, and policymakers were forced to alter their agendas to work effectively and efficiently to tackle the effects of the crisis. The crisis showed that local involvement at the grassroots level was the most meaningful mechanism and that local participation could pose an organisational challenge to controlling the pandemic and its effects.

Most countries enacted state-centred response plans, with China being the first to introduce a complete lockdown on provinces and cities with a state-centric enforced rule. In the first 20 months, less attention was paid to the roles of non-state actors and rebel groups in areas with limited statehood, with only one study focusing on rebel rulers by Marta Furlan (Furlan 2020). Other studies focused on practicalities and the legitimacy of rebels in Middle Eastern and North Africa (MENA) (Alijla 2021b). Other research examined the response of non-state actors and their engagement with international organisations (Biedscheid 2020; Swed 2021). Similarly, little attention is being paid to grassroots initiatives and local non-governmental and civil society organisations.

In this chapter, the focus is on understanding how the non-state actor, Hamas, developed their responses to the societal and state-centric challenges in Gaza amid political and military conflict. Findings are presented which examine leadership, legitimacy and politicisation of the COVID-19 crisis. The argument, albeit indirect, is that public health issues in limited statehood areas are systematically interconnected with the political and socio-economy of the area, which affects vulnerable groups. Therefore, this chapter transcends and integrates standard interdisciplinary domains to study the COVID-19 crisis in limited statehood areas and the role of non-state actors.

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2 Gaza Strip: Conditions and Geography

The Gaza Strip is situated in the Mediterranean Sea's south-east corner and is around 41 kms long. The shoreline strip's breadth varies from five km in the centre to eight km in the north and twelve km in the south, as indicated in Fig. 1. The Gaza Strip is bordered on the north and east by Israel's green line, on the south by Egypt, and on the west by the Mediterranean. With a total area of 378 km^2, the strip's population at the end of 2021 was estimated to be around 2.1 million people (PCBS 2021).

The Gaza Strip has been experiencing a very complicated socio-political, economical, and developmental crisis for a long time. This is due to the geopolitical situation, especially the Israeli occupation since 1967, two Intifadas, the establishment of the Palestinian Authority, a series of conflicts (2009, 2012, 2014, and 2021), a blockade, and internal political division since 2007 (Alijla and Al Masri 2019). Since 2007, the Gaza Strip has been under the control of Hamas—a non-state actor that has a military

Fig. 1 Location of Gaza Strip

force and governs the Gaza Strip using formal and informal powers, coercive and non-coercive (Alijla 2021a).

During COVID-19, Hamas divided the Gaza Strip based on the administrative lines and divisions of the local governance, delegating roles and decision-making regarding curfew and lockdown imposition to local police heads. This is how Hamas de-facto police forces controlled the Gaza Strip. They also set up three isolation hospitals on both sides of the Gaza Strip (considering the two entries from/to the Gaza strip) in the north and south.

3 COVID-19 as a New Crisis

Since the beginning of the pandemic, experts and scientists have examined the various dimensions of vulnerabilities in responding to the crisis. Although it is too early to expect the publishing of studies concerning the political and social impact of the pandemic, coronavirus has proven to be a popular topic for study. These studies focus mainly on science–society relations, specifically in urban spaces and on aspects of social distancing. Some of these studies focus on the sociology of pandemics (ISA 2020; Sadati et al. 2020; Ward 2020), the economic effect of the coronavirus (Rae 2020), and on the media, communication, and misinformation surrounding the disease (Fuchs 2020; Wen et al. 2020). Other studies and seminars focus on the political dimension, particularly on emergency measures and their effect on democracy and legitimacy. For example, a dataset by the Varieties of Democracy Institute (V-Dem) measured how restrictions and emergency laws have affected democratic principles, and how they paved the way for more authoritarianism.

Many regimes, such as Egypt and Jordan, have restricted freedom of expression and the judiciary's and legislature's capacities to hold executives accountable (Edgell et al. 2020). Franco et al. examined civil society responses to COVID-19 in informal settlements in Latin America (Duque Franco et al. 2020). Other scholars have examined the tentative legitimacy of some regimes and how they managed their legitimacy during the pandemic (ArabCenter 2020). Some scholars and experts have attempted to examine social reproduction and gender in the MENA region (Nicola 2020). Al-Ali addressed the gendered implications of the crisis in the global south with a focus on inequalities (Al-Ali 2020).

The legitimacy of states and non-state actors during the pandemic has been a central part of debates among scholars and experts. The need for lockdowns encouraged many scientists to provide input into strategies for lockdowns that affect political, economic, and social life (Taylor 2020). For the provision of services, in both democracies and non-democracies, non-state actors rely on public approval of their actions to gain public legitimacy (Malejacq 2017). In a democracy, political survival and legitimacy can be affected if the government response to the pandemic is ineffective (Elisa 2020). If citizens are concerned, which is often the case, governments and political institutions create an image of 'taking action'. This can be limited to addressing the topic politically and in the public sphere, while they often fail to

act effectively. Consequently, citizens are unable to track the effectiveness of any policies implemented or the outcomes in general.

In authoritarian regimes, more coercive authorities use force to enforce measures. As citizens are often unable to question government actions and policy implementations in authoritarian regimes, it becomes exceedingly challenging to reject measures implemented by the government, which is the case in most Middle Eastern countries. Non-state actors, such as Hezbollah and Hamas, have more coercive power and alternatives than the state for dealing with public health concerns. These measures are implemented and reinforced by loyalty, defined communities (geographically and also by religious groups), and the capacity of these groups to act quickly due to their legitimacy within their communities, as well as sought-after external legitimacy, as in the case of Hamas.

Charismatic leadership, a religious narrative, and semi-military power to enforce measures provides a strong base for non-state actors to act and be more effective than a state which may have lost the population's trust. This is mainly visible in the case of Hezbollah in Lebanon, where the great majority of the people has lost trust in formal institutions, perceiving them as corrupt, untrustworthy, and therefore looked towards Hezbollah for welfare services that were seen as being higher quality and more accessible (Alijla 2020). Adding to that, both Hezbollah and Hamas have developed an excellent welfare system that competes with formal institutions, combined with a paramilitary group, and volunteers that can enforce measures, while simultaneously providing services. Hamas, as non-state actors, are required to act to meet the expectations of their communities, who look up at them as their protectors. The COVID-19 crisis is also an opportunity for groups such as Hamas to gain external legitimacy from international organisations, such as UN agencies, through coordination and collaboration with them directly.

Due to severe income inequalities in the Middle East, service provision and economics, which result in the poor performance and corruption of formal institutions, non-state actors play a significant role in filling the gap and providing services, particularly health-care and education. Inequality in receiving services during the pandemic has also contributed to the malaise and pressure experienced by the general population, primarily from people who live under the poverty line. Although most countries in the Middle East and North Africa (MENA) region suffer from a high level of inequality in terms of economic disparities and limited access to service provisions (mainly health care and education), Lebanon and Palestine are more deeply affected for several reasons. In Lebanon, there is a high level of inequality and corruption. The education and health care systems are divided along sectarian and partisan lines (Alijla 2016). In the Gaza Strip, there is inequality and limited access to health care and high-quality education due to the Israeli siege that has been in place since 2006. Military attacks on the Gaza Strip have damaged the health care and education systems, as well as food supply (Winter 2016). The majority of people in Gaza also have inadequate access due to inequalities when accessing services as a result of society's polarisation. For instance, Hamas officials and senior activists have better access to services in their institutions and more stable income, while the majority are struggling to have income or access. Fatah-backed (Fatah is the

rival of Hamas) employees and activists also have a semi-stable income paid by the Palestinian Authority (PA) on monthly bases, which allow many of them to have access to private services. Despite these inequalities, the great majority still receive inferior service. Most importantly, Gaza's political inequalities are visible as Hamas excludes other political groups from engaging in the Gaza Strip's governance (A1, personal communication, February 2021, p. 1).

Although research in this chapter relies on official data, it was difficult to obtain detailed information about COVID-19 and measures from public sources until late July 2020. Hamas considers itself as the governing state in the Gaza Strip and acts accordingly. Since the beginning of the crisis, the United Nations (UN) and its agencies have worked intensively to establish and support early warning crisis and risk analysis mechanisms/systems in MENA, particularly public health databases, which provide infographics, and easy and accessible data to the public. The Palestinian Ministry of Health in the West Bank shares daily information about the number and location of cases. This mechanism is also followed by the Hamas government in the Gaza Strip, which announces new infections at a press conference whenever they are detected. This was the case up until late June when it started to publish more detailed information. The current crisis is not only a public health concern that has political and economic consequences. It is a crisis that encapsulates another crisis in the region, particularly in Lebanon and Gaza. How did Hamas and Hezbollah respond? How prepared were they? And what was the role of their leadership?

4 COVID-19 in Gaza

In Gaza, because of the Israeli siege imposed since 2006, the Hamas government has effectively controlled the coronavirus. On 22 March 2020, the Ministry of Health under Hamas announced that COVID-19 had infected two persons in forced quarantine. The two individuals came from Pakistan through Egypt via the Rafah crossing. At the end of August, a sudden rise of positive cases hit the Gaza Strip. On September 2, 369 cases were discovered, relating to a breach in quarantine policies, as another 37 were confirmed positive (PMOH 2020b). As of 11 January 2022, more than 942,551 positive cases were reported and 1,323 were reported just on January 10, with a total death toll of 1,726 (MoH-Gaza 2022). In many neighbourhoods and due to huge increases in COVID-19 cases in 2021, Hamas's de-facto government and police imposed a very strict lockdown. In many cases, they used excessive violence against civilians who broke the lockdown restrictions (Abu Don 2020). As for vaccination, the Gaza Strip ministry of health administered more than 1,957,960 doses of various COVID-19 vaccines (Sputnik, Pfizer and Moderna).

Since 2006, Israel has imposed a tight siege, hindering individuals' ability to move freely in and out of the Gaza Strip. As Gaza is under siege, it is also in a state of war. The siege is an incremental mechanism of war and a form of outright aggression that relies on oppression and pressure from outside and from within to achieve political goals at the expense of civilians. The ongoing siege and the three

major wars on the Gaza Strip have undermined and weakened the health care system. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), in 2018 alone, there were 308 attacks against medical workers and health facilities in Palestine (OCHA 2018). In May 2021, the health system in the Gaza Strip buckled under Israeli bombardments for eleven days. During the eleven days of bombardments, Israel attacked the only operating coronavirus laboratory, killing two senior doctors (Alfarra 2021).

The number of hospital beds in the Gaza Strip hospitals is approximately 2,900, which equates to 1.3 beds for every 1,000 people (WHO 2020). In the Gaza strip, 70% of the population are refugees who rely mostly on United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) health services and on the already damaged health system of the Palestinian Authority under Hamas rule, which has minimal testing capacity. According to Abdelrahman Soboh, the local WHO coordinator, there are only around 50–60 ventilators (AJELSA 2020). The vulnerable state of the Gaza health system forced Israeli military generals to argue that the health system in the Gaza Strip will hinder their efforts to act (as in case of attacks) in the Gaza Strip as it would lead to catastrophe (widespread virus or total collapse of health facilities). The Israeli military's de-development policies towards the Gaza Strip aim to keep the Gaza Strip at a severe disadvantage, without allowing it to collapse entirely. According to a public health expert in the Gaza Strip, "Israel wanted the Gaza Strip and its health care system to be on the edge of the knife, not collapsing, but at the same time not able to develop or have a high quality" (A2, personal communication, August 2020, p. 2). Israel's policy toward Gaza in the pandemic is a furthering of this notion. On 5 April, the Israel National Security Institute conducted a simulation experiment in case the virus spread in Gaza and hundreds died. They concluded that Israel must work to prevent the spreading of the virus in the Gaza Strip.

With a presidential decree, the Palestinian government announced a state of emergency in early March and enforced a total lockdown in particular areas to counter the virus' spread. The decree was followed by establishing a national emergency committee to counter the pandemic and the spread of the virus. This main committee set up local committees and community groups to assist in cases of emergency (Abdelhamid 2020). By contrast, the de-facto government of Hamas refused to declare a state of emergency, distinguishing itself from the rest of the occupied territories, arguing that the Gaza Strip had no coronavirus cases. Hamas framed their rejection of the presidential decree from its political stance, showing off its power, local sovereignty, and authority over the Gaza Strip. However, following social and international pressure, Hamas started to take measures after international organisations like WHO approached their institutions. They took this as a kind of legitimacy for their authority in the Gaza Strip (A3, personal communication, July 2020, p. 3).

Besides, due to the population density (including refugee camps) as well as the economic hardship and the inability to impose social distancing, Hamas was not able to enforce a complete lockdown, fearing a community backlash. On the one hand, Hamas, as a religious movement, could not close mosques quickly in the beginning, as many of its hardline leaders rejected the idea of lockdown and the closure of

mosques (A4, personal communication, July 2020, p. 4). On the other, the tight control over the two entrances to the Gaza Strip, Erez in the North and Rafah in the south, provided Hamas with the ability to enforce quarantine and monitor (generally) the state of entry and exit. By 3 August 2020, when the cases of coronavirus had increased in the Gaza Strip, there had been only one death and seven active cases. As the quarantine was enforced and isolation clinics and buildings were designated, the WHO, United Nations Office for the Coordination of Humanitarian Affairs (OCHA), and other INGOs contributed to virus containment efforts by providing coordination services with the Israeli forces, facilitating testing kits and medical equipment.

5 Service Provision by Non-State Actors

Hamas (established in 1987) is a non-state actor with a military wing and complex social services structures that have been in place since the formation of both parties. Social welfare for non-state actors, especially in the Middle East, is not only about service provision; instead, it is about ethnic and sectarian politics (Cammett 2014). In the case of Hamas, it is also about political and ideological division fuelled by power games between the Palestinian Authority, Hamas, and other groups. The primary focus of service provision by non-state groups is usually between the group and the beneficiary or the community under their control.

In societies with weak formal institutions, there are several factors to consider regarding non-state actors. Most importantly, whether the non-state actor adopts a state-centric or extra-state political strategy for welfare services provision. Another factor is whether the group faces competition from other parties. In a state-centric approach, according to Camment (2014), the group uses the state's formal institutions to seek national power and serve members of other political parties or groups. This is opposite to the extra-state approach, in which the group favours their supporters and engages in militant acts and protests (Cammett 2014).

In the Gaza Strip, Hamas has a de-facto government status that relies primarily on pre-existing (from Palestinian Authority, pre-2007 structure) formal institutions rather than its own institutions. In addition, Hamas built reputable welfare services after the Oslo Accords.[1] As a result of political repression against Hamas, many Islamist activists turned to building well-functioning, high-quality services as Non-Governmental Organisations (NGOs) (A5, personal communication, January 2021, p. 5). The Gaza Strip has a multi-layered governance structure where Hamas is seemingly the main governing body and service provider. In reality, the PA in Ramallah, the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), International NGOs, and other local organisations are the main structures governing the Gaza Strip, making it a rather peculiar case

[1] The Peace accord signed between the Palestinian Liberation Organization and Israel in 1993. Based on the accord, Israel should have left the occupied East Jerusalem, West Bank, and the Gaza strip in 1999, establishing a Palestinian state.

(A4, personal communication, July 2020, p. 4). Despite this, Hamas has been the only security service provider since 2007, with very organised, well trained and professional security agencies that can enforce measures and provide security (Sayigh 2011). Although UNRWA has a responsibility to provide services in the Gaza Strip, as more than 60% of the population of the Gaza Strip are refugees, Hamas has tried to channel more resources to lift some of the burden on the health sector (as well as other sectors) due to the harsh Israeli siege, attacks that destroyed many health facilities and strict rules on the entry of medical supplies.

Hamas is a hybrid form of non-state actor and service provider. First, it claims authority over public administration in the Gaza Strip, but it demands that others (the PA) provide the services and resources. Second, Hamas channels all international aid and donations to the Hamas welfare organisation even though these donations are for all Palestinians in Gaza, including the Turkish Hospital. They adopt an extra-state ideology and simultaneously claim that they are the governing body in the Gaza Strip. For example, Hamas' hospitals and health clinics such as Al-Khidma Al-A'ama Hospital, Dar Al-Salam Hospital, and the Kuwaiti Hospital were not designated for coronavirus patients and did not assist in fighting the virus. The rest of the hospitals were funded and sourced by the Palestinian Authority, over which Hamas has semi-control. That strategy was to minimise the resources used in Hamas facilities while maximising their external legitimacy and demonising their competitors. Most importantly, service providers such as non-state actors try to portray themselves as protectors and community guardians. The next section will focus on the practicalities of the crisis, the question of legitimacy, and the politicisation of the virus.

6 Hamas, Its De-facto Government and the COVID Crisis

When it comes to the coronavirus crisis, the practicalities in question are how states and non-state actors prepare themselves and react. Practicalities include urgent measures to tackle inequalities among the population they control in times of crisis. These inequalities and the inability to access health care directly impact the ability of formal institutions to respond to the pandemic. Also, practicalities mean enforcing a lockdown and social distancing measures, as well as responding to the economic consequences of the pandemic and lockdown. Social distancing measures and lockdown mean that many street vendors, daily wage workers, and others rely on social services or partisan social benefits. These are not available to all members of society, restricting access to the livelihood of its members. This leads to breakdowns in society and a rejection of lockdown measures by many. Social distancing is another recommendation that many cannot practise, especially in open markets in densely inhabited areas like in the Gaza Strip. To respond effectively to the pandemic as a public health crisis, and to have the capacity to impose measures, health institutions must be able to mobilise resources, therefore coercive power is needed. This should be complemented by dispensing economic resources to protect the vulnerable who have lost their livelihoods.

In Gaza, over time, Hamas changed its reaction to the virus and started taking measures after criticism from the public and medical experts. From 3 March, a compulsory 14-day quarantine was introduced on returnees from Egypt via the Rafah crossing. By 10 March, 1,542 persons were isolated for quarantine in schools in Rafah and Khan Younes (PMOH 2020a, p. 3). On 15 March, 1,287 people were in compulsory quarantine distributed across 20 schools, hospitals, houses and medical centres, and another 2,071 cases were in quarantine in their homes. Out of a suspected 99 cases, two were confirmed positive, which caused panic in the Gaza Strip. Despite Hamas initially acting as an 'independent' entity from the West Bank authority, they eventually followed the same measures, such as shutting markets, schools, and places of worship. Hamas also used hotels and school buildings for quarantine. The primary 'special' measure was building 2,000 rooms for quarantine on the northern and southern crossings (Rafah in the south and Beith Hanoun in the north) for travellers and whoever has symptoms.

In addition, Hamas set up a local ministerial committee with the Ministry of Health, Ministry of Education, Ministry of Interior, Ministry of Religious Affairs, Ministry of Finance, and the Ministry of Local Governance. It is clear from their committee that the Hamas government included the Ministry of Awqaf (religious affairs), which they saw as vital in raising awareness. Also, they installed a thermometer at the Rafah crossing. In the beginning, compulsory quarantine was introduced for travellers from China, South Korea, Iran, Italy, Singapore and Hong Kong. The quarantine was in built-in rooms near the Rafah crossing made from metal containers. They also installed a mobile clinic near the Rafah crossing and formed several medical teams to follow up with the quarantined individuals. As of the end of 2021, Hamas de-facto government did not require quarantine, rather it tried to impose vaccinations. According to a medical doctor in Gaza who was part of the committee, "committees were established in every hospital in the Gaza Strip and provided with the necessary data and advice including the development of a protocol of medical treatment" (A6, personal communication, June 2020). The Hamas Ministry of Health conducted training for workers and health personnel in hospitals and primary care centres and paramedics in preparing for the virus. It included proper scientific and practical responses to suspicious cases and provided safe transportation methods, according to approved evidence and procedures (PMOH 2022).

Hamas also organised an awareness campaign. The Health Education Department of the Ministry of Health printed 122,000 leaflets and 200 awareness posters about the coronavirus and distributed them to the Ministry of Health, UNRWA, military medical services and NGOs. Hamas also urged mosques to use Friday prayers to inform and preach about coronavirus, its symptoms, and the importance of hygiene and social distancing from a religious point of view. Isolation and quarantine of infected persons were introduced in two designated hospitals (Isolation Hospital and the European Hospital). The quarantine of non-infected personnel was limited to hotels (Blue Beach Hotel, El Sadaqa-Turkish Hospital). Amid the crisis and effective quarantine measures, Hamas introduced the Corona Police Unit, responsible for ensuring quarantine and self-isolation (A3, personal communication, July 2020, p. 3).

El Sadaqa Hospital was designated to receive quarantined cases with pre-existing medical conditions, while the European Hospital was designated as the COVID-19 treatment hospital.

Moreover, three adjacent schools were used as isolation centres. New Standard Operating Procedures (SOP) were issued for dealing with arrivals via the crossings where a PCR COVID-19 examination was performed on all detainees on the fourth and 19th days of quarantine, and there was an extension of quarantine to 21 days. Additionally, Hamas issued a decree to close all wedding halls, restaurants, markets and all forms of gatherings (PMOH 2020b), although some violations took place by Hamas. For instance, the funeral of Hamas' leader Abu Osama Al Kurd, saw thousands of mourners attend, who were not implementing social distancing measures and only making minimal use of protective medical masks (Shehab 2020). Protective medical masks were used, according to our sources, to set an example in order to avoid criticism for violating their own decision to prohibit gatherings and out of fear of transmitting the virus to many elderly persons in the Hamas leadership (A3, personal communication, July 2020, p. 3).

When positive cases skyrocketed in September 2020, Hamas took stringent measures, isolated cities, and blockaded streets. In some cases, they deployed hundreds of soldiers to impose curfew and lockdown. In that regard, Hamas tried to minimise contact between people, especially in highly dense areas. For instance, the Gaza Strip was separated into five areas: Rafah, Khan Younes, the Middle Zone, Gaza and North Gaza. Each of these areas was also divided into many zones and neighbourhoods: Rafah (7 areas), Khan Younes (12), the Middle Zone (11), Gaza (14) and North Gaza (9). Based on the number of positive cases and spread, Hamas would designate areas with one of three colours: red for high restrictions, orange for medium restrictions and green for low restrictions. Until the beginning of February, Hamas imposed a total curfew on Friday and Saturday. Although Hamas tried to decrease the number of infections, the number was still 150–250 daily.

7 COVID-19 as a Political Tool

In many societies, the virus has been weaponised by political leaders. For example, the former US president's use of the phrase the "Chinese Virus", led to the rise of racist acts and harassment against Asians in the United States (Lindaman and Viala-Gaudefroy 2020). Others have accused China as being the primary source of the virus, or of developing biological weapons (Seaboyer & Jolicoeur, 2020). In turn, Russia and China have also weaponised the virus for political gain and propaganda against other nations.

COVID-19 was weaponised in most of the Middle East. In the Gaza Strip, the politicisation started from the beginning of the crisis with the rejection of Palestinian President Abbas's decision to declare a state of emergency by the Hamas de-facto government. However, at a later stage, Hamas adopted stringent measures of isolation and quarantine and complete closure of the Gaza strip, which has allowed Hamas

to control and prevent the spread of the virus. The initial Hamas rejection aimed to show Gaza as an independent political entity. According to a Palestinian researcher, "The announcement of the state of emergency and isolation in the West Bank was received from Hamas's activists with jokes from one side and claims that the PA is doing that to prevent people from demonstrating against Trump's plan" (A1, personal communication, February 2021, p. 1).

Hamas has used the crisis to attack its opponents, waging a campaign against its opponent, the Palestinian Authority. Hence, Hamas has accused the PA of banning (or reducing) the supposed medications, analysis kits, and other disposables relevant to COVID-19. As a public health expert argues, "Health and educational services in Gaza have been a conflict area between Hamas and the Palestinian Authority in Ramallah. The coronavirus crisis was a chance for Hamas to accuse and blame the PA for low quality and poor preparation against the virus". Besides that, the crisis has been an excellent justification by Hamas to prevent public protests, activities, and demonstrations organised by opponents such as Fatah and the Palestinian left "to keep social distance" (A3, personal communication, July 2020).

Israel has also taken advantage of the coronavirus crisis to present an ethical form of intervention and show their rational, human side, where it intervenes when needed, but keeps Gaza on a knife-edge and the brink of collapse (Noa and Dekel 2020). Additionally, Israel has set many conditions for testing kits and Personal Protective Equipment (PPE) into Gaza. Many INGOs were also prevented from donating ventilators (Levy 2020). Hamas used this crisis to coordinate indirectly with Israel by sending medical doctors to Israel for training purposes and also sending testing samples to Israel instead of to the West Bank laboratories as it is supposed to (AlArabiya 2020). According to Mukhaimar Abu Said, a political scientist, because of the crisis, an indirect talk between Israel and Hamas has also been initiated on prisoner swaps, which helped Hamas secure testing kits from Jordan through WHO (PAG 2020). According to al-Monitor, "Al-Sinwar hinted that Hamas might concede the exchange deal in return for allowing the entry of supplies to improve living conditions and medical assistance in Gaza".

8 Leadership

Non-state actors and rebel leaders are political entrepreneurs who can mobilise masses, exert and transform authority across ideological, social, political and economical ideologies and at different levels in the society (Malejacq 2017). Leaders not only issue orders and mobilise the use of power and violence; they are also an integral part of public administration and policy making. Leaders are also seen protecting their followers and the population from the mayhem of failed states and their governments which the population distrust, such as in Lebanon (Tilly 2005). Rebel and non-state actors also provide an alternative form of governance, mainly when they have strong charismatic personalities that can allow them to mobilise and

influence the population. In the coronavirus crisis, leadership has played an influential role in mobilising people, raising awareness, and advocating for collaboration between all parts of the society through state institutions.

It is not easy to separate the leadership of the de-facto government of Hamas and Hamas leadership because Hamas controls the health service despite being funded and managed partially by the Palestinian Authority in Ramallah (A2, personal communication, August 2020). The decisions of the governmental committee in Gaza are entirely associated with Hamas. For instance, the 2,000 quarantine rooms north and south of Gaza were built by the Al-Qassam (the military wing of Hamas), despite active ministries such as the Ministry of Health, among others, carrying out public work (A7, personal communication, August 2020). The Hamas leadership decided to build these isolation rooms (Alalam 2020b). The leadership of Hamas has mobilised charitable organisations, including security agencies, to follow up, monitor, and trace self-isolating individuals. The Interior Ministry of Hamas, using its security apparatus, has conducted several drills on the virus spread in densely populated areas (A8, personal communication, July 2020). In a TV programme, the Hamas leader in Gaza invited people to wear masks and linked it to the tradition of using the Palestinian 'Kuffiya' to cover one's nose and mouth. He also sent letters and messages to Gaza leaders and heads of families and communities to help the de-facto authorities fight the coronavirus (Alalam 2020a).

Most importantly, the Hamas leadership, particularly Al-Sinwar, threatened Israel with the use of force if they restricted medical equipment and testing kits after the Israeli government stated they would conditionally allow medical equipment and testing kits in return for information about the captive Israeli soldiers that have been in Gaza since the 2014 war. Yahya Al-Sinwar announced that "six million Israelis may have to stop breathing" if Israel is unwilling to supply the Gaza Strip with the necessary respirators for coronavirus patients (Abuamer 2020).

9 Legitimacy

Hamas tried to exploit the crisis to seek recognition and legitimacy from external parties such as WHO and UN agencies as well as bypass the Palestinian Authority in Ramallah to coordinate with the Israeli authorities about managing the public health crisis. As a Palestinian civil society activist argues, "the coronavirus crisis has been exploited by Hamas to legitimise itself. For example, Hamas has a better chance to strengthen its relations with international organisations like WHO" (A9, personal communication, June 2020).

In this regard, the coordination of WHO and the United Nations with the Hamas local authority was seen as a sign of legitimacy or recognition of their authorities in the Gaza Strip. For instance, in Hamas's news outlets, Hamas is seen to coordinate and work with international organisations. In contrast, UN agencies coordinate their work with the Palestinian Authority in Ramallah but deal with local authorities directly

through hospitals, clinics, and employees of the Ministry of Health who report to the Ministry of Health in the West Bank (UN 2020).

According to a Palestinian journalist in Gaza, Hamas also sent medical doctors from Gaza to be trained in Israeli hospitals, without coordinating with the Palestinian Authority in Ramallah. They said: "Hamas's local legitimacy has been shaken because it could not send such a medical team to Israel without direct/or indirect 'coordination' with Israel, the question that Hamas has long used against Fatah and the PA". The criticism against Hamas was based on the "attempts of Hamas to deal as an independent entity" far from the formal and internationally recognised Palestinian regime, which meant practising more measures that deepen the Palestinian division (A7, personal communication, August 2020). Hamas indeed used this crisis as a reasonable justification, amid public fear and panic around the virus, to open the doors for coordination with the Israeli authorities (directly and indirectly) which, according to Palestinian experts, could be the beginning of sectorial coordination with Israel, in a way to seek legitimacy and independence from the PA which is attempting to take back control of the Gaza Strip.

In addition, Hamas' approach towards Israel and the INGOs was a message to the international community, and nationally, that it is capable of acting as a governing body in the Gaza Strip to contain the virus and is more efficient in dealing with it than other parties in the region (A8, personal communication, July 2020). On the other hand, Hamas has been struggling since the 2006 Palestinian Legislative Council elections, and 2007, locally, regionally, and internationally. PA and Fatah refuse to collaborate, Israel imposes a tight siege, Egypt and other regional powers reject Hamas ideology and tackle it from a security perspective, and international agencies try to bypass Hamas's de-facto administration. Therefore, Hamas is concerned about opening channels of cooperation with any external body, seeks external legitimacy due to the internal fragmentations, and is in competition with the Palestinian Authority in Ramallah. This is in contrast to the case of Hezbollah, which only substitutes formal institutions and welfare services in areas where they have influence.

10 Conclusion

The COVID-19 crisis has burdened both states and non-state actors, in which priorities and resources were given to fighting the virus and its consequences. Although non-state actors adopt strategies similar to states, their strategies rely on their previously developed welfare systems, leadership and capacity to mobilise resources and collaborate with formal institutions and international organisations.

This chapter analyses the response of non-state actors to the pandemic in the Gaza Strip. The chapter highlighted essential features of the institutional structures and welfare system, as well as the governing patterns of Hamas as a non-state actor. Hamas mobilised its resources and members, including military personnel, to join the fight against the virus. They have seen the success of containing the virus to show themselves as the protector of their communities.

The key findings suggest that Hamas relied on their previous experiences in service provision and welfare organisations that they have developed. Hamas acts like the de-facto government, exploiting the crisis to gain political and external legitimacy, adopting an extra-state approach concerning the Palestinian Authority. Hamas was more interested in gaining legitimacy and recognition from the international community, through its collaboration with UN agencies. The coronavirus crisis has been a centre of political mobilisation and used as a political tool. Hamas used it against Fatah and the Palestinian Authority in the West Bank. It has exploited the crisis to score points against the PA, opening new channels, albeit indirectly through the UN with Israel, to bypass Ramallah's Palestinian Authority. The weaponisation of the coronavirus was intense against the non-state actors in divided societies like Lebanon, while it was weaponised against the political institutions of the PA, Israel and also against Hamas by Israel from the other side.

This chapter also suggests that the Hamas leader Al-Sinwar has played a significant role in advocating for the adoption of public health measures, such as wearing masks and ensuring social distancing in their communities. Charismatic and influential leaders can mobilise resources faster when they act in the absence of the state or weak state institutions. The crisis has shown that non-state actors have acted in a similar way to states, but have also sought to gain external legitimacy, when needed. Their major success relies on two main factors, their pre-existed developed welfare system and their capacity to mobilise their loyalists easily, mainly through their charismatic leaders.

Finally, this chapter builds upon "Xiamen Call for Action: Building the Brain of the City—Universal Principles of Urban Health", by stressing the first two principles of governance and urban health, namely, clear leadership and inclusiveness (Ebikeme et al. 2019). Leadership is critical in dealing with crises, particularly a public health crisis in a conflict area, which necessitates inclusion as an integral part of human rights.

