

Do We Have Strategies to Prevent Emerging Fatal Pathogens?

Nelson Busic*

University of Idaho, 875 Perimeter Dr, Moscow, ID 83844, USA

*: All correspondence should be sent to: Dr. Nelson Busic

Author's Contact: Dr. Nelson Busic, Ph.D., E-mail: nelsonbusicui@gmail.com

DOI: <https://doi.org/10.15354/si.24.co215>

Funding: No funding source declared.

COI: The author declares no competing interest.

AI Declaration: The author affirms that artificial intelligence did not contribute to the process of preparing the work.

To prevent the transmission of fatal pathogenic microorganisms, a comprehensive strategy is needed that includes public health interventions and research projects. An effective approach is to improve surveillance systems in order to rapidly identify and address epidemics, enabling swift isolation and treatment of sick persons. In addition, practices such as regular handwashing and adherence to established food safety regulations can aid in minimizing the transfer of harmful microorganisms. Research endeavors should prioritize the development of novel vaccines and antimicrobial therapies to counteract the emergence of new infections. Moreover, the implementation of stringent infection control measures in healthcare settings can effectively prevent nosocomial infections and restrict the transmission of these lethal microorganisms. Through the integration of proactive public health actions and state-of-the-art research developments, we can successfully avert the spread of fatal pathogens and safeguard global health security.

Keywords: Emerging Fatal Pathogens; Preventive Strategies; Global Health; Epidemic; Pandemic

Science Insights, 2024 August 31; Vol. 45, No. 2, pp.1461-1464.

© 2024 Insights Publisher. All rights reserved.



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the [Creative Commons Attribution-NonCommercial 4.0 License](https://creativecommons.org/licenses/by-nc/4.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed by the Insights Publisher.

THE EMERGENCE of highly pathogenic pathogens presents a substantial risk to public health, as they have the potential to rapidly propagate and result in extensive morbidity and mortality (1-3). Therefore, it is critical to adopt efficient preventive measures to reduce the likelihood of these hazardous microorganisms creating epidemics. We herein show various essential preventive techniques that can be employed to resist the emergence of deadly pathogenic microorganisms and safeguard public health.

Early detection and surveillance are crucial measures for

preventing the emergence of deadly pathogenic microbes (4, 5). Through vigilant surveillance and prompt detection of emerging pathogenic microorganisms, public health authorities can proactively enforce containment strategies to prevent widespread dissemination. This can involve employing sophisticated diagnostic tools, such as polymerase chain reaction testing, to identify the precise microorganisms responsible for sickness and monitor their dissemination. However, political concealment would be the potential obstacle to the early vigilant detection, as seen in the COVID crisis (6, 7).

Another essential preventive technique is immunization. The successful story of COVID vaccines based on mRNA technology provided us with a novel way to develop vaccines to conquer new pathogenic microbes (8-10). Vaccines confer immunity against specific pathogens, hence diminishing the probability of infection and halting the transmission of disease. The development of novel vaccinations is crucial for protecting vulnerable populations and preventing epidemics caused by emerging fatal pathogenic microbes (11, 12). It is necessary for governments and health organizations to allocate resources towards research and development to provide efficacious vaccinations against these perilous infections.

Aside from immunization, practicing proper hygiene is also crucial in preventing the spread of developing deadly pathogenic microorganisms (13, 14). Basic measures such as practicing regular hand hygiene, properly concealing coughs and sneezes, and maintaining distance from persons who are ill can effectively mitigate the transmission of contagious diseases. Public health campaigns can effectively disseminate information to the general population regarding the significance of adhering to proper hygiene protocols to mitigate the spread of disease-causing microorganisms.

Implementing quarantine measures can serve as a successful preventive technique against the emergence of deadly pathogenic microorganisms (15, 16). Through the process of segregating persons who are infected or suspected of being infected with a hazardous infection, public health authorities can effectively halt the transmission of the disease to other individuals. During epidemics or pandemics, quarantine procedures can be widely adopted to effectively restrict the transmission of infections and safeguard the broader population. However, it is necessary to do a comprehensive evaluation of the regional, country, and even global lockdown and its detrimental impact on the overall welfare of individuals (17-19).

Antibiotic stewardship is another crucial technique for preventing the emergence of fatal pathogenic microorganisms (20, 21). Excessive and improper utilization of antibiotics might result in the emergence of bacteria that are resistant to antibiotics, hence complicating the