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Public Health Policy and Infectious Disease Control: Lessons from Recent Outbreaks

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KEYWORDS

Infectious Diseases, Public Health Policy, COVID-19 Pandemic, Ebola Outbreak, Global Health Preparedness

ABSTRACT:

This research explores the complex dynamics of public health policy and its crucial role in managing pandemics, considering the unprecedented challenges presented by recent outbreaks of infectious diseases. Examining the worldwide consequences of the COVID-19 pandemic and the Ebola outbreak, we analyze the insights gained from these emergencies, highlighting the necessity for flexible policy development, cooperative endeavors, and the incorporation of community-led strategies. This study adds to the current discussion on pandemic preparedness and the development of robust public health systems. This research paper examines the significant influence of the COVID-19 pandemic and the Ebola outbreak on worldwide public health. It specifically analyzes the efficacy of public health policies and the involvement of mathematical models in managing infectious diseases. Understanding the development of public health responses requires considering the historical context of infectious disease outbreaks such as the Spanish Flu, H1N1, SARS, and MERS. This study conducts a comparative analysis of the responses to the COVID-19 pandemic and the Ebola outbreak, taking into account their distinct challenges and contextual factors. The emergence of the COVID-19 pandemic, resulting from the SARS-CoV-2 virus, has presented a multifaceted global health crisis that requires swift and flexible public health measures. Conversely, the Ebola epidemic in the Democratic Republic of Congo revealed difficulties that are unique to areas affected by conflict and emphasized the significance of involving the community in efforts to control the disease. The paper explores the global ramifications of these outbreaks, encompassing not only health consequences but also economic, societal, and international relations implications. The interdependence of global health is examined by analyzing the responses to COVID-19 and Ebola, highlighting the crucial requirement for collaborative endeavors, exchange of information, and fair allocation of resources. The research utilizes a case study methodology, specifically examining the COVID-

19 pandemic and the Ebola outbreak as illustrative instances. Data collection encompasses the evaluation of implemented public health policies, the utilization of mathematical models for analysis, and the contemplation of ethical ramifications in the study of global health emergencies. The paper concludes by providing policy recommendations derived from the insights gained from these outbreaks. It highlights the importance of flexible and data-driven policymaking, international collaboration, and the incorporation of community-led strategies.

I. Introduction

The onset of the 21st century has been characterized by unparalleled difficulties presented by outbreaks of infectious diseases, with two notable occurrences standing out in recent recollection: the COVID-19 pandemic and the Ebola outbreak. The COVID-19 pandemic, triggered by the novel coronavirus SARS-CoV-2, has arisen as a worldwide health emergency, impacting millions of individuals and fundamentally altering societal conventions. The Ebola outbreak in the Democratic Republic of Congo underscored the persistent danger of infectious diseases, especially in areas dealing with complex socio-political environments and areas of conflict[1], [2].

The COVID-19 pandemic, which originated from the emergence of the novel coronavirus SARS-CoV-2, has been an unparalleled worldwide health crisis since its discovery in late 2019. The virus swiftly crossed international boundaries, resulting in extensive sickness, overwhelming healthcare systems, and presenting complex challenges to societies. Simultaneously, the Ebola outbreak in the Democratic Republic of Congo emphasized the ongoing danger presented by extremely contagious diseases, especially in areas grappling with intricate socio-political challenges, such as conflict zones[3], [4].

The profound importance of studying these outbreaks resides in the fundamental insights they provide for formulating global public health policies. The COVID-19 pandemic highlighted the necessity of flexible, data-driven policymaking when dealing with unforeseeable infectious risks, while the Ebola outbreak emphasized the significance of customizing interventions to particular geographical and socio-political circumstances. Both crises have emerged as crucial benchmarks for comprehending the intricacies of infectious disease control and the vital significance of robust and adaptable public health systems[5], [6].

Throughout history, there have been recurring challenges posed by infectious disease outbreaks, which have had a significant impact on societies and have influenced the direction of public health strategies. The Spanish Flu of 1918, the H1N1 pandemic in 2009, and the outbreaks of more recent viruses such as SARS and MERS have had a lasting impact on public health interventions. The historical context offers a thorough framework for assessing the development of infectious disease management, revealing the adaptive strategies utilized throughout history[7], [8].

