Pandemic Preparedness: Lessons Learned from Covid-19

Fabiola Mwendwa G.

School of Applied Health Sciences Kampala International University Uganda

ABSTRACT

The COVID-19 pandemic exposed critical gaps in global pandemic preparedness, underscoring the need for a multifaceted approach to mitigating future crises. This paper examines the epidemiological characteristics of COVID-19, evaluates public health response strategies, and assesses the resilience of healthcare systems and economic structures. While countries worldwide adopted diverse interventions, such as lockdowns, testing, and vaccination campaigns, disparities in outcomes highlighted the importance of tailored, evidence-based strategies. The pandemic also demonstrated the interconnectedness of health and economic systems, emphasizing the necessity for integrated planning and equitable resource distribution. By analyzing lessons from the COVID-19 crisis, this study proposes actionable strategies to transform pandemics from global catastrophes into manageable outbreaks with minimal societal impact.

Keywords: Pandemic preparedness, COVID-19, Public health response, Healthcare system resilience, Economic recovery, Vaccine equity.

INTRODUCTION

Reducing the risk and impact of pandemics through effective preparedness is one of the world's most urgent priorities. When COVID-19 began to spread around the world, a majority of the population believed that we were well prepared. Clearly, we were not. As we tally the losses and failings, we must leverage this crisis as an opportunity for learning. That is the goal of this paper. We examine the many dimensions of pandemic preparedness and response, analyzing the progress, problems, and lessons associated with each [1, 2]. We examine where we excelled and what we got right, but we do not shy away from discussing those areas where we have failed. While the compendium showcases the problems encountered, the ultimate goal of this work is to build effective strategies to overcome the inevitable hurdles. As we write this piece, the pandemic rages, but the international community must already start thinking about the next pandemic and the one after. We must start formulating evidence-based strategies to prove wrong the widely shared sentiment that pandemics are inevitable, are primarily a health security issue and naturally result in concomitant economic despair [3, 4]. Pandemics are, in fact, the result of harmful deforestation, wet markets, weak public health systems, and inequitable economic structures. While pandemics unfold globally, the response to avert them needs to be tailored to the specific needs and problems faced by the different sectors across countries. A one-size-fits-all top-down response has failed. We have learned from COVID-19 that tackling the pandemic in isolation of other aspects of public health, the economy, and society is leading to long-term harm, and so we hope to learn from our outdated approach to public health to design strategies that will change pandemics into mere "outbreaks" with minimal economic, social, and health impacts [5, 6].

Background of the Covid-19 Pandemic

In December 2019, Wuhan, Hubei Province, China, experienced a surge of people with pneumonia of an unknown cause. On 7 January 2020, a novel coronavirus, COVID-19, was officially listed as one of the diseases under the International Health Regulations. COVID-19 spread rapidly, with a high infection rate from human to human, to various geographical locations globally. On 11 March 2020, it was declared a

pandemic around the globe [7, 8]. There are reports of local epidemics linked to SARS-CoV-2 re-emergence. The coronaviruses, α-CoVs and β-CoVs strains are zoonotic, transmitted from animal to animal, animal to human, and finally, human to human. The source of β-CoVs is zoonotic as a bat reservoir that can transfer to an intermediate host and be transmitted to humans. These strains may change by mutation and recombination, which favor human infection. The emergence of this virus triggered rapid responses during the early phase of the epidemic. However, due to the lack of knowledge about this virus and the pandemic in humans, difficulties arose in the public health response to control the outbreaks. The COVID-19 pandemic affects populations in many ways: psychological distress, mental health issues, and economic shutdowns. The aftermath of the COVID-19 pandemic has seen changes in global agendas, geopolitics, and global governance. It is important to be prepared for future pandemics and outbreaks. Readiness involves aspects of vaccine development, surveillance, and alert activities. In addition, it also requires assurance mechanisms for the equitable and ethical allocation of vaccine supplies, especially for low- and middle-income countries to ensure their accessibility to COVID-19 vaccines [9, 10].