References

A1 (2021, February) Interview, Palestinian Researcher-Gaza [Mobile]
A2 (2020, August) Interview, Palestinian Public Health expert, Gaza [Telephone]
A3 (2020, July) Interview, Palestinian Journalist, Gaza [Telephone]
A4 (2020, July) Interview, Palestinian expert [Mobile]
A5 (2021, January) Interview, Palestinian academic [Personal communication]
A6 (2020, June) Interview Palestinian doctor [Telephone]
A7 (2020, August) Interview, Palestinian Journalist, Gaza [Telephone]
A8 (2020, July) Interview, Palestinian Researcher-Cairo [Mobile]
A9 (2020, June) Interview, Palestinian CSO activists [Mobile]
Abdelhamid M (2020) الاستجابات والتحولات الفلسطينية في زمن الكورونا. Majalat Al-Dirasat Al-Filastiniyah, Summer(123), 191–201
Abu Don M (2020, April 9) Blockaded Gaza reports 116 new coronavirus cases. https://cutt.ly/BkbAUFC

Abuamer A (2020, April 10) Hamas rejects Israeli conditions to help Gaza confront coronavirus. Middle East Monitor. https://www.middleeastmonitor.com/20200410-hamas-rejects-israeli-conditions-to-help-gaza-confront-coronavirus/

AJELSA (2020, March 15) لجنة المتابعة الحكومية في غزة تغلق معبر رفح أمام المسافرين وسط المخاوف من فيروس كورونا. عاجل.. https://bit.ly/324m0UB

Alalam (2020a) السنوار يدعو وجهاء غزة لمساندة الجهات المختصة لمواجهة كورونا—قناة العالم الاخبارية. http://tiny.cc/27lnuz

Alalam (2020b) حماس تعلن مواصلة العمل ببناء الف غرفة عزل صحي في غزة—قناة العالم الاخبارية . http://tiny.cc/w6lnuz

Al-Ali N (2020) Covid-19 and feminism in the Global South: Challenges, initiatives and dilemmas. Eur J Women's Stud 27(4):333–347. https://doi.org/10.1177/1350506820943617

AlArabiya (2020, May 1) Hamas coordinates coronavirus trainings for Gaza doctors, nurses in Israel: Reports. Al Arabiya English. https://bit.ly/2DNf4yz

Alfarra J (2021, June 18) Israel's occupation is Gaza's main medical problem, insist professionals. Middle East Monitor. https://www.middleeastmonitor.com/20210618-israels-occupation-is-gazas-main-medical-problem-insist-professionals/

Alijla A (2016) Between inequality and sectarianism: Who destroys generalised trust? The case of Lebanon. Int Soc Sci J 66(219–220):177–195. https://doi.org/10.1111/issj.12122

Alijla A (2020) Trust in Divided Societies: State, Institutions and Governance in Lebanon, Syria and Palestine. Bloomsbury Publishing. https://www.bloomsbury.com/us/trust-in-divided-societies-9781838605322/

Alijla A (2021a) The (Semi) State's Fragility: Hamas, Clannism, and Legitimacy. Soc Sci 10(11):437. https://doi.org/10.3390/socsci10110437

Alijla A (2021b) 'We are in a Battle with the Virus': Hamas, Hezbollah, and covid-19. Middle East Law Governance XX(1):13. https://doi.org/10.1163/18763375-14010001

Alijla A, Al Masri A (2019) New Bottles, Old Wine: The Contemporary Palestinian Political Division. Journal of Islamic and Middle Eastern Multidisciplinary Studies, 6(1), 1–23. https://doi.org/10.17077/2168-538X.1116

ArabCenter (2020, June 18) Coronavirus in Iran and the Question of Legitimacy—Nader Hashemi. https://www.youtube.com/watch?v=mmNEPvk0yDg

BBC (2020, May 11) Coronavirus: Wuhan in first virus cluster since end of lockdown. BBC News. https://www.bbc.com/news/world-asia-china-52613138

Biedscheid, J. (2020). Non-state Actors' COVID-19 Response in Nepal (No. 3342; Independent Study Project (ISP) Collection). ISP. https://digitalcollections.sit.edu/isp_collection/3342

Cammett M (2014) Compassionate Communalism: Welfare and Sectarianism in Lebanon (1st ed.). Cornell University Press

Duque Franco I, Ortiz C, Samper J, Millan G (2020) Mapping repertoires of collective action facing the COVID-19 pandemic in informal settlements in Latin American cities. Environ Urban 32(2):523–546. https://doi.org/10.1177/0956247820944823

Ebikeme C, Gatzweiler F, Oni T, Liu J, Oyuela A, Siri J (2019) Xiamen call for action: Building the brain of the city—Universal Principles of Urban Health. J Urban Health 96(4):507–509. https://doi.org/10.1007/s11524-018-00342-0

Edgell AB, Luhrmann A, Maerz S, Lachapelle J, Sandra G, Alijla A, Vanessa AB (2020) Pandemic Backsliding: During Covid-19 (PanDem). Varieties of Democracy (V-Dem) Institute. www.v-dem.net/en/our-work/research-projects/pandemic-backsliding/

Elisa N (2020) Government legitimacy key factor in coronavirus response: Roundup on presidential campaigns, legitimacy, and coronavirus. Centre For Public Impact (CPI). https://cpi.production.parallax.dev/insights/government-legitimacy-key-factor-coronavirus-response-roundup-presidential-campaigns-legitimacy-coronavirus

Fuchs C (2020) Everyday life and everyday communication in coronavirus capitalism. TripleC: communication, capitalism & critique. Open Access J Global Sustain Inf Soc 18(1): 375–399. https://doi.org/10.31269/triplec.v18i1.1167

Furlan M (2020) Rebel governance at the time of Covid-19: emergencies as opportunities for rebel rulers. Studies Conflict Terrorism 1:24. https://doi.org/10.1080/1057610X.2020.1816681

ISA (2020) Global sociology and the coronavirus. International Sociological Association. https://www.isa-sociology.org//en/publications/isa-digital-worlds/global-sociology-and-the-coronavirus

Levy G (2020) Israel trading in ventilators for helpless Gazans is inhumane—Opinion—Haaretz.com [News Agency]. Haartz. https://www.haaretz.com/opinion/.premium-israel-trading-in-ventilators-for-helpless-gazans-is-inhumane-1.8768709

Lindaman D, Viala-Gaudefroy J (2020) Donald Trump's 'Chinese virus': The politics of naming. The Conversation. http://theconversation.com/donald-trumps-chinese-virus-the-politics-of-naming-136796

Malejacq R (2017) From rebel to quasi-state: governance, diplomacy and legitimacy in the Midst of Afghanistan's Wars (1979–2001). Small Wars Insurgencies 28(4–5):867–886. https://doi.org/10.1080/09592318.2017.1322332

MoH-Gaza (2022) COVID-19 Daily Report. Ministry of Health-Gaza. https://www.moh.gov.ps/portal/coronavirus/

Nicola P (2020) COVID–19 and the Crisis of Social Reproduction in the Middle East and North Africa, 13/07/20, Think Development (WICID) Blog. The Warwick Interdisciplinary Research Centre for International Development. https://bit.ly/2CcpxTG

Noa S, Dekel U (2020, April) The coronavirus in Gaza: Insights from a War Game. INSS. https://www.inss.org.il/publication/coronavirus-and-gaza/

OCHA (2018) Over 700 road obstacles control Palestinian movement within the West Bank. United Nations Office for the Coordination of Humanitarian Affairs - Occupied Palestinian Territory |. https://bit.ly/3A2frOO

PAG (2020, May) COVID-19 and Gaza [Facebook Live Talk]. Palestine Academic Group On COVID-19 and Gaza, Online

PCBS. (2021). الجهاز المركزي للاحصاء الفلسطيني | أوضاع الفلسطينيين في نهاية عام. Palestinian Central Bureau of Statistics. https://www.pcbs.gov.ps/postar.aspx?tabID=512&lang=ar&ItemID=4149&mid=3915&wversion=Staging

PMOH (2020a) COVID-19 Daily Report 12/03 [Government]. Ministry of Health-Gaza. https://bit.ly/3agt5kJ

PMOH (2020b) Daily Report for COVID 19 Virus 3/8/2020b. Ministry of Health-Gaza

PMOH (2022) Daily Report for COVID 19 Virus 22/03/2020. Ministry of Health-Gaza. https://bit.ly/3fBJqBi

Rae M (2020) The challenge of measuring the economic impact of coronavirus. https://doi.org/10.4135/9781529741377

Sadati AK, Lankarani B, Bagheri Lankarani K (2020) Risk society, global vulnerability and fragile resilience; sociological view on the coronavirus outbreak. Shiraz E-Med J https://doi.org/10.5812/semj.102263

Sayigh Y (2011) We serve the people—Hamas Policing in Gaza (1st edn). Crown Center for Middle East Studies

Seaboyer A, Jolicoeur P (2020) The Weaponization of COVID-19: A Comparison Between China and Russia. In COVID-19 and the Future of Global Order (1st ed.). Network for Strategic Analysis (NSA)

Shehab. (2020, May 10). بالفيديو جماهير غفيرة تشيع جثمان القيادي بحماس أحمد الكرد. Shehab News Agency. https://bit.ly/3fD7ML4

Swed O (2021) Implausible sovereigns and their organizational logic: Violent non-state actors' response to COVID-19. Small Wars Insurgencies 32(8):1302–1331. https://doi.org/10.1080/09592318.2021.1956091

Taylor C (2020, May 19) Scientists propose a 50 days on, 30 days off coronavirus lockdown strategy. CNBC. https://www.cnbc.com/2020/05/19/study-proposes-50-days-on-30-days-off-coronavirus-lockdown-strategy.html

Tilly C (2005) Trust and Rule (1st ed.). Cambridge University Press. https://www.cambridge.org/core/books/trust-and-rule/DFDAC1971F4054E6183BE99EB94670FA

UN. (2020, April 28). منظمة الصحة العالمية: غزة لم تبدأ منحنى انتشار فيروس كورونا، لكن الانتشار مسألة وقت.. UN News Agency. https://bit.ly/2DEy81Y
Ward PR (2020) A sociology of the Covid-19 pandemic: a commentary and research agenda for sociologists. J Sociol 56(4):726–735. https://doi.org/10.1177/1440783320939682
Wen J, Aston J, Liu X, Ying T (2020) Effects of misleading media coverage on public health crisis: a case of the 2019 novel coronavirus outbreak in China. Anatolia 31(2):331–336. https://doi.org/10.1080/13032917.2020.1730621
WHO (2020) Health conditions in the occupied Palestinian territory, including east Jerusalem, and in the occupied Syrian Golan [UN report]. World Health Organization
WHO (2022) WHO Coronavirus (COVID-19) Dashboard. World Health Organization. https://covid19.who.int
Winter Y (2016) The Siege of Gaza: spatial violence, humanitarian strategies, and the biopolitics of punishment: The Siege of Gaza: Yves Winter. Constellations 23(2):308–319. https://doi.org/10.1111/1467-8675.12185

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India Coping Strategies, Response and Sustainable Future to COVID-19 in the Capital of India, Delhi

Aakriti Grover and R. B. Singh

Source Jawgmaps/uMap/OpenStreetMaps

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Urban Health and Wellbeing, https://doi.org/10.1007/978-981-19-8163-0_10

1 Introduction

COVID-19 was declared a Public Health Emergency by the World Health Organization (WHO) on 30 January 2020. Due to the high transmission rate, the virus spread across the globe very quickly creating fear and anxiety among people. Most countries advised their people to follow new social norms such as: adequate physical distancing, covering the mouth and nose using face masks, avoiding handshakes and social gathering, following travel restrictions, etc. The COVID-19 pandemic brought unprecedented pressure on health services, from a shortage of testing and medical supplies to lack of supplies in rural areas, and in slums in urban areas (Gatzweiler et al. 2020). The disease has put a spotlight on some of these inequities. India is witnessing an amazing balance between these problems and acts of courage and heroism as our frontline healthcare providers lean in to take care of people across the nation. COVID-19 has presented India with an important opportunity to address these issues. Within a short timespan, India became self-reliant in medical supplies.

Due to the COVID-19 pandemic, nearly 70 countries have halted childhood vaccination programmes, and in many places, health services for cancer screening, family planning, or non-COVID-19 infectious diseases are being neglected. The pandemic is also jeopardising the achievement of climate action initiatives and several other Sustainable Development Goals (SDGs). According to the World Bank, an additional 88–115 million people experienced extreme poverty during 2020 because of COVID-19 (International Science Council 2021).

Health is a complex subject and therefore, urban health action plans must call for expertise from the research community, working across disciplines and expertise (Ebikeme et al. 2019). Health communication and preparedness may be taken as a central theme to control the pandemic, especially at the school level by introducing knowledge about communicable and infectious diseases in the curriculum. As young citizens are the future of the nation, they should be trained to fight back such challenges in the most efficient and effective ways.

2 Introducing the City: Delhi

Delhi (National Capital Territory of Delhi), the capital of India, is located in northern India. It occupies an area of 1,483 km^2 and is bounded by the neighbouring states of Haryana and Uttar Pradesh. For administrative purposes, Delhi is divided into 11 districts namely, North, North-East, North-West, West, South, South-West, South-East, New-Delhi, Central, Shahdara and East. It also enjoys the status of Union Territory of India.

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Delhi accounts for 1.38% of the total country's population and its annual population growth rate (1.92 percent) is very high (Census of India 2011). The United Nations projects the total population of Delhi urban agglomeration is likely to be 22.4 million by 2025, mainly in the urban areas (United Nations 2007). Population density is an indicator of population concentration and resultant pressure on land resources. The average density was 274 persons per km^2 in 1901 but increased to 11,297 by 2011 (Directorate of Economics and Statistics 2014).

3 Timeline of COVID-19 Response in Diverse Geographical Environments

There was faint mention of COVID-19 in print and social media by January 2020, but communication regarding its severity, spread and related information on precautions was limited to some sections of the population. Families with friends and family members in other parts of the world had a more detailed idea of the deadly nature of the pandemic. However, as it spread in China, then Italy and swiftly to other parts of the world, it soon landed in India, on 30 January 2020. The first positive case of COVID-19 in India was a female student from the University of Wuhan. On 2 March 2020, Delhi reported its first case, a person who had travelled from Italy. Four months later, in a grim milestone on 6 July 2020, Delhi became the first city to report over 100,000 cases in the country. On the brighter side, there was a considerable dip in the daily count, positivity ratio and death rate in the city (Financial Express 2020).

In a televised address on 19 March 2020, Prime Minister Narendra Modi urged that from 22 March people should observe a 'Janata Curfew' (7 a.m. to 9 p.m.) to restrain and fight coronavirus. The elaborate message given importance by the Prime Minister encouraged people to prepare for the days ahead. Modi stressed self-control and appealed to people to practise social distancing. This one-day curfew acted as a preliminary awareness measure. Two days later, on 24 March, Modi addressed the country at 8 p.m. and under the Disaster Management Act 2005 announced a three-week lockdown for the whole country until 14 April. This was to stop the spread of coronavirus that had already claimed nine lives and had infected at least 519 others up until 24 March (30 cases and 1 death in Delhi) (Delhi State Health Bulletin 2020). By 18 January 2021, all 37 states and union territories had reported their first cases of COVID-19.

During the nationwide lockdown, all services and shops were closed except pharmacies, hospitals, banks, grocery shops and other essential services. Educational and research institutions, commercial and private establishments, places of worship, public transport and social, political, sports, entertainment, academic, cultural, religious activities were suspended. Although care had been taken, essential services were not affected, but the sudden news of stringent lockdown led to panic purchasing of essential goods. The police ensured that there was strict implementation of the lockdown rules by arresting people who violated them.

All the public health messages were in Hindi, and were translated while they were being telecasted into local languages by the regional media. Following the announcement, a telephone message was sent in various languages about the precautions that needed to be taken. This helped a large section of the illiterate population of India to understand the basics of coronavirus. Protective measures were given importance with aggressive public awareness campaigns through multiple media channels. Physical distancing, personal hygiene and use of face masks were widely emphasised and practised. At a later stage people were fined Rs. 2,000 for not wearing masks.

The Government of India was quick to recognise the threat of COVID-19 and introduced a series of expeditious steps to contain the transmission. These included: an Advisory by the Ministry of Health and Family Welfare on Social Distancing (Ministry of Health and Family Welfare); closure of all educational establishments (schools, universities, etc.), gyms, museums, cultural and social centres, swimming pools, and theatres; and the promotion of online education.

The effective use of mobile technology was employed by the introduction and implementation of a smartphone application called Aarogya Setu for contact tracing and aiding in quarantine and related containment measures. This mobile application was developed by the National Informatics Centre, Ministry of Electronics and Information Technology to provide information on the spread of infection and identification of clusters. The Delhi Government launched 24×7 authorised helpline numbers and Delhi Corona app to provide COVID-19 pandemic-related information.

Numerous measures were taken by the Delhi government before the implementation of lockdown, such as: setting up dedicated 'flu corners in hospitals, home quarantine of travellers, postponement of exams, closure of cinema halls, public swimming pools, gyms and night clubs, prohibiting the gatherings of over 200 people such as seminars, conferences, and Indian Premier League cricket matches, suspension of the Delhi-Kathmandu bus service to name a few (Akhil 2020). After the lockdown announcement, state borders were sealed and incoming international flights and all public transport were suspended by the Delhi government. All these efforts were rigorously implemented, keeping in mind the limited availability of expensive testing kits. Slowly and steadily testing was expanded and up until the 10 May, 1.6 million tests indicated a 4% positivity in the country (Ministry of Health and Family Welfare 2020).

The lockdown in India was extended until 3 May, then to 17 May and then 31 May 2020. That is, after careful evaluation, lockdown was extended in four stages with conditional relaxations. In April, lockdown areas were classified as "red zone", indicating the presence of infection hotspots, "orange zone" indicating some infection, and "green zone", with no infections and accordingly, relaxations were announced. The revisions on zones and rules were updated from time to time. In the fourth lockdown, red zones were further divided into containment and buffer zones. Local bodies were given the authority to demarcate containment and buffer zones.

On the Government Stringency Index, defined by the Oxford Coronavirus Government Response Tracker (OxCGRT), on 22 March 2020 India had the maximum stringency Index of 100 (University of Oxford 2021). However, it dipped to between 80 and 90 in May, increased to 85 by September and dropped to 68.98 on 8 February

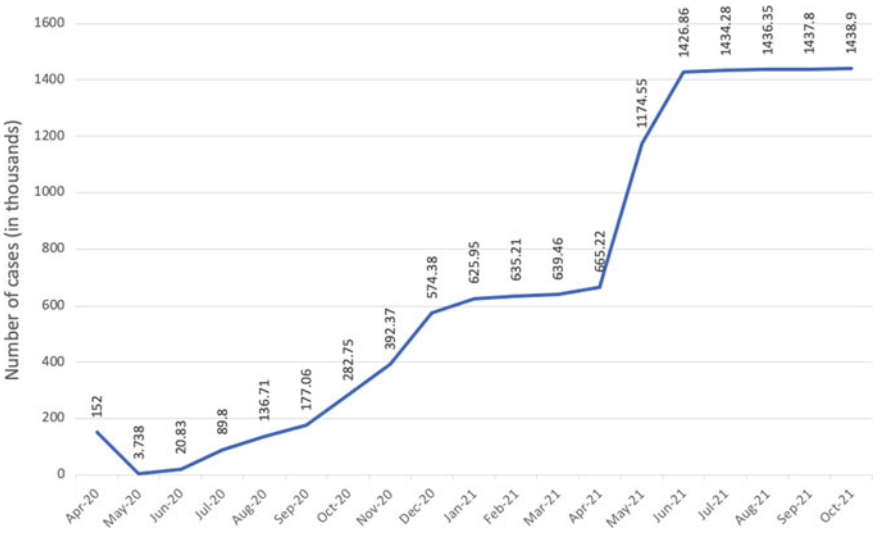

Fig. 1 Cumulative cases of COVID-19 in Delhi (1 April 2020 to 1 October 2021) with date on x-axis and number of cases on y-axis (Compiled from reports by Delhi Government)

2021.[1] From the beginning of June 2020, the response to Covid was better planned—new cases and subsequent deaths or recovery were more closely followed. Under the Ninth Unlock guidelines were issued by the Government whereby swimming pools, cinema halls and educational intuitions were opened. This decision came against the backdrop of falling infection rate and acceleration of recovery rate to 96.91 percent.

From March 2020, there have been massive public information campaigns on the COVID-19 pandemic based on coordinated information. Since 9 April India has been one of the eight countries in the world to require face masks outside the home at all times, a policy which is still in practice. With 0.5 hospital beds per 1,000 and 21 percent of population in extreme poverty, India has a 2% positive test rate with 10.84 million total cases, which have led to a total of 155,080 deaths.

4 Time-Line Of COVID-19 Effects

Since the first positive case of Covid–19 in Delhi on 2 March, dedicated testing and monitoring has taken place. Despite stringent lockdown and precautions the number of cases has fluctuated but reached over 1.43 million on 1 October 2021 (Fig. 1). The Cumulative Positivity Rate of 5.19% and the Case Fatality Rate of 1.74% was noted after the second wave in April-June 2021.

[1] https://covidtracker.bsg.ox.ac.uk/stringency-map.

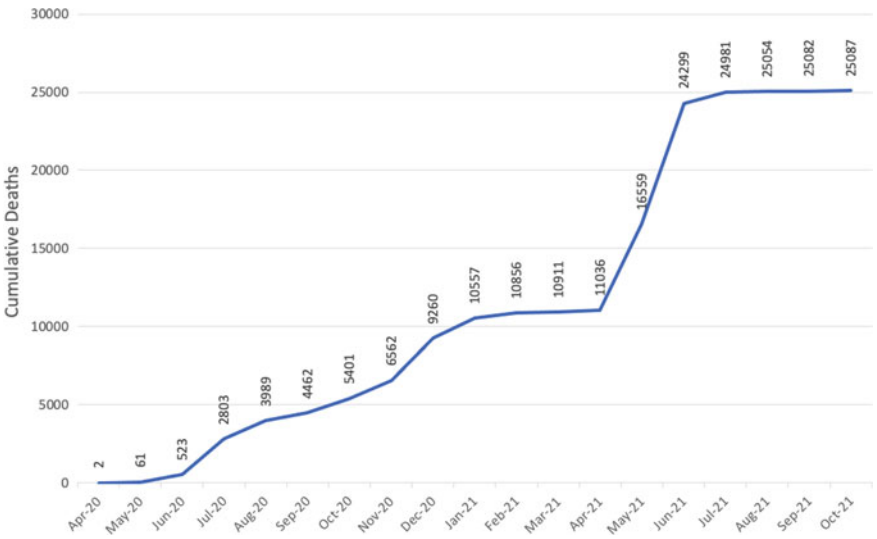

Fig. 2 Cumulative deaths of COVID-19 in Delhi (1 April 2020 to 1 October 2021) with date on x-axis and number of cases on y-axis (Compiled from reports by Delhi Government)

Figure 2 shows that the cumulative deaths also shot up as soon as the first case appeared, to reach 25,087 on 21 October 2021 (Fig. 2). However, a combination of factors including the efforts of the Government has kept the death rate per one million population, much lower compared to other countries of the world.[2] Countries with similar demography and density have found it is nearly impossible to control the mortality rate. Till now, 75,68,51,787 tests have been conducted in India, with 18,54,167 positive cases and 18,25,050 recoveries (98.43 Discharge Ratio) in Delhi alone.[3]

A serological survey, which checks the prevalence of a disease in a population, by detecting the presence of specific antibodies against the virus is performed to diagnose infections and autoimmune illnesses. It can also be conducted to check if a person has developed immunity to certain diseases. Recently the findings of blood sample tests through the third Nationwide Sero survey were released. At the national level, more than 28,500 people from 70 districts were surveyed. The survey showed evidence of past exposure to COVID-19 of 21.4% among the adult population, 31.7% in urban slums (that is the highest) while exposure was 26.2% in urban non-slum areas and 19.1% in rural areas. Seroprevalence was 25.3 percent for 10–17 years, 19.9 percent among 18–44 years old and around 23.4% among surveyed people belonging to 45–60 and 60+ years. Gender-wise results reflected 22.7% for females as compared to 20.3 percent among males. Considering India's population at 1.36 billion and excluding children below 10 years of age, the 21.6 percent prevalence translates into

[2] (https://www.worldometers.info/coronavirus/).

[3] (https://www.mygov.in/covid-19).

nearly 25 crore (10 m in the international system) Indians suggesting that one out of every five Indians may have been exposed to the Coronavirus (Ray 2021; Financial Express 2021).

The National Centre for Disease Control (NCDC) conducted the first survey in Delhi earlier in June 2020 while the fifth round was conducted in February 2021. In comparison to the nationwide results, the Delhi survey showed that more than 56% of Delhi's population had been exposed to the virus suggesting half of the city's population had been infected but developed antibodies and recovered. This may indicate that the city is moving towards achieving herd immunity, even though a lot of asymptomatic infections have occurred. South-East Delhi had the highest seroprevalence rate (62.2%) while North Delhi had the lowest (49.1%) rate among the total 11 districts.

However, the virus is still around us and the dip in cases accompanied with higher recovery rates plus vaccination drive does not guarantee or ensure a safe future. The nature of the virus is highly volatile and the new strains of virus recently identified are again raising alarms. Delhi's COVID-19 tally reached 18,54,167 cases and 26,091 deaths with 3,026 active cases (February 18, 2022). The cumulative recovery rate continues to hover slightly above the 98 percent mark with overall recoveries to be 18,25,050 (Hindustan Times 2021; Government of India 2022; https://www.mygov.in/covid-19).

5 Consequences and Unprecedented Tragedies

The hard times of lockdown brought many sections of the society under severe distress. There were sudden lifestyle changes, closure of businesses, loss of jobs (both formal and informal) and overtime for frontline workers. With wide diversity and inequalities, India faced multiple challenges, not only due to the pandemic, but also due to the seemingly vicious cycle of suffering that seems unlikely to end in the near future.

With wide rural–urban discrepancies, India is already suffering from the triple burden of diseases. While the health infrastructure of the most developed countries of the world failed to combat the pandemic effectively, it was nearly impossible for India to sail through the situation smoothly. The sudden surges were harsh and the limitations in the health sector have been highlighted. India spends nearly 1.3% of its GDP on the health sector, which is a dismal amount compared to the magnitude of challenges and urgency of action, especially in the 68% of rural areas. To help to address the health challenges, the private sector is a key service provider, around a $32 billion industry, accounting for 70 percent of beds, 80 percent of ventilators, and yet initially it was only looking after 10 percent of the entire COVID caseload (Khandelwal 2020). The public sector hospitals, doctors and nurses were burdened with provision of basic COVID care, in addition to the existing load of non-COVID care. Primary health-care largely caters to the rural areas, having meagre relevance in urban India where the bulk of COVID-19 cases were identified.

The health care personnel too faced challenges, apart from being over-burdened with patients. Seshadri and Geetha (2020) in their detailed analysis from January to April found 49 incidents of violence to doctors all over India. The incidents included: verbal, physical, psychological, social and sexual violence; the majority were verbal (60%) cases followed by physical (50%) violence. Lyengar et al. (2020) recorded that the exact number of cases cannot be determined, however, some glaring examples can be cited. On 8 April 2020, two trainee doctors in New Delhi were allegedly assaulted by a neighbour who accused them of spreading the disease. Violence against doctors exacerbated during the lockdown due to inaccessible healthcare, fear of quarantine and restrictions, frustration, and stress (Kapoor 2017). These cases included not only verbal abuse, but serious reports of manhandling and even abduction and murder. Staff were also stigmatised for contracting the virus and categorised as 'untouchables'.

Violence against women also increased significantly especially from March to May 2020. There were a total of 1,477 complaints, which are merely the tip of the iceberg as many cases are not even reported (Radhakrishnan et al. 2020). There was a steep rise of around 94 percent in domestic violence reported from 23 March 2020 to 16 April 2020 by the National Commission of Women (The Economic Times 2020a) and many other agencies across the country. These levels of domestic violence expose the fact that the vulnerable section of the society was being further deprived of honest and dignified life. Being stuck in their house, with no possibility of venturing out for help or safety net, both women and children faced discrimination and violence beyond imagination. In Delhi too, 2,446 women calls were received from emergency helplines till April, mainly accounting for abuse and domestic violence (Ratnam 2020).

Even the helpline on violence against children received twice the numbers of calls received on average days (Nigam 2020). The Vikas Puthran of Childline India Foundation (CIF) reported between 20 and 31 March, there was a 50 percent increase in the number of calls to 3,00,000 as compared to 2,00,000 (Buckshee 2020). Self-quarantine combined with online education identified the children close to abusers. Since all the educational institutes equipped themselves with online teaching soon after the lockdown was imposed, it caused rural urban divide in access to quality education. Cases of suicides due to unavailability of laptop/smartphone were also reported in India. The street children working as rag pickers or selling knick-knacks on roadsides are already under-privileged faced with acute hunger and poverty. According to one estimate, Delhi has more than 70,000 street children and the number may be much higher (Shrangi 2019; Unni 2020). Similarly, children of migrant labourers encountered a mountain of unforeseen problems of hunger and illnesses. Although relief and transit camps did provide food, shelter and water, the plight of the children worsened due to various external factors.

Loss of livelihood was the most obvious consequence of the lockdown. All commercial, industrial and agricultural activities came to a standstill pushing poor people further to the margins and even the middle class to hand-to-mouth level. Worst hit were the self-employed, small businesses, migrant labourers, people on daily wage and unskilled employees. According to trade union reports, 60,000–70,000 people left the state of Gujarat for their home state, neighbouring Rajasthan, within days

after the lockdown order (Khanna 2020; Sharma and Khanna 2020). According to estimates by Research and Information System for Developing Countries and based on NSSO data, 4–6 million people are waiting to return to Uttar Pradesh, 1.8–2.8 million to Bihar, 700,000–1 million to Rajasthan and 600,000–900,000 to Madhya Pradesh (Singh and Magazine 2020; Sengupta and Jha 2020). India's lockdown order led to a jump in the unemployment rate from 21% to 26% in mid-April (Centre for Monitoring Indian Economy (CMIE) 2020). The data show that the unemployment rate increased from 7.03% in May 2019 to 23.98% on 2 May 2020 (Centre for Monitoring of Indian Economy 2020).

The pandemic for the first time, brought 'invisible' migrants and the phenomenon of migration to the centre stage of policy concern around social protection (Acharya and Porwal 2020). While migrants have driven the engine of globalisation, they have not reaped great benefits from the process. In the wake of COVID-19, the very factors that made them desirable as a workforce are turning against them. They were also devoid of any compensation or relief from the government. With only four hours notice for the imposition of lockdown, millions of labourers working in various establishments in cities were stuck without any support or safety net. The choice between virus and starvation was clear and sadly, India witnessed large scale reverse migration from cities to parent states, all done by foot for hundreds of kilometres with women, children and infants. Their multi-fold hardship was increased due to loss of shelter, wages, fear of getting infected and anxiety. It is estimated that there are 400 million informal workers in the country, that is 90 percent of the total workforce.

The endless list of consequences cannot ignore mental health issues due to prolonged isolation. Sleeplessness, appetite, anxiety, depression, obsessions, loneliness and boredom, and an increased use of tobacco and alcohol were visible in all sections of the society. People with existing health issues were more vulnerable to mental health illnesses due to non-availability of health services and running out of their drug supply. Stigma, physical violence, discrimination, denial of services and social rejection were popular bi-products of the pandemic mainly faced by frontline workers and COVID-19 patients. A steep increase in suicide cases became a major concern. The distress and depression triggered by nationwide lockdown elicited 'non-coronavirus deaths' of which suicides were the major cause with 338 deaths from March to May. According to the data, 80 people killed themselves due to loneliness and fear of being tested positive for the virus. The suicides are followed by migrants dying in accidents on their way back home (51), deaths associated with withdrawal symptoms (45), and those related to starvation and financial distress (36) (March 19 to May 2, 2020) (The Economic Times 2021). It was reported that by the end of April over 2,600 callers were provided psychiatric counselling by the Institute of Mental Health (Business Insider 2020). Adolescents came under family, economic and educational pressure too. An INSPIRE scholarship recipient from prime college in Delhi committed suicide stating financial issues to arrange laptop to continue online classes during the pandemic. In another incident the Additional Commissioner of Income Tax at Delhi committed suicide over fear of spreading COVID-19 to their family (India Today 2022). COVID-19 not only is a viral infection, but also can be referred to as a global psychological pandemic.

Specific groups that are severely affected but have received less limelight and help are the beggars, persons with special abilities, weekly market vendors, sex labourers, transport workers, waste pickers, home-based workers, day wage delivery boys and cooks, tourist industry people and most importantly women.

6 Unintended Environmental Quality Impacts of the Pandemic

The most notable positive impact of the pandemic was the bouncing back of the environment. Reports and photographs from all over India flooded the social media in the early days of the lockdown earlier (Fig. 3). The most famous were flocks of flamingos in Mumbai and the peacocks in Delhi. Migratory birds were returning to lakes and waterbodies they had abandoned. While people stayed indoors, nature healed and rejuvenated (Yashvardhini 2021). The pollution levels in River Ganga and Yamuna dropped dramatically. The air was so clean that Mt. Kanchenjunga from Siliguri and Mt. Everest from parts of Bihar was visible during this period (The Indian Express 2020).

Since transportation was minimal and industries shut down, the air quality drastically improved. Research based on meteorological, as well as satellite data, confirmed it was the same for all parts of India. Delhi Central Pollution Control Board (CPCB)

Fig. 3 Flamboyance of flamingos at Mumbai (*Source* CBS News (2020) https://www.cbsnews.com/news/flamingos-mumbai-india-coronavirus-lockdown/, April 30, 2020)

reported an air quality index of 78 percent in cities that was 'good' and 'satisfactory' during lockdown as compared to 44 percent cities in the pre-lockdown phase. The air quality assessment results by Mahato et al. (2020) demonstrated that during lockdown air quality had significantly improved. The concentrations of PM10 and PM2.5 reduced most (>50%) in comparison to the pre-lockdown phase. Other pollutants, namely, NO2 and CO levels have also reduced during the lockdown phase. The lockdown not only helped to contain the spread of the virus, but also reduced environmental degradation reflected by the analysis of the environmental quality index by Ghosh and colleagues (2020). The study found that overall environmental quality had improved compared to the same months in the previous year, although according to the general trend of environmental quality degradation, the year 2020 was expected to face the worst environmental conditions than in the year 2019.

The water quality of major rivers improved in response to: minimal industrial effluent discharges; no human activities involving disposal of worshipped puja materials and garbage; no anthropogenic activities such as outdoor bathing; washing of clothes; vehicle washing and cattle washing; and no pilgrimage activities taking place during the lockdown phase (CPCB report).

7 COVID-19 and Civil Society's Response, Welfare Schemes and Stories Of Inspiration

However, the aftermath of the lockdown was so significant that government agencies alone could not cope. Civil society, NGOs and other associations came forward to selflessly extend much needed care, resources and emotional support. Motivated volunteers came together to generate awareness about "dos and don'ts" to contain the spread of virus, spread motivational and inspirational messages, serve food and water to the needy, distribute protection kits and volunteer in hospitals and quarantine centres.

Most interesting to note is the changing nature of the NGOs. They employed innovative ways to reach out to people to cater to their needs, for instance, the Green Dream Foundation, along with a few Indian Institute of Technology (IIT) graduates started COVID SOS, a platform to help senior citizens/physically challenged individuals through volunteers within walking distance. They are using a GPS-based technology to find and assign the most suitable volunteer within minutes. The aim was to generate awareness and support the emergency services (ET Government 2020).

HelpAge India helped to create awareness by providing outreach and assistance to the elders in both rural and urban areas through their 160 mobile healthcare units and helpline services. They drove to the interior of the country to disseminate knowledge about the "dos and don'ts" related to the Covid 19. The HelpAge teams distributed meals, survival kits (rice, wheat, spices, cooking oil etc. along with Corona protective gear like masks, bathing and washing soaps), protective hygiene kits (sanitisers,

masks, tissues, handwash etc.) and medicines to disadvantaged elders, the homeless, migrant workers and poor people living in urban slums & villages (HelpAge India 2020). The efforts by Red Cross volunteers were also much appreciated. Relief material consisting of over 1,00,000 face masks, 4,000 surgical gloves, body bags, 100 PPE kits, 2,400 bottles of hand sanitisers was distributed across the country (International Committee of the Red Cross 2020). The Gurdwara Bangla Sahib, a well known Sikh shrine in the capital city of Delhi, provided langar seva (free community feast) selflessly all through the period along with free ambulance service and medicines at subsidised rates. The community kitchen in the Gurudwara served people relentlessly regardless of caste, class, religion, gender, social or economic status or political consideration. The Delhi Sikh Gurdwara Management Committee (DSGMC) through its network of Gurdwaras in the capital, including Gurdwara Bangla Sahib, fed over 1.5 million people during the lockdown (Ahuja 2020). The Economic Times reported that Gurudwara Bangla Sahib was serving 40,000 meals a day (Economic Times 2020).