An examination of the reactions to the COVID-19 pandemic and the Ebola outbreak provides a detailed comprehension of the efficacy of different approaches. Distinct challenges and responses have been shaped by variations in transmission dynamics, healthcare infrastructure, and socio-cultural factors. While the international community allocated resources to create vaccines and carry out widespread testing for COVID-19, the response to the Ebola outbreak required active involvement of the community, meticulous tracking of contacts, and targeted vaccination strategies to address the unique challenges posed by the epidemic.

The COVID-19 pandemic and the Ebola outbreak have had a significant global impact, affecting not only health but also economies, societies, and international relations in lasting ways. The COVID-19 pandemic resulted in extensive disruptions, economic recessions, and increased recognition of global interconnectedness. Moreover, the Ebola outbreak revealed the weaknesses of healthcare systems in regions affected by conflict, emphasizing the necessity for specific international assistance and collaboration[9], [10].

The global responses to these outbreaks have demonstrated the interdependence of global health, underscoring the significance of cooperative endeavors, exchange of information, and fair distribution of resources in addressing infectious disease risks[11]. The interconnectivity between different factors serves as a catalyst for reassessing and strengthening the fundamental principles of public health policies at both regional and global levels.

The importance of studying these outbreaks goes beyond the immediate health consequences and has a broader impact on public health policy. Both crises act as testing grounds for comprehending the intricacies of infectious disease management and the crucial significance of public health measures in lessening the effects on communities and global welfare. Amidst the challenges faced by the global community, it is crucial to extract and analyze the knowledge gained from these outbreaks in order to guide future policymaking, intervention strategies, and global health preparedness.

II. Literature Review

The current discourse on global health emphasizes the interdependent connection between infectious diseases and public health policies as a prominent focus. The COVID-19 pandemic and the Ebola outbreak illustrate the complex difficulties presented by infectious agents, prompting a thorough analysis of the dynamic interaction between efficient public health policies and infectious disease control. This study aims to extract valuable knowledge from recent outbreaks, providing insights into the complex strategies needed to navigate the changing landscape of health risks.

R. Rohr et al.[12] investigates the interrelationships between emerging infectious diseases and global food production systems. The interdisciplinary approach prioritizes comprehending and reducing the hazards presented by zoonotic diseases within the framework of food production. J. Budd et al.[13] explores the crucial significance of digital technologies in addressing the COVID-19 pandemic. The article examines the utilization of digital tools for tracking, monitoring, and controlling the transmission of the virus, emphasizing the technological progress that has influenced the public health response. J. Bullard et al.[14] examines the predictability of contagiousness in individuals who test positive for SARS-CoV-2. The research provides valuable insights into diagnostic sample analysis for accurately predicting the virus's transmission potential. K. J. Land et al.[15] explores the concept of REASSURED diagnostics, highlighting the significance of Real-time, Affordable, Simple, Sensitive, User-friendly, and Rapid diagnostics in guiding disease control strategies. The authors endorse the use of these diagnostic tools to enhance the effectiveness of health systems and enhance patient outcomes. The article by L. W. Meredith et al.[16] examines the swift adoption of SARS-CoV-2 sequencing to investigate instances of healthcare-associated COVID-19. The study highlights the significance of genomic surveillance in comprehending the patterns of transmission dynamics. R. M. Gil et al.[17] examines the unequal health consequences of the COVID-19 pandemic on the Hispanic/Latinx community in the United States. This study illuminates the disparities in health that exist within this specific demographic group.

The study conducted by C. Xu et al.[18] centers on the mathematical modeling and analysis of the dynamics of Ebola virus transmission. The study offers valuable insights into the mathematical components of controlling infectious diseases. D. E. Bloom et al.[19] analyze the challenges posed by infectious diseases in the current era and propose the need to enhance the global response. The paper highlights the significance of a strong worldwide reaction to newly arising infectious diseases. The study conducted by M. G. Baker et al.[20] assesses the impact on American workers who are at risk of contracting infections or diseases, offering valuable information on how to mitigate the risk of COVID-19 transmission in work environments. L. Dong et al.[21] examine the public mental health emergency in China during the COVID-19 pandemic, offering valuable perspectives on the psychological dimensions of this worldwide crisis. The study conducted by K. A. John et al.[22] examines the frequency of depression, anxiety, and stress among healthcare professionals in a tertiary care hospital in South Kerala during the COVID-19 pandemic.