Epidemiological Characteristics of Covid-19

COVID-19 is a contagious and heavily transmissible disease caused by the novel coronavirus, SARS-CoV-2. SARS-CoV-2, a member of the coronavirus family, is a single-stranded RNA virus capable of infecting individuals through respiratory droplets. On average, the virus's incubation period is approximately 5.1 days, meaning that it takes about a week for symptoms to appear post-exposure. Frequent hand hygiene is one of the greatest lines of defense against communicable disease spread because respiratory viruses can spread not only by respiratory droplets but also by landing on surfaces. The spread route of the disease is not 100% truly airborne; however, close contact precautions are required in certain medical settings. One must have prolonged exposure to someone with COVID-19 to be considered at risk for transmission. Aerosols, small infectious particles that can float in the air for longer periods, are formed when an infected person breathes, coughs, sneezes, talks, yells, sings, or engages in other vocal activities [11, 12]. Case reports and observational studies of epidemiological features in many countries have shown that multiple demographic factors affect COVID-19 vulnerability. Mortality rates are highest among older adults aged 65 and older and people of any age with underlying health conditions. Some studies show that men are more likely than women to be hospitalized, sick enough to require ICU care or die from COVID-19. The accessibility of the healthcare system, as well as living and working conditions, can exacerbate the severity of socio-economic factors on the amount of stress in those communities. Additional studies offer evidence to explain the increased vulnerability to COVID-19 for those who endure pre-existing health problems. Patients with comorbidities are found to have a poor prognosis compared to those without comorbidities. When one has an underlying health condition, the body has to work hard at fighting off a disease and may not function well from the start. Asymptomatic COVID-19 individuals can infect others in the same manner as symptomatic individuals. In just one research trial, about 80% of COVID-19 illnesses were moderate. Globally, the average percentage of COVID-19 cases has varied but has generally been shown to be approximately 20%. More accurate statistics on the percentage of COVID-19 cases globally are available; studies show that as many as 40% of COVID cases can be asymptomatic at the county level. Successful monitoring and outbreak management are impossible without tracking contacts of individuals with diseases [13, 14].

Public Health Response Strategies

A variety of public health measures were used worldwide to manage the COVID-19 pandemic, including testing, contact tracing, quarantine, isolation, social distancing measures, travel restrictions, mask-wearing, health screening, lockdowns, and vaccination campaigns. The appropriateness and effectiveness of these public health interventions could be context-specific and could therefore differ between countries based on their governance structures, availability of resources, public compliance, infrastructure, and disease risk. Since the beginning of the pandemic, a constant dialogue between scientists, policymakers, and the public has been critical to addressing these various aspects, sharing perspectives, identifying divergence among them, and suggesting possible implementation strategies for each intervention scenario. Real-time data on the geographical and time distribution of COVID-19 was critical for all of the public health responses above. Rapid changes in the number of cases and case rates, as well as calculated reproductive numbers, could guide the reinforcement or relaxation of public health measures in specific geographic areas, while also allowing for evaluating the impact of implemented strategies. This could also include the sequencing of specific variants and the determination of their distribution over time and space,

which also informed potential policy discussions about travel measures. Results also showed that countries that implemented public health interventions before a small percentage of the population was infected had a tremendous impact in flattening the trajectory of the epidemic in time, therefore reducing the risk of overwhelming health systems and saving thousands of lives. Regional and global health organizations played a crucial role in communicating measures for specific contexts and sharing best practices, as well as in conducting technical missions in the field. They have also been central in offering recommendations for managing international travel and vaccination campaigns. In a post-pandemic world in which countermeasures are no longer necessarily immediately implementable, sharing such evidence is crucial to inform professional audiences striving to further develop public health strategies [15, 16].