There have been numerous incidents of individuals rising to help elders by arranging items of daily needs, sanitisation and meals. An exemplary example was set by the First Lady Smt. Savita Kovind as she stitched face-masks at Shakti Haat in the President's Estate for distribution at the Delhi Urban Shelter Improvement Board.

8 Welfare Schemes Undertaken by Delhi State Government

As the pandemic persisted, the Delhi Government announced many innovative and genuine welfare schemes, such as giving compensation to the family of deceased doctors and construction workers. The Government launched the Delhi Corona mobile app to fill in the real-time information gap on the availability of beds and ventilators at both government and private hospitals designated for COVID-19 treatment. The app also provided information on COVID-19 cases and the number of tests conducted, government orders, containment zones, COVID-19 Health Services, and services during lockdown like finding a hunger relief centre or finding a shelter or to apply for rations etc. It also provides a platform to donate to the Chief Minister/ Lt. Governor relief Fund and circulated 24×7 helpline and WhatsApp numbers.

The Government of Delhi disbursed around $4,00,000 to 488 construction workers under various welfare schemes. Free meals were distributed at the Night shelters and Hunger relief centres. The government also pledged to provide financial assistance to drivers of autos, taxis, and e-rickshaws. Additionally, compensation of one crore (10 million) rupees was given to the family members of the employees who died due to COVID-19 was also announced.

Managing health services during the pandemic became a larger challenge. First and foremost, additional human power for sanitation, security and nursing was arranged, quarantine centres were identified, helpline numbers set up and Corona Foot Warriors and Containment Teams were created.

The Government paid attention to monitoring fake news in both print and electronic media and social media platforms. In April, the Government presented the '5 T's model' of response which refers to testing, tracing, treatment, teamwork, and tracking COVID-19 cases (Business Standard 2020). They also made announcements to suspend labourers' rents, launched 11 hunger helpline numbers and distributed free rations of food grains (DVARA Research 2020).

Generating public awareness was one of the top priorities of the Government. District and sub-divisional magistrates were given the responsibility to sensitise the public with the help of schoolteachers, police, metro employees, airport authority, railways, Delhi Disaster Management Agency and government hospitals. According to official records, the Government provided over 60,000 free pulse oximeters to asymptomatic and mild symptom corona patients undergoing home isolation in the city (last updated—September 2020) (The Economic Times 2020b). This device measures blood oxygen levels and if the oxygen level reaches 90% or below, the patient is hospitalised.

9 Vaccine-Related Information

The COVID vaccine was launched in India on 16 January 2021 and the healthcare and frontline workers were the first to be vaccinated. Following them were persons over 50 years of age and persons under 50 years with comorbid conditions (Ministry of Health and Family Welfare 2021). On the first day 3,352 sessions were held with 1,91,181 beneficiaries vaccinated. Two types of COVID-19 vaccines were supplied for the vaccination drive—Covishield vaccine (made by Serum Institute of India Ltd.) and Covaxin vaccine (made by Bharat Biotech International Ltd). India also supplied vaccine to Bangladesh, Myanmar, Nepal, Bhutan, the Maldives, Mauritius, Seychelles, Sri Lanka, Bahrain, Oman, Afghanistan, Barbados and the Dominican Republic as gifts (NDTV, 2021).

The second phase of vaccination commenced on 1 March 2021. More than 5 million people have been inoculated with the vaccine doses since 16 January—21 days as compared to 24 days in the US, 43 days in the UK and 45 days in Israel (Live mint 2021). In Delhi, more than 32 thousand beneficiaries have received the vaccine since 23 February (Business Standard 2021). On 1 March, Prime Minister Hon. Shri. Narendra Modi got vaccinated with the indigenous Covid vaccine. Setting an example as the national leader was a remarkable step in removing vaccine hesitancy and inspiring people to follow his example to overcome the challenges posed by the pandemic.

10 Concluding Remarks

This chapter comprehensively analyses the spatial pattern and trends of the spread of COVID-19 in the capital city of Delhi in India. It outlines the impacts as well as the steps taken by the government, NGOs and civil society. The Prime Minister addressed citizens about the curfew and taking precautions. All institutions were closed ensuring the rules of curfew and lockdown to be followed. The Governments of India and Delhi made apps, the Argya Setu and the Delhi Corona app, respectively. These applications provided information regarding COVID-19. Furthermore, NGOs, civil society and some associations came forward to aid the citizens during the time of pandemic.

The crisis posed by the pandemic is equivalent to any war and to fight this war, India must increase the share of investment in the health sector, particularly public health. The unexpected spikes were unpleasant, highlighting the health-care sector's shortcomings outlined above. Under different welfare schemes, the Delhi government distributed roughly $4,00,000 to 488 construction workers. Preparedness and health communication are the irreplaceable ultimate key. The current crises are a result of the prevalence of informal work, poverty, poor living conditions and widespread illiteracy. One of the government's major concerns was raising public awareness. With the support of teachers, police, metro staff, the airport authority, railroads, the Delhi Disaster Management Agency, and government hospitals, district and sub-divisional magistrates were tasked with educating the public.

The pandemic caused by the coronavirus disease is the gravest health emergency of our times, and is disrupting social, economic and political systems and lives worldwide. Despite a relief package amounting to US$22.6 billion for the poor, along with other efforts, the situation seems grim and hence community participation needs to be encouraged to supplement the efforts of the Government. Widespread pandemics like this cannot be managed by applying one approach. Integrated knowledge of environmental, social, and economic factors must be applied to effectively address complex urban and planetary health issues.

References

Acharya R, Porwal A (2020) A vulnerability index for the management of and response to the COVID-19 epidemic in India: an ecological study. The Lancet Glob Health 8(9):e1142–e1151. https://doi.org/10.1016/S2214-109X(20)30300-4

Ahuja A (2020) The Sikh community keeps doing what it does right, serves the people selflessly even during the coronavirus pandemic, NDTV. Accessed on 25 Feb 2020

Akhil NR (2020) Delhi government's response to COVID-19 (till April 23, 2020). https://prsindia.org/theprsblog

Buckshee D (2020) Child abuse, pornography on the rise in India's COVID-19 lockdown? https://fit.thequint.com/coronavirus/is-child-abuse-on-the-rise-in-indias-COVID-19-lockdown. Accessed on 25 Feb 2021

Business Insider (2020) COVID-19 triggering panic attacks, depression and suicides, say experts. https://www.businessinsider.in/india/news/covid-19-triggering-panic-attacks-depression-and-suicides-say-experts/articleshow/76656305.cms

Business Standard (2020) 100,000 random tests, '5 Ts': Kejriwal's plan to check coronavirus in Delhi. https://www.business-standard.com/article/current-affairs/100-000-random-tests-5-ts-kejriwal-s-plan-to-check-coronavirus-in-delhi-120040700820_1.html. Accessed on 28 Feb 2021

Business Standard (2021) COVID-19: over 20K beneficiaries vaccinated on Tue in Delhi; total 320,000. https://www.business-standard.com/article/current-affairs/COVID-19-over-20k-beneficiaries-vaccinated-on-tue-in-delhi-total-320-000-121022301494_1.html. Accessed on 26 Feb 2021

CBS News (2020) More than 150,000 flamingos have flocked to Mumbai during India's coronavirus lockdown—and now they're painting the waters pink. https://www.cbsnews.com/news/flamingos-mumbai-india-coronavirus-lockdown/. Accessed on 20 Feb 2021

Census of India (2011) Provisional population totals, NCT of Delhi, Ministry of Home Affairs, Government of India, New Delhi, India

Centre for Monitoring of Indian Economy (CMIE) (2020) Unemployment rate in India. https://unemploymentinindia.cmie.com/. Accessed on 28 Feb 2021

Directorate General of Health Services (2020) Delhi state health bulletin for containment of COVID-19. https://delhifightscorona.in/wp-content/themes/gocoronago/health-bulletin-pdfs/03-24.pdf. Accessed on 26 Feb 2021

Directorate of Economics and Statistics (2014) Statistical abstract of Delhi, Government of NCT of Delhi, 1–190.

Dvara Research (2020) Interventions of states in response to COVID-19 outbreak. https://www.dvara.com/research/resources/notes/interventions-of-states-in-response-to-COVID-19-outbreak/. Accessed on 27 Feb 2021

Ebikeme C, Gatzweiler F, Oni T, Liu J, Oyuela A, Siri J. (2019) Xiamen call for action: building the brain of the city—universal principles of urban health. J of Urban Health 96(4):507–509. Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s11524-018-00342-0

ET Government (2020) Civil society: the third pillar of strength in fight against coronavirus. https://government.economictimes.indiatimes.com/news/governance/civil-society-the-third-pillar-of-strength-in-fight-against-coronavirus/75642349

Financial Express (2020) Delhi becomes first city with over 1 lakh COVID-19 cases in India, daily case count sees sharp drop. https://www.financialexpress.com/lifestyle/health/delhi-coronavirus-tally-latest-update-COVID-19-cases-in-delhi-death-toll-arvind-kejriwal-positivity-recovery-rate-latest-news/2015345/ Accessed on 25 Feb 2021

Financial Express (2021) No, coronavirus transmission hasn't slowed down! Why ICMR is worried over latest sero survey findings. https://www.financialexpress.com/lifestyle/health/no-coronavirus-transmission-hasnt-slowed-down-why-icmr-is-worried-over-latest-sero-survey-findings/2188560/. Accessed on 25 Feb 2021

Gatzweiler F, Fu B, Rozenblat C, Su HJJ, Luginaah I, Corburn J, Boufford JI, Vela Valdes J, Nguendo-Yongsi B, Howden-Chapman P, Singh RB, Cooper R, Oni T, Zhu YG (2020) COVID-19 reveals the systemic nature of urban health globally. Cities & Health 1–5. https://doi.org/10.1080/23748834.2020.1763761

Ghosh S, Das A, Hembram TK, Saha S, Pradhan B, Alamri AM (2020) Impact of COVID-19 induced lockdown on environmental quality in four Indian megacities using Landsat 8 OLI and TIRS-Derived Data and Mamdani Fuzzy Logic Modelling Approach. Sustainability 12(13):5464. https://doi.org/10.3390/su12135464

Government of India. (2022) #IndiaFightsCorona COVID-19. https://www.mygov.in/covid-19. Accessed on 21 Feb 2022

HelpAge India (2020) COVID-19 emergency response: situation on ground. https://www.helpageindia.org/COVID-19-emergency-response/. Accessed on 28 Feb 2021

Hindustan Times (2020) Delhi government joins hands with civil society groups in fight against COVID-19. https://www.hindustantimes.com/cities/delhi-government-joins-hands-with-civil-society-groups-in-fight-against-COVID-19/story-l6O7N70N0tpZHravy9NSnK.html. Accessed on 25 Feb 2021

Hindustan Times (2021) Delhi reports 145 new COVID-19 cases, 2 deaths; recovery rate hovers around 98%. https://www.hindustantimes.com/cities/delhi-news/delhi-reports-145-new-COVID-19-cases-2-deaths-recovery-rate-hovers-around-98-101614089091036.html. Accessed on 28 Feb 2021

ICRC (2020) Red Cross volunteers applauded for role in COVID-19 response. https://blogs.icrc.org/new-delhi/2020/05/09/red-cross-volunteers-applauded-for-role-in-COVID-19-response/. Accessed on 26 Feb 2021

India Today (2022) Delhi logs 24,383 new Covid cases; positivity rate exceeds 30%. https://www.indiatoday.in/coronavirus-outbreak/story/covid-corona-cases-deaths-positivity-rate-delhi-latest-1900222-2022-01-14. Accessed on 21 Feb 2022

International Science Council (2021) The ISC-IIASA Synthesis Report, Newsletter 16 February

Kapoor MC (2017) Violence against the medical profession. J of Anaesthesiology Clin Pharmacology 33(2):145–147. Medknow Publications. https://doi.org/10.4103/joacp.JOACP_102_17.

Khandelwal S (2020) Debating the process, impact, and handling of social and health determinants of the COVID-19 pandemic. Indian J of Soc Psychiatry 36(5):64. https://doi.org/10.4103/ijsp.ijsp_226_20.

Khanna P (2020) Delhi decoded: impact of COVID-19 on social sector. https://www.livemint.com/news/india/delhi-decoded-impact-of-COVID-19-on-social-sector-11604559028956.html. Accessed on 27 Feb 2021

Live mint (2021) 21 days into covid vaccination drive, India inoculates 5 million beneficiaries. https://www.livemint.com/news/india/21-days-into-covid-vaccination-drive-india-inoculates-5-million-beneficiaries-11612533039758.html. Accessed on 28 Feb 2021

Lyengar KP, Jain VK, Vaishya R (2020) Current situation with doctors and healthcare workers during COVID-19 pandemic in India. Postgrad Med J. https://doi.org/10.1136/postgradmedj-2020-138496

Mahato S, Pal S, Ghosh KG (2020) Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India. Sci of the Total Environ 730:139086. https://doi.org/10.1016/j.scitotenv.2020.139086

Ministry of Health and Family Welfare (2020) Advisory on social distancing measures in view of spread of COVID-19 disease. https://www.mohfw.gov.in/pdf/SocialDistancingAdvisorybyMOHFW.pdf. Accessed on 27 Feb 2021

Ministry of Health and Family Welfare (2021) Information regarding COVID-19 vaccine. https://www.mohfw.gov.in/covid_vaccination/vaccination/index.html. Accessed on 27 Feb 2021

NDTV (2021) Sent 229 lakh covid vaccine doses to other countries: foreign ministry. https://www.ndtv.com/india-news/sent-229-lakh-covid-vaccine-doses-to-other-countries-foreign-ministry-2369480. Accessed on 1 Mar 2021

Nigam S (2020) COVID-19: India's response to domestic violence needs rethinking. SSRN Electron J. https://doi.org/10.2139/ssrn.3598999.

Radhakrishnan V, Sen S, Singaravelu N (2020) Data: domestic violence complaints at a 10-year high during COVID-19 lockdown. https://www.thehindu.com/data/data-domestic-violence-complaints-at-a-10-year-high-during-COVID-19-lockdown/article31885001.ece. Accessed on 27 Feb 2021

Ratnam D (2020) Domestic violence during COVID-19 lockdown emerges as serious concern. https://www.hindustantimes.com/india-news/domestic-violence-during-COVID-19-lockdown-emerges-as-serious-concern/story-mMRq3NnnFvOehgLOOPpe8J.html. Accessed on 28 Feb 2021

Ray K (2021) Over 21% Indians aged above 10 had the coronavirus, says latest national sero-survey. https://www.deccanherald.com/national/over-21-indians-aged-above-10-had-the-coronavirus-says-latest-national-sero-survey-947452.html. Accessed on 27 Feb 2021

Sengupta S, Jha MK (2020) Social policy, COVID-19 and impoverished migrants: challenges and prospects in locked down India. The International Journal of Community and Social Development 2(2):152–172. https://doi.org/10.1177/2516602620933715
Seshadri L, Geetha M (2020) COVID-19: a "Violent" pandemic for health care workers in India. https://doi.org/10.18231/j.ijirm.2020.023
Sharma S, Khanna S (2020) India's migrant workers face long walk home amid coronavirus lockdown. https://www.reuters.com/article/health-coronavirus-india-migrant-labour-idINKBN21D2N3. Accessed on 26 Feb 2021
Shrangi V (2019) On Delhi's streets, 70,000 children have nowhere to go. https://www.hindustantimes.com/delhi-news/on-delhi-s-streets-70-000-children-have-nowhere-to-go/story-eOS1UqQCztDgqXm4aztVgJ.html. Accessed on 25 Feb 2021
Singh S, Magazine A (2020) Explained: Indian migrants, across India. https://indianexpress.com/article/explained/coronavirus-india-lockdown-migran-workers-mass-exodus-6348834/. Accessed on 28 Feb 2021
The Economic Times (2020a) India witnesses steep rise in crime against women amid lockdown, 587 complaints received: NCW. https://economictimes.indiatimes.com/news/politics-and-nation/india-witnesses-steep-rise-in-crime-against-women-amid-lockdown-587-complaints-received-ncw/articleshow/75201412.cms. Accessed on 28 Feb 2021
The Economic Times (2020b) Delhi Govt provided over 60,000 oximeters to Covid-19 patients in the city: official data. https://health.economictimes.indiatimes.com/news/medical-devices/delhi-govt-provided-over-60000-oximeters-to-covid-19-patients-in-city-official-data/78348162
The Indian Express (2020) Rediscovering sustainable development through a Covid-19 lockdown lens. https://indianexpress.com/article/opinion/web-edits/rediscovering-sustainable-development-through-a-covid-19-lockdown-lens-6399986/. Accessed on 20 Feb 2021
United Nations (2007) World urbanization prospects—the 2007 revision. Department of economic and social affairs, Population division, New York, 2007
University of Oxford (2021) Relationship between number of COVID-19 cases and government response. https://covidtracker.bsg.ox.ac.uk/stringency-map. Accessed on 28 Feb 2021
Unni JC (2020) Social effects of COVID-19 pandemic on children in India. Indian J of Prac Pediatrics 22(2):214. https://doi.org/10.1136/bmj.m1669
Yashvardhini, N. et al (2021) Positive impact of COVID-19 induced lockdown on the environment of India's national capital, Delhi. Spat Inf Res 468

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NEPAL: COVID-19 Response in Biratnagar

Suraj Bhattarai and Suman Kumar Karna

Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction to the City

Biratnagar is located in Province 1 of Nepal (Fig. 1), previously known as the Eastern Development Region. It is the capital city of Morang district. Biratnagar is the second largest city of Nepal, both in area (77.5 km^2) and population (242,548); Kathmandu being the largest. Biratnagar is also the largest business hub of the region.

Biratnagar Metropolitan City has 19 wards (Fig. 2). It is surrounded by the other municipalities of Province 1 in the east, west, and north, and by Indian districts in the south. Biratnagar is 238 km away from Kathmandu (over 375 km driving distance).

There are a total of 47,798 households, with an average household size of 4.57. The male population is slightly higher than female population (sex ratio 104.9). The literacy rate is 80.5%.

2 COVID-19 Response in Biratnagar

The local municipal government took charge of the COVID-19 response, under the direction of the provincial government, which in turn received directions from the central government (Ministry of Health and Population). With the detection of a second case of COVID-19 on 23 March 2020, the government of Nepal declared a nationwide lockdown effective from 24 March (MOHP 2022). Although the government of Nepal loosened the lockdown almost four months later on 21 July, the Biratnagar Metropolitan City Authority encouraged the residents to practise vigilance in

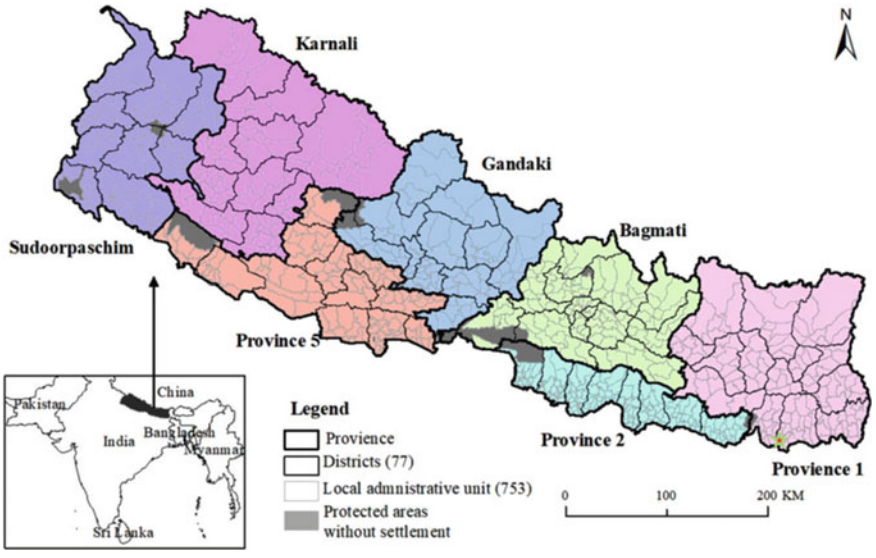

Fig. 1 Map of Nepal showing seven provinces

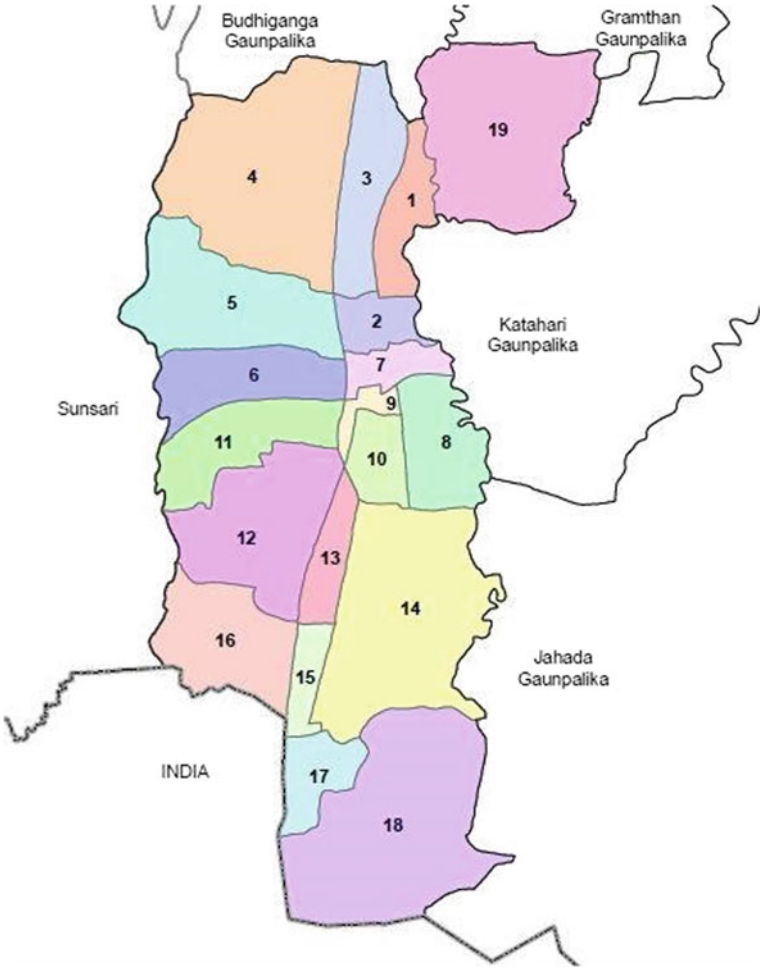

Fig. 2 Biratnagar, showing 19 wards and their bordering areas (*Source* Office of the Municipal Executive at Biratnagar Metropolitan City)

mobility, travel and daily business (Nepali Times 2020). Celebration of national and local festivals and fairs was discouraged and any form of mass gatherings, political events, social events (wedding, worships, funeral) and seminars was restricted.

Initially, the infected cases were mainly those people who returned to Biratnagar from other cities of Nepal, or from neighbouring states of India (Parajuli et al. 2020). But during the winter of 2020 (October to December), the city reported clusters of cases in the community, who did not necessarily have a travel history, or contact with someone who had recently travelled to or from high-risk areas. During the second wave too, the city reported community transmission of COVID-19 cases, and underwent lockdown in May and June 2021. Education institutions were closed

during lockdown and the surge of cases in the city peaked. Most of these institutions utilised virtual and digital platforms throughout these two years to continue teaching learning activities and conduct routine examinations.

3 The City's COVID-19 Initiatives That Align with the Systems Approach

The metropolitan city established a COVID-19 Help Desk at the Nepal–India border points (e.g. at Rani Point of Entry) and other key hub areas where there was high movement of people through industrial corridors, bus parks, city centres and shopping malls. Those areas were routinely disinfected, and hand-washing stations and public toilets were set up. Additionally, holding centres were set up at several border points and 'participatory mobility mapping' was launched with the support of the International Organisation of Migration (IOM), where public health professionals and local volunteers mapped the mobility of people. These mobility maps were used to plan targeted pandemic response measures (IOM Nepal 2020).

In coordination with the District COVID-19 Crisis Management Committee, respiratory specimen (swab) collection booths were set up in the border points and selected hub areas. Initially, the specimens had to be transported to Kathmandu for SARS-CoV-2 testing at the National Public Health Laboratory—the only laboratory with the capacity to perform COVID-19 reverse transcriptase polymerase chain reaction tests (RT-PCR). On 19 April 2020, Koshi Hospital (a tertiary level provincial hospital) became capable of performing RT-PCR tests, and subsequently at least five RT-PCR laboratories were added in the province, which made it easier and quicker to perform tests and obtain results. Most of the new labs were set up outside the main hospital building, or housed in rented or temporary buildings, to prevent viral spreading. In addition to PCR tests, the city utilised rapid antibody testing kits (RATs) to screen people crossing the border and trace people who were in contact with infected individuals.

During the first and second waves of the pandemic in 2020 and 2021 respectively, the city designated all 21 public health facilities, with a total capacity of 356 beds, for COVID and non-COVID services; these included one tertiary hospital, one primary health care centre and 19 health posts (IOM Nepal 2020). Non-public health facilities were also converted to COVID-19 wards, for example, Biratnagar Eye Hospital, Biratnagar Hospital, Golden Hospital, Neuro Hospital, and Nobel Medical College and Teaching Hospital. Additionally, new quarantine and isolation centres were set up that provided basic facilities to suspected and confirmed COVID-19 cases. Free ambulance services were arranged to transport affected individuals between home and quarantine/isolation facilities. A few select hospitals arranged telemedicine consultation services for infected individuals staying in home isolation and for patients with non-COVID illnesses.

Similarly, health facilities in the city successfully deployed 272 highly skilled health workers during the pandemic to cater to the health needs of both COVID and non-COVID patients. The health workforce included 67 doctors, 77 nurses, 81 auxiliary nursing midwives and 47 auxiliary health workers. As an initiative to motivate and retain the health and allied workforce, the metropolitan city coordinated with the federal government to provide health insurance benefits and risk allowances to all frontline medical professionals, sanitation workers, and government service staff.

Some physicians working in Biratnagar proactively provided distant psychological first aid to individuals at quarantine and isolation centres. Physicians also contributed to the publication of a pocketbook targeted to frontline clinicians, 'Clinical management of COVID-19 disease in healthcare setting', and contributed to the drafting of ad hoc guidelines on healthcare waste management, environmental sanitation, disinfection, and management of infected individuals in isolation.

The city's response in terms of risk communication and community engagement for the containment of COVID-19 was also noteworthy. When the number of cases was going up, the city arranged for megaphones and the distribution of pamphlets in public places. Around 200 school teachers were mobilised to deliver awareness messages in vulnerable, marginalised and underprivileged communities. Additionally, COVID-19 awareness messages were aired through local radios and television channels. The Ministry of Social Development did daily media briefings with information on daily cases and recovery rate, bed occupancy, and government's response measures. Information about COVID-19 related myths and truths was shared with the public through the ministry's website.

Several national and international non-governmental organisations, development agencies, civil society organisations and business enterprises provided technical and non-technical support throughout the pandemic period. From an economic perspective, the government of Nepal announced financial support to private sector employers and workers all over the country that were registered with and contributing to the national social security programme (ILO 2021).

4 System Challenges

Despite all these initiatives, the city faced several health system challenges while responding to the pandemic. There was no proper guidance to health facilities regarding the mixing or segregation of COVID-19 and non-COVID-19 patients. Many health facilities lacked standard critical care equipment, such as adequate ventilator beds or negative pressure rooms, and suffered from a deficit of qualified staff (Bhattarai et al. 2020). Availability of oxygen to the sick patients was one of the major challenges, especially during the second wave (Bhattarai et al. 2021). Occupational safety and health of all health care workers was largely ignored.

Health equity was another concern, as many people had to buy health services with heavy out-of-pocket expenditures during the crisis. Low-income families, unemployed individuals, and informal sector workers became the victim of weak health systems. There was a huge gap between public and private service providers, in terms of costs and quality of care, which affected health care for many COVID-19 and non-COVID-19 patients. Moreover, research was less prioritised by the stakeholders of pandemic management. Digitalisation of health services systems had been a long-standing issue; the city did not have a proper surveillance and reporting mechanism for COVID-19 and other infectious diseases.

5 Current state of COVID-19 in Biratnagar

Approximately 7% of the city's population has already been infected with COVID-19 (Biratnagar Metropolitan City 2022). By 13 January 2022, the total number of laboratory- confirmed COVID-19 cases was 16,453 (which is 1.7% of the total national case burden i.e. 942,522 cases as shown in Fig. 3A), with 387 active cases (MOHP 2022). By this date, COVID-19 had taken the lives of 198 individuals in the city (Fig. 3B), which is again 1.7% of total 11,610 deaths that occurred in the whole country. Altogether, 10,022 RT-PCR tests and 2,189 rapid antigen tests have been performed in Biratnagar.

All public and private hospitals in Biratnagar have become capable of efficiently managing mild to severe COVID-19 cases, and there is no scarcity of isolation, oxygen, or critical care beds (Biratnagar Metropolitan City 2022). Small to large-scale businesses in Biratnagar are operational, with most workers able to resume their work and support their livelihoods. However, disparities between formal and informal sector workers, in terms of access to health services and support provided by the local government, remain.

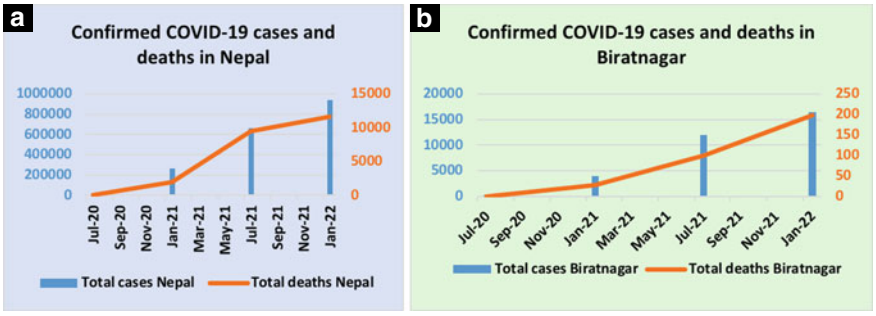

Fig. 3 Confirmed COVID-19 cases and deaths in Nepal and Biratnagar Metropolitan City (Jul 2020–Jan 2022)

6 Conclusion

Learning from this pandemic, we can say that formal collaborative studies are required to identify the determinants of COVID-19 burden and to understand the association between vulnerable areas and populations and the magnitude of COVID-19 impact in the city. Furthermore, health disparities and inequalities in the city can be minimised at the society level, only if the pandemic preparedness and response plans are improved at the city, provincial and national levels, taking a systems governance approach (Ebikeme et al. 2019). Therefore, as the first step, the city should map the major disciplines or sectors as well as the key stakeholders of health emergency preparedness and response at the local level. Then, as the next step, the city should facilitate intersectoral and interdisciplinary communication, coordination and engagement across all levels of government during all phases of the project cycle, which include planning, decision-making, and implementation.

References

Bhattarai S, Dhungana J, Ensor T, Shrestha UB (2020) Assessment of service availability and infection prevention measures in hospitals of Nepal during the transition phase of COVID-19 case surge. medRxiv 2020.05.13.20097675. https://doi.org/10.1101/2020.05.13.20097675

Bhattarai S, Neopane A, Shrestha B, Stewart BT, Mock C (2021) Availability of oxygen and other essential medical products in COVID-19 treatment facilities of Nepal. Asia Pac J Public Health. https://doi.org/10.1177/10105395211053924

Biratnagar Metropolitan City, Office of the Municipal Executive. Available from: https://www.biratnagarmun.gov.np/en. Accessed 14 Jan 2022

Ebikeme C, Gatzweiler F, Oni T et al (2019) Xiamen call for action: building the brain of the city—universal principles of urban health. J Urban Health 96:507–509. https://doi.org/10.1007/s11524-018-00342-0

International Labor Organization (ILO) (2021) Social protection responses to COVID-19 in Nepal. Available from: https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-kathmandu/documents/publication/wcms_809272.pdf

International Organization for Migration (IOM Nepal) (2020) Population mobility and public health risk mapping. Available from: https://reliefweb.int/report/nepal/population-mobility-and-public-health-risk-mapping-covid-19-preparedness-and-response-5

Ministry of Health and Population, Government of Nepal. COVID-19 updates. Available from: https://covid19.mohp.gov.np/. Accessed 14 Jan 2022

Nepali Times (2020, July 21) Nepal ends COVID-19 lockdown. Available from: https://www.nepalitimes.com/latest/nepal-ends-covid-19-lockdown/

Parajuli KS, Banstola A, Parajuli RR (2020, September 5) Assessment of COVID-19 pandemic in Nepal: a lockdown scenario analysis. medRxiv: 2020.09.03.20187807. https://doi.org/10.1101/2020.09.03.20187807

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NEW ZEALAND: Aotearoa New Zealand Cities Under Covid-19—A Systems Perspective

Philippa Howden-Chapman and Libby Grant

Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

Aotearoa New Zealand (NZ) is a cluster of three islands in the South Pacific temperate climate zone. At the 2018 Census, NZ had a population of five million, predominantly European, with 16.7% indigenous Māori, 8.3% Pasifika peoples, 15.7% Asian people and 1.6% of people from other countries. More than a quarter of the NZ population was born overseas and another one million people, who have citizenship or residency, live overseas. These demographic, ethnic and residency characteristics have created pressure points in the response to the COVID-19 pandemic.

NZ was first settled by Polynesian seafarers in the thirteenth century. The first European explorers arrived in the seventeenth century and in 1840 the British Crown and indigenous Māori chiefs signed Te Tiriti o Waitangi/the Treaty of Waitangi. The Treaty promised Māori sovereignty over their lands and other assets and the same rights as British citizens, but shortly afterwards multitudes of British settlers arrived, attracted by promises of fertile and abundant land made by the colonial government and the New Zealand Company. These earlier settlers were from a variety of social backgrounds, but many were escaping the dire effects of industrialisation, the Irish famine and the Scottish clearances. The British Government's de facto support of the New Zealand Company and expropriation of land led to land wars in the 1860s. Those tribes who opposed the sale and theft of land suffered raupatu, the loss of most of their ancestral lands. Despite Māori being included in the Liberal welfare state at the beginning of the twentieth century and the 1935 Labour welfare state, the loss of ancestral land and assets has had major detrimental intergenerational effects.