As we wrap up this investigation into Public Health Policy and Infectious Disease Control, the combination of insights from COVID-19 and Ebola uncovers a significant story of strength, cooperation, and flexibility. The global response, which includes strategic lockdowns, vaccination campaigns, and

community engagement, showcases the vital importance of policymaking that is grounded in evidence. These lessons act as a guide leading us towards a future where proactive public health policies serve as long-lasting protections against infectious threats. Recent outbreaks serve as not only episodes in the annals of public health but also as a model for a better equipped and resilient global society.

III. Structure of SARS-CoV-2 and Ebola virus

a. Ebola virus structure: The Ebola virus, aptly named for its elongated, thread-like appearance, belongs to the filovirus family. As depicted in the electron microscope image below, these menacing pathogens stretch from 800 to 1,000 nanometers in length, placing them among the largest viruses known to science as shown in figure-1(a).

- Genome: At the core of the Ebola virus lies its single-stranded, non-segmented RNA genome. This genetic material carries the instructions for building new virus particles.
- Nucleocapsid: The RNA genome is tightly wrapped around a protein called nucleoprotein (NP). This complex, called the nucleocapsid, forms a helical core that gives the virus its characteristic thread-like shape.
- Matrix protein (VP40): Surrounding the nucleocapsid is a layer of matrix protein (VP40). This protein helps give the virus its shape and rigidity and plays a role in viral assembly and budding.
- Glycoprotein (GP): The outermost layer of the Ebola virus is made up of glycoprotein (GP) spikes. These spiky projections are what give the virus its crown-like appearance in images.
- The GP protein plays a crucial role in viral attachment and entry into host cells. It binds to specific receptors on the host cell surface, triggering the fusion of viral and cellular membranes, allowing the viral genome to enter the cell.
- Additional proteins: Besides the major structural proteins, the Ebola virus encodes several other proteins involved in various functions, such as viral RNA synthesis, immune evasion, and suppression of host cell defenses.

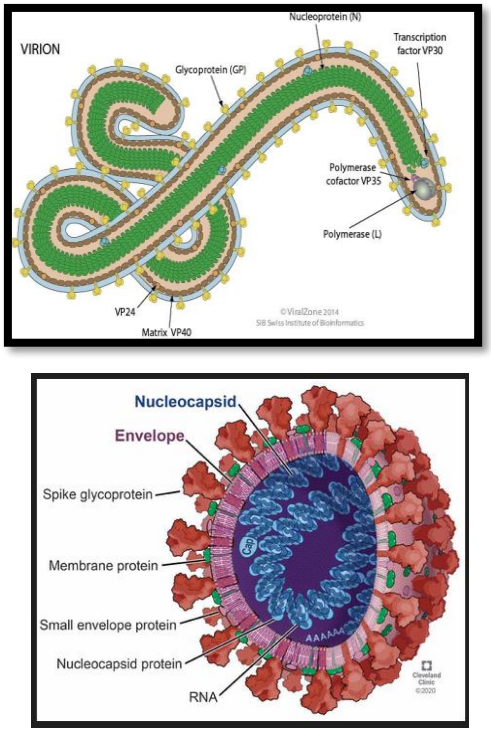

Figure 1 a. Ebola virus b. SARS-CoV-2

b. Structure of SARS-CoV-2 virus

SARS-CoV-2 belongs to the coronavirus family, named for the crown-like appearance of their spike proteins. The virus is roughly spherical in shape and measures about 60-120 nanometers in diameter, much smaller than the Ebola virus. SARS-CoV-2 is highly infectious and can cause a range of symptoms, from mild respiratory illness to severe pneumonia and death. Table-1 shows more comparative analysis.