Lockdowns and Movement Restrictions

To reduce the number of new infections, many countries have implemented some kind of population-wide restrictions in the form of lockdowns. The belief is that since as much as 90% of SARS-CoV-2 transmission has taken place through social contact, reducing people's contact is key to lowering the reproduction number R. Lockdowns can also be justified by the need to protect the healthcare system from being overrun because of a high number of patients with COVID-19. The huge variation in the stringency of measures taken by countries, within and across the four UK regions, makes comparisons of the impacts of different policy measures extremely difficult. Some countries have chosen partial lockdowns, only halting certain economic activities such as stopping hospitality or non-essential retail. The timing of the lockdown may be as relevant as strictness; for example, more than 75% of the UK population was placed in lockdown on either the 4th or 26th of November [17, 18]. Most of the publicly accessible research reports focus on compliance with lockdown rules. There are some reports showing heterogeneity in response; hence only average compliance is shown, some focusing on demographics, and some including findings on involuntary risk-taking by ignoring the guidelines, vaccine hesitancy, and future compliance scenarios. People may have varying motivations for compliance or non-compliance, and it has been suggested that there are both positive and negative coping mechanisms for dealing with stress during the pandemic, including not looking at the news, distancing from others, or talking about their anxieties during the lockdown. It concludes that people may be less likely to comply with new lockdown rules over concerns about the impact of lockdowns on the economy and mental health and may also be less likely to seek a test if they have symptoms. It also notes the implications when re-implementing an identical intervention would be likely to be less effective than the first time, as had been observed in some countries when cases increased a second time. It suggests that an alternative to a full lockdown may be to define specific changes to roles and behaviors for vulnerable and key worker families enforced only in areas of high case numbers. The negotiated approach of this approach—using individual rather than collective responsibility for controlling the virus—could be said to mirror an underlying principle of current advances in regulation: moving from a command-and-control approach to negotiating to change behavior. Bearing in mind all the various considerations, it has also been concluded that 'very few' UK population studies had been done to clarify variations in behavior and motivations between the general population and vulnerable high-risk groups during the COVID-19 pandemic, at a time when governments around the world were advising those who are clinically vulnerable to take extra precautions [19, 20].

Healthcare System Preparedness

Healthcare systems worldwide have had to handle surges in patient numbers during the COVID-19 pandemic. Overall, they exhibited initial preparedness capacities. A major challenge was the allocation of scarce resources such as intensive care units. The responsiveness of a healthcare system is not only dependent on the number of hospital beds and other infrastructure but also on the availability of medical supplies, such as ventilators. However, in many healthcare systems, the most important bottleneck is the availability of trained staff. This is, for example, the case in low-income, but also a few high-income countries. The COVID-19 pandemic showed that basing response measures solely on the stocks available may not provide a relevant benchmark for the level of preparedness required. Countries with well-funded healthcare systems, high bed capacities, and a low staff-to-patient ratio have the means to deal with big surges in demand. High hospital staffing levels, and in particular high staffing levels of nurses and nursing assistants, facilitated higher than predicted quit ratios and an increase in inpatient care capacity. In countries with higher community transmission, healthcare professionals were likely to be affected, many of whom continued to get infected during the second wave. Millions of healthcare-associated infections occur each year, with a significant number happening in low- and middle-income countries, costing billions of dollars. Given such situations, hospital management had to learn how to adapt to the

constantly changing knowledge about the virus from a hospital management perspective, which was very limited. The pandemic pushed for a revisiting of hospital capacity planning and design by facilitating or accelerating policies through the recognition of fundamental human needs and rights. The pandemic also had an impact on investments in healthcare personnel and hospitals. Even with the set targets of major initiatives in mind, significant restructuring in healthcare services is anticipated. Antimicrobial resistance also marks an important element of pandemic preparedness and proper management [21, 22].