After WWII, many Māori who lived in rural areas migrated to the cities and became part of the 87% urban population. Consequently, Māori have experienced one of the most rapid recorded demographic transitions in family size. However, Māori and Pacific populations have lower levels of home ownership, higher levels of intergenerational households and suffer household crowding (Howden-Chapman 2021). As household crowding is the key housing risk factor for infectious and respiratory diseases (World Health Organization 2018), these groups are at higher risk of catching COVID-19 (Steyn et al. 2020).

NZ has a unicameral Westminster-style government, with regional and local councils. Auckland, the largest city (1.5 million people), is the main entry point by air or sea; Christchurch is the second largest city and Wellington, the capital city, is third largest. Most governments are social-democratic or liberal. The current government is a progressive Labour–Green government that has adopted a wellbeing framework for the budget, which attempts to balance environmental, social, cultural and economic outcomes (Chapman and Howden-Chapman 2021).

2 COVID-19 Arrival and Government Response

In January 2020, the Minister of Health announced that public health staff would meet passengers from China "to actively look for signs of the novel coronavirus", which was notified in China in December 2019 and was rapidly transmitted globally. However, it was not until late February that the first COVID-19 case in NZ was diagnosed in a person arriving in Auckland from Iran, which led to the government restricting people entering NZ in line with the 2017 *New Zealand Influenza Pandemic Plan: A framework for action*, which describes a strategy of exclusion and quarantine requirements (Ministry of Health 2017).

In March 2020, the Cabinet authorised a group of senior government ministers to make decisions on the response to the COVID-19 outbreak and border measures. The government used the legal powers available to them to implement various measures to manage a very dynamic and complex situation. These legal powers existed under a framework of legislation, which had at its core the Civil Defence Emergency Management Act 2002 (CDEMA), that was used to declare a state of national emergency, the Epidemic Preparedness Act 2006 and the Health Act (other legislation used included the Immigration Act and the Public Finance Act) to ensure the continued smooth running of health services, emergency services, utilities and other essential services (2021). New legislation, the COVID-19 Public Health Response Act 2020 was also passed, which clarified that the existing enforcement powers can only be carried out by "a constable or an enforcement officer acting under the authority of the constable" (Gillespie 2020).

Prime Minister (PM) Jacinda Ardern first outlined the decision to step up the initial response to COVID-19 by "going hard, and going early" in a 21 March press conference when she introduced a four-tier alert level system, with Alert Level 4 ("the Lockdown") the most stringent (Ardern 2020). Following the scientific advice of academic epidemiologists, in April NZ moved explicitly to an elimination strategy, articulated in the *COVID-19 Health and Disability System Response Plan.*

> We are currently pursuing a version of an elimination strategy that seeks to eradicate or minimise cases of COVID-19 from New Zealand to a level that is manageable by the health system, until a vaccine becomes available to achieve population-level immunity. (Ministry of Health 2020)

Other measures were slower; following initial WHO advice, wearing of masks was neither advised nor made mandatory on public transport until August 2020. The public was encouraged to use active contact tracing using the NZ COVID Tracer app, which records the location of all people aged 12 and over at all alert levels, but this did not become mandatory until September 2021. Contact tracing and the difficulties of home isolation have become more pronounced under the Delta variant and, more recently, the Omicron variant of COVID-19.

At the time of writing, anyone entering NZ is required to isolate for 14 days, except those arriving from the Pacific Islands. Depending on the alert level, gatherings of people are restricted and social distancing and mask wearing is required. With few exceptions, borders were closed, except for NZ citizens and permanent residents who

were successful in an online lottery for a room in managed isolation and quarantine facilities for the requisite two weeks, and if symptomatic had to move into an isolation facility. Non-New Zealand citizens or residents had to get approval from Immigration NZ before travelling to New Zealand. The government delayed its plan to reopen the border until the end of July 2022 to help keep Omicron, the dominant COVID variant, out of the community.

3 Economic Support Measures

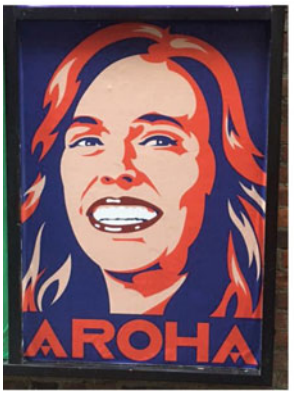
In March 2020, following the government's first wellbeing budget, the Reserve Bank of NZ announced an emergency official cash rate cut due to concern over the impact of the pandemic on the economy and the government announced a $12 billion COVID-19 package to support health, businesses, jobs and consumer spending. The package included $5b in wage subsidies, available for businesses and employers to prevent them from laying off staff or reducing their hours, which was later extended until September, and then reintroduced in late February 2021. After another lockdown in August 2021, the subsidy was extended again until 3 September 2021.

In March 2020, retail banks provided a six-month mortgage repayment holiday scheme for people whose incomes have been affected by the pandemic, which was extended to 31 March 2021. The Government announced a $6.25b business financing guarantee scheme to underwrite bank loans to small and medium-sized businesses, with the government carrying 80% of the credit risk, and the banks the remainder. The government then announced a nationwide freeze on rent increases for six months and limited the termination of tenancies for three months.

4 How Citizens Were Informed

Early on, the PM and the Director-General of health (DGH) began a widely followed practice of running reassuring daily 1 p.m. COVID-19 press conferences and all-of-government press conferences, where media were able to put questions to the PM and DGH. These press conferences were very popular and the DGH became a nationwide celebrity with songs, raps and fan fiction written in his honour, tea-towels and carry bags printed with his face (they sold out very quickly); and 5,000 New Zealanders

voted in a petition to name him New Zealander of the Year (Ward 2020). https://covid19.govt.nz/updates-and-resources/posters/.



NZ PM Jacinda Ardern

NZ Ministry of Health

Dr Ashley Bloomfield cake

5 How the COVID Problem was Framed and Measures Reinforced

The problem was framed by the government as a serious, urgent health threat that could be controlled by appropriate precautionary measures. The consistent framing emphasised the importance of the exceptional cooperation of the population and the dedication of the essential workforce. Nevertheless, the government received ongoing criticism from the opposition National Party for not providing a clear timeframe for 'freedom', i.e., the lifting of all COVID restrictions that occurred earlier in the UK, Australia and Denmark and more recently there have been disruptive protests by 'anti-vaxxers'.

The PM's language used was factual and plain. She spoke frequently about the evidence, the advice of the experts and referred more specialised, technical questions to the DGH. The tone of the PM's briefings was empathetic, and appealed to the collective "team of 5 million" and the sense that all people were part of a team working together to beat the pandemic (New Zealand Government 2020a). She expressed understanding and compassion towards those who might be experiencing difficulties and did not underestimate potential problems:

> *I know how hard this will be, especially for New Zealanders who face the first day of lockdown unemployed and with an uncertain future … I know how hard this is going to be for New Zealanders already living in overcrowded, cold, and damp accommodation; how hard it will be for our elderly and those who live on their own. It won't be easy, but the alternative is worse.* (New Zealand Government 2020a)

The PM appealed to people's shared humanity in her daily exhortations to be kind (New Zealand Government 2020a). In response, people around the country echoed her calls and teddy bear displays appeared in cars and windows.

The Government established a taskforce to enforce compliance with alert level restrictions, which gave officials, including the police, powers to enforce measures designed to restrict unnecessary movement, such as closing roads, stopping people breaking alert level rules, and prohibiting or regulating traffic (New Zealand Government 2020b). While there was an emphasis on trust, explanation and encouragement of the necessity to stick to the rules, the public was also reminded that the police did have the authority under the Civil Defence Emergency Management Act 2002 to act if people were not complying with the restrictions. The lockdowns have been mainly monitored by the police and a free non-emergency police phone line was available for people to report infringements.

While the police had prosecuted 1,000 people by early March 2021, their approach has been light-handed in response to government signals about breaches of lockdown restrictions. Under the Health Act the police had powers "to compel, enforce or ensure compliance with a medical officer of health's requirements, such as self-isolation." The head of the new task force stated that the police's top priority was "to keep New Zealanders well, safe and the country sustainable" (Cooke 2020). The police commissioner commented that the police can act only on a referral from a health official: "They're concerned that prosecution may discourage that honesty, so public health has not so far referred any of those breaches to us" (Patterson 2021).

6 COVID-19 and Ethnicity

Different ethnic groups have been differently affected by the pandemic. Māori communities have historic memories of the devastating impact of the 1918 influenza epidemic, which killed Māori at nearly eight times the rate of Europeans (Wilson et al. 2012). This experience contributed to an already strong sense of community cohesion in the face of a health threat like COVID-19 and led to some communities with higher Māori populations taking protective actions by setting up roadside checkpoints. Police were usually present at these checkpoints supporting Māori and after initial controversy these checkpoints were well accepted.

Māori were initially under-represented as cases, but this has changed markedly over the period of the pandemic with Māori now (February 2022) experiencing the highest percentage of total cases, 32.8% (Ministry of Health 2021). Māori also had an increased risk of becoming severely ill, higher rates of hospitalisation and a 50% higher risk of dying from COVID-19 than Europeans (Ministry of Health 2021). This is due to higher rates of existing health conditions and poor housing conditions—25% of Māori live in crowded housing. Māori are also more likely to be working in jobs with a higher risk of infection (Steyn et al. 2020, 2021). Māori also have lower rates of vaccination than non-Māori: currently 85% of the total eligible Māori population is vaccinated compared with 94% of NZ's total eligible population (Ministry of Health

Table 1 Total COVID-19 cases by ethnicity February 2020–February 2022

	Total cases since first NZ case	Percentage of all cases	Deaths	Percentage of population
Māori	5521	32.8	18	16.7
Pacific Peoples	3704	22	5	8.3
Asian	2455	14.6	4	15.7
Middle Eastern, Latin American and African (MELAA)	466	2.8	2	1.6
European/other	4381	26.1	24	70.2
Unknown	290	1.7	0	
Total	3813	100	53	

Source Ministry of Health: https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-data-and-statistics/covid-19-case-demographics
StatsNZ: https://www.stats.govt.nz/information-releases/estimated-resident-population-2018-base-at-30-june-2018

2022). Pasifika people, two-thirds of whom live in the Auckland region, also make up a disproportionate 22% percentage of all cases. Initially and during Delta, they were the worst affected ethnic group with 73.7% of cases (Ministry of Health 2021). Pasifika have high rates of existing health conditions, greater levels of poverty and 45% live in crowded multi-generational housing, all associated with more severe outcomes from COVID-19 (Steyn et al. 2020).

Interpretation of ethnicity data is difficult because of the regional and social nature of community outbreaks. For example, the biggest cluster so far has occurred in the Samoan community linked to a church gathering. With regards to returnees coming into NZ and going through managed isolation the ethnicity data is dependent on the prevalence of COVID-19 in the countries of returnees' travel origin e.g., the high number of Asian cases likely reflects the high prevalence of SARS-CoV-2 in Indian and South-East Asia. There have been several large cohorts of essential workers coming from overseas (seasonal workers, mariners) and sports teams with high rates of SARS-CoV-2 e.g., the arrival of deep sea fishing trawlers with largely Indonesian or Philippino crews, almost all of whom tested positive (Table 1).

7 Consequences

At the end of March 2020, NZ reported its first COVID-related death, but by June there were no active cases and NZ moved to Alert Level 1. However, in August four new cases of COVID-19 were reported in Auckland, which was moved to higher levels that were not lowered until September. This pattern has been recurring since, with almost two-thirds of the confirmed cases being imported or related to imported cases. The total number of deaths in February 2022 was 53.

Apart from the direct consequences, there are also indirect consequences of COVID-19. Survey results during the first year of the pandemic have found a mixed impact on mental health (Every-Palmer et al. 2020). During the first COVID-19 lockdown about one third of respondents reported moderate or high psychosocial distress, significantly higher than the baseline rate of 8.2% of the total adult population reported in the NZ Health Survey 2018/19. However, not all experiences of the lockdown were negative, with 62% of respondents reporting an experience of positive consequences of the lockdown including more family time, working from home and a quieter, less polluted environment. Moreover, NZ was one of 12 countries where the rates of suicide declined initially during COVID compared to the previous year (Pirkis et al. 2021).

Rates of family, whānau and domestic violence have increased in NZ during the pandemic. Although the total number of police investigations of domestic violence during the first lockdown in 2020 was unchanged during the pandemic, other measures, such as sexual violence prevention services and helplines suggest they increased at every alert level. It is generally acknowledged that most offences are under-reported to police (Ministry of Justice 2021).

More positively, during the first two weeks of the first lockdown in March 2020 motor vehicle crashes in the Waikato region decreased to almost one quarter compared to the previous two weeks (Christey et al. 2020). A month later, the number of road deaths in New Zealand decreased by 74% compared to the average for April in 2017–2019 and continued to decline during most months in 2020 (International Transport Forum 2020).

8 Impact on Other Infectious Diseases

There was a dramatic reduction in the incidence of influenza and other respiratory viral infections as a result of the COVID-19 pandemic control measures. During the winter of 2020 there was no annual influenza outbreak detected. There was a 67.7% reduction in influenza during the lockdown and 99.9% post-lockdown compared with the 2015–2019 period (Huang et al. 2021), with one of the contributing factors likely to be the higher rate of influenza vaccination in 2020 (35% more vaccinations were recorded by the NZ National Immunisation Register during April–June 2020 compared with 2019). There were also marked reductions observed for other respiratory viruses for the post-lockdown period compared with 2015–2019: respiratory syncytial virus (RSV; 98.0% reduction), human metapneumovirus (hMPV; 92.2%), enterovirus (82.2%), adenovirus (81.4%), parainfluenza virus types 1–3 (PIV1–3; 80.1%), and rhinovirus (74.6%). When restrictions were eased post-lockdown there was a significant increase in the incidence of rhinovirus and an epidemic of respiratory syncytial virus (RSV), which particularly affected young children (ESR 2021).

9 Delays in Other Medical Treatments

COVID-19 did have an adverse impact on cancer services in NZ during the first lockdown period, but this has largely been mitigated. For cancer diagnosis there was a 40% decrease in cancer registrations during March–April 2020 (the first lockdown) compared to 2018–2019, but the numbers picked up to reach pre-lockdown levels over the following months. In terms of cancer treatment (surgery and medical oncology), the impact of COVID-19 has been minimal. Interestingly, there was a 21% increase in cancer surgeries among Māori in the year to October 2020 compared to the same period in 2018 and 2019, but there were also decreases in attendance for radiation therapy of 8% in the year to October 2020 (Gurney et al. 2021).

10 Economic Consequences

10.1 Unemployment

When NZ went into lockdown for the first time on 26 March 2020, with all except essential workers required to stay at home, over 50% of the workforce were affected with half this number working from home and 25% unable to work. The Government provided a wage subsidy to support businesses to continue to pay their employees over this period. Despite this many people were made redundant, were forced to work reduced hours or suffered a pay cut (ANZ 2020). Levels of unemployment increased by 1.1% from pre-pandemic (fourth quarter of 2019) to a peak of 5.2% in the third quarter of 2020. This was less than the OECD where unemployment increased by 3.3% pre-pandemic to a height of 8.6% in the second quarter of 2020. NZ had the tenth lowest unemployment level in the OECD as a whole for the last quarter of 2020 and the ninth lowest for the first quarter of 2021. Underemployment increased from 10.1% in the last quarter of 2019 to a peak of 13.1% in the third quarter of 2020, then decreased to 12.2% by the first quarter of 2021 (Wilson et al. 2021).

10.2 Increasing Inequalities

The pandemic has had a greater negative impact on women**:** decreased job security and financial safety for female workers; increased duplication of paid and unpaid work; an increase in violence both inside and outside the home; increased risk of exposure to COVID-19 due to the nature of women's work and greater concentration of women in the essential workforce. Women are also at risk of worse health outcomes for the same reasons. Māori and Pacific women are disproportionately affected (Masselot and Hayes 2020). Women have also had to bear a greater burden

from the closure of schools and childcare in terms of managing paid work and children at home.

Underemployment affected women more than men with a peak of 16.4% in the second quarter of 2020 compared with a peak of 12.9% for men in the third quarter of 2020 (Wilson et al. 2021).

COVID-19 has also exacerbated educational inequalities as children living in poverty or in areas with limited or no internet connectivity were unable to access online learning and continue their schooling during lockdown (Mutch 2021). As the pandemic has continued, there has been a marked increase in homeschooling.

The effects of mobility restrictions during the lockdown also affected the population unequally, with differential mobility observed during the lockdown—less deprived areas were less mobile in comparison with more deprived areas which experienced increased mobility (Campbell et al. 2020).

11 Conclusion

Aotearoa New Zealand is a small island country, which has had several advantages in dealing with COVID-19: it has clear borders; a relatively cohesive community; low levels of corruption; and an effective government, which has largely maintained public support for its policies and actions. By the time the pandemic reached NZ, it was able to learn from the effectiveness of different approaches taken in overseas countries. The consensus to date has been that the system response has been a success, albeit a very costly one (Grant 2020; OECD 2022). Per capita, NZ has the lowest case fatality rate of any OECD country (Wilson et al. 2020). Prior to the pandemic, the Government had already adopted a wellbeing systems approach to policy in general and adopted a science-based approach, heavily informed by epidemiology, to manage the pandemic. Every step subsequently was weighed up not only for the health implications, but for the social, cultural and environmental consequences.

References

Ardern J (2020) PM address—Covid-19 update 21 March 2020. New Zealand Government, Auckland

ANZ (2020, April 3) New Zealand Weekly Focus

Campbell M, Marek L, Wiki J, et al (2020) National movement patterns during the COVID-19 pandemic in New Zealand: the unexplored role of neighbourhood deprivation. J Epidemiol Community Health 75(9)

Chapman R, Howden-Chapman P (2021) Does reframing urban policy around wellbeing support carbon mitigation? Buildings Cities 2(1):688–699. https://doi.org/10.5334/bc.115

Christey G, Amey J, Campbell A, et al (2020) Variation in volumes and characteristics of trauma patients admitted to a level one trauma centre during national level 4 lockdown for COVID-19 in New Zealand. N Z Med J 133(1513)

Cooke H (2020, March) Coronavirus: top cop Mike Bush to lead new taskforce, says police will enforce new rules. Stuffconz
ESR (2021) ESR data highlights surge of respiratory syncytial virus (RSV)
Every-Palmer S, Jenkins M, Gendall P et al (2020) Psychological distress, anxiety, family violence, suicidality, and wellbeing in New Zealand during the COVID-19 lockdown: a cross-sectional study. PLoS ONE 15(11):1–19. https://doi.org/10.1371/journal.pone.0241658
Grant D (2020) The covid-19 pandemic what happened? Was New Zealand prepared? Policy Q 16(3). https://doi.org/10.26686/pq.v16i3.6546
Gillespie A (2020, May 19) Are New Zealand's new COVID-19 laws and powers really a step towards a police state? The Conversation
Gurney JK, Millar E, Dunn A et al (2021) The impact of the COVID-19 pandemic on cancer diagnosis and service access in New Zealand—a country pursuing COVID-19 elimination. Lancet Reg Health 10:1000127–1000227. https://doi.org/10.1016/j.lanwpc.2021.100127
Howden-Chapman P (2021) Royal Society Te Apārangi Te Tapeke Fair Futures panel, Spotlight on Housing Te Tapeke Fair Futures in Aotearoa. Royal Society Te Apārangi, Wellington
Huang, SQ, Wood T, Jelley L, et al (2021) Impact of the COVID-19 nonpharmaceutical interventions on influenza and other respiratory viral infections in New Zealand. Nat Commun 12(1001)
International Transport Forum (2020) Road safety data New Zealand. Paris
Masselot A, Hayes M (2020) Exposing gender inequalities: impacts of covid-19 on Aotearoa New Zealand employment. N Z J Employ Relat 45(2):57–69
Ministry of Health (2017) New Zealand influenza pandemic plan: a framework for action, 2nd edn. Ministry of Health, Wellington
Ministry of Health (2020) COVID-19 health and disability system response plan. New Zealand Government, Wellington
Ministry of Health (2021) COVID-19: case demographics
Ministry of Health (2022) COVID-19: vaccine data Wellington 2022 [cited 2022, February 2]. Available from: https://www.health.govt.nz/our-work/diseases-and-conditions/covid-19-novel-coronavirus/covid-19-data-and-statistics/covid-19-vaccine-data#uptake. Accessed 2 Feb 2022
Ministry of Justice (2021) The New Zealand crime and victims survey. Key findings cycle (3 October 2019-November 2020). Wellington
Mutch C (2021) COVID-19 and the exacerbation of educational inequalities in New Zealand. Perspect Educ 39(1)
New Zealand Government (2020a) Prime Minister's press conference: Wednesday 25 March 2020. Wellington
New Zealand Government (2020b) All of government press conference: Wednesday 25 March 2020. Wellington
New Zealand Government Unite against COVID-19 2021. https://covid19.govt.nz/updates-and-resources/posters/
OECD (2022) New Zealand economic Snapshot economic survey of New Zealand (2022): OECD [cited 2022, February 2]. https://www.oecd.org/economy/new-zealand-economic-snapshot/
Patterson J (2021, March) Covid-19: police prosecute nearly 1000 breaches. Radio New Zealand
Pirkis J, John A, Shin S et al (2021) Suicide trends in the early months of the COVID-19 pandemic: an interrupted time-series analysis of preliminary data from 21 countries. Lancet Psychiatry 8(7):579–588. https://doi.org/10.1016/S2215-0366(21)00091-2
Steyn N, Binny R, Hannah K, et al (2020) Estimated inequities in COVID-19 infection fatality rates by ethnicity for Aotearoa New Zealand. N Z Med J 133(1521)
Steyn N, Binny R, Hannah K, et al (2021) Māori and Pacific people in New Zealand have a higher risk of hospitalisation for COVID-19. N Z Med J 134(1538)
Ward T (2020, May) All the weird and wonderful creative tributes to Dr Ashley Bloomfield. The Spinoff
Wilson N, Chambers T, Kvalsvig A, et al (2020) NZ's "Team of 5 million" has achieved the lowest COVID-19 death rate in the OECD—but there are still gaps in our pandemic response. Public Health Expert, Wellington

Wilson N, Grout L, Summers J, et al (2021) Use of the elimination strategy in response to the COVID-19 pandemic: health and economic impacts for New Zealand relative to other OECD countries. Available at SSRN

Wilson N, Telfar Barnard L, Summers JA, et al (2012) Differential mortality rates by ethnicity in 3 influenza pandemics over a century, New Zealand. Emerg Infect Dis 18(1):71–77

World Health Organization (2018) WHO Housing and health guidelines. WHO, Geneva

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NIGERIA: Coping with COVID-19 in Two Urban Communities in Ibadan, Nigeria

Akinyinka O. Omigbodun

Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

The arrival of the severe acute respiratory distress syndrome coronavirus 2 (SARS-CoV-2) in Nigeria in February 2020 caught the health system and other community services largely unprepared to cope with the challenges that the pandemic was to bring. This lack of preparedness was particularly felt in urban areas where large population concentrations in overcrowded spaces provided circumstances that were highly conducive to the rapid spread of an airborne respiratory disease such as SARS-CoV-2.

The first confirmed case of SARS-CoV-2 in Nigeria was an expatriate who developed symptoms in Ota on the outskirts of Lagos metropolis, Nigeria's most populous urban area, just about 100 kms from Ibadan. It was confirmed (Federal Ministry of Health 2022) on 27 February 2020, just 16 days after the World Health Organization had named the disease associated with the new virus as coronavirus disease-19 (COVID-19). This set off a scramble among various agencies on devising mechanisms for coping with a disease about which even experts in infectious diseases knew very little.

Measures were being introduced worldwide to contain the spread of COVID-19, largely in the form of restrictions to travel and lockdowns of communities. There were also efforts to encourage the practice of personal hygiene, such as frequent washing of hands and use of hand sanitisers. People were required to maintain minimum physical distances from one another. These measures may look simple, but in urban slums which have overcrowded dwellings and already lacked sufficient water for domestic use, and where most of the inhabitants worked in the informal sector and earned wages on a daily basis, measures imposed were difficult to implement and were perceived as almost akin to those seen in situations of war (Omigbodun and Lilford 2020).

As reliable tests for the infection were developed, deployment of the tests and deciding who should be tested with the limited number of test kits available became another challenge. Slum inhabitants were again at a disadvantage in this. Relief materials, especially food items, that were assembled to meet the needs of people living in communities that had been locked down were not reaching those most in need. Government agencies remained behind the curve for the most part in tackling these difficulties and the population had to find ways of coping. The objective here is to explore some of the mechanisms developed to cope with the challenges posed by COVID-19 in two deprived urban neighbourhoods in the city of Ibadan.

2 Ibadan Metropolis

Ibadan, situated just about 100 kms north of the coast of the Atlantic Ocean, is the largest indigenous city in Africa. It is by far the largest city in South-West Nigeria, one of the most highly urbanised spaces in Africa. Relatively large towns already existed

in the area even prior to the rapid urbanisation that occurred after many African states gained political independence about 60 years ago. The indigenous inhabitants are ethnic Yoruba who congregated into urban communities largely as a consequence of the people's perceived need to come together for mutual defence during the unstable era of the eighteenth and nineteenth centuries. The pace of urbanisation intensified further in the late twentieth century and it is still continuing.

The city of Ibadan also serves as the capital of Oyo State, one of Nigeria's 36 sub-national governments in a federal arrangement. The metropolis is divided into eleven local government areas, five of which are in the urban core of the metropolis whilst the other six have various degrees of population concentration, with densely populated neighbourhoods in the immediate outskirts of the city and more rural settlements, including farming communities, in the exurbs.

Ibadan rapidly evolved as an urban settlement nearly 200 years ago in the zone of transition between the tropical rainforest belt of what is now Southern Nigeria and the savannah that is the dominant vegetation in the interior of West Africa, away from the coastal areas. The name of the city itself was derived from the expression "beside the savannah". The Oyo Empire was one of the dominant empires of the West African savannah from about the fourteenth century until the eighteenth century, by which time the trans-Atlantic slave trade had begun to exact a heavy toll on the kingdom (Akintoye 2014). There were frequent wars between neighbouring kingdoms, many in an effort to capture people who could be sold as slaves. This forced many communities to aggregate into large population concentrations for mutual defence.

By the early nineteenth century, internal dissension and external pressure combined to cause the disintegration of the Oyo Empire. Many people fled from the exposed savannah settlements to resettle in the tropical rainforest zone, which offered some protection from cavalry raids by the newly established Fulani caliphate of Sokoto. In these new settlements, people organised themselves into compounds that housed extended families. The typical compound would have structures arranged in a quadrangular pattern around a central courtyard where gatherings were held. These courtyards would generally measure about 60 m^2 and the external perimeter of the compound would have a vegetable garden. As the families enlarged, these spaces became overcrowded. More structures were put up for new generations in the space initially set aside as courtyards, creating chaotic slum conditions that exist in the urban core of large Yoruba towns up till now. Ibadan, the largest of these settlements, also has the highest number of such clusters of urban overpopulation and deprivation.

The current Ibadan metropolis was the third and longest enduring settlement to develop at the location. This settlement began around 1830, at the conclusion of the first major civil war in Yorubaland in which one of the most powerful Yoruba kingdoms, Owu, was utterly destroyed by an alliance of other Yoruba clans. The victorious allies established a military camp in Ibadan that developed into the current huge conurbation. The breakup of the Oyo Empire in the 1830s hastened the development of Ibadan, with people streaming from the destroyed capital of Oyo-Ile in the middle of the savannah into the forest belt toward the coast.

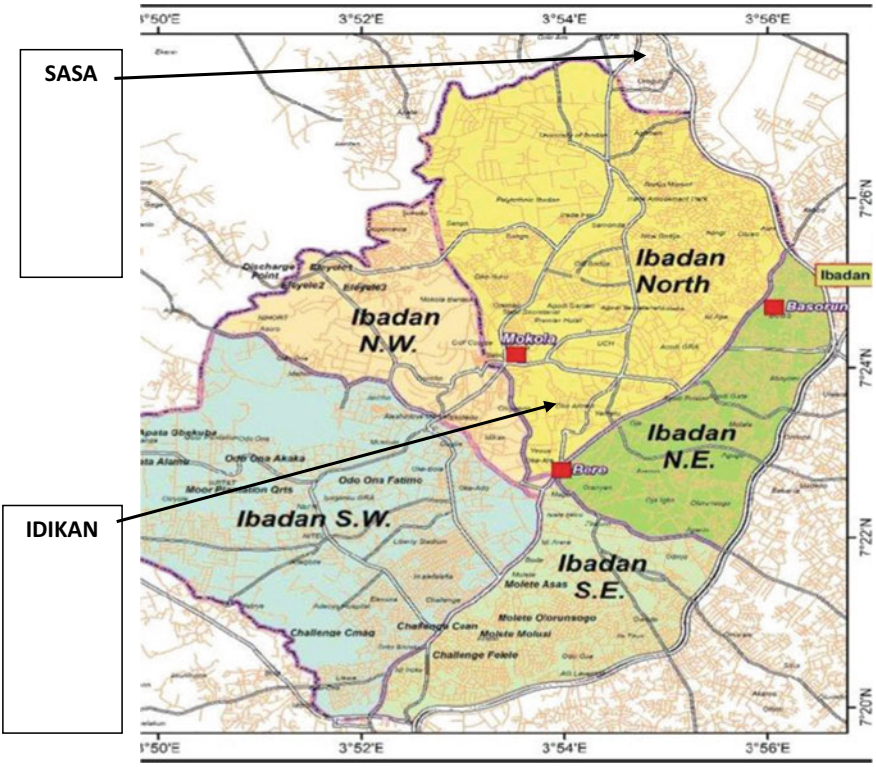

Fig. 1 Ibadan metropolis urban core

Many of the settlements that now constitute the Ibadan metropolis started out as separate settlements. Many were satellite towns to the core municipality of Ibadan but have fused into a large conurbation occupying more than 3000 km^2. Many of these settlements are characterised by poor sanitation, including open sewers, lack of potable water (no pipe-borne water in most of them), lack of access to motorable roads for many houses and lack of formal healthcare facilities (Fayehun et al. 2022). Our assessment of the response to the COVID-19 challenge focussed on two of these communities, one in the inner urban core of Ibadan (Idikan) and the other on the outskirts of the core municipality (Sasa) (see Fig. 1).

3 The Communities of Idikan and Sasa

Prior to the onset of the COVID-19 pandemic, a project had been commenced in the communities of Idikan and Sasa, deprived urban neighbourhoods in Ibadan, by the Improving Health in Slums Collaborative (2019), a multi-partner, multi-method

collaboration, which was targeted at assessing the status of access to healthcare in these communities (and five other communities in Bangladesh, Kenya, Nigeria and Pakistan), and finding ways to improve the access of inhabitants to healthcare of good quality. The two communities were intentionally selected to represent established older communities (Idikan) and relatively new emergent neighbourhoods (Sasa) in Ibadan metropolis.

Idikan is one of the earliest areas to be settled in Ibadan, the community having been in existence since about 1840. Many inhabitants are descendants of those early settlers and form clans of related extended families. There is an old, tarred road in the community, with three markets organised around it. Many structures there are constructed with compacted earth, although some were made with cement blocks. Most have rusted corrugated iron roofs and the structures are generally run-down. The community is poorly planned, with the houses arranged haphazardly. The environment is characterised by poor general sanitation and drainage channels partially filled with solid waste. The road network is poor and the health facilities available are not easily accessible when there are health emergencies. Of the 36 health facilities recorded there, only seven can be regarded as formal facilities running clinics, with four being privately owned and three being run by government agencies (Ahmed et al. 2020).

Sasa was first settled in the late 1960s by villagers displaced by a large international agricultural project established nearby. These inhabitants were later joined by migrants, mainly from northern Nigeria, who came as traders in foodstuffs. The settlement, which has a long, tarred road going through it, has well-spaced, mostly permanent, structures with poor sanitation and refuse-filled drainage channels. Energy supply is not constant and most of the 32 health facilities in the community were patent medicine vendors (22 places), with some herbal medicine practitioners, traditional birth attendants and one state-run primary health centre that offers treatment and preventive care, including immunisations, making up the full complement of available health facilities (Ahmed et al. 2020). Participatory mapping techniques were deployed in both Sasa and Idikan to obtain accurate maps of dwellings and health service points in the two communities (Yeboah et al. 2021) before engaging with the dwellers about their health status and the options available to them for healthcare (Improving Health in Slums Collaborative 2019; Yeboah et al. 2021).

Engagement with the communities began some two years before pandemic control measures were introduced by the authorities and continued for just over two months after a lockdown was first imposed (Ahmed et al. 2020). Engagement with community dwellers and stakeholders prior to the introduction of COVID-19 control measures involved identifying the common illnesses for which residents of the community sought care and their pattern of care-seeking behaviour. After the introduction of the control measures, engagement with community dwellers continued through phone conversations with careful note-taking (Ahmed et al. 2020). Transcripts from the in-person engagements and the phone conversations were subjected to thematic analysis, focussing on availability, affordability and acceptability of both preventive and curative care services.

4 Response to the COVID-19 Pandemic

After the first case was confirmed in Nigeria at the end of February 2020, task forces were constituted by both the Federal and the sub-national governments to institute measures to protect the population from infection and make preparations to treat those who would get infected in spite of the protective measures. One such task force was established by the Government of Oyo State for which Ibadan is the capital city.

By the end of March 2020, just under 140 cases had been confirmed throughout Nigeria and the first case in Ibadan (Omobowale et al. 2021) was confirmed on 22 March 2020. Measures to contain the spread of the infection were promulgated by the Oyo State Task Force almost immediately. These measures included those imposed by the national task force such as a ban on interstate travel and restrictions to free movement within cities, prohibition of social gatherings and all public functions of more than 20 people (including gatherings for religious worship). There was also a closure of schools, public offices, shops and markets, other than those selling food and pharmaceuticals for treatment of ailments. In addition, a dusk-to-dawn curfew was imposed to curtail the activities of night clubs and prevent night parties (Ahmed et al. 2020; Omobowale et al. 2021). These measures were extended for a further three weeks after the initial 30 days of enforcement, although the curfew was eased, beginning at 10 pm and ending at 4 am. The use of face masks was made compulsory and physical distancing of at least 2 m required between individuals not from the same household in public spaces. After the second three-week period of restrictions, religious gatherings were allowed.