- Envelope: The outermost layer of the virus is a fatty membrane called the envelope. This membrane is borrowed from the host cell during viral assembly and conceals the internal viral machinery from the immune system.
- Spike glycoprotein (S protein): Embedded in the envelope are crown-like spikes formed by a protein called the spike glycoprotein (S protein). These spikes are the defining feature of SARS-CoV-2 and play a crucial role in viral infection.
- S1 and S2 subunits: Each S protein is made up of two subunits: S1 and S2. The S1 subunit binds to specific receptors on the host cell, like a key fitting into a lock. The S2 subunit then facilitates fusion of the viral and cellular membranes, allowing the viral genome to enter the host cell.
- Nucleocapsid: Beneath the envelope lies the nucleocapsid, a core structure composed of the

viral RNA genome tightly wound around proteins called nucleoproteins. This genomic RNA carries the genetic instructions for building new virus particles.

- Membrane protein (M protein): Lining the inner side of the envelope is a layer of membrane protein (M protein). This protein plays a crucial role in maintaining the viral structure and facilitating virus assembly and budding.
- Envelope protein (E protein): Another protein embedded in the envelope is the envelope protein (E protein). This protein has various functions, including shaping the viral envelope, interacting with the host cell membrane, and evading the immune system.
- Accessory proteins: Besides the major structural proteins, SARS-CoV-2 encodes several non-structural proteins involved in various functions like viral replication, immune evasion, and manipulating host cell processes.

Table 1 Comparative study[23], [24]

Area	**COVID-19 (as of 4, 2024)**	**Ebola (2014-2016 West Africa)**	**Ebola (2022 Uganda outbreak)**
Confirmed Cases	764 million	28,646	164 (142 confirmed, 22 probable)
Deaths	6.8 million	11,315	55 (confirmed)
Case Fatality Rate (CFR)	0.89%	39.50%	33.5% (confirmed)
Transmission	Airborne, close contact	Mainly through direct contact with body fluids of infected persons	Mainly through direct contact with body fluids of infected persons
Asymptomatic Cases	40-50%	25%	Unknown
Vaccine Availability	Multiple highly effective vaccines available globally	No licensed vaccine available (under development)	No licensed vaccine available (under development)
Estimated Global Economic Impact	US$15.7 trillion in 2020 alone	US$53 billion in affected countries	Unknown

IV. COVID-19 virus (SARS-CoV-2) Case Study

- Origin and Spread of SARS-CoV-2: The analysis of the COVID-19 case commences by investigating the source and transmission of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Examining the source of the virus, which is most likely transmitted from animals to humans, and its initial dissemination among human populations is crucial for comprehending the worldwide consequences of the subsequent pandemic.
- Global Impact on Health, Economy, and Society: The diverse and complex effects of the COVID-19 pandemic on worldwide health, economies, and societies. Examining the trend of infection rates, severity of illness, and demographic disparities reveals the diverse effects on different regions and populations. Furthermore, the economic consequences, disruptions to daily routines, and enduring societal transformations offer a comprehensive outlook on the worldwide ramifications of the pandemic.

Public health policies

- Lockdowns, Social Distancing, and Mask Mandates: An examination of the public health strategies implemented during the COVID-19 pandemic involves a thorough examination of measures such as lockdowns, social distancing, and mask mandates. This section evaluates the efficacy of these interventions in reducing the transmission of the virus, alleviating the burden on the healthcare system, and safeguarding populations at high risk.

Analyzing regional disparities and levels of adherence offers valuable insights into the intricate execution of these policies.

- Vaccination Campaigns and International Cooperation: The tactics utilized in immunizing populations against COVID-19, highlighting the importance of vaccination campaigns and global collaboration. An analysis of the global progress, dissemination, and availability of vaccines, along with the cooperative endeavors between nations and organizations, clarifies the crucial role of vaccination in public health strategies designed to control the pandemic.

V. Ebola virus case study

- Location-Specific Challenges in the Democratic Republic of Congo: The analysis of the Ebola case study begins by examining the specific challenges that were encountered during the outbreak in the Democratic Republic of Congo (DRC). The containment and management of the Ebola virus are particularly challenging due to factors such as the intricate socio-political landscape, ongoing conflict zones, and limited healthcare infrastructure in the country. Comprehending these complexities is crucial for placing the response strategies implemented in the area into their proper context.
- Effects on Local Communities and Healthcare Systems: This section explores the significant influence of the Ebola epidemic on indigenous communities and healthcare infrastructures in the Democratic Republic of the Congo (DRC). An analysis is conducted to examine the broader consequences of the virus, specifically its impact on public health, social structures, and economic stability. Assessing the burden on healthcare facilities and the interruptions to regular healthcare services provides insight into the difficulties experienced by the local populations.

Public health policies

- Approaches to Vaccination and Involvement of the Community: This subsection specifically examines the vaccination strategies that were put into place during the Ebola outbreak, with a particular emphasis on the significance of involving and involving the community. This article examines the progress and implementation of Ebola vaccines, as well as initiatives aimed at fostering trust among impacted communities. Gaining insight into the cultural, social, and historical factors that impact vaccine acceptance is essential for evaluating the efficacy of vaccination strategies in the specific circumstances of the Democratic Republic of Congo (DRC).
- Methods of monitoring and controlling the spread of a disease: The surveillance measures and containment efforts that were put in place to control the transmission of Ebola in the Democratic Republic of Congo (DRC). This encompasses the mobilization of swift response teams, the identification and monitoring of individuals in close contact with infected individuals, and the implementation of isolation protocols. Assessing the efficacy of these tactics in detecting and quarantining cases, halting the spread, and ultimately managing the epidemic offers valuable understanding of the complexities of infectious disease management in difficult circumstances.

Overall, the Ebola case study provides a thorough examination of the specific difficulties encountered in the Democratic Republic of Congo, the consequences for local communities and healthcare systems, and the public health strategies implemented to address the outbreak. This case study enhances our comprehension of infectious disease control strategies in regions with distinctive contextual obstacles by analyzing the responses to Ebola.

VI. Lessons from Recent Outbreaks

Area	COVID-19	Ebola
Surveillance and Early Detection	Fragile global monitoring systems. Delayed identification of initial cases.	Strengthen global disease surveillance networks with real-time data sharing and early warning systems. Invest in rapid diagnostic tools and decentralized testing capabilities.
Contact Tracing and Case Management	Difficulty contact tracing due to asymptomatic transmission.	Prioritize effective contact tracing strategies including digital tools and community-based approaches.

	Overwhelmed healthcare systems.	Strengthen healthcare infrastructure and surge capacity with trained personnel and flexible resources.
Community Engagement and Communication	Misinformation and mistrust in public health guidance. Cultural and social barriers to interventions.	Foster open communication and transparency with clear, consistent messaging tailored to diverse communities. Build trust through community engagement and partnerships with local leaders and organizations.
Risk Mitigation and Control Measures	Varying effectiveness of different interventions (e.g. lockdowns, masks) . Challenges balancing health and economic considerations.	Implement evidence-based public health measures, balancing effectiveness with social and economic impact. Invest in research on optimal intervention strategies for future outbreaks.
Vaccine Development and Deployment	Rapid development of highly effective vaccines. Unequal access to vaccines globally.	Invest in research and development for rapid vaccine development platforms. Ensure equitable vaccine distribution and access through international cooperation and resource sharing.
Healthcare Workforce Preparedness	Shortage of qualified healthcare personnel. Lack of personal protective equipment (PPE).	Strengthen healthcare workforce training and education, focusing on infectious disease preparedness. Stockpile and ensure adequate PPE supplies with regular maintenance and distribution plans.
International Cooperation and Solidarity	Uneven global response and support. Lack of coordination and sharing of resources.	Promote international collaboration and resource sharing through established mechanisms and rapid response teams. Strengthen multilateral health institutions to provide leadership and coordination in global health emergencies.
Future Preparedness and Resilience	Need for sustainable investments in health systems. Importance of addressing underlying social and economic determinants of health	Build resilient health systems with strong primary healthcare, disease prevention strategies, and emergency preparedness plans. Address underlying social and economic inequalities to improve overall health outcomes and community resilience.

VII. Conclusion & Future Directions

Key Findings and their Implications for Public Health: The analysis of COVID-19 and Ebola case studies reveals that implementing adaptable and evidence-based public health policies is crucial in reducing the impact of infectious disease outbreaks. The lessons gleaned underscore the significance of tailored approaches, involvement of the community, and international cooperation. The importance of public health highlights the necessity for adaptable and nimble response frameworks that can be customized to address various challenges posed by emerging infectious threats.

Call for Ongoing Research and Adaptability in Policy Planning: Continuous dedication to research and flexibility in policy planning are essential due to the ever-changing nature of infectious diseases. Continual research is essential for comprehending the changing patterns of disease transmission, the emergence of new variants, and the lasting impacts of infectious diseases on populations. It is recommended that policymakers promote a culture of adaptability, based on up-to-date data, interdisciplinary collaboration, and knowledge gained from past outbreaks.

Emerging trends in the control of infectious diseases: This section delves into upcoming trends in the field of infectious disease control, focusing on what lies ahead. Technological advancements, including the integration of artificial intelligence and machine learning, may revolutionize early detection, prediction, and response strategies. Moreover, the implementation of genomics in monitoring and comprehending the

development of pathogens is positioned to improve accuracy in intervention strategies. Recognizing and adopting these patterns is essential for maintaining a competitive edge in the field of infectious disease management.

Strategies for global cooperation and preparedness: The need for global cooperation and preparedness strategies is underscored by the interconnectedness revealed in the case studies. Enhancing global cooperation in the areas of data sharing, allocation of resources, and research endeavors is crucial for a cohesive worldwide approach to combat infectious disease threats. Creating and practicing preparedness strategies that go beyond national boundaries guarantees a synchronized reaction, reducing the possible chain reactions of future pandemics.

Ultimately, this research highlights the crucial interaction among public health policies, adaptive strategies, and technological advancements in effectively managing infectious diseases. This study enhances global preparedness for future infectious disease challenges by synthesizing crucial findings and emphasizing the significance of ongoing research and global collaboration. It contributes to the collective efforts aimed at strengthening public health systems.

References

[1] M. Taryam *et al.*, "Factors Affecting the Uptake of COVID-19 Vaccine among Dubai Airport's Professionals," *South East. Eur. J. Public Heal.*, vol. 17, no. January, pp. 1–14, 2021, doi: 10.11576/seejph-5091.

[2] M. J. P. Poirier, J. Hard, and J. Holst, "Covid-19 pandemic providing a window of opportunity for higher educa-tion: Case study of a three-country teaching-learning experience," *South East. Eur. J. Public Heal.*, vol. 17, no. November, pp. 1–12, 2021, doi: 10.11576/seejph-4924.

[3] U. Laaser *et al.*, "Exchange and Coordination: Challenges of the Global One Health Movement," *South East. Eur. J. Public Heal.*, vol. 19, no. November, pp. 1–30, 2022, doi: 10.11576/seejph-6076.

[4] D. Eick, O. Aubert, K. Dempsey, M. Ozawa, E. Van Eerd, and J. Neicun, "The COVID-19 pandemic and the right to health of people who use drugs," *South East. Eur. J. Public Heal.*, no. June, pp. 1–22, 2023, doi: 10.56801/seejph.vi.281.

[5] G. Vimala and V. D. Phalke, "A cross sectional study on assessment of health problems and psychosocial problems of elderly tribal population," *J. Krishna Inst. Med. Sci. Univ.*, vol. 9, no. 4, pp. 50–57, 2020.

[6] M. V. Ghate, P. Shidhaye, and P. Deoraj, "Mitigating risk of covid-19 transmission at antiretroviral therapy (Art) centres in india," *J. Krishna Inst. Med. Sci. Univ.*, vol. 9, no. 3, pp. 107–110, 2020.

[7] S. D. Datta, A. Talwar, and J. T. Lee, "A Proposed Framework and Timeline of the Spectrum of Disease Due to SARS-CoV-2 Infection: Illness Beyond Acute Infection and Public Health Implications," *JAMA*, vol. 324, no. 22, pp. 2251–2252, Dec. 2020, doi: 10.1001/jama.2020.22717.

[8] S. P. Adhikari *et al.*, "Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: A scoping review," *Infect. Dis. Poverty*, vol. 9, no. 1, pp. 1–12, 2020, doi: 10.1186/s40249-020-00646-x.

[9] M. M. Hossain, A. Sultana, and N. Purohit, "Mental health outcomes of quarantine and isolation for infection prevention: a systematic umbrella review of the global evidence," *Epidemiol. Health*, vol. 42, pp. 1–11, 2020, doi: 10.4178/epih.e2020038.

[10] R. K. Webster, S. K. Brooks, L. E. Smith, L. Woodland, S. Wessely, and G. J. Rubin, "How to improve adherence with quarantine: rapid review of the evidence," *Public Health*, vol. 182, pp. 163–169, 2020, doi: 10.1016/j.puhe.2020.03.007.

[11] V. Khetani, Y. Gandhi, S. Bhattacharya, S. N. Ajani, and S. Limkar, "Cross-Domain Analysis of ML and DL : Evaluating their Impact in Diverse Domains," vol. 11, pp. 253–262, 2023.

[12] J. R. Rohr *et al.*, "Emerging human infectious diseases and the links to global food production," *Nat. Sustain.*, vol. 2, no. 6, pp. 445–456, 2019, doi: 10.1038/s41893-019-0293-3.

[13] J. Budd *et al.*, "Digital technologies in the public-health response to COVID-19," *Nat. Med.*, vol. 26, no. 8, pp. 1183–1192, 2020, doi: 10.1038/s41591-020-1011-4.

[14] J. Bullard *et al.*, "Predicting infectious severe acute respiratory syndrome coronavirus 2 from diagnostic samples," *Clin. Infect. Dis.*, vol. 71, no. 10, pp. 2663–2666, 2020, doi: 10.1093/cid/ciaa638.

[15] K. J. Land, D. I. Boeras, X. S. Chen, A. R. Ramsay, and R. W. Peeling, "REASSURED diagnostics to inform disease control strategies, strengthen health systems and improve patient outcomes," *Nat. Microbiol.*, vol. 4, no. 1, pp. 46–54, 2019, doi: 10.1038/s41564-018-0295-3.

[16] L. W. Meredith *et al.*, "Rapid implementation of SARS-CoV-2 sequencing to investigate cases of health-care associated COVID-19: a prospective genomic surveillance study," *Lancet Infect. Dis.*, vol. 20, no. 11, pp. 1263–1272, 2020, doi: 10.1016/S1473-3099(20)30562-4.

[17] R. M. Gil, J. R. Marcelin, B. Zuniga-Blanco, C. Marquez, T. Mathew, and D. A. Piggott, "COVID-19 pandemic: Disparate health impact on the hispanic/latinx population in the United States," *J. Infect. Dis.*, vol. 222, no. 10, pp. 1592–1595, 2020, doi: 10.1093/infdis/jiaa474.

[18] C. Xu and M. Farman, "Dynamical Transmission and Mathematical Analysis of Ebola Virus Using a Constant Proportional Operator with a Power Law Kernel," *Fractal Fract.*, vol. 7, no. 10, 2023, doi: 10.3390/fractalfract7100706.

[19] D. E. Bloom and D. Cadarette, "Infectious disease threats in the twenty-first century: Strengthening the global response," *Front. Immunol.*, vol. 10, no. MAR, pp. 1–12, 2019, doi: 10.3389/fimmu.2019.00549.

[20] M. G. Baker, T. K. Peckham, and N. S. Seixas, "Estimating the burden of United States workers exposed to infection or disease: A key factor in containing risk of COVID-19 infection," *PLoS One*, vol. 15, no. 4, pp. 4–11, 2020, doi: 10.1371/journal.pone.0232452.

[21] L. Dong and J. Bouey, "Public Mental Health Crisis during COVID-19 Pandemic, China," *Emerg. Infect. Dis.*, vol. 26, no. 7, pp. 1616–1618, 2020, doi: 10.3201/eid2607.202407.

[22] K. A. John and V. S. Aparna, "Prevalence of depression, anxiety and stress among healthcare workers during COVID-19 outbreak in a tertiary care hospital in South Kerala: A cross sectional study," *J. Krishna Inst. Med. Sci. Univ.*, vol. 11, no. 4, pp. 65–72, 2022.

[23] Wo. H. Organization, "Coronavirus Disease (COVID-19)." pp. 70–75, 2023, doi: 10.18356/9789210025195c010.

[24] Our World in Data, "Coronavirus Pandemic (COVID-19) - Our World in Data." p. 1, 2022, [Online]. Available: https://ourworldindata.org/coronavirus.