Economic Impacts and Recovery Efforts

The COVID-19 pandemic had immediate and extensive economic repercussions. The pandemic response led businesses to close or reduce hours, and for a while, our primary concern was the extraordinary number of jobs lost. Whether caused by policy or fear, this resulted in major income loss for people and companies. By the end of 2020, although many of those jobs were being replaced, many more were lost. Global trade was also disrupted. At the same time, some of these impacts were not experienced by others. Those sectors that have done well have thrived during the pandemic. This outsized effect on different sectors exacerbates historical inequality in our economy and has significant implications for disaster recovery policy. For example, the data shows that certain groups are disproportionately represented in the categories of jobs lost. This means that the impact of the recession has been disproportionately large for these groups. This is also evident internationally [23, 24]. To mitigate some of the economic fallout of the pandemic, governments at all levels and in many countries have intervened. In the U.S., the federal government delivered stimulus checks, expansions to unemployment benefits, credits to employers for employee retention, and support programs for small businesses. States also provided unemployment benefits and grants to small businesses and workers. These were broad-based measures designed to reach as much of the economy as possible. Though important to recovery, government intervention cannot resolve the extent to which disparities had an outsized impact on different sectors of the economy. In the mid and longer term, we are likely to see firms structurally change. Workplaces will be redesigned, consumer demand will not be the same, and global supply chains will also change. In addition, there are longer-term implications for the labor market. Work is already moving out of densely populated cities as remote work becomes permanent. In short, there will continue to be medium and longer-term insecurities and adjustments. This health crisis has shown us that economic planning must be integrated with public health preparedness. For example, how would we keep food and basic goods flowing if we were not able to have in-person contact with one another? How would we keep public services moving? [25, 26].

CONCLUSION

The COVID-19 pandemic has provided invaluable insights into the vulnerabilities of global health systems and the socio-economic fabric of our societies. It highlighted the need for robust healthcare infrastructure, equitable access to medical resources, and agile governance to respond effectively to crises. Moving forward, pandemic preparedness must prioritize integrated strategies that address health disparities, ensure vaccine accessibility, and fortify economic resilience. The lessons learned from COVID-19 reinforce the urgency of global cooperation and innovation to minimize the impact of future pandemics, turning them into manageable outbreaks rather than catastrophic events. By adopting a holistic approach, the international community can transform the collective experience of this crisis into a foundation for a safer and more prepared world.

REFERENCES

1. Coccia M. Preparedness of countries to face COVID-19 pandemic crisis: strategic positioning and factors supporting effective strategies of prevention of pandemic threats. Environmental Research. 2022 Jan 1;203:111678.
2. Coccia M. Preparedness of countries to face covid-19 pandemic crisis: Strategic positioning and underlying structural factors to support strategies of prevention of pandemic threats. Environmental Research. 2022 Jan;203(111678):10-16.
3. Hynes W, Trump B, Love P, Linkov I. Bouncing forward: a resilience approach to dealing with COVID-19 and future systemic shocks. Environment Systems and Decisions. 2020 Jun;40:174-84.
4. Soesanto RH, Dirgantoro KP, Priyantim N. Indonesian Students' Perceptions towards AI-Based Learning in Mathematics. Journal on Mathematics Education. 2022;13(3):531-48.
5. Lee A, Houston AR. Diets, diseases, and discourse: Lessons from COVID-19 for trade in wildlife, public health, and food systems reform. Food Ethics. 2020 Nov;5:1-4.

6.   Bell ML, Pollitt KJ, Deziel NC. COVID-19 and the environment: the pandemic and beyond. Environmental Research Letters. 2023 Sep 1;18(9):092001.

7.   Saqlain M, Munir MM, Ahmed A, Tahir AH, Kamran S. Is Pakistan prepared to tackle the coronavirus epidemic?. Drugs & Therapy Perspectives. 2020 May;36:213-4. springer.com

8.   Rustam F, Khalid M, Aslam W, Rupapara V, Mehmood A, Choi GS. A performance comparison of supervised machine learning models for Covid-19 tweets sentiment analysis. Plos one. 2021 Feb 25;16(2):e0245909.

9.   Pedrosa AL, Bitencourt L, Fróes AC, Cazumbá ML, Campos RG, de Brito SB, Simões e Silva AC. Emotional, behavioral, and psychological impact of the COVID-19 pandemic. Frontiers in psychology. 2020 Oct 2;11:566212. frontiersin.org

10.   Daly M, Robinson E. Psychological distress and adaptation to the COVID-19 crisis in the United States. Journal of psychiatric research. 2021 Apr 1;136:603-9.

11.   Wang L, Wang Y, Ye D, Liu Q. Review of the 2019 novel coronavirus (SARS-CoV-2) based on current evidence. International journal of antimicrobial agents. 2020 Jun 1;55(6):105948.

12.   Hsu LY, Chia PY, Lim JF. The novel coronavirus (SARS-CoV-2) pandemic. Ann Acad Med Singap. 2020 Mar 16;49(3):105-7.

13.   Pazan F, Wehling M. Polypharmacy in older adults: a narrative review of definitions, epidemiology and consequences. European geriatric medicine. 2021 Jun;12:443-52.

14.   Bernal JL, Andrews N, Gower C, Stowe J, Robertson C, Tessier E, Simmons R, Cottrell S, Roberts R, O'Doherty M, Brown K. Early effectiveness of COVID-19 vaccination with BNT162b2 mRNA vaccine and ChAdOx1 adenovirus vector vaccine on symptomatic disease, hospitalisations and mortality in older adults in England. MedRxiv. 2021 Mar 2:2021-03. medrxiv.org

15.   Xiang Y, Jia Y, Chen L, Guo L, Shu B, Long E. COVID-19 epidemic prediction and the impact of public health interventions: A review of COVID-19 epidemic models. Infectious Disease Modelling. 2021 Jan 1;6:324-42. sciencedirect.com

16.   Matrajt L, Leung T. Evaluating the effectiveness of social distancing interventions to delay or flatten the epidemic curve of coronavirus disease. Emerging infectious diseases. 2020 Aug;26(8):1740.

17.   Madewell ZJ, Yang Y, Longini IM, Halloran ME, Dean NE. Household transmission of SARS-CoV-2: a systematic review and meta-analysis. JAMA network open. 2020 Dec 1;3(12):e2031756-. jamanetwork.com

18.   Onakpoya IJ, Heneghan CJ, Spencer EA, Brassey J, Plüddemann A, Evans DH, Conly JM, Jefferson T. SARS-CoV-2 and the role of close contact in transmission: a systematic review. F1000Research. 2022 Nov 17;10:280. nih.gov

19.   McBride O, Murphy J, Shevlin M, Gibson-Miller J, Hartman TK, Hyland P, Levita L, Mason L, Martinez AP, McKay R, Stocks TV. Monitoring the psychological, social, and economic impact of the COVID-19 pandemic in the population: Context, design and conduct of the longitudinal COVID-19 psychological research consortium (C19PRC) study. International journal of methods in psychiatric research. 2021 Mar;30(1):e1861. wiley.com

20.   Smith LE, Potts HW, Amlôt R, Fear NT, Michie S, Rubin GJ. Engagement with protective behaviours in the UK during the COVID-19 pandemic: a series of cross-sectional surveys (the COVID-19 rapid survey of adherence to interventions and responses [CORSAIR] study). BMC Public Health. 2022 Mar 10;22(1):475. springer.com

21.   Simen-Kapeu A, Reserva ME, Ekpini RE. Galvanizing action on primary health care: analyzing bottlenecks and strategies to strengthen community health systems in West and Central Africa. Global Health: Science and Practice. 2021 Mar 15;9(Supplement 1):S47-64. ghspjournal.org

22.   Gurung GB, Panza A. Implementation bottlenecks of the National Health Insurance program in Nepal: Paving the path towards Universal Health Coverage: A qualitative study. The International Journal of Health Planning and Management. 2022 Jan;37(1):171-88. [HTML]

23.   Montenovo L, Jiang X, Lozano-Rojas F, Schmutte I, Simon K, Weinberg BA, Wing C. Determinants of disparities in early COVID-19 job losses. Demography. 2022 Jun 1;59(3):827-55. dukeupress.edu

24.   Holder M, Jones J, Masterson T. The early impact of COVID-19 on job losses among black women in the United States. Feminist Economics. 2021 Apr 3;27(1-2):103-16.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited

https://rijournals.com/scientific-and-experimental-sciences/

25.   Aruru M, Truong HA, Clark S. Pharmacy Emergency Preparedness and Response (PEPR): a proposed framework for expanding pharmacy professionals' roles and contributions to emergency preparedness and response during the COVID-19 pandemic and beyond. Research in Social and Administrative Pharmacy. 2021 Jan 1;17(1):1967-77. nih.gov

26.   Marome W, Shaw R. COVID-19 response in Thailand and its implications on future preparedness. International journal of environmental research and public health. 2021 Feb;18(3):1089. mdpi.com