5 Coping with COVID-19 in the Urban Communities

Engagement with the residents of the communities continued through telephone calls throughout the period that the containment measures were enforced and through to the end of May 2020. Prior to the imposition of the restrictions, members of the communities had provided information about the diseases for which they usually sought care. These included communicable diseases such as malaria, cough, diarrhoea, typhoid and skin infections. The non-communicable diseases commonly reported were hypertension, stroke, peptic ulcers, arthritis and asthma. Maternal and perinatal health needs also featured prominently.

More than three-quarters of the inhabitants in both communities preferred to use formal healthcare facilities (Fayehun et al. 2022). When COVID-19 restrictions were imposed, many of the slum residents had difficulty accessing health facilities and some of the health personnel who lived far away had difficulty coming to work at the facilities. Most inhabitants of the neighbourhoods did not have proper face masks and many of those that were improvised were farcical in appearance and may not have been effective at all. Barriers impeding access to care included reduced household income, increased cost of healthcare, increased challenges in physically reaching

healthcare facilities and exacerbated reluctance of residents to seek healthcare due to fear of catching COVID-19 at facilities and the ensuing stigmatisation.

The most important issue emphasised by many of the stakeholders was the sharp drop in household income for most of the families living in the two communities, this being particularly so in Idikan. Since dealing in foodstuffs was a major occupation in Sasa and the trade in food was not restricted except by the curfew, many residents were still able to earn a living. The drop in income meant there was less food for members of the household. Although the government had announced that there would be palliative measures to help citizens cope, many of those most in need were not receiving these supplies.

As a coping mechanism, when it came to gaining access to health care, community members used their phones to call health workers to discuss health issues or to ascertain whether the primary healthcare centres were open to deliver services. They also used their phones to read messages from the Nigerian Centre for Disease Control (NCDC) about health, safety and avoidance of catching the COVID-19 infection (Ahmed et al. 2020). Although there was no regulatory framework for remote consulting of healthcare workers (Fayehun et al. 2020) and most health workers had received no specific training about remote consultations, many health workers stated that they had provided health advice remotely and had directed patients that appeared to have serious problems to the nearest health facility for proper physical examination and diagnosis. Another reported practice was to resort to seeking care from some auxiliary nurses who were themselves residents of the communities.

6 Advocacy to Government and Response

Clear communication with slum communities was needed about available healthcare services, infection control measures and the importance of continuing to seek care for non-COVID-19 conditions, including pregnancy and long-term health problems. Many of the residents of these neighbourhoods felt alienated from what government officials were doing to combat the pandemic. Information flow could have been managed better and the distribution of relief materials to deprived neighbourhoods should have been prioritised.

Engagement with stakeholders and inhabitants of these communities provided an insight into the challenges they faced as restrictions were imposed. The plight of the inhabitants was brought to the attention of policymakers through news and opinion pieces in local and national newspapers and the electronic media (radio, television). It was a pleasant surprise to see government officials respond by visiting the communities to assess the situation first-hand and offer palliatives. The residents were happy and grateful for this response.

7 Resilience in the Communities

The resilience of residents enabled them to cope until restrictions to movement and other activities were lifted. People assisted each other and shared food with the most disadvantaged inhabitants. Although being confined in cramped conditions did lead to reports of exacerbations of mental health problems and some increase in gender-based violence, residents of the communities generally extended a helping hand to those experiencing difficulties (Ahmed et al. 2020). One restriction that many did not like was that on religious gatherings.

One thing that members of the communities reported that they found encouraging was that despite the overcrowded conditions in their houses and the lack of water for the prescribed frequent handwashing, those developing symptoms of infection were relatively few and mortality attributable to COVID-19 in these communities was rare, which is in keeping with what had been observed in other parts of sub-Saharan Africa (Adams et al. 2021). Even 24 months after the first restrictions were imposed in Oyo State, the total number of confirmed cases of COVID-19 in the state was 10,211, with 202 deaths recorded (COVID-19 Data Repository 2022). Throughout Nigeria, a nation of more than 200 million people, only about 255,000 confirmed cases were recorded, with 3,142 deaths.

8 Conclusion

Effective public health strategies must consider the perspectives, insights and solutions of those who live and work in slums because they are a significant proportion of the urban population in Nigeria and many other low and middle-income countries. In the communities described, advocacy to policymakers on their plight during the lockdown that was imposed to combat COVID-19 led to a government response that brought palpable relief to the residents of those communities.

In crisis situations, such as the restrictions occasioned by the COVID-19 pandemic, policymakers and those planning healthcare services should ensure that the costs of accessing healthcare do not escalate and further deter healthcare usage, or unfairly disadvantage neighbourhoods that are already deprived. Remote consultations for health problems should be considered to reduce face-to-face contact when trying to control the spread of infectious pathogens like SARS-CoV-2. The provision of services to deal with mental health issues and gender-based violence should be included in measures to ameliorate the effects of lockdowns.

References

Adams J, MacKenzie MJ, Amegah AK, Ezeh A, Gadanya MA, Omigbodun A, Sarki AM, Thistle P, Ziraba AK, Stranges S, Silverman M (2021) The conundrum of low COVID-19 mortality burden in sub-Saharan Africa: myth or reality? Global Health Sci Pract 9(3):433–443. https://doi.org/10.9745/GHSP-D-21-00172

Ahmed SAKF, Ajisola M, Azeem K, Bakibinga P, Chen YF, Choudhury NN, Fayehun O, Griffiths F, Harris B, Kibe P, Lilford RJ, Omigbodun A, Rizvi N, Sartori J, Smith S, Watson SI, Wilson R, Yeboah G, Aujla N, Azam SI, Diggle PJ, Gill P, Iqbal R, Kabaria C, Kisia L, Kyobutungi C, Madan JJ, Mberu B, Mohamed SF, Nazish A, Odubanjo O, Osuh ME, Owoaje E, Oyebode O, Porto de Albuquerque J, Rahman O, Tabani K, Taiwo OJ, Tregonning G, Uthman OA, Yusuf R (2020) Improving health in slums collaborative: 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):e003042. https://doi.org/10.1136/bmjgh-2020-003042

Akintoye SA (2014) A history of the Yoruba people. Dakar, Senegal, Amalion Publishing, pp 242–270. ISBN 978-2-35926-027-4

COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. https://github.com/CSSEGISandData/COVID-19. Accessed 9 March 2022

Fayehun F, Omigbodun A, Owoaje ET (2020) Mobile technology can improve access to healthcare in Nigeria—if it's regulated. The Conversation. Available: https://theconversation.com/mobiletechnology-can-improve-access-to-healthcare-in-nigeria-if-itsregulated-137182. Accessed 26 May 2020

Fayehun O, Ajisola M, Uthman O, Oyebode O, Oladejo A, Owoaje E, Taiwo O, Odubanjo O, Harris B, Lilford R, Omigbodun A (2022) On behalf of the improving health in slums collaborative: a contextual exploration of healthcare service use in urban slums in Nigeria. PLoS ONE 17(2):e0264725

Federal Ministry of Health, Nigeria. Health Minister: first case of COVID-19 confirmed in Nigeria. https://www.health.gov.ng/index.php?option=com_k2&view=item&id=613:health-minister-first-case-of-covid-19-confirmed-in-nigeria. Accessed 9 Mar 2022

Improving Health in Slums Collaborative (2019, May 30) A protocol for a multi-site, spatially-referenced household survey in slum settings: methods for access, sampling frame construction, sampling, and field data collection. BMC Med Res Methodol 19(1):109. https://doi.org/10.1186/s12874-019-0732-x

Omigbodun A, Lilford R (2020) COVID-19: locking down urban settlements in sub-Saharan Africa. NIHR ARC West Midlands News Blog 2:3–4

Omobowale MO, Bamgboye EA, Akinyode A, Falase OS, Ladipo TO, Salami O, Adebiyi AO (2021) Contextual interpretation of COVID-19 pandemic among public space users in Ibadan Metropolis, Oyo State, Nigeria: an ethnographic review. PLoS ONE 16(11):e0259631. https://doi.org/10.1371/journal.pone.0259631

Yeboah G, Porto de Albuquerque J, Troilo R, Tregonning G, Perera S, Ahmed SAKS, Ajisola M, Alam O, Aujla N, Azam SI, Azeem K, Bakibinga P, Chen Y-F, Choudhury NN, Diggle PJ, Fayehun O, Gill P, Griffiths F, Harris B, Iqbal R, Kabaria C, Ziraba AK, Khan AZ, Kibe P, Kisia L, Kyobutungi C, Lilford RJ, Madan JJ, Mbaya N, Mberu B, Mohamed SF, Muir H, Nazish A, Njeri A, Odubanjo O, Omigbodun A, Osuh ME, Owoaje E, Oyebode O, Pitidis V, Rahman O, Rizvi N, Sartori J, Smith S, Taiwo OJ, Ulbrich P, Uthman OA, Watson SI, Wilson R, Yusuf R (2021) Analysis of OpenStreetMap data quality at different stages of a participatory mapping process: evidence from slums in Africa and Asia. ISPRS Int J Geo-Inf 10(4):265. https://doi.org/10.3390/ijgi10040265

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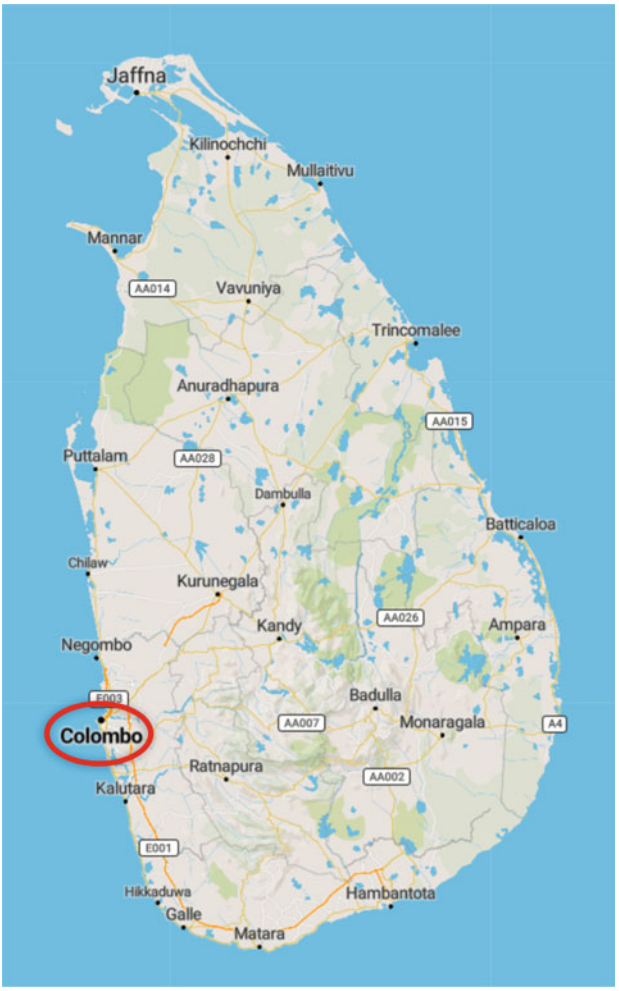
SRI LANKA: A Case Study of Colombo

Ruwan Wijayamuni, Dinuka Guruge, and Saroj Jayasinghe



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P. Howden-Chapman et al. (eds.), *Cities Under COVID-19: A Systems Perspective*,
Urban Health and Wellbeing, https://doi.org/10.1007/978-981-19-8163-0_14

1 Introduction

1.1 Brief History

The city of Colombo has been the commercial capital of Sri Lanka for over two centuries. The city borders the sea and monsoonal rains cause periodic flooding. The large Kelani River marks its northern borders and there are multiple waterways within the city. The river is the major source of water for the city. The city's border with the Indian ocean made it an important port for trade with Europe as far back as the fifth century. During the eighth century there were settlements of Arab traders in the area. The Portuguese invasion took place in 1505 and in the mid-1600s the area was controlled by the Dutch, who grew cinnamon in the area now known as Cinnamon Gardens. The British invasion in the early nineteenth century had a profound impact and in 1815 Colombo was proclaimed the capital of Ceylon. A breakwater was built during the 1870s.

After ending the conflict with the Liberation Tigers of Tamil Eelam in 2009, the city has continued to grow and is spreading north and south along the coast as people migrate to the city for work. After the conflict, the city has shown rapid development and progress. The land area of the city has recently been extended through reclamation of 269 hectares from the sea. The city merges with the rest of the Colombo District which is part of the Western Province.

An estimated 561,314 (in 2012) live in 37 m^2 and there is a daily floating population of around 500,000 workers and school children. The current population is 648,034 (Worldometers 2021). There are wide disparities in distribution of population with some very densely populated low-income settlements and other extremely affluent high-rise apartments, with vertical density. The city is very cosmopolitan, with almost equal proportions of Sinhala, Tamils and Muslim groups.

1.2 Administrative Systems

There are overlapping governance structures and processes for Colombo (Worldometers 2021). The city is governed to a large extent by the Colombo Municipal Council (CMC), directly elected by the people in local government elections (FairMed 2021). However, the line ministries of the government and the devolved Western Provincial Council also have a range of responsibilities toward the city (e.g. the security

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and hospitals are mainly under the central ministries). The council's fifteen departments are responsible for the provision of several key services: public health and curative services, solid waste management, road maintenance, street lighting, water and drainage, and veterinary services. In addition, other departments provide social services, sports and recreation, library services, finance administration and training. The fire and rescue services are carried out solely by Colombo Municipal Council fire and rescue division and cover the whole CMC area with six substations.

The health services within the city of Colombo constitute several nested systems that function within the broader Government of Sri Lanka's public sector's Ministry of Health. Most of the secondary and tertiary facilities of the government are provided by the Ministry of Health and the Western Provincial Council. There is also a growing private sector, especially at tertiary levels of care and in primary care. However, there is no formal referral system that links the different providers. Preventive health services, maternal and child health, and primary level curative care are provided by the CMC. Primary level curative care is also provided by independent private care providers, out-patient clinics in private hospitals, and state medical personnel in private practice.

There is a high concentration of Ministry of Health tertiary level hospitals within the city and another, the Maligawatta District Hospital is managed by the provincial council. The National Hospital of Sri Lanka is the key tertiary care hospital in the country and provides extensive in-ward and outpatient facilities for the general public in Colombo and other areas of the country. It is funded, provided and administered by the Ministry of Health. The ministry manages a number of tertiary-care teaching hospitals. All the services are provided at zero-user charge and are funded by taxes.[1] The majority of private-sector hospital beds are within the Colombo CMC. However, their total bed strength in the whole of Colombo District was 2,314, which is less than 50% of the three major hospitals within the city of Colombo: National Hospital of Sri Lanka; Lady Ridgeway Hospital for Children and Castle Street Hospital for Women (Ministry of Health 2017). The highest concentrations of private sector beds are also in Colombo.

All the state-sector hospitals provide out-patient facilities for their follow-up patients, as well as walk-in facilities at zero-user charge. There are several single-practitioner clinics scattered throughout the city. The CMC provides health care services (preventive and curative) for the public through its preventive services and primary care: 14 maternal and child health clinics; 13 CMC maternity homes and child welfare centres; 32 dispensaries in the curative section and a microbiology laboratory. In contrast, the private sector plays a bigger role in ambulatory care compared to their contributions towards inpatient care. The hospitals and several other clinics around the city conduct busy outpatient clinics conducted by its staff as well as by

[1] National Hospital of Sri Lanka has 3,000 beds and provides comprehensive services in all the major and minor specialties; the Lady Ridgeway Hospital for Children has more than 1,000 beds; the Castle Street Hospital for Women has 442 beds and performs more than 16,000 deliveries per year.

consultants from the state sector who work off-hours for a service-for-fee system (called 'channel consultations').

The Public Health Department is part of the Colombo Municipal Council, which has a rich 100-year tradition (Colombo Municipality Council 2021). Its main tasks relate to provision of maternal and child welfare, food hygiene, control of epidemics and preventive services, health education, pollution control, school health and vector-control. It is independent of the Ministry of Health's unit, though supportive of the latter's activities.

1.3 Food Systems

Colombo city and suburbs have small-scale farming, mainly producing quantities for households' own consumption. The city depends on production of food from other regions, particularly through diverse channels from rural areas. Manning Market is the main national distribution centre. The food supply chain has the traditional intermediaries and commissioned agents. Prices in the city are dependent on these groups, and they are believed to be responsible through market manipulations for high prices.

Sri Lanka has a number of policies related to food: the Ministry of Agriculture's National Agricultural Policy; the Ministry of Health's National Nutrition Policy and the Nutrition and Indigenous Medicine; and other policy documents directly or indirectly addressing issues related to food (i.e. prices, security, safety and nutrition). The Food Act, for example, regulates and controls food manufacturing, safety, importation, sale, distribution and inspections. The local authorities have delegated power to enforce the Food Act. In general, there is fragmentation of the institutional authorities and responsibilities at the national level and local authorities have limited roles and responsibilities (Thiel et al. 2019).

Approximately half the country's economic activities are concentrated in Colombo and its adjacent areas. The largest international seaport, airport and transport hubs of rail and buses are all located within this area. Consequently, traffic congestion on the roads is progressively getting worse and is being exacerbated by the progressive shift to private modes of transport. In terms of the infrastructure needed to support active (non-motorised) transport, pavements are seen mostly by main roads. Pedestrian networks and dedicated bicycle paths are almost non-existent. Consequently, air and noise pollution are high predominantly due to vehicle emissions. However, Colombo also has a network of canals and a water transport system, which has been operationalised, but with limited success (Ministry of Transport 2014).

Ecologically, Colombo is one of the first wetland cities and 1,900 hectares (more than 8%) are contiguous wetland areas (Ramsar 2018). Yet, satellite imaging has shown a drastic reduction in per-capita green space from 1980 to 2015; in 1980 it was 31.0 km^2 but dropped to 5.02 km^2 in 2015. The per capita green space (2015) is 7.16 m^2, while the WHO standard is 8 m^2 (Pussella and Lin 2020) .

The built area consists of low-income settlements, high-rise buildings and areas with housing that have gardens. Surveys have shown that above 50% of the city population are living in poorly serviced slums or dilapidated housing schemes. They occupy 9% of the land area, which is therefore densely populated. A survey by the Urban Development Authority identified 68,812 families living in 1,499 community clusters (underserved settlements). These families have limited access to basic amenities, such as clean water, electricity and sanitation (Urban Regeneration Programme 2021). Satellite imaging has shown a steady increase in urban heat islands located in the central business area of Colombo, near the harbour, across the coastal belt and along the main transportation network (Ranagalage et al. 2017).

2 Covid-19 in Sri Lanka

The country has faced three major waves of COVID-19. The first patient, a tourist, was detected in late January 2020; the first Sri Lankan patient was not detected until early March 2020. The spread of the virus in the first wave was largely contained by intense restrictions in mobility that were then implemented. The onset of COVID-19 saw epidemics in several identified locations. One area that attracted attention was Bandaranayake Mawatha in Hultsdorf area of Colombo 12. It is an overcrowded street with low-income settlements, an underserved urban settlement where physical distancing is almost impossible (Karunanayake 2020). There were 2,722 individuals living in an area of 6,955 m^2 (0.007 km^2) or 388,857.1/km^2, who were sharing toilets. The outbreak happened during a locked-down period, primarily due to the public health response, but imposed by a police curfew when residents were confined to their homes (Jeewandara et al. 2021) and the containment was similar to the experience in other densely populated slums such as Dharvi-Mumbai (density 277,136/km^2) (Golechha 2020). These policies were successful until the end of September 2020, to the extent that there was hardly a wave, except for a cluster in a Sri Lankan Navy Base, that began 22 April and was in a suburban area (Wijesekara et al. 2021). People presumably were infected during preventive work, where they were deployed to identify and transport contacts and in a detection centre for people who were drug dependent in Kandakadu (Wijesekara et al. 2021; Jeewandara et al. 2021). Community screening in Colombo also detected cases in another dense, underserved settlement.

The second wave originated in late September 2020. The first few cases in a garment factory in Minuwangoda went undetected, until it spread to a larger number of people, as well to a fish market and harbour workers (Arambepola et al. 2021). This was likely due to people with little power or authority not seeking help early, and delays in screening for and detecting those who had COVID-19 symptoms (Arambepola et al. 2021; Jayasinghe et al. 2021). The second outbreak was reported in an apparel industry factory in an adjoining suburb (Minuwangoda, Gampaha) and then in a fish market in the municipality council area (WHO, SEARO, Sri Lanka 2020). The spread was rapid and affected most parts of Colombo and Sri Lanka.

Strict measures were reintroduced and the epidemic appeared to be under control by the end of March 2021 (Hettiarachchi et al. 2021). COVID-19 case rates suggest that Colombo was the main hub in the spread of the disease: in the city of Colombo 2,691.0 per 100,000; in Colombo District 1,247.0 per 100,000; and in Sri Lanka 428.9 per 100,000.

The third wave emerged after the relaxation of measures in April 2021 (especially prior to the New Year) led to a steady increase in cases and was named the New Year cluster. In all, after the third wave in 2021 there were 14,573 deaths. In December 2021 further developments resulted in a fourth wave, as Omicron was detected in Sri Lanka (WHO, SEARO 2021). Its transmissibility is high and there is evidence that it has the ability to infect people despite complete vaccination with two doses (Discovery Health 2021).

2.1 Social Consequences

Colombo has about 1,700 extremely poor cluster settlements. These are concentrated in the Colombo North, Central and Borella/Dematagoda areas that have 1,544 cases in them (Perera 2021). Here, basic amenities and services are scarce, over 41% of settlements have to make do with common toilets; 33% have no metered water connection; more than 50% of households are single-parent households; and 78% of households earn less than about US$100 per month (Perera 2021).

People here are mostly employed in the informal sector and were severely affected during lockdowns. All indications are that the differential impacts of the pandemic widen existing socio-economic impacts in the city, as well as the nation. The state attempted to counter this trend by providing dry rations, food and financial packages to these affected areas through the Ministry of Home Affairs (Covid-19 Relief Services and Updates 2021).

2.2 Unintended Consequences of Response to the Pandemic

Violence against women has increased during the lockdown period in COVID-19 (Hapuarachchi, 2020). This indicator is based on the number of inquiries reaching the National Committee on Women, which comes under the purview of the Ministry of Women and Child Affairs. However, rates of homicides reported to the police remained almost the same in 2020 as preceding years, despite the lockdowns and curfews: 502 (2016); 452 (2017); 489 (2018); 479 (2019); 464 (2020) Total suicides reported to police have also remained relatively stable (Sri Lanka Police 2021).

In two public health areas, there was a decrease in incidence. The rates of admission from deliberate self-harm decreased during the early phases of the epidemic (Knipe et al. 2021). Deaths from road traffic crashes for 2018, 2019, were 3,097, 2,829, respectively and these figures decreased to 2,363 in 2020 (National Council

for Road Safety: Road Accidents). Admissions from dengue and leptospirosis have also shown a decline, most likely due to mobility restrictions (Niriella et al. 2021; Liyanage et al. 2021).

Some regions reported a significant reduction in monthly admissions to general medical wards, hospital mortality rates, numbers of coronary angiograms and percutaneous coronary interventions and in admissions with acute coronary syndrome, and delays in presenting to hospital (Kumanan et al. 2020). The services provided by the health services were disrupted, especially during the early phase of the epidemic. With time, certain services were able to respond and maintain functionality, e.g., haemato-oncology in the private sector and oral cancer survivors (Hewamana et al. 2021; Ratnasekera et al. 2020). Novel methods such as telemedicine were adopted and several private sector consultation platforms began to provide telephone or video consultations, in many specialties (e.g., ophthalmology) (Perera et al. 2020; Abeydeera 2020).

The pandemic also had other behavioural consequences. A web-based survey using a Google form shared through social media, i.e., Facebook, Instagram, Twitter and WhatsApp, found an overall increase in physical inactivity and evidence of sedentariness. With the existing digital divide, this is likely to be a biassed sample (Sooriyaarachchi et al. 2021). Food insecurity was observed in poorer households of Colombo coupled with higher rates of childhood wasting and of overweight, suggesting a dysregulation of food intake and exercise (Jayatissa et al. 2021).

2.3 Economic Consequences

A survey of poor households in Colombo reported a reduction in monthly household income in about 90% of households mainly due to loss of employment (64.7%), salary deductions (49.2%) and loss of additional income sources (40.1%). This was coupled with an increase in expenditures mainly due to rising prices of food (Jayatissa et al. 2021). Though the state provided quarantine, tests and all healthcare free of user-charges, there are hidden costs of illness. A study estimated the direct and indirect costs of illness (Gamage et al. 2021). Quarantine, which was mandatory to all first-level contacts during the initial stages of the epidemic, affected a substantial number of people. The non-health related direct costs include transport, food supplements and other personal purchases. The indirect costs were related to loss of earnings due to illness or death. The government allocated extra resources for health (approximately 0.7% of GDP), but the impact on poverty has been significant (World Bank 2021). Loss of jobs and reduced earnings are predicted to widen inequality and increase the poverty rate from 9.2% in 2019 to 11.7% (2020), based on the US$3.20 per day poverty rate.

3 Response to the Epidemic

The COVID-19 response was centralised. In January 2020, the president appointed a multi-sectoral national committee to formulate strategies and plans to combat COVID-19. The legal authority to ensure procedures of quarantine were given in the Quarantine and Prevention of Disease Ordinance No. 3 of 1897 (Arambepola et al. 2021; Jayasinghe et al. 2021). This task force was formed even before the first case was reported in the country. Later a National Operation Centre (NOCPCO) chaired by the army commander was established to coordinate implementation of countrywide plans. The national policy was for PCR-positive people to be managed in designated hospitals and primary contacts in quarantine centres. Toward this end, the defence forces built almost 60 quarantine centres around the country to provide accommodation free-of-charge for all contacts. Schools closed on 13 March 2020, the airport by 19 March and island-wide curfews were imposed from 20 March.

Gazettes were issued that made masking in public and physical distancing compulsory. Most institutions and commercial establishments introduced facilities for handwashing, screening of temperatures and guidance for physical distancing. Some establishments screened their workers with transparent plastic or similar sheeting and ensured that they were masked.

Regular media updates and health education were provided. Essential household items and financial assistance were distributed. Colombo followed the national system-wide strategy, though contact tracing and home quarantine were under the CMC's preventive health services. After the initial success in crushing the first wave, the country relaxed its controls. It then faced several clusters of waves. These were named by the government according to the places of origin. A second wave beginning in April 2021 was supposedly due to the relaxation of restrictions in the traditional New Year. These were clusters originating in a suburban factory and fish market and the epidemic has since spread to several low-income settlements in Colombo and surrounding areas.

3.1 Vaccination

The plans for vaccination were determined centrally with the Ministry of Health playing a key role. The first batches of vaccines were used for frontline health staff. Then the vaccination of the public began. Vaccination began in the first few days of March 2021, and within two weeks 103,269 people were vaccinated (Hettiarachchi et al. 2021). In the city of Colombo, the initial group to receive the vaccine were over-30s in 19 of the 47 municipal wards. Vaccinations were based on two criteria: the COVID-19 disease burden (the number of cases emerging from a particular area); and the number of COVID-19 deaths in a particular area.

On 18 March 2021 the vaccination of those over 60 years began. A healthcare team took the COVID-19 vaccine to the 28 homes for the elderly within the council

area and other people over 60 were vaccinated at six centres across the city. The relatives of any immobile elderly in their own homes were told to inform the closest Medical Officer of Health (MOH) office.

3.2 Informing the Public

Vibrant television and radio media, including state outlets, kept the public well informed. The city of Colombo received information available to most other areas of the country. The government media is handled by the Ministry of Mass Media. One major print media outlet of the state is the Associated Newspapers of Ceylon Ltd (Lake House) that produces widely read newspapers in Sinhala, Tamil and English (Lake House: Our History 2021). Of the TV channels, Rupavahini is a state-run corporation, Sri Lanka Rupavahini Corporation (SLRC) created by an act of parliament (Rupavahini: About Us 2021). Another is the Independent Television Network Ltd that produces more popular programmes. The Sri Lanka Broadcasting Corporation is the state radio channel and has a complementary Lakhanda radio for more popular entertainment (Ibrahim S. Business Today: The Struggle 2021). All news bulletins had reports on the COVID-19 situation and advice on prevention for the public. Due to the lock down, newspapers were irregular. However, public health messages were also sent through WhatsApp and mobile messaging and included health advice and information on travel restrictions and curfews.

Official communications were mainly through press conferences held by the NOCPCO and the Ministry of Health. The initial stage saw the Director-General of health services (DGHS) and the head of the NOCPCO making regular interviews over TV. These were initially structured during the first wave and used principles of disaster risk communication.

3.3 Framing the Problem

Initially the problem of restricting mobility to control the spread of the infection was framed as a law-and-order issue. The government relied on the Quarantine Ordinances enacted in 1897 and imposed police curfews (Quarantine Ordinances Sri Lanka 2021). This was partly due to the legal position at a time when parliament was not functioning. The president used his executive powers and the Quarantine Act to restrict mobility and police curfews. The relevant gazettes were released to impose severe nationwide travel restrictions during the initial phase of the epidemic. Penalties and arrests were imposed on those violating the laws. The lockdowns were monitored by the police and the defence forces. Media regularly showed arrests of persons for violating curfews and quarantine laws. As a result, there were accusations of militarising the response. The state-controlled and private television media regularly reported the number of those arrested for violating curfews. This was probably based

on the assumption that Sri Lankans lack self-regulation and will only respond to law and order.

There were appeals for people to wear masks, maintain physical distance and avoid crowds. This was done by the medical profession, the Ministry of Health and others, including mobile phone providers who replaced the ring tones with a recorded message in Sinhala, Tamil and English informing of dangers and requesting compliance with health measures.

Restrictions were relaxed in stages. The duration of curfews was the main modifiable factor. The other was to allow one person from each household to venture out to obtain essential food or medicines. Using public transport, including interprovincial travel was banned. Public transport and functions such as weddings were some of the last restrictions to be lifted. On the demand side, institutions were directed to encourage work from home and severely limit the numbers of people allowed to work in a confined area.

4 City as an Evolving Geospatial System

Colombo is part of the wider system because of overlapping services like transport and the lack of clear demarcated borders. It is a social-ecological system with interlocking functions that have an impact on future trajectories: resilience, adaptability, and transformability (Walker et al. 2004). The city has grown over the years and satellite images show progressive increases in the density of the built environment and a reduction in green spaces (Weerakoon 2017; Senanayake et al. 2013). There have been rapid transitions in subsystems, for example, the recent extension of the city through reclaiming land in Colombo. With Chinese collaboration, 269 hectares of reclaimed land were added to the city. This development is intended to lead to a rapid extension of high intensity growth in the built environment, aimed at developing a financial district (CHEC Port City Colombo (Pvt) Ltd 2021). The peripheral urban areas show higher rates of growth in the built environment. Some areas in the centre of the city were taken over for urban development, with its low-income settlements replaced by high-rise apartments and the people in the area relocated to other areas. These projects operate under the Urban Development Authority and the municipality has little role to play. However, the preventive services in these areas continue to be under the jurisdiction of the Municipality.

5 Systems Approach to the Spread of COVID

COVID-19 spreads mainly by droplets and aerosols. Therefore, close contact and lack of protection and immunity are crucial for viral spread. The spread of the infection can be viewed in different ways. One appropriate method is to consider it as forming

networks of contacts that help to spread the disease. Compartment models are easier, but assume relatively homogenous people within each compartment.

Colombo has several low-income settlements within the city. These consist of dense populations of people living in a small area. They form the informal workforce and some of them were slums (i.e. temporary structures) that have been improved with time to be more solid structures. The other form of income in these areas comes from migrant workers, who remit some of their earnings to the households. In relation to epidemics, these informal settlements have specific vulnerabilities (e.g., overcrowding that prevents social distancing and therefore accelerating spread), higher relative impacts (e.g., disruptions to livelihoods that support informal sector) and complex challenges of slums and low-income settlements (e.g., providing health care in overcrowded settlements).

5.1 Systems Approach to Control Measures

As described in the previous sections, control measures in the country were through centralised mechanisms of a task force established even before the first case of COVID-19 was detected (Arambepola et al. 2021; Jayasinghe et al. 2021). A National Operation Center for Prevention of COVID-19 Outbreak (NOCPCO) was established under the army commander on 17 March 2020, which made most of the major decisions. The initial period of the pandemic saw the dissolution of parliament. As a result, the power was mainly with the executive president who used several Government Gazettes to implement control measures. This characterised the first phase of the pandemic.

The task force, the NOCPCO, the Ministry of Health and other ministries were essentially nested sub-systems at multiple levels, which self-organised and have their own adaptive cycles. The Ministry of Health and other ministries had their expert committees that submitted reports to the centralised body. The CMC was part of this process. However, it had some room for manoeuvring on policy options in the wider system. The preventive services of random PCR testing, identifying contacts, coordination and implementation of the vaccination programme were largely under their control. The political leadership of the CMC is not with the party in power in the parliament. However, their abilities to use separate laws is very limited. The laws related to quarantine (the Quarantine Act) have given wide-ranging powers to the Director-General of health services in the Ministry of Health.

5.2 Systems and Human Mobilities

Restrictions on the dynamic transport system was a crucial lever in the control of the epidemic. As the mode of COVID-19 spread is mainly droplets or aerosols containing the virus, close contact is essential for its spread. Contact is facilitated by mobility of

infected or non-infected non-immune. The transport systems therefore play a crucial role in its spread, more so public transport that encourages clustering of people in the confined spaces of a bus or train.

Banning inward travel to the country reduced the numbers arriving with the infection. The restrictions on inter-provincial travel effectively reduced the numbers spreading from the cities to other areas of the country. These mobility and transport restrictions curtailed the spread of the disease at a local level. It also discouraged the congregation of people in static locations such as offices, functions (e.g., weddings) and sites of entertainment (e.g., cinemas).

5.3 Health Systems and Vaccination

Vaccinations in the health system in Sri Lanka are mainly provided by the state sector. Based on the central recommendations of the task force and the Ministry of Health Advisory Committee, the council administered the vaccine through its network of clinics. These clinics were complemented by the army opening large, well-organised vaccination centres in several locations in the city, as well as elsewhere. By 12 December 2021, more than 13.5 million (almost 63% of the 21.7 million total population of Sri Lanka) had been vaccinated with two doses (WHO, SERO 2021). A number of different vaccines was available: Sinopharm, Covishield, Sputnik, Pfizer and Moderna.

5.4 System Consequences

The COVID-19 epidemic had impacts on the economy at both micro- and macro-levels. At a micro-level there were effects due to illness (e.g., loss of productivity), loss of livelihoods (e.g., loss of work from closure of businesses) and costs of health-care (World Bank 2021). There were added impacts on social contacts. Figure 1 summarises the economic impacts of COVID-19, especially relevant to Sri Lanka. It outlines the pathways of households and communities moving towards poverty.

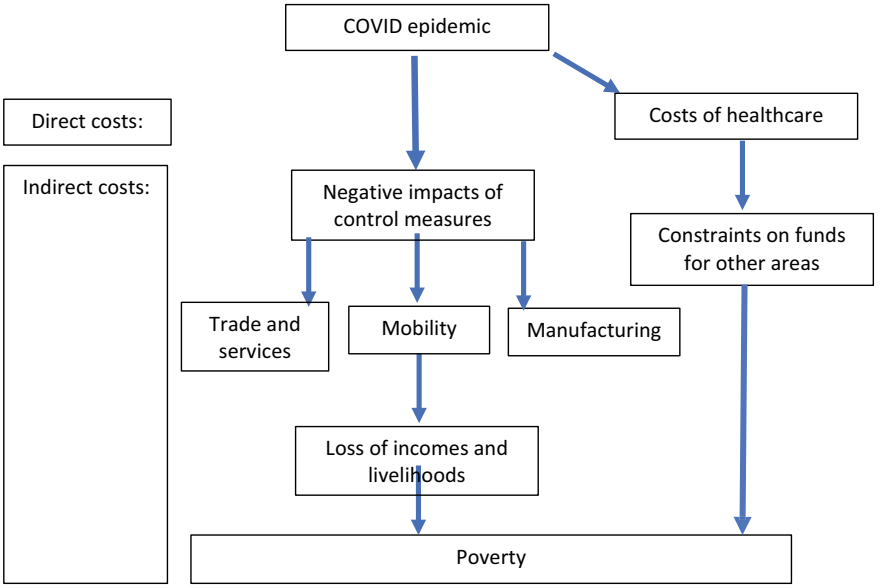

Fig. 1 Direct and indirect economic costs of COVID-19

6 Conclusion

This chapter outlines the evolution of the COVID-19 pandemic in Sri Lanka and its capital, Colombo, using a systems approach. This perspective draws attention to the dynamic nature of multiple systems that exist in cities and how they interacted during the epidemic. The range of roles played by different characteristics of systems is described. Further study of these systems would enable a more in-depth understanding of disasters of this nature and help society to take measures to prevent, mitigate and adapt.

References

Abeydeera A (2020) Telemedicine in ophthalmology during the COVID-19 pandemic. Community Eye Health 33(109):40. Epub 2020 Sept 1. PMID: 33304052; PMCID: PMC7677802

Arambepola C, Wickramasinghe ND, Jayakody S, Hewage SA, Wijewickrema A, Gunawardena N, Dhanapala S, Prathapan S (2021) Sri Lanka's early success in the containment of COVID-19 through its rapid response: clinical and epidemiological evidence from the initial case series. *PLoS One*, July 29, 16(7):e0255394. https://doi.org/10.1371/journal.pone.0255394

CHEC Port City Colombo (Pvt) Ltd. (2021) Building a world class city for South Asia. https://www.portcitycolombo.lk/about/. Accessed 12 Dec 2021

Colombo Municipality Council (2021) Public Health Department. https://www.colombo.mc.gov.lk/public-health.php. Accessed 12 Dec 2021

Covid-19 Relief Services and Updates (2021). http://www.thimbirigasyaya.ds.gov.lk/index.php/en/covid-19/dry-ration-bags-worth-lkr-10000-distribution.html. Accessed 12 Dec 2021

Discovery Health (2021) South Africa's largest private health insurance administrator, releases at-scale, real-world analysis of Omicron outbreak based on 211 000 COVID-19 test results in South Africa, including collaboration with the South Africa. Press Release, 14 December 2021. https://www.discovery.co.za/corporate/news-room. Accessed 12 Dec 2021

FairMed (2021) The Colombo Municipal Council. https://fairmedsrilanka.org/what-we-do/current-projects-in-sri-lanka/colombo-municipal-council-cmc. Accessed 12 Dec 2021

Food Security and Nutrition in City Region Food System Planning Policy brief Colombo (Sri Lanka) based on Thiel F, Phillips I, Drechsel N. 2019. Rapid Scan: Colombo City Region Food Systems and their vulnerability towards climate change related shocks. International Water Management Institute, Colombo, Sri Lanka

Gamage A, Kenneth A, Samarawickrama M., de Silva A (2021) Direct and indirect costs related to quarantining primary-contacts of patients with COVID-19 in Sri Lanka. The World Congress of Epidemiology: WCE 2021: Virtual congress: Melbourne Australia, September 2021

Golechha M (2020) COVID-19 containment in Asia's largest urban Slum Dharavi-Mumbai, India: lessons for policymakers globally. J Urban Health 97(6):796–801. https://doi.org/10.1007/s11524-020-00474-2

Hapuarachchi P (2020) Rate of violence against women increases amidst COVID-19. News First, 06 May 2020. https://www.newsfirst.lk/2020/05/06/rate-of-violence-against-women-increases-amidst-covid-19/

Hettiarachchi K, Deane R, and Rathnayake M (2021) Community vaccination drive: special measures for vaccination rollout for elderly in Colombo city. The Sunday Times, March 21. https://www.sundaytimes.lk/210321/news/special-measures-for-vaccination-rollout-for-elderly-in-colombo-city-436990.html. Accessed 12 Dec 2021

Hewamana S, Skandarajah T, Jayasinghe C, Deshapriya S, Senarathna D, Arseculeratne G, Harischandra M, Somasundaram G, Srinivasan V, Somiah S, Munasinghe N, Hewawasam S, Ekanayake L, Wadanamby R, Galagoda G, Lin TT, Balawardena J (2021) Blood cancer care in a Lanka. PLoS ONE 16(9):e0256941. https://doi.org/10.1371/journal.pone.0256941

Ibrahim S. Business Today: The Struggle (2021). https://www.businesstoday.lk/article.php?article=5257. Accessed 12 Dec 2021

Jayasinghe S, Weerawarana S, Jayaweera DT (2021) Addressing COVID-19 in resource-poor settings: Comparing the experiences of Vietnam and Sri Lanka. Am J Public Health 111(3):387–389. https://doi.org/10.2105/AJPH.2020.306108

Jayatissa R, Herath HP, Perera AG, Dayaratne TT, De Alwis ND, Nanayakkara HPLK (2021) Impact of COVID-19 on child malnutrition, obesity in women and household food insecurity in underserved urban settlements in Sri Lanka: a prospective follow-up study. Public Health Nutr 24(11):3233–3241. https://doi.org/10.1017/S1368980021001841

Jeewandara C, Guruge D, Jayathilaka D, Deshan Madhusanka PA, Pushpakumara PD, Tanussiya Ramu S, Sepali Aberathna I, Saubhagya Rasikangani Danasekara DR, Pathmanathan T, Gunatilaka B, Malavige S, Dias Y, Wijayamuni R, Ogg GS, Malavige GN (2021) Transmission dynamics, clinical characteristics and sero-surveillance in the COVID-19 outbreak in a population dense area of Colombo, Sri Lanka, April–May 2020. PLoS ONE 16(11):e0257548. https://doi.org/10.1371/journal.pone.0257548

Karunanayake C (2020) Pandemic recovery in urban settings: planning for the unplanned. Talking Economics, 28 October 2020. Institute of Policy Studies. https://www.ips.lk/talkingeconomics/2020/10/28/pandemic-recovery-in-urban-settings-planning-for-the-unplanned/. Accessed 12 Dec 2021

Knipe D, Silva T, Aroos A, Senarathna L, Hettiarachchi NM, Galappaththi SR, Spittal MJ, Gunnell D, Metcalfe C, Rajapakse T (2021) Hospital presentations for self-poisoning during COVID-19 in Sri Lanka: an interrupted time-series analysis. Lancet Psychiatry 8(10):892–900. https://doi.org/10.1016/S2215-0366(21)00242-X

Kumanan T, Rajasooriyar C, Guruparan M, Sreeharan N (2020) The impact of COVID-19 on the delivery of critical health care: experience from a non-high-income country. Asia Pac J Public Health 32(8):473–475. https://doi.org/10.1177/1010539520963626

Lake House: Our History (2021) http://www.lakehouse.lk/about/our-history. Accessed 12 Dec 2021

Liyanage P, Rocklöv J, Tissera HA (2021) The impact of COVID-19 lockdown on dengue transmission in Sri Lanka: a natural experiment for understanding the influence of human mobility. PLoS Negl Trop Dis 15(6):e0009420. https://doi.org/10.1371/journal.pntd.0009420

Ministry of Health (2017) Basement Report of the Institution Frame of Private Sector of Western Medicine and State Indigenous Medicine Sector http://www.health.gov.lk/moh_final/english/public/elfinder/files/publications/2019/Private%20and%20indigenous%20medicine%20report%202017.pdf. Accessed 12 Dec 2021

Ministry of Transport (2014) Urban Transport System Development Project for Colombo Metropolitan Region and Suburbs: CoMTrans Urban Transport Master Plan Summary Report 2014. http://www.transport.gov.lk/web/images/downloads/F-CoMTrans_Main_S.pdf

National Council for Road Safety: Road Accidents. https://www.transport.gov.lk/web/index.php?option=com_content&view=article&id=29&Itemid=149&lang=en#road-accidents. Accessed 12 Dec 2021

Niriella MA, Ediriweera DS, De Silva AP, Premarathna BHR, Jayasinghe S, de Silva HJ (2021) Dengue and leptospirosis infection during the coronavirus 2019 outbreak in Sri Lanka. Trans R Soc Trop Med Hyg 115(9):944–946. https://doi.org/10.1093/trstmh/trab058

Perera Y (2021) Covid cases drop in Colombo. Daily Mirror, 02 Nov 2021. https://www.dailymirror.lk/print/front_page/Covid-cases-drop-in-Colombo/238-222777. Accessed 12 Dec 2021

Perera SR, Gambheera H, Williams SS (2020) "Telepsychiatry" in the time of COVID-19: overcoming the challenges. Indian J Psychiatry 62(Suppl 3):S391–S394. https://doi.org/10.4103/psychiatry.IndianJPsychiatry_848_20. Epub 2020 Sept 28

Pussella PGRNI and Lin L (2020) Availability of green spaces in Colombo Municipal Council (CMC) area. In: 10th Annual Research Session of Sabaragamuwa University of Sri Lanka, 16th December 2020. Accessed 12 Dec 2021

Quarantine Ordinances Sri Lanka (2021). https://www.quarantine.health.gov.lk/images/pdf/act/quarantine_and_prevention_of_disease_act553.pdf. Accessed 12 Dec 2021

Ramsar (2018) 18 cities recognized for safeguarding urban wetlands. http://www.ramsar.org.news/18-cities-recognized-for-safeguarding-urban-wetlands. Accessed 12 Dec 2021

Ranagalage M, Estoque RC, Murayama Y (2017) An urban heat island study of the Colombo Metropolitan Area, Sri Lanka, based on landsat data (1997–2017). ISPRS Int J Geo Inf 6(7):189. https://doi.org/10.3390/ijgi6070189

Ratnasekera N, Perera I, Kandapolaarachchige P, Surendra G, Dantanarayana A (2020) Supportive care for oral cancer survivors in COVID-19 lockdown. Psychooncology 29(9):1409–1411. https://doi.org/10.1002/pon.5463

Rupavahini: About Us (2021). http://www.rupavahini.lk/about-us/about-rupavahini. Accessed 12 Dec 2021

Senanayake IP, Welivitiya WDDP, Nadeeka PM (2013) Urban green spaces analysis for development planning in Colombo, Sri Lanka, utilizing THEOS satellite imagery—a remote sensing and GIS approach. Urban for Urban Greening 12:307–314

Sooriyaarachchi P, Francis TV, King N, Jayawardena R (2021) Increased physical inactivity and weight gain during the COVID-19 pandemic in Sri Lanka: an online cross-sectional survey. Diabetes Metabolic Syndrome 15(4):102185. https://doi.org/10.1016/j.dsx.2021.06.022

Sri Lanka Police: Crime Statistics (2021) https://www.police.lk/index.php/item/138

The World Bank (2021) Sri Lanka development update 2021. Economic and Poverty Impact of COVID-19. https://thedocs.worldbank.org/en/doc/15b8de0edd4f39cc7a82b7aff8430576-0310062021/original/SriLanka-DevUpd-Apr9.pdf. Accessed 12 Dec 2021

Urban Regeneration Programme (2021) Website of the Urban Development Authority. https://www.uda.gov.lk/urban-regeneration-programme.html. Accessed 12 Dec 2021

Walker B, Holling CS, Carpenter SR, Kinzig A (2004) Resilience, adaptability and transformability in social–ecological systems. Ecol Soc 9(2):5. http://www.ecologyandsociety.org/vol9/iss2/art5
Weerakoon KGPK (2017) Analysis of spatio-temporal urban growth using GIS integrated urban gradient analysis; Colombo district, Sri Lanka. Am J Geogr Inf Syst 6(3):83–89
WHO, SEARO (2021) Press release: WHO South-East Asia Region confirms first few cases of Omicron, 3 December 2021. News release. https://www.who.int/srilanka/news/detail/03-12-2021-who-south-east-asia-region-confirms-first-few-cases-of-omicron. Accessed 12 Dec 2021
WHO, SEARO, Sri Lanka (2020) Genomic sequencing conducted to understand the October 2020 COVID-19 outbreak in Sri Lanka, 3 November 2020. https://www.who.int/srilanka/news/detail/03-11-2020-genomic-sequencing-conducted-to-understand-the-october-2020-covid-19-outbreak-in-sri-lanka. Accessed 12 Dec 2021
Wijesekara NWANY, Herath N, Kodituwakku KALC, Herath HDB, Ginige S, Ruwanpathirana T, Kariyawasam M, Samaraweera S, Herath A, Jayawardena S, Gamge D (2021) Predictive modelling for COVID-19 outbreak control: lessons from the navy cluster in Sri Lanka. Military Medicine Research 8(1):31. https://doi.org/10.1186/s40779-021-00325-4
World Bank (2021) The COVID-19 impact on livelihoods and poverty in Sri Lanka: Background Note to Sri Lanka Poverty Assessment. World Bank, Washington, World Bank. https://openknowledge.worldbank.org/handle/10986/35496. Accessed 12 Dec 2021
Worldometers (2021) Main cities by population in Sri Lanka. https://www.worldometers.info/world-population/sri-lanka-population/. Accessed 12 Dec 2021

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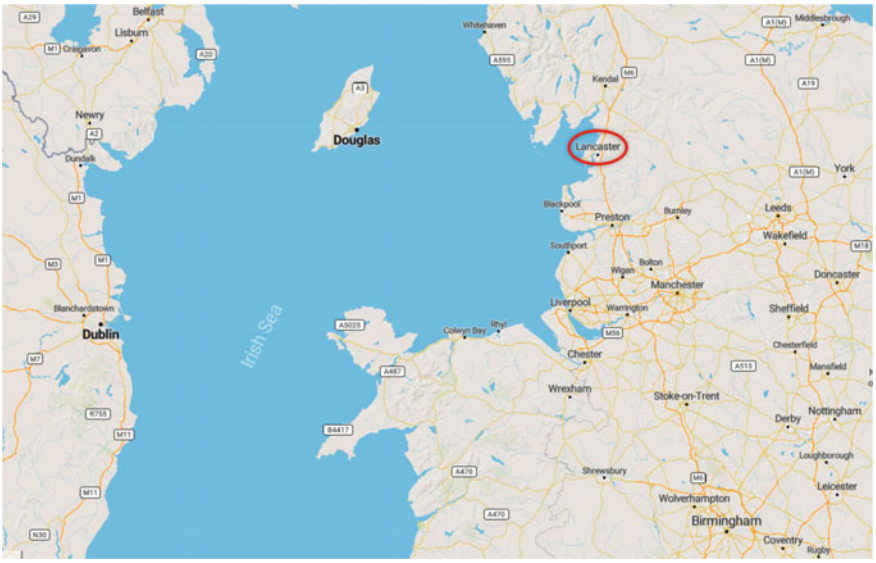
UNITED KINGDOM: A Case Study of Lancaster

Rachel Cooper, Louise Mullagh, Naomi Jacobs, and Nuri Kwon



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Urban Health and Wellbeing, https://doi.org/10.1007/978-981-19-8163-0_15

1 Background

Lancaster is an historic city located in the county of Lancashire, in the north-west of England. A population of approximately 146,038[1] makes it the fourth largest district council in the county. The city covers an area of approximately 576.2 km^2, is located 7 km from the coast and includes the seaside town of Morecambe. It is the most northerly city in Lancashire, is located on the river Lune and was once one of the most important ports in England.

Lancaster has areas of high socio-economic status, with the Morecambe Bay NHS Trust, the city's two universities and Heysham Power Station being the main employers. However, Morecambe also has some of the highest levels of socio-economic deprivation in England. Lancaster's economy is predominantly service-oriented (Lancashire Council 2021) and 80% of the district's businesses are small or medium enterprises, with few national chains in the city. The city's location in the north-west of England means the climate is temperate and sees a high amount of rainfall, which has caused significant flooding in the past. As a district Lancaster covers a range of landscapes, from the coastal area of Morecambe, to the hilly city itself and out towards the Pennine belt. Further north of the district lie the Lakeland fells and mountains, and to the east the Yorkshire Dales. Good infrastructure, including the M6 motorway and the West Coast Main Line mean the city is well connected to Scotland, Manchester and London (Fig. 1).

The ecosystem of local governance in England is complex, with different tiers resulting from moves towards a more devolved landscape. In the north-west of England there is a mixture of metropolitan city areas (Manchester and Liverpool) with elected mayors, unitary authorities who deliver services usually provided by county councils (e.g., social care, education, highways), county councils (Lancashire),

Fig. 1 Lancaster skyline (*Source* David P, CC BY-SA 2.0/Wikimedia commons)

[1] 2019 mid-year population estimate. https://www.lancashire.gov.uk/lancashire-insight/area-profiles/local-authority-profiles/lancaster-district/.

district councils (Lancaster) and parish councils. The district of Lancaster is represented by two members of parliament: one for Lancaster and Fleetwood (Labour) and one for Morecambe and Lunesdale (Conservative). There are three tiers of governance within the district: Lancashire County Council, Lancaster City Council and parish (neighbourhood/village) councils, all providing a wide range of services across the district. During the COVID-19 pandemic, in addition to the services and guidance provided by the UK government, each tier of local governance was required to adapt their service provision to ensure residents and businesses were supported. These services were operating in emergency mode at the beginning of the pandemic and once more during the resurgence of cases in the district from August 2020. The National Health Service (NHS) also provided essential services during this period.

Provision of key services is divided between Lancashire County Council, who provides education, highways, registrations of births, marriages and deaths, social care and Lancaster District Council, who provides waste collection, housing, planning and building control and council tax collection. The district council (referred to for the rest of this chapter as city council/the council) is run by an elected council, with an executive committee of members who are also portfolio holders. The chief executive has overall responsibility for council officers who are split into three directorates; Communities and the Environment, Corporate Services and Economic Growth and Regeneration (Lancaster City Council 2021).

2 Timeline of COVID-19 Response

Communication during the pandemic was split between national governments (with separate communications issued from England, Scotland, Wales and Northern Ireland), Public Health England, the NHS, county councils (Lancashire) and district councils (Lancaster). The UK government's public information campaign began in February 2020 with the publication of posters and other graphic communication telling citizens to wash their hands. This then became a more urgent campaign once cases began to rise in the UK. The government began holding regular press conferences where the Prime Minister or a member of the executive cabinet would update the public on television, along with scientists and government medical officers. The phrase 'Stay at home, protect the NHS, save lives' became prominent when the first lockdown was introduced in March 2020 and was accompanied by a range of graphic material (Figs. 2 and 3).

Public Health England also distributed television adverts and graphical materials advising the public to wash their hands, cover their faces and maintain social distancing (hands, face, space) (Fig. 2). Lancaster City Council does not have a remit for public health, instead being responsible for environmental health. It produced materials in the city centre to guide residents on social distancing measures (Fig. 3) and its website and communication channels pointed towards the national campaigns.

The city council also communicated information through a variety of channels about its key services and changes to provision, in addition to outlining support

Fig. 2 Public Health England COVID-19 information—hands, face, space

Fig. 3 City centre materials to guide residents on social distancing measures

available to residents and businesses. As soon as the pandemic began, it sent a letter to all homes and businesses in the district with phone numbers and information about service provision. This was followed by regular updates on its websites, provision of extended hours for customer services, COVID-19 information officers who were present in the city and surrounding areas, social media and regular video meetings.

Throughout the pandemic the MP for Lancaster and Fleetwood had governmental briefings relating to the changing regulations and the introduction of the tier system.

These were often arranged at short notice due to the fast pace of developments and implementation of policy. The leader of the city council also received briefings from the central government prior to some public announcements being made, but also had to rely on information provided to the public. Both the MP and the leader of the council had issues in getting up-to-date information from the central government. This placed pressure upon them when providing advice and guidance to constituents and residents. Laws were passed relating to social gatherings and business closures and these were enforced by police. Locally, Lancaster City Council ensured compliance of social distancing measures in local businesses, operated a "COVID safe" scheme, and enforced closures of non-essential retail, hospitality, leisure and personal care businesses.

3 Timeline of Effects

The four UK countries (England, Northern Ireland, Scotland, Wales) were each subject to different regulations and lockdowns. Key dates for England, including lockdowns and the introduction of the tier system are illustrated in Fig. 4.

When the tier system was introduced in October 2020, Lancaster was placed in the same tier as the whole of Lancashire, despite cases in the west of the county being much lower than in eastern regions (such as Blackburn with Darwen and Burnley). This was highlighted in November when the Lancaster and Fleetwood MP called

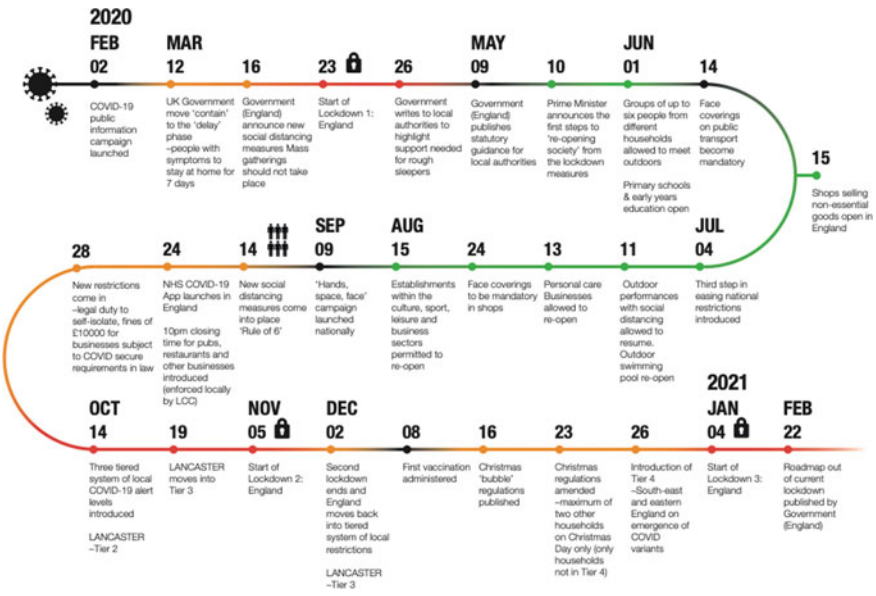

Fig. 4 Timeline of key COVID-19 events

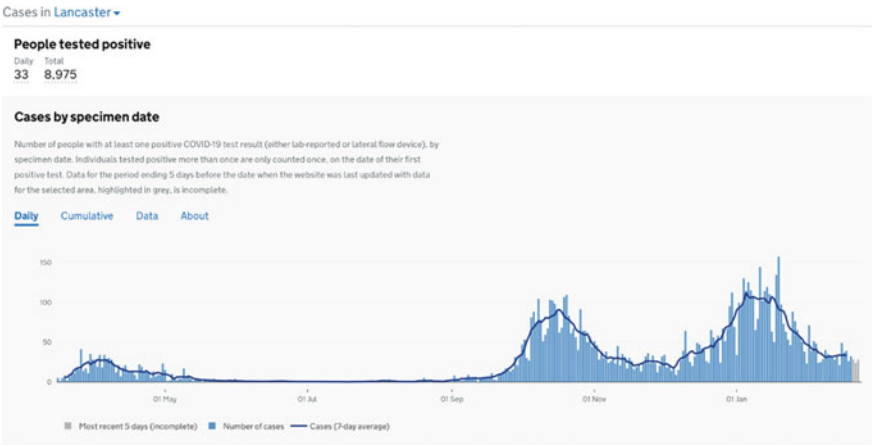

Fig. 5 Graph of daily COVID-19 cases in Lancaster (from UK Government Data Dashboard)

for a more local approach, suggesting Lancaster and Fylde, who had fewer cases, should be placed in a lower tier. However, not long after this, cases in this area began to rise again and so the MP accepted that Lancaster should remain in the same tier as the rest of the county. Communications between national government, MPs and local councils often consisted of briefings arranged with short notice. Furthermore, the complex ecosystem of regional and local governance in England resulted in a lack of understanding of that ecosystem by civil servants and politicians in central government, and a lack of clarity in the guidelines whilst working at high speed. The rapid rollout of national and subsequently regional tier systems, which were often leaked to national press ahead of official announcements, meant it was vital for local government officers and politicians, including the Lancaster MP, to communicate locally and offer reassurance and support to local residents and businesses. Lancaster district itself did not have a significantly high level of cases (Figs. 5, 6, and 7), but Lancashire and the North West both saw very high cases. By the 12 February 2021 Lancaster had 8586 cases (6039 per 100,000 of the population), Lancashire had 88,913 cases (7,289.2 per 100,000) and the North West had 551,777 (7,516.2 per 100,000) and the UK 4,013,799[2] (Lancashire County Council 2021). The UK saw the highest death rates in Europe, with 116,287 people dying by 12 February 2021. By this date, Lancaster had 261 deaths, and Lancashire 2,700 (third highest among upper tier local authorities)[3] (UK Government COVID-19 Data Dashboard 2021).

[2] Lab confirmed cases.

[3] Deaths within 28 days of positive test by date of death.

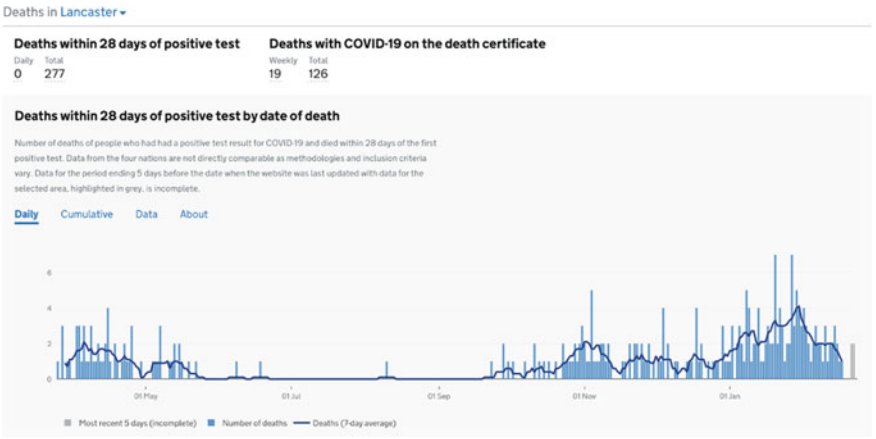

Fig. 6 Graph of daily COVID-19 deaths in Lancaster (from UK Government Data Dashboard)

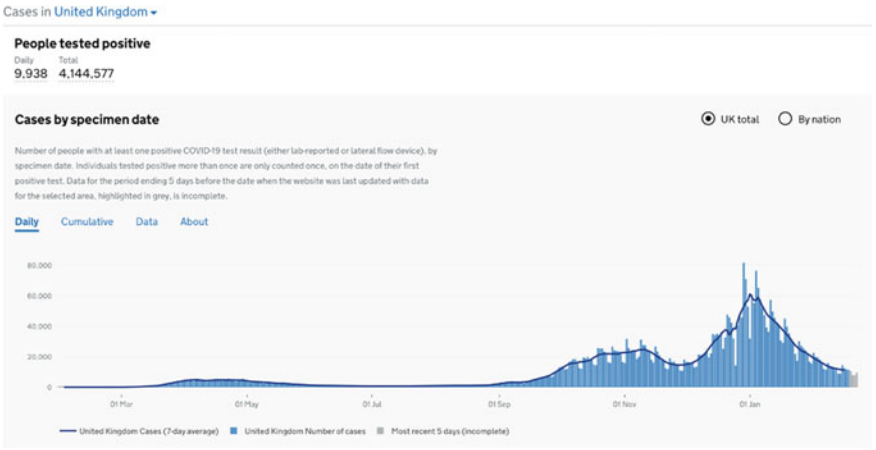

Fig. 7 Graph of daily COVID-19 cases in UK (from UK Government Data Dashboard)

4 Consequences

4.1 Urban Form

The pandemic resulted in tangible changes to the urban form of Lancaster, particularly around the city centre. In order to ensure compliance with social distancing in the pedestrianised areas of the city centre, signage was installed and seating was taped so that people could not sit down. The city's charter market, which has been in existence since the eighteenth century, is usually located in a pedestrian zone that sees heavy footfall under normal circumstances. In order to keep the market operating

and supporting small local businesses, the market was relocated to Dalton Square; an historic area close to the town hall (Fig. 8).

The square is usually open to traffic, but it was closed off to enable the market to operate on Wednesdays and Saturdays, in addition to encouraging more pedestrians to use the space. The relocation also enabled the council to experiment with using this area for pedestrians only as part of a larger, long-term plan with Lancashire County Council to redesign the whole city centre transportation system, including its notorious one-way gyratory system. The urban realm also saw the transformation of buildings, with offices reused for customer services to enable social distancing and the town hall being used as a vaccination centre (Fig. 9).

Fig. 8 Dalton Square closure notices and hand sanitiser station

Fig. 9 Pop-up bicycle lanes in Lancaster City Centre

Transportation around the city was also redesigned when central government issued orders to local and county councils to deploy cycle and walking paths (image) in order to encourage more people into active travel, which would take the pressure off public transport. This involved the closure of some smaller roads, where in some cases barriers were combined with containers of plants and greenery. Plans were already in place to develop the city's active travel plans in the future, and these were brought forward and prototyped during the pandemic.

Nationally a picture emerged that large portions of the population were unable to access green space within a ten-minute walk (Mell 2021). As the impact of pandemics in the past have highlighted the need for careful consideration of urban design and its effects on urban health, the impact of the design of urban spaces will need to be reconsidered and designed to enable greater wellbeing post COVID-19.

4.2 Policymaking

Within the city council, policies that had been on the agenda for the future were brought forward and essentially prototyped; including working from home, roll-out of digital technologies, active travel and urban realm. The process of policymaking was challenging in the early stages whilst effective modes of communication were being established between elected members and council officers. A key policy that came from central government and had to be enacted by the city council was the implementation of business support schemes to assist local businesses, which had to be funded initially by the city council until they were able to recoup funds from central government.

The city council had developed an emergency plan prior to the pandemic, which dealt with a range of risks, such as fire or flood, and included a plan for a pandemic. However, the pandemic plan dealt primarily with the provision of services, which were placed in Band 3 (least essential) to Band 1 (most essential and statutory[4]). One key task in the early stages of the pandemic was to redeploy staff from Band 3 to ensure that the key services in Bands 1 and 2 were adequately staffed. The plan was revised as it was implemented as no officers or councillors had operational experience of a pandemic. It continues to be a working document where learning is incorporated.

[4] The City Council's Emergency Plan prioritised services in three bands—with Band 1 being statutory and vital services, Band 2 being important services and Band 3 being services from where staff could be re-deployed.

4.3 Digital Technology

The rapid implementation of work-from-home orders meant the city council had to ensure all staff working from home had adequate hardware, software and internet connection. This deployment occurred successfully, with Microsoft Teams being used for all meetings within the council, for council executive committee meetings and for community calls. This deployment of technology also saw a roll out of devices to staff who were not office based and did not tend to use digital technology, such as bin collectors, who were provided with new technology equipment and embraced it. Attendance at virtual all-staff meetings also increased during the pandemic, and it is perceived that there has been greater engagement in the democratic process and across communities when video calls were held.

A key challenge in the reliance upon technologies, both within the council and in communities, particularly for children who had to homeschool and residents who needed assistance, was the provision of equipment and access to the internet. A range of charitable organisations donated equipment to schools and mobile phone and internet providers enabled free access to those in need. Residents in rural areas also found issues with broadband connectivity, which is part of a wider national issue with mobile and broadband provision in rural and remote areas.

4.4 Social Consequences

Throughout the pandemic there was a strong sense of community both within the council and in communities. Small mutual aid groups developed that helped vulnerable residents who were shielding with shopping or made phone calls to those who were lonely. In an interview with the city council leader, she expressed her pride in the officers across the council who had worked throughout the pandemic, often in different roles. The city council set up a community hub at the onset of the pandemic, providing support for residents in a range of areas. This was considered an example of good practice and included in the Carnegie Trust's 'Pooling Together' report (Coutts et al. 2020). The city council transformed from being just a service provider to being a connector and network actor during the last year, seeing themselves more as an enabler, with the skills and resources to connect communities and organisations to foster a sense of shared responsibility across the district. Furthermore, the council worked to provide all homeless residents with accommodation, which would normally be a complex operation due to often complex needs and the different organisations involved in such a process.

5 Conclusion

5.1 Impact of Taking a Systems Approach

Governments at all scales can employ systems thinking in order to aid policymakers in not only understanding but also influencing the spread of infection and the wide range of impacts it has across communities (Bradley et al. 2020). The systems approach diagram (Fig. 10) illustrates the complex relationships between the national government, local government and the statutory regulations carried out by all organisations. It also highlights the partnerships that were vital to service delivery during the pandemic and the policy areas the city council intends to develop further in the future.

We saw that Lancaster took an approach that was partly systematic, but also partly emergent and responsive. Certain actions taken by the city council had been mandated by the national government, such as the requirement for local authorities to provide adequate shelter for the homeless population, the distribution of financial support to businesses in the district and the provision of increased space for cycling and walking (carried out in partnership with Lancashire County Council).

Other actions, such as those in the city council's emergency plan, also followed protocols. The lack of operational experience both within the district, county and national governments led to responsive learning throughout the pandemic and, therefore the importance of reflection became apparent in these processes. The planned responses within the council's emergency plan, such as prioritising key services, were adapted as officers gained clearer insights into what was required for each service. The city council was able to respond to the service needs of the community by redeploying staff rapidly into key areas, such as bin collection and customer services. This was only possible because their workforce was of adequate size, a result of the council not out-sourcing any services. In recent years the practice of out-sourcing which began in the 1980s has been reversed, with councils taking the decision to 'in-source' to provide higher quality services, better value for money and to provide high-quality employment (Sasse et al. 2020).

Barriers to the city council taking a systems approach were discovered, namely the complexity of governance at the regional and local level in the English regions. This mix of governance types and the resultant confusion by central government about roles and requirements of government at a local level led to lack of clear communication and the implementation of large-scale tier regulations. It was felt by local leaders that at certain stages of the pandemic a local approach to tiers and also to the track and trace system might have worked more effectively.

The way in which the city council moved from the role of service-provider to 'connector' is also important to consider in the context of systems approaches. Whilst regulatory responses were seen in some areas of the city council's response, a more emergent approach was seen in their response to residents in need. Within a week of the lockdown announcement in March 2020 the council moved to set up their district community hub, which relied upon the assistance and support of community

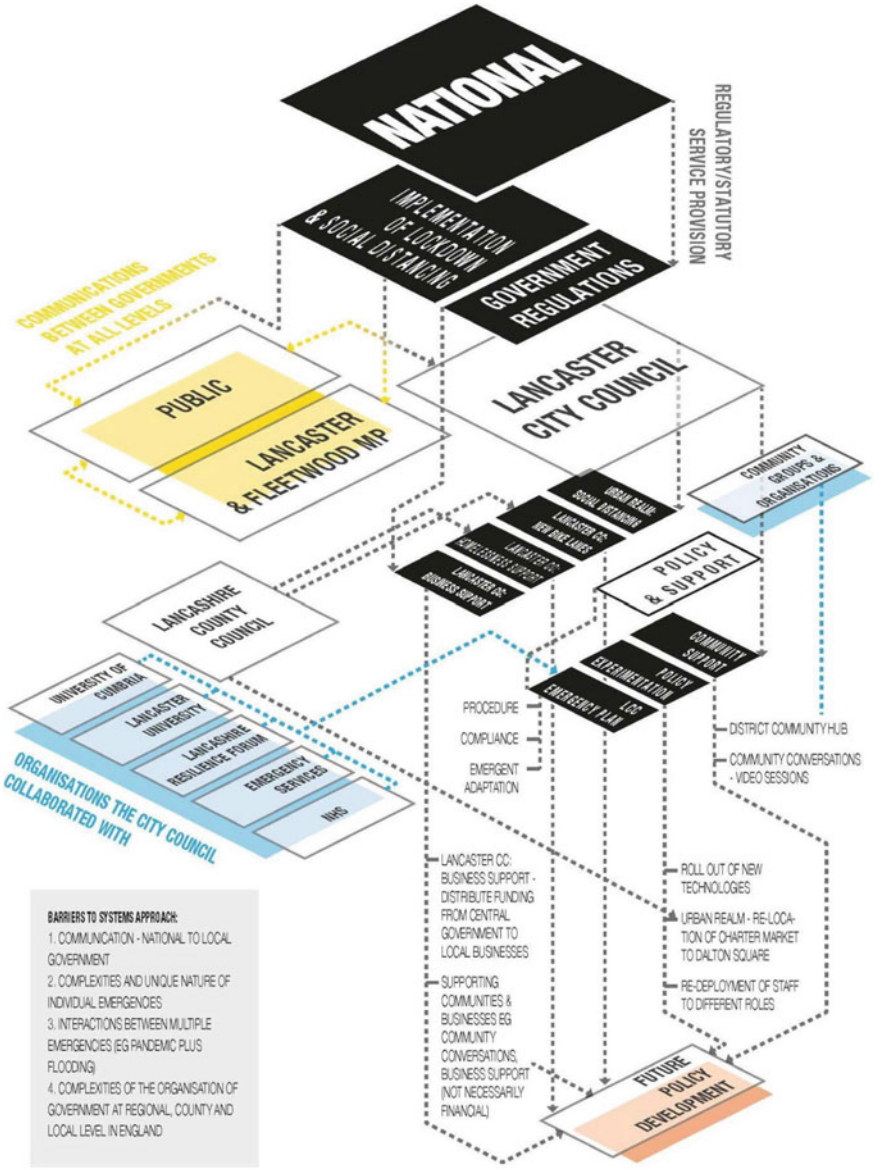

Fig. 10 Systems map showing interrelationships between Lancaster city council and other organisations

groups within the district. Whilst this was not included in the emergency strategy or required by central government, it became a key method of both communicating with and providing support for those who were particularly vulnerable.

5.2 Evidence of On-Going Policy Change

Prior to COVID-19, the city council was focussing on three priorities: meeting the climate emergency, building community wealth, and building community power. Through their work, they were focussing on community engagement, which they carried out through community mapping, community organising and understanding where people meet, and understanding the different kinds of groups and how they connect. As the pandemic started to impact, the council began pulling together the community organisations, community leaders and other institutions and organisations in order to support one another and share information. Whilst simultaneously providing and bringing together support in the district, the council maintained focus on their three core priorities that would also be priorities in the future. This demonstrates that forward planning for policies needn't be abandoned during extraordinary circumstances and can act as a framework to support actions during these times to maintain focus.

The city council also brought forward internal and external facing policies that had been on the horizon, such as the need to tackle the issues with the city's homeless population, flexible working from home, and encouragement of active travel in the city through cycling and walking and changes to the urban realm. In fact, the pandemic offered opportunities for experimentation in policy areas relating to active travel and the urban realm, where officers from the city council and county council were able to observe the impact of pop-up cycle lanes and the pedestrianisation of Dalton Square due to the relocation of the charter market. The council also experienced the removal of 'red tape' and policies that might take a long time to enact have been carried out rapidly. This was demonstrated in the speed at which the city's homeless population were provided with shelter and care, a task which would normally have taken much more time and become far more complex.

It is also apparent that key officers and leadership within the council are keen to learn from their experiences of the pandemic and embed lessons from this time into their future planning. This will inform policies around transportation, the public realm and human resources. In particular, the leadership is keen to harness the new skills and enthusiasm demonstrated by some staff who were redeployed or had opportunities to demonstrate skills during this period.

The council's emergency plan has also been affected by this pandemic, most notably through the reflections and experiences of those involved in delivering the plan, which have been written into it and transformed it from written plan to working document. Officers have realised that whilst there is a need for the plan to contain operational steps and procedures it is also vital that flexibility is built into the plan. It is also vital that the plan reflects the possibility of emergencies overlapping and

occurring simultaneously, for example experiencing a pandemic whilst experiencing flooding or other emergencies caused by climate change. A systems approach is imperative as pandemics do not occur in a vacuum, and in the future the co-existence of multiple and simultaneous emergencies such as pandemics and climate change-related flooding is likely to increase. Being prepared is vital, as is the ability to immediately collaborate with key groups, organisations and agencies, whilst building in a certain degree of flexibility.

The benefits found by Lancaster relating to community and organisational motivation and cohesion was partly contingent upon strong leadership, which cannot always be relied upon to be present in organisations such as local government. This presents a risk factor that must be included in a systems approach, of ensuring leadership at the level of politicians down to leadership at organisation and directorate level. These interreliant and complex issues should be addressed in parallel and between all levels of governance, with clear lines of communication between national, regional and local governments.

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References

Bradley DT, Mansouri MA, Kee F, Garcia LMT (2000) Systems approach to preventing and responding to COVID-19. E Clin Med 21. https://doi.org/10.1016/j.eclinm.2020.100325. Accessed Feb 2021

Coutts P, Ormston H, Pennycook L, Thurman B (2020) Pooling together: how community hubs have responded to the COVID-19 emergency, Carnegie Trust

Gov.uk. Government (England) guidance. https://www.gov.uk/government/publications/making-a-christmas-bubble-with-friends-and-family/making-a-christmas-bubble-with-friends-and-family. Accessed 17 Feb 2021

Gov.uk. NHS COVID-19 app. https://covid19.nhs.uk. Accessed Feb 2021

Lancashire County Council (2021) Lancaster district. https://www.lancashire.gov.uk/lancashire-insight/area-profiles/local-authority-profiles/lancaster-district/. Accessed Feb 2021

Lancaster City Council (2021) Council structure. http://www.lancaster.gov.uk/the-council-and-democracy/about-the-council/council-structure 9. Accessed Feb 2021

Mell I (2021) Access to urban parks is far from equal—fining people who travel to reach nature is not the answer, The Conversation. https://theconversation.com/access-to-urban-parks-is-far-from-equal-fining-people-who-travel-to-reach-nature-is-not-the-answer-153258. Accessed Feb 2021

Sasse T, Nickson S, Britchfield C, Davies N (2020) Government outsourcing: when and how to bring public services back into government hands, Institute for Government

UK Government COVID-19 Data Dashboard. https://coronavirus.data.gov.uk. Accessed Feb 2021

UK Government Shielding Guidelines. https://www.gov.uk/government/publications/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19. Accessed Feb 2021

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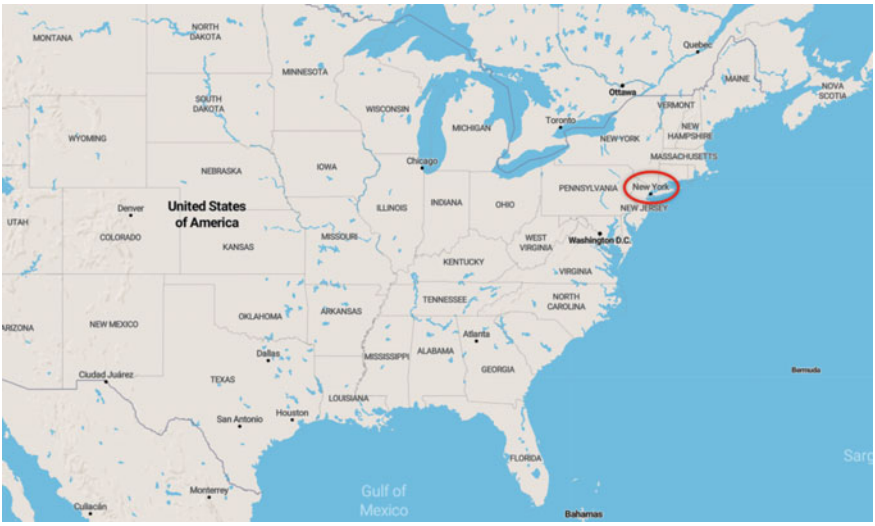
United States of America: New York City and COVID-19

Amy Howden-Chapman and Veronica Olivotto



Source Jawgmaps/uMap/OpenStreetMaps

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1 Introduction

New York City (NYC) was the first major epicentre of COVID-19 in the USA, largely because of its population size, density, and location as a commercial and tourist hub (Angel et al. 2020). Discrepancies between the mayoral, state and federal responses defined both public messaging and policy responses aimed at containing infection and preventing deaths. Mayor Bill de Blasio publicly criticised the response on the federal level led by the Trump administration, while ongoing disagreements between de Blasio and New York State Governor Andrew Cuomo contributed to delays in instituting stay-at-home orders; this substantially increased the number of cases and deaths throughout the city (Shaman 2020). Overall, the impact of the COVID-19 pandemic in NYC magnified the cumulative health and employment disadvantages already existing for many, especially low-income communities and communities of colour. COVID-19 also reduced the financial and institutional ability of NYC to protect the health and wellbeing of its residents.

We discuss impacts of the pandemic in NYC, including effects on housing, transportation and disparities in job losses, which increased inequality in health and earnings. Some innovative policy responses, such as the reallocation of street space for dining and recreation are also discussed.

We cover the first two spikes of cases in March–April 2020 and then in December 2020–January 2021, as well as policies and responses instituted between. Statistics are provided until December 2021.

2 Demography

NYC comprises five boroughs (Manhattan, The Bronx, Staten Island, Queens and Brooklyn) with an estimated total population of 8.34 million (CENSUS 2019) and 27,000 people per square mile, the highest urban density in the United States (New York City Department of City Population 2019). NYC's high poverty rate has been declining slowly over the last decades, with a 3.6% reduction during 2013–2018. However, the rate (17.3%) remains starkly above the national average (11.8%) (Office of the Mayor 2019). Over the last decade, income inequality has increased, with households earning at the 20th percentile experiencing only a 10% increase in annual income from $20,000 to $22,000, while those in the 80th percentile saw income growing 22%, from $126,000 to $154,000 (Fig. 1).

Fig. 1 Map of New York City showing five boroughs (*Source* NYC MapPLUTO)

3 City Governance and Autonomy

During the course of the pandemic, the term of de Blasio, NYC mayor since 2014, ended and he was succeeded in January 2021 by Eric Adams. After Cuomo's resignation, Kathy Hochul succeeded him as governor in August 2021. In terms of governance, many fiscal, regulatory and enforcement powers sit with Albany, the state's capital. The state sets a broad range of policies that affect local issues, from vehicle speed limits to plastic bags in grocery stores. The Metropolitan Transportation Authority (MTA), the entity that controls the NYC subway, is—perversely—controlled by the state governor, so that revenue for this vital service for New Yorkers can only be increased by state legislature decision (Five Borough Future 2019). Most importantly in a pandemic, governance structures mean that the NYC mayor cannot mandate a lockdown without the approval of the state's governor.

4 The Pandemic's Impact on Health Expenditure, Health Insurance Costs and Rates

Prior to the pandemic, New Yorkers' health care expenditure totalled $163 billion in 2019, the second highest in the country (Rodin DMPH et al. 2014, p. 61). In response to the pandemic, the Department of Financial Services kept the increase in insurance premiums for 2021 to a 1.8% increase for individuals (Department of Financial Services 2020). Despite such provisions the pandemic has had a severe impact on many people's ability to pay for health insurance, in part due to severe wage losses in some industries. Many New Yorkers who suffered the highest share of job losses are also less covered by insurance. The pandemic halted a long-term trend that saw a steady drop in the rate of uninsured New Yorkers from 9.3% to 6.9% in the period from 2015 to 2019 (Community Service Society 2020). The overall number of uninsured varies by industry. Some industries hit hard by the pandemic have particularly high rates of uninsured workers, including restaurants and hotels (26%), construction (24%), personal services (21%), and administrative and support services (14%) (Parrot 2021). Ongoing pandemic-related job losses in face-to-face industries will exacerbate social and economic disparities. Although average wages in the face-to-face sector (e.g., hospitality and construction) are only one-third those in the remote sector, total 2020 estimated wage losses were $28 billion in the former and $11 billion in the latter (Parrot 2021).

5 Hospital Losses and Relief

NYC's healthcare services landscape is complex. We focus on the NYC Health + Hospitals (H+H), which is the largest public health care system in the U.S. H+H operates eleven acute care hospitals, five nursing homes, six diagnostic and treatment centres, and more than 70 community-based primary care sites, serving primarily the poor and working class. H+H typically operates on a one percent profit margin (Palazzolo and West 2020). Its non-operating revenues include federal, state and municipal grants (the latter being the largest) and investment earnings. During the height of the pandemic the H+H system lost $20 million a week in operating revenue as elective procedures were cancelled. Shortfalls in funding were made up by $246.2 million in Federal Emergency Management Agency (FEMA) funding related to COVID-19 and $31 million to protect workers' salaries against budget cuts (New York City Council 2020). Other federal pandemic relief programmes provided an estimated $3.3 billion for hospitals in NYC.

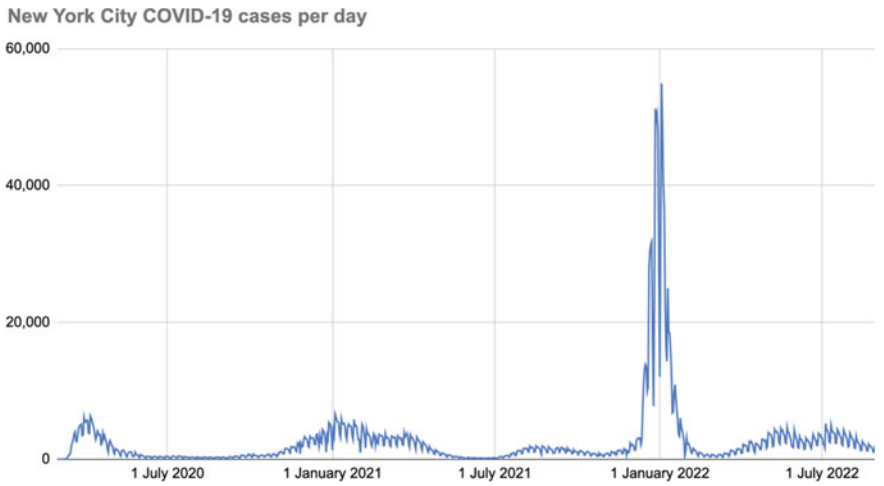

Fig. 2 Daily COVID-19 confirmed cases in New York City. NYC Health (2021) (*Source* GitHub, https://github.com/nychealth/coronavirus-data/tree/master/trends)

6 Timeline of Covid-19 Effects

There were three peaks in cases, in March/April 2020, in December 2020–January 2021 and a much higher Omicron peak in December 2021 (Fig. 2). This last spike may be attributable to much wider access to and availability of testing than at the beginning of the pandemic, when the reliance was solely on hospitals and urgent medical clinics; pop-up street COVID-19 testing sites and testing at pharmacies were not deployed until later in the pandemic. At the same time, it may also mean that confirmed cases at the beginning of the pandemic went largely undercounted. Additionally, the higher infectivity of Omicron is a factor. Figure 3 shows confirmed deaths spiking in December 2020–January 2021, followed by a smaller rise in deaths in January 2021–December 2021.

Here we provide the main impacts of the pandemic on hospital services, in terms of the ability to detect COVID-19 cases and the availability of hospital equipment, as well as the immediate consequences for people's behaviour following the introduction of measures such as mask wearing and social distancing. We also show how existing racial disparities in health have been exacerbated by the pandemic.

7 COVID-19 Cases and Death Count

NYC has not implemented a comprehensive contact tracing programme, and the limited testing means that determining the rate of transmission of the virus has been a difficult process, given the large numbers of undocumented infections, fluctuating

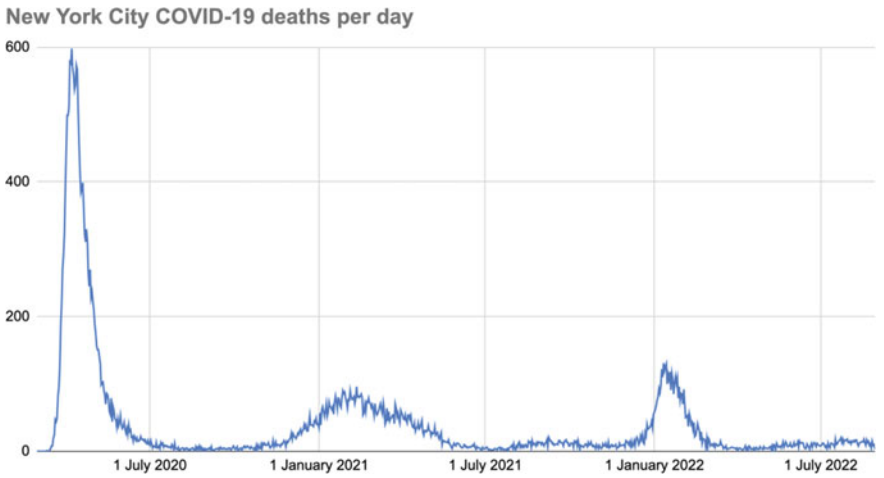

Fig. 3 Daily confirmed COVID-19 deaths in New York City. NYC Health (2021) (*Source* GitHub, https://github.com/nychealth/coronavirus-data/tree/master/trends)

Table 1 COVID-19 by the numbers in NYC (Feb 2022)

Measure	Number of NYC residents
Confirmed cases (people with a positive molecular test)	1,937,200
Probable cases (people with a positive antigen test, or symptoms and confirmed exposure, or probable death)	340,453
Total cases	2,277,653
Hospitalisations (within 14 days of diagnosis)	160,308
Confirmed **deaths** (with positive molecular test)	34,271
Probable deaths (cause of death listed as COVID-19 or similar, but no positive molecular test)	5,513
Total deaths	39,784

Source NYS Department of Health

infection detection rates and conflicting reports of cases. This is also why the NYC Department of Health (DOH) refers to confirmed and probable cases on their data platform. In July 2020, scientific publications tried to ascertain the crude case-fatality risk (CFR), i.e., the number of deaths per number of confirmed cases, or the adjusted CFR (i.e., the crude CFR adjusted for delay from infection or diagnosis until death) in NYC (New York City Council 2020) (Table 1).

8 Availability of Ventilators and Protective Equipment

Living in NYC during the 2020 March/April peak meant experiencing the constant presence of ambulance sirens, and indeed between 16 March and 15 April there was a 60% increase in emergency medical services calls compared to the same period in 2019, primarily comprising respiratory and cardiovascular calls (Prezant et al. 2020). The surge in hospitalisations also brought a shortage of critical protective equipment and ventilators. Early in April, one hospital sector journal declared that NYC hospitals would be 25,000 ventilators short, considering that 4,000 COVID-19 patients hospitalised were already on ventilators at the time (Anderson 2020).

The shortage of protective equipment and ventilators, which spiked as hospitalisation rates first peaked in April 2020 (Goodman and Goldstein 2020) was primarily met with a response at the state level. Cuomo announced an executive order allowing the redistribution of protective equipment, and ventilators by the national guard between different locations across the state. At a federal level there was criticism that the national stockpile, the responsibility of the Trump administration, was poorly maintained. Ventilator shortages also extended to field hospitals. A field hospital was rapidly assembled within the Billie Jean King National Tennis Center at the cost of $52 million and ultimately served only 79 patients (Rosenthal 2020). Other army corps field hospitals such as that erected in the Javits Convention Center on Manhattan's West Side treated a greater number of COVID-19 patients, but never reached full capacity (New York State 2020). In terms of hospital beds, the shortages echoed spatial disparities in hospital care, with wealthy boroughs having a proportionally greater number of hospital beds than less wealthy boroughs (5 hospital beds for every 1,000 residents in Manhattan, vs 1.8 per 1,000 residents in Queens, 2.2 in Brooklyn and 2.4 in the Bronx) (Wadhera et al. 2020).

9 Stay-At-Home Orders, Mask Wearing and Social Distancing

The state-wide Policies that Assure Uniform Safety for Everyone (PAUSE) of March 2020 listed ten policy directives including: limiting public gatherings to ten people or less, directing all non-essential businesses to close, requiring individuals to only leave their home to access essential services, social distancing of six feet in public places, and the limiting of outdoor recreational activity and public transport. The PAUSE lasted 55 days and highlighted existing tensions between de Blasio and Cuomo. On April 15 de Blasio announced that New Yorkers visiting grocery stores would be required to wear some type of face covering. Cuomo later issued an executive order requiring all New Yorkers to wear a face covering in public. Two days later Cuomo announced an executive order requiring all people in New York State to wear a mask or a face covering when in public and in instances where social distancing cannot be maintained, such as on public transportation.

Racial disparity also had an impact on measures to prevent the virus spread. A May 2020 report issued by the Brooklyn District Attorney General showed the racial breakdown of social-distancing enforcement from March 17 through May, which until that time was conducted by officers of the NYPD. Within the Brooklyn borough, police had arrested a total of 40 people for social-distancing violations. Of those a vast majority, 35 were African-American, four were Hispanic and only one was white. The violations carried potential fines of $250–$500 (NYC to fine people violating social distancing rules 2020). Evidence of disproportionate policing of ethnic minority groups in NYC is long standing and well documented (Levchak 2021). Existing racial disparities in NYC also underlie spatial differences in health, which as explained below, begin with differences in cases, hospitalisation rates and death counts.

10 Evidence of Pandemic Ethnic Disparities and Their Causes

In April 2020, the Brookings Institution published an analysis showing how black people in almost every US State were more likely to be infected with the virus than white people (Rashawn 2020). In mid-April 2020, the NYS Department of Health COVID-19 Data Tracker showed that in NYC, black people, who represent 22% of the population, accounted for 28% of the deaths. Hispanics, representing 29% of the population, accounted for 34% of the deaths (NYS Department of Health 2021). Age and population-adjusted black mortality was reportedly more than twice that for whites. Such disparities also have spatial attributes. Early studies conducting descriptive statistics on hospitalisation rates and deaths across NYC's five boroughs as of April 25 found the Bronx, which has the highest proportion of racial/ethnic minorities, the most people living in poverty and the lowest levels of educational attainment, had higher rates of hospitalisation and deaths related to COVID-19 than the other four boroughs (Wadhera et al. 2020). These findings echo previous research in NYC, which has found increasing inequality between wealthy and poor neighbourhoods in mortality from HIV/AIDS, diabetes, and liver disease between 1989 and 2001 (Karpati et al. 2006).

More recent studies have taken a granular approach to understanding health disparities by analysing the social distribution of COVID-19 testing and associated indicators of confirmed positive cases, deaths, and disease severity across NYC zip codes (Maroko et al. 2020; McPhearson et al. 2020). Results showed COVID-19 had a disproportionate impact on communities with lower incomes and a higher proportion of ethnic minority groups; the highest incidence was in the Bronx and Queens zip codes. Zip codes in the top quantiles of testing, confirmed cases, mortality, and severity all showed consistently higher social vulnerability as indicated by poverty, unemployment, disability, population under 17, language isolation, rent burden, and housing crowding (McPhearson et al. 2020). Another study suggests that legacies of

spatial segregation due to redlining—discriminatory practices where banks historically avoided investing based on neighbourhood demographics—correlated at a neighbourhood level with higher COVID-19 cases and deaths, suggesting that in historically neglected neighbourhoods, containing COVID-19 is more difficult (Choi and Unwin 2020).

Pre-existing comorbidities is a key risk indicator for COVID-19 pointing at higher mortality rates across communities of colour, although at the time of this study, research only looked at selected cohorts of patients in specific hospital systems across the city and not at city-wide scale (Ogedegbe et al. 2020). The linkages between occupational exposure and poverty are, however, already evident. Black and Hispanic populations are more likely to be exposed to the risk of transmission because they work outside their homes; 44% of NYC's independent contractors, who primarily work in low-paying industries, are part of ethnic minority groups. In NYC, 24% of frontline workers live at or below twice the poverty line. They also may suffer inequalities that do not allow them to adequately social distance (e.g., home crowding) (Yancy 2020). Ethnic minority groups may have unequal ability to afford insurance and so many black people testing positive may be uninsured and, therefore, avoid hospitalisation and contribute to undetected deaths at home (which may have influenced overall case rates and comorbidities). The larger share of people without insurance in NYC are immigrants, partly because they are also cut off from many other government services. However, since the pandemic, black people in NYC reported losing health insurance twice as often as white New Yorkers (CUNY Graduate School of Public Health and Health Policy 2020).

NYC lost 750,000 payroll and self-employed/independent contractors' jobs on average between February and December of 2020, the single worst job decline since the 1930s (Parrot 2021). Nearly two-thirds of jobs lost were held by workers paid less than $40,000 annually, whereas only 10% of lost jobs occurred among those who earned $100,000 or more annually (Parrot and Moe 2020). An estimated 68% of job losses were among workers of colour and Latinx workers were 21% more likely to have lost jobs than other workers. The disparity in job losses between white women and white men was also great (2 to 1) since many women stayed home to care for children not attending school or daycare (Parrot 2021).

11 Broader Consequences for Housing, Transport and Public Space

In this section we discuss the consequences of the pandemic for three key sectors which are important for the longer-term recovery of New Yorkers: housing conditions and ability to pay rent, transportation, and public space. We describe how certain housing characteristics made some ethnic groups more exposed than others by increasing chances of transmission. We also briefly discuss responses to the current

housing crisis when many people fall behind on rent and mortgage payments. Transportation, especially through public subway and bus services, is crucial for many low-income workers and essential workers to reach their jobs. We discuss how trips for some ethnic groups declined due to increased fear of virus transmission, and the measures set in place by the Metropolitan Transportation Authority (MTA) to keep the subway and bus services running for those who cannot work from home.

11.1 Consequences for Housing

Housing conditions determine many health outcomes. Three main dynamics of insecure housing appear to be exacerbating exposure to COVID-19 as well as being worsened by the current pandemic: forced evictions, crowding and the relationships between displacement, crowding and confirmed COVID-19 cases.

Research analysing cumulative rental displacement by zip code showed that the rate of confirmed COVID-19 cases in July 2020 was highly, significantly, and positively correlated with the 2017–2020 rate of housing evictions in NYC (Egan et al. 2020). Eviction is likely to increase COVID-19 infection rates because it contributes to overcrowded living environments, doubling up (Gray 2021), transiency, limited access to healthcare, and a decreased ability to comply with pandemic mitigation strategies, such as social distancing. It is also a driver of further health inequality as historic trends show eviction is more frequent in neighbourhoods where predominantly ethnic minorities live (Benfer et al. 2021). NYC zip codes with high rates of crowding are also positively correlated with confirmed COVID-19 cases (Egan et al. 2020).

11.2 Consequences for Transportation and Public Space

As the extent of the pandemic's effects in the city became glaringly clear, panic over coronavirus transmission in public transportation systems spread. Yet avoiding public transportation was not a choice for some social groups. By March 17 the MTA, the largest transportation system in North America, saw its ridership plummeting by 60% on subways and 49% on buses, compared with the previous year. Similarly, interurban transportation like Metro-North Railroad and the Long Island Rail-Road (LIRR), also run by the MTA, saw a 90% and 67% drop in ridership respectively against the previous year (Goldbaum 2020).

Currently, subway ridership is 82% down compared to the previous year and bus patronage is down 79% (NY Hudin Center, 2020). Due to the ensuing budget deficit of $15.9 billion, the MTA is requesting $12 billion in federal funds, among other measures. The human cost is also high: 4,000 MTA employees tested COVID positive and 136 employees, mostly subway and bus drivers, have died through job exposure. In early March 2020, the MTA barred their transit workers from wearing masks,

because they were afraid that it would cause panic in riders. This policy initially followed guidance from the WHO and CDC that healthy people did not need to wear masks. The high number of workers infected in the early days of the pandemic also put strain on the operations of the system, causing lengthy delays before stay-at-home orders were put in place, when ridership was still high. The MTA was sharply criticised by its employees for these high infection rates and loss of life amongst workers.

The decline in MTA ridership was uneven across the city. According to MTA commuting data (turnstile data repository) from 20 March 2020, ridership in some poorer areas of NYC, such as the Bronx, remained 20% higher than in the wealthier borough of Manhattan. This disparity between wealthier and poorer citizens is aligned with race and underlies the extreme and long-standing health disparities in NYC.

While trips on public transit decreased, there was an increase in private car ownership caused in large part by fears about contracting the virus on public transit, and the ability of white-collar workers to work from home or in locations outside the city. The Department of Motor Vehicles reported that in Manhattan, Brooklyn, Queens and the Bronx, vehicles registered between August and October 2020 increased by 37% compared with the same period in 2019 (the increase was only 6% in Staten Island, which already has significantly higher car ownership than another borough). Partly in response to these changing travel patterns, the mayor in June 2020 unveiled a plan for the rapid installation of 20 miles of new busways and bus lanes. While the MTA controls the operation of city buses, the city oversees the city streets, which are under the purview of the NYC Department of Transportation. However, the expedited rollout of the busways, which was initially scheduled for October 2020, is behind schedule, in part due to local opposition.

From 7 May 2020, subway service was reduced from 24 h, with the subway closing between 2 and 5 a.m., for the first time since 1904. These cuts to MTA service have had the greatest impact on essential workers and those in low-wage jobs. Subway and bus service were "in crisis" (with very slow bus speeds) even before the pandemic (New York City Department of Transportation 2019). The MTA's pre-pandemic plans to put the subway system back into a state of good repair, such as replacing the antiquated signal system, are also delayed. Ridership is not expected to get back to pre-pandemic rates (90%) until at least 2024.

11.3 Long-Term Policies for Public Space Activities: Open Streets and Open Restaurants

The NYC Department of Transportation also sought to implement programmes that encourage active travel modes such as walking and cycling though the Open Streets initiative announced by de Blasio in May 2020 and rolled out in the subsequent months. Open Streets was in part a response to the increase in car travel created by the pandemic, as New Yorkers tried to avoid public transit. Others took to cycling,

with trips in July 2020 increasing to 80% above the July 2019 level. The increase was primarily driven by more women cyclists: women's biking numbers rose 147% compared to a 68% increase among men. Walking and cycling had to contend with increased car speeds, partly a result of less congested streets. Over February–August 2020, there was a 67% increase in the number of speeding tickets issued per day.

The initial Open Streets programme designated streets primarily for walking, exercise and cycling with a five mile per hour vehicle speed limit. The initial pilot programme consisted of just four open streets (1.6 miles) and lasted for just over a week. The primary critique of the pilot programme was the heavy presence of NYPD officers at the sites. The city subsequently committed to creating 67 miles of Open Streets plus temporary protected bike lanes, totalling roughly 100 miles of active travel infrastructure throughout the city.

The broader Open Streets programme has met with mixed success. While in some communities residents took it upon themselves to manage the barriers that limited through-traffic and signalled the presence of the corridors, in other neighbourhoods this responsibility fell to the NYPD who failed to perform the task consistently. One citizen's audit of Open Streets in Brooklyn concluded that the programme was "structurally racist", noting not only that there were more Open Streets designated in predominantly white neighbourhoods, but that 70% of streets in white neighbourhoods were installed properly compared with just 12% in predominantly non-white neighbourhoods (Aickin 2020).

The 12 March 2020 ban on events with more than 500 people required that restaurants reduce their capacity by 50%, and on 16 March Cuomo further limited restaurants, which had not already voluntarily opted to do so, to only serve customers via takeout and delivery. This restriction was not lifted until 4 May, when the third phase of New York's reopening plan began. On 28 May, as the weather began to warm and patrons collecting drinks and food increasingly started to gather outside restaurants, the NYC Council introduced legislation calling for the city's Department of Transportation (which has jurisdiction over the city's streets and sidewalks) to identify streets, sidewalks, and plazas that could be utilised for outdoor dining. On June 22 the mayor officially opened its Open Restaurants programme allowing outdoor dining to utilise sidewalks, parking spaces and backyards. The programme has significant implications for public space across the city. Immediately after the programme was announced, 6,800 establishments were authorised to serve food and drinks at outdoor tables. By September 2020, when a permanent version of the Open Streets programme was announced, more than 10,000 restaurants were participating, occupying 10,000-plus curbside parking spaces across the city.

Restrictions placed on NYC's restaurants due to the pandemic have had major implications for the city's cultural and economic life. In 2019, the restaurant industry employed 317,800 people, a large proportion of whom are immigrants (60% compared to 45% across all occupations). These workers were especially hard hit by the pandemic. Despite the city's rollout of the Open Streets programme, as of August 2020 employment in the restaurant industry was still only 55% of February 2020's pre-pandemic levels.

By the end of 2021, the NYC Planning Commission passed a city zoning amendment to develop and regulate a permanent outdoor dining programme. The amendment is under review by newly elected Mayor Adams (NYC Planning ZAP Search 2022). Similarly attempts are ongoing to pass legislation through the NYC Council to make Open Streets permanent. The bill contains attempts at increasing the equitable rollout of the programme by "provid[ing] resources to at least 20 open street sites in areas that would be otherwise underserved by the program" (The New York City Council 2020). However by October 2021, only 46% of the designated Open Streets were operational (2022).

12 Conclusions

During the course of the pandemic, de Blasio's seven-year mayoral term came to an end and he was succeeded in January 2021 by Eric Adams. Similarly, Cuomo was replaced by Kathy Hochul as governor in August 2021, after Cuomo's resignation. Overall, the brunt of governing pandemic responses in 2020 fell largely on de Blasio and Cuomo. The opening sections of this chapter described and illustrated city case rates and death counts, focusing on the immediate responses by city and state-level governing bodies. The initial poor coordination on mask wearing and social distancing and poor deployment of testing sites may have contributed to wider community transmission, with case rates being undercounted at the early stages of the pandemic. Disparities in impacts across social groups in the impact of the pandemic were likely accentuated by some poor decisions (e.g. banning subway train drivers from wearing masks) and lack of coordination across levels of governance. The impact of first, second and booster shot vaccinations—though not described here—along with stricter implementation of mask mandates and social distancing clearly resulted in lower death rates as the pandemic continued.

We also focused on the systemic interconnection between inequality across existing social groups in access to health services, including equipped hospitals and insurance, transportation, rent-stabilised housing, better paid and secure jobs and citizenship status. These inequalities were reflected in COVID-19 case rates and deaths. Such inequalities are spatially codified and have resulted in a disproportionately high loss of life among the disadvantaged, as well as greater wage losses among people of colour and lower income groups. We believe that a systematic and consistent assessment of the overall impact of such inequalities is important in pointing to more effective pandemic management programmes in the future. It is also desirable to find ways to buttress the financial resilience of the City to manage future pandemics, to protect the future health and wellbeing of NYC residents.

We also looked at the impacts of the pandemic on NYC's housing, transport and employment status. We noted the detrimental impacts on public transit, and the need to make good the damage done to the transit system for the sake of social equity.

Lastly, we noted creative measures to make use of social distancing rules, describing the rollout of the public space programmes Open Streets and Open Restaurants. Efforts to embed these programmes in the city are ongoing.

References

Aickin S (2020) Op-Ed: 'Open streets' isn't working for all of the people [Internet]. Streetsblog New York City [cited 2021 Mar 14]. https://nyc.streetsblog.org/2020/07/07/op-ed-open-streets-isnt-working-for-all-of-the-people/

Anderson M (2020) Ventilators in critical shortage in New York City: 3 updates. Becker's Hospital Review [Internet] (Covid 19 coverage). https://www.beckershospitalreview.com/supply-chain/ventilators-in-critical-shortage-in-new-york-city-3-updates.html

Angel S, Blei AM, Lamson-Hall P, Salazar MM (2020) The coronavirus and the cities

Benfer EA, Vlahov D, Long MY, Walker-Wells E, Pottenger JL, Gonsalves G et al (2021) Eviction, health inequity, and the spread of COVID-19: housing policy as a primary pandemic mitigation strategy. J Urban Health 98(1):1–12

CENSUS (2019). https://www.census.gov/quickfacts/newyorkcitynewyork

Choi Y, Unwin J (2020) Racial impact on infections and deaths due to COVID-19 in New York City. arXiv. 2007.04743 (Preprint posted July 9, 2020)

Community Service Society (2020) Statement: poverty declined in New York City for fifth straight year but census data fails to capture devastating economic impact of COVID-19 [Internet]. https://www.cssny.org/news/entry/statement-poverty-declined-in-new-york-city-for-fifth-straight-year-but-cen

CUNY Graduate School of Public Health and Health Policy (2020) Coronavirus testing ramps up in the city and more New Yorkers benefit from public and private assistance [Internet]. https://sph.cuny.edu/research/covid-19-tracking-survey/week-7/

Department of Financial Services (2020) DFS announces 2021 health insurance premium rates, protecting consumers during COVID-19 pandemic [Internet]. COVID-19 updates. https://www.dfs.ny.gov/reports_and_publications/press_releases/pr202008132

Egan Z, Grabowski Z, Olivotto V (2020) Covid-19 and housing precarity? [Internet]. Resilience Quarterly. https://medium.com/resilience/covid-19-and-housing-precarity-from-systemic-failure-towards-a-just-recovery-4083b48535a5

Five Borough Future (2019) New York City Autonomy [Internet]. https://fiveboroughfuture.com/autonomy-white-paper

Goldbaum C (2020) Subway shutdown: New York closes system for first time in 115 years. The New York Times [Internet]. [cited 2020 May 17]. https://www.nytimes.com/2020/05/06/nyregion/nyc-subway-close-coronavirus.html

Goodman DJ, Goldstein J (2020) Virus hospitalizations are up in N.Y.C. But this time, it's different. The New York Times [Internet]. https://www.nytimes.com/2020/10/30/nyregion/new-york-city-coronavirus-hospitals.html

Gray N (2021) Problem: overcrowding. City J [Internet] (Special Issue). https://www.city-journal.org/overcrowding-is-a-factor-in-covid-infection

Karpati AM, Bassett MT, McCord C (2006) Neighbourhood mortality inequalities in New York City, 1989–1991 and 1999–2001. J Epidemiol Community Health 60(12):1060–1064

Levchak PJ (2021) Stop-and-frisk in New York City: estimating racial disparities in post-stop outcomes. J Crim Just 73:101784

Maroko A, Nash D, Pavilonis B (2020) Covid-19 and inequity: a comparative spatial analysis of New York City and Chicago hot spots. J Urban Health 97(4):461–470

McPhearson T, Grabowski Z, Herreros P, Mustafa A, Ortiz L, Kennedy C et al (2020) Pandemic injustice: spatial and social distributions of the first wave of COVID-19 in the US Epicenter

New Report Identifies Significant Inequities in Mayor de Blasio's Open Streets Program and Calls For Permanent Infrastrastructure and Expansion to Neighborhoods Left Out [Internet]. Transportation Alternatives [cited 2022 Feb 27]. https://www.transalt.org/press-releases/jdudnv7ekk8zzcaz9387yy70dltppa

New York City Council (2020) Note on the fiscal 2021 executive budget for New York City health + hospitals. Finance Division.

New York City Council-File #: Int 1933–2020 [Internet] [cited 2022 Feb 27]. https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=4424528&GUID=796B94D6-9FD4-4448-8E8A-9A631444F421&Options=&Search=

New York City Department of City Population (2019) Planning-population-current and future populations—DCP [Internet]. Current and Projected Populations [cited 2019 Nov 17]. https://www1.nyc.gov/site/planning/planning-level/nyc-population/current-future-populations.page

New York City Department of Transportation (2019) Better buses action plan [Internet] [cited 2020 Dec 6]. https://www1.nyc.gov/html/brt/downloads/pdf/better-buses-action-plan-2019.pdf

NYC Planning ZAP Search [Internet]. [cited 2022 Feb 27]. https://zap.planning.nyc.gov/projects/2021Y0291

NYC to fine people violating social distancing rules (2020) [Internet]. PIX11. [cited 2021 Mar 23]. https://pix11.com/news/coronavirus/nyc-to-fine-people-violating-social-distancing-rules/

NYS Department of Health. Fatalities (2021) [Internet]. [cited 2022 Feb 26]. https://covid19tracker.health.ny.gov/views/NYS-COVID19-Tracker/NYSDOHCOVID-19Tracker-Fatalities?%3Aembed=yes&%3Atoolbar=no&%3Atabs=n

New York State (2020) Governor Cuomo announces four sites identified by army corps of engineers on initial list of temporary hospitals [Internet]. Governor Andrew M. Cuomo. [cited 2021 Mar 23]. https://www.governor.ny.gov/news/governor-cuomo-announces-four-sites-identified-army-corps-engineers-initial-list-temporary

Office of the Mayor (2019) Mayor de Blasio announces New York City poverty rate hits historic low [Internet]. https://www1.nyc.gov/office-of-the-mayor/news/449-19/mayor-de-blasio-new-york-city-poverty-rate-hits-historic-low

Ogedegbe G, Ravenell J, Adhikari S, Butler M, Cook T, Francois F et al (2020) Assessment of racial/ethnic disparities in hospitalization and mortality in patients with COVID-19 in New York City. JAMA Netw Open 3(12):e2026881

Palazzolo J, West MG (2020) Coronavirus takes financial toll on New York City's 'safety-net' hospitals—WSJ [Internet] [cited 2021 Mar 14]. https://www.wsj.com/articles/coronavirus-takes-financial-toll-on-new-york-citys-safety-net-hospitals-11591904490

Parrot J (2021) New York City's covid-19 economy will not snap back [Internet]. New York, New York, USA: The New School Center for New York City Affairs. http://www.centernyc.org/reports-briefs/new-york-citys-covid-19-economy-will-not-snap-back

Parrot J, Moe L (2020) The new strain of inequality: the economic impact of Covid-19 in New York city. New York: The New York School Center for New York City Affairs

Prezant DJ, Lancet EA, Zeig R, Lai PH, Appel D, Webber MP et al (2020) System impacts of the COVID-19 pandemic on New York City's emergency medical services. J Am Coll Emerg Physicians Open 1(6):1205–1213

Rashawn R (2020) Why are Blacks dying at higher rates from COVID-19? [Internet]. Brookings Institute. https://www.brookings.edu/blog/fixgov/2020/04/09/why-are-blacks-dying-at-higher-rates-from-covid-19/

Rodin DMPH, Meyer J, Health Management Associates (2014) Health care costs and spending in New York State. NYS Health Foundation, p 61

Rosenthal BM (2020). This hospital cost $52 million. It treated 79 virus patients. The New York Times [Internet] [cited 2021 Mar 23]. https://www.nytimes.com/2020/07/21/nyregion/coronavirus-hospital-usta-queens.html

Shaman JL (2020). Differential effects of intervention timing on COVID-19 spread in the United States

Wadhera RK, Wadhera P, Gaba P, Figueroa JF, Joynt Maddox KE, Yeh RW et al (2020) Variation in COVID-19 hospitalizations and deaths across New York City boroughs. JAMA 323(21):2192
Yancy CW (2020) COVID-19 and African Americans. JAMA 323(19):1891

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Conclusion

Philippa Howden-Chapman, Franz Wilhelm Gatzweiler, Isaac Luginaah, and Rachel Cooper

In this book, authors from 15 different countries used systems perspectives to analyse their cities' responses to COVID-19 in the first two years of the pandemic. In this concluding chapter, we outline the different policy approaches, the outcomes achieved and some of the global lessons learnt. We are conscious that the pandemic and the outcomes are unpredictable, and not yet over. However, the pattern of excess deaths in our case study countries, excluding those countries where the data are considered less reliable or not available, has shown that by mid-2022, Omicron has presented new challenges for the effectiveness of early strategies (The Economist 2022a, b).[1]

Prior to the outbreak of COVID-19, the Xiamen Call for Action issued by the Urban Wellbeing Committee of the International Science Council provided principles for meeting urban challenges. Pandemic planning was recognised as an important element of good urban governance (Ebikeme et al. 2019). Once COVID-19 became a pandemic, the OECD (2021) also provided guidelines that stressed the need for increasing community engagement in urban governance. The OECD's framework identified five main policy dimensions that drive people's trust in government institutions: responsiveness, reliability, integrity, openness and fairness. The various

[1] Exact reporting dates vary.

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urban responses to COVID-19 have highlighted that trust in government is certainly paramount.

While quick responses to complex problems presented by a pandemic are essential, COVID-19 has also made clear that 'quick fixes' alone are inadequate. As the divergent policies of the Brazilian, Indian and Chinese governments have shown, the limitations of following a single policy over time are also evident. A path that relies heavily on non-scientific guesses or rigid command-and-control measures can disregard human rights and may exclude people by minimising public communication. Without transparent decision-making, responsive measures and good communication, public trust may be rapidly eroded. Policies that are inflexible may eventually produce unintended consequences, which make desired outcomes harder to achieve. Even more democratic countries, which rely heavily on citizens' participation in government, collaborative governance and multiple channels of communication and deliberation, have been severely tested by successive waves of COVID-19 and growing misinformation.

Quick fixes, such as lockdowns, may be necessary and tolerated as emergency responses in the early stages of a pandemic, but more sophisticated and complex systemic solutions are required in the medium term. Both China and New Zealand, like a small number of other countries, initially followed what was called a 'zero' or 'elimination' policy. According to Our World in Data, despite their vast differences in size, these two countries have some of the lowest rates of deaths per million people. But to date, despite the virus's evolution, China has maintained this policy, while New Zealand has progressively moved to rely on other policy measures and opened its borders. Being able to easily close and open borders is a major geographical advantage of an island state.

The importance of social cohesion and broad conformity with strict disease prevention policies is essential, especially at the onset of the pandemic. Gaining and maintaining the cooperation of the population requires communicating, building collective awareness and trust and creating a society where governments and community organisations work together closely. Following this model, some countries have shown that it is even possible to have health dividends of increasing life expectancy in the short term during the pandemic (The Economist 2022a, b). Despite initial measures restricting freedom, these countries have benefitted from high levels of trust in government and good public communication (Goldfinch et al. 2021). However, with the Omicron variant, the situation is becoming more tenuous than during the earlier Delta variant. Despite initially high levels of trust, tempers and trust are becoming frayed, particularly among minorities.

More generally, Freedom House (2020) reports that since the pandemic, democracy and human rights conditions have grown worse in 80 countries: "Governments have responded by engaging in abuses of power, silencing their critics, and weakening or shuttering important institutions, often undermining the very systems of accountability needed to protect public health." Trust has also declined during the pandemic. The Edelman Trust Barometer (2021), also discussed by UNICEF (2021), reveals that an increasing number of people no longer know where to get reliable information and increasingly believe that government leaders, business leaders and journalists

purposely try to misinform the public. Individualistic ideology has pervaded social discourse to greater levels. This has resulted in a global 'infodemic' which has brought trust down to a record low. As Paulo Saldiva writes in his chapter on Brazil:

> *The concurrent infodemics disseminated ignorance, hate, reinforced prejudices and most probably contributed to the dissemination of disease in our city and country. The spread of ignorance is an unpredicted challenge for scientists. Perhaps the moment has arrived when it will be necessary to study the epistemology of ignorance and devise systematic methods to counterbalance the spreading of deliberate misinformation.*

1 A Complex Systems Perspective

How do our case studies help us to understand the pandemic from a complex systems perspective? Increasingly complex problems mixed with uncertainty and high risks need to be met by increasingly adaptive problem-solving capabilities. These are skills which need to be learnt for good governance-knowledge which is unevenly distributed and not always possessed by politicians elected to government. We need to seriously invest in building network information gathering and learning capacities in a way which not only maintains but rebuilds economic and social development. The networked complex systems approach seen in EU governance structures, which has underpinned both policy and logistic responses in Europe, provides an interesting example of this approach.

In some instances, partial governance collapse, which can be highly problematic where it involves unpredictable and potentially uncontrollable losses, can also be an opportunity for renewal, regeneration and restructuring of urban interconnections. Gunderson and Hollings (2002) adaptive cycle demonstrates that in most complex systems, after a tipping point has been reached, systemic renewal is an opportunity for learning. Tainter (1988), in pointing to the dangers of complexity, also notes that innovation and creativity can lead complex systems, like cities, to appropriate levels of complexity which match the problem issues confronted.

Regeneration also provides an opportunity to address the wellbeing of disadvantaged groups, such as ethnic minorities and those in the precariat or informal economy who have already been most seriously affected. The welfare systems in many cities have been destabilised and there is an urgent need to address questions of health and wellbeing by restoring and improving knowledge and data for creative action.

Moreover, in the background, economic and population growth have enlarged the human ecological footprint at the expense of planetary health. COVID-19 is an infectious disease that is transmitted between animals and humans—a 'zoonotic disease'. Putting ecosystem health under pressure has caused this zoonotic disease to spread among humans. Cities can play an important role in restructuring connections between people and the planet, with strategies that work to address interlinked ecological and human challenges. Cities must grapple with their role in multilevel governance and take a broad view of the social and environmental determinants of health and wellbeing above and below the city level.

Canada, of the countries included, has most explicitly adopted a 'social determinants of health' framework to deal with COVID-19. This framework implicitly assumes a community-level systems approach, which emphasises how gender, income, employment, working conditions and ethnicity, including Indigenous identity, have shaped individuals' experiences of the pandemic. Within the Canadian federal context, the Canadian Middlesex-London Health Unit also issued orders under the provincial Health Promotion and Protection Act, which provided additional protection to the local county. This approach helped to identify existing inequities and contributed to reducing the number of COVID-19 cases.

In two post-colonial British Commonwealth countries, Canada and New Zealand, where the Crown has constitutional partnerships with indigenous populations, municipal governments have obligations and delegated authority from provincial and national governments respectively. Records of COVID-19 patient ethnicities and socio-economic indicators were collected and highlight the need to incorporate a health equity approach to pandemic preparedness, response, and recovery. In Canada, elected band councils, which govern First Nations communities, make decisions that affect their local communities. In New Zealand, as the scale of the pandemic became evident, Māori tribal groups and urban authorities and Pacific health and church groups undertook government-funded primary health care and social and food support, particularly during lockdowns, or when people were in home isolation.

Cities in Finland are part of self-governing municipalities, as are cities in Nepal under its new federal arrangement, so throughout the pandemic these cities have been responsible for implementing most of the practical actions and were encouraged to set their own local rules and practices, although some political and regional tensions have still arisen.

2 Key Risk Factors and Broader Consequences

Our city case studies make clear that unemployment has increased in many cities, especially among workers in the informal economy. The state of the economy has important ramifications for cities that fundamentally grow as employment and cultural centres. With more than 80% of global GDP being generated in cities, their social support role is critical. Cities are *not* built just to be growth engines of the global economy, which jeopardise planetary health (75% of global carbon emissions and 75% of the world's natural resources are consumed in cities) (UN Habitat 2020). Cities have to provide multifunctional systems to regulate and balance various aspects of human wellbeing, such as job and income support, and equity. To do this well, they need financial and administrative support from the national state which, our case studies suggest, can lessen the otherwise severe effects of a pandemic.

The risks of living in crowded households have been exacerbated by the economic consequences of the pandemic. A key aspect has been the decline in regular employment, especially for informal workers in countries such as Brazil, Cameroon, Nigeria

and Sri Lanka, contributing to overcrowding. According to the World Bank, an additional 88 to 115 million people experienced extreme poverty during 2020 because of COVID-19 (International Science Council 2021). In countries without welfare states, not all cities were able to provide financial assistance to buffer workers and households, or even saw it as a responsibility of their city, or region/state, to do so.

The WHO International Guidelines on Housing and Health (2018) identified that household crowding, whether within a house or in dense slum areas, is the main risk for spreading infectious disease, particularly during pandemics. People living in these circumstances are not only very vulnerable to COVID-19, but during lockdowns, which of course are impossible to enforce in densely crowded slums, are even more at risk of domestic violence. Even in countries like Finland and New Zealand, with well-developed social welfare states focused on social inclusion, recent migrants, with fewer resources, were more likely to be in crowded houses. Another of the common, but more worrying, impacts was the disruption of children's schooling. This was mentioned in most case studies, even when more prosperous governments provided laptops to families who needed them for their children's schooling.

Among the longer-term risks arising from the pandemic are consequences such as the deferral of regular vaccinations and displacement of other essential health services. Due to the pandemic, nearly 70 countries have halted childhood vaccination programmes and, in many places, health services for cancer screening, family planning, or non-COVID infectious diseases are being neglected. The pandemic is also jeopardising the achievement of climate action initiatives and several other Sustainable Development Goals.

Nevertheless, in many of the cities we examined, there were some positive results, for example declining deaths from road traffic accidents, largely because restricting people's movement was introduced to slow the spread of the pandemic. The New York and Lancaster case studies profile that despite different and sometimes conflicting policies across city, state and federal or national governments following severe COVID-19 outbreaks, innovative changes have been made in the urban fabric of these cities in response to the pandemic and in planning the recovery. Urban streetscapes have been changed, cafes and restaurants have taken over parking places and pedestrians and cycles have more space on the roads. In Mumbai, flamingos flocked back into the city.

In some cases, policies that had been on the future agenda of developed countries' city governments have been brought forward and essentially prototyped, including working from home, rolling out digital technologies, active travel and improving the urban realm. In Hangzhou city in China, where high technical expertise is concentrated in the use of real-time data, as well as mobile app expertise, this technology enabled better tracing and control of COVID. In Delhi, in India, a smartphone application called Aarogya Setu was developed for contact tracing and aiding in quarantine and related containment measures. In New Zealand, mobile phones were used to convey public health information, to record visits for track and tracing and to seek medical advice on a helpline. In Nepal and Sri Lanka, the government also implemented a 'ring tone intervention' through its national telecommunications to raise public awareness of COVID-19 and vaccinations. Public health professionals and

local volunteers also developed innovative low-tech Participatory Mobility Mapping with the support of the International Organization of Migration. These mobility maps were used to plan targeted pandemic response measures.

The pandemic and the shortage of vaccines were a stimulant to the production of new pharmaceuticals. Within a short time span, India became self-reliant in medical supplies. Cuba and India both ramped up their pharmaceutical developments and rapidly vaccinated their populations and were then able to subsidise vaccines to low-income countries which were not priorities for large Western firms. In Brazil, research institutes and universities began to develop first generation vaccines. Brazil, China and Cuba, where political leaders held frequent meetings with scientists, all funded major research programmes.

3 Cumulative Burdens

In countries such as Nigeria and Brazil, where there are large slum areas, with poor, makeshift housing, often made of dangerous materials (Sheuya et al. 2007), and with high air pollution and narrow uneven laneways, distributing relief services is a major problem. Research on socioeconomic vulnerability in São Paulo, which tracked the spatial variation of confirmed deaths due to COVID-19, found that over three quarters (77%) of spatial variability of case fatality was highly influenced by the physical, economic, social and cultural environments (Bermudi et al. 2020).

In Sri Lanka, the pandemic predictably spread first in an underserved urban settlement where physical distancing is almost impossible. The outbreak happened during a 'locked-down' period and there was a police curfew imposed and the residents were confined to their homes. These slum inhabitants were again at a major disadvantage. Relief materials, especially food items, that were assembled to meet the needs of people living in communities that had been locked down, were not reaching those most in need.

The Nobel Prize winning economist Amartya Sen recalled in his books *The Idea of Justice* and *Development as Freedom* his childhood memories of the partition between India and Pakistan: it was dire poverty that led informal workers to cross sectarian lines to feed their families and many were killed (Sen 1999, 2009). During the pandemic, São Paulo has also provided a unique and tragic opportunity to evaluate how urban disparities interact with human health. As Paulo Salvida eloquently stated,

> *Poor people have a significantly higher risk of dying because of COVID-19 in São Paulo. They did not die because of lack of medical assistance. They died because they are poor, do not have time to control their chronic health conditions and because they could not afford to socially isolate. They died because of bad housing. They died trying to make money to survive.*

This observation highlights the critical importance of incorporating a health equity approach to pandemic preparedness, response, and recovery in urban centres. An equity response to the pandemic should be evident at many different points in a

system, requiring a need for multiple and interrelated corrective or preventive actions by multiple actors at appropriate levels. The New York case study also highlights the importance of a health equity approach to pandemic preparedness, response, and recovery in urban centres.

In all the cities we looked at, greater hardship became noticeably more marked between the poor and those who had regular jobs in areas other than hustling, tourism, or service industries which were also badly affected by the pandemic. Even in so-called developed countries, low-income groups with few savings or reserves have found themselves in great hardship compared to middle-class households with more housing space, choices about working from home or not working, and resources at their disposal. In New Zealand, where essential workers in service industries were universally praised through the lockdowns, the government took the opportunity to garner public support to pass Fair Pay Agreement legislation, which will facilitate setting minimum standards across whole industries and occupations.

4 Multi-level Governance

Although our focus in this book is on cities, there is an urgent need for well coordinated whole-of-society action, both before and after the peak of the pandemic. The first prerequisite for coordinated and effective governance is the freedom for legitimate state actors to develop strategic short, medium and long-term policies, and to fund and enact public health measures, with the support of the population. When these conditions have been compromised by military or political intransigence, multi-level governance is complicated and compromised.

In Havana (Cuba) and Gaza, two of our other case studies, these prerequisite conditions were severely compromised; both are under blockades from neighbouring countries. Cuba is still subject to ongoing US sanctions, which severely constrain the Cuban economy, making it even more vulnerable to the pandemic's economic and other effects. As a result of destabilisation from ongoing wars, Gaza is governed by non-state actors such as Hamas, who effectively act as a government, but also restrict some civil liberties.

Although Sri Lanka's civil war ended in 2009, an army commander led the command-and-control pandemic response efforts, which were framed as a law-and-order issue with the lockdowns monitored by the police and defence forces, which led to accusations of militarising the response. However, it was the Ministry of Health that made appeals for people to wear masks, maintain physical distancing and avoid crowds. The Ministry also worked with mobile phone providers to replace ring tones with a recorded message in Sinhala, Tamil and English that highlighted the dangers and requested compliance with the health measures. In Cameroon, an ongoing war in the northern and southern regions may be part of the explanation as to why Cameroon is one of the African countries most affected by the pandemic and probably underlies the non-compliance of parts of the population to health measures put in place by the government.

In China, whole-of-government control is the dominant governance approach; working with NGOs and disadvantaged groups is not a priority. The authors contend that this approach is demonstrably more effective than in liberal democracies and there is some evidence for this in the first pandemic wave, although this is less apparent in the second wave in 2022. Even so, there is a greater variety of policy responses than is immediately evident. In Zhengzhou, a more rural province, there was an effective mobilisation at the grassroots level during its anti-epidemic campaign.

Although some top-down policy actions are not welcomed by vulnerable groups initially, life improves as COVID-19 becomes more controllable, at least for periods. In China, the central government responded to public demands and made more humane policies to balance social needs and epidemic control, e.g., allowing one person to go out every two days to buy supplies for ordinary families, and community volunteers delivered supplies for families during the quarantine period and elderly people living alone. The government also stockpiled food, masks, and medicine to ensure adequate supplies and stable prices, and set up a hotline for medical services.

As reported in India, it was staff in the public, not the better resourced private health services and hospitals, who bore the brunt of care, as well as dealing with hostility and fear in some of the population. As in many other countries, essential workers and community leaders and NGOs stepped in when the policy and workforce gaps became rapidly evident as Grover and Singh highlight in their chapter on New Delhi:

> *The disease has put a spotlight on some of these inequities. India is witnessing an amazing balance between these problems and acts of courage and heroism as our frontline healthcare providers lean in to take care of people across the nation.*

While some countries, such as the Netherlands and Germany, are culturally renowned for collective civic discipline, in many of the city case studies, individuals' sense of responsibility and self-discipline in implementing lockdown policies has also been important.

5 Conclusion

As these case studies have made clear, a truly effective response to the COVID-19 pandemic must be manifest in many different points in a system, with multiple coordinated corrective or preventive actions by multiple actors at multiple governance levels. Such an effective response to the pandemic is one which exploits networks across well-informed individuals and groups in cities and regions with high levels of internal and external coordination and information provision. It involves heterogeneous actors at different scales interacting vertically with national and regional

government and linking across all the key urban domains including health, employment, housing, transport, social service and environmental dimensions. Even urban governance sectors such as local planning can contribute to a coordinated response strategy.

Outstanding themes from the case studies include the importance of policy flexibility in response to the changing circumstances of a developing pandemic. This will only occur if layers of government communicate well and understand each other's constraints. There also has to be a willingness to consider and try new approaches and learn from other members of intercity networks, both domestically and internationally. In cities and countries with successful responses, a high level of collective willingness to 'pull together' was notable, especially in the early stages of the pandemic. However, such solidarity tends to fray over time, and this in turn requires city residents to continue to think creatively about how to support each other.

The lessons from the response to COVID-19 will apply to other large urban challenges, such as mitigating and adapting to climate change. Almost all such urban issues have health and wellbeing dimensions. Thinking systemically about how to tackle them is invaluable, for a well-rounded and intelligent way forward for our cities (Fig. 1).

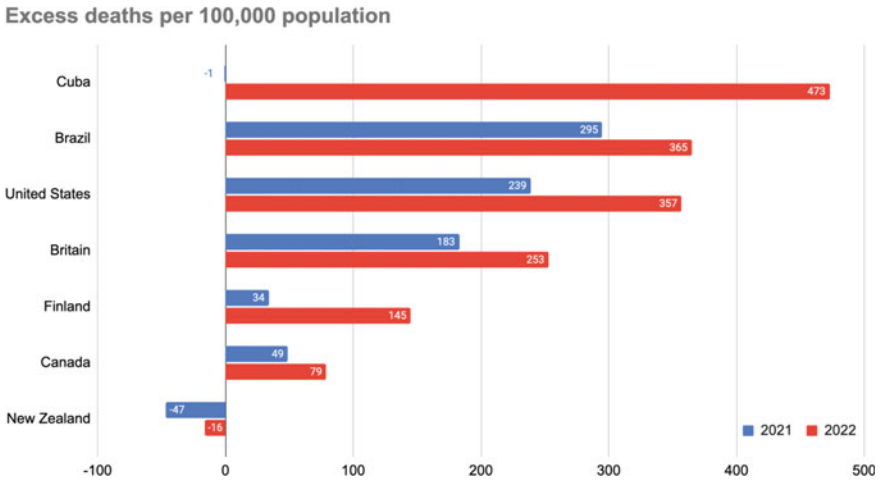

Fig. 1 Excess deaths since country's first 50 COVID-19 deaths (September 2021 and 2022) (*Data source* The Economist 2022b)

References

Bermudi PMM, Lorenz C, Aguiar BS, Failla MA, Barrozo LV, Chiaravalloti-Neto F (2020) Spatiotemporal ecological study of COVID-19 mortality in the city of São Paulo, Brazil: shifting of the high mortality risk from areas with the best to those with the worst socio-economic conditions. Travel Med Infect Dis 39:101945. https://doi.org/10.1016/j.tmaid.2020.101945

Ebikeme C, Gatzweiler F, Oni T, Liu J, Oyuela A, Siri J (2019) Xiamen call for action: building the brain of the city—universal principles of urban health. J Urban Health. https://doi.org/10.1007/s11524-018-00342-0

Edelman Trust Barometer (2021) https://www.edelman.com/trust/2021-trust-barometer. Accessed 20 Aug 2022

Freedom House (2020) Democracy under lockdown: the impact of COVID-19 on the global struggle for freedom. https://freedomhouse.org/sites/default/files/2020-10/COVID-19_Special_Report_Final.pdf. Accessed 11 Jan 2021

Goldfinch S, Taplin R, Gauld R (2021) Trust in government increased during the Covid-19 pandemic in Australia and New Zealand. Aust J Public Admin. https://doi.org/10.1111/1467-8500.12459

Gunderson LH, Holling CS (eds) (2002) Panarchy: understanding transformations in human and natural systems. Island Press

International Science Council (ISC) (2021) Unleashing science: delivering missions for sustainability. International Science Council, Paris. https://doi.org/10.24948/2021

Organization of Economic and Cultural Development (OECD) (2021) Policy responses to coronavirus (COVID-19) enhancing public trust in COVID-19 vaccination: the role of governments. https://www.oecd.org/policy-responses/enhancing-public-trust-in-covid-19-vaccination-the-role-of-governments-eae0ec5a/coronavirus. Accessed 12 Jan 2022

Sen A (1999) Development as freedom. Oxford University Press, Oxford

Sen A (2009) The idea of justice. Penguin Books, London

Sheuya S, Howden-Chapman P, Patel S (2007) The design of housing and shelter programmes: the social and environmental determinants of inequalities. J Urban Health Bull N Y Acad Med 84(1):i98–i108

Tainter JA (1988) The collapse of complex societies. Cambridge University, New York, NY

The Economist (2022a) Tracking covid-19 excess deaths across countries. https://www.economist.com/graphic-detail/coronavirus-excess-deaths-tracker. Accessed 2 Sept 2022a

The Economist (2022b) The Economist's tracker for covid-19 excess deaths. https://github.com/TheEconomist/covid-19-excess-deaths-tracker. Accessed 2 Sept 2022b

UNICEF (2021). Trust in the age of COVID-19: the role of governments, businesses and UNICEF A conversation with Edelman's global data and analytics lead Mr. Yannis Kotziagkiaouridis. https://www.unicef.org/globalinsight/stories/trust-age-covid-19-role-governments-businesses-and-unicef. Accessed 11 Jan 2022

UN Habitat (2020) World cities report 2020: the value of sustainable urbanization. UN Habitat, Geneva

World Health Organization (2018) WHO housing and health guidelines. WHO, Geneva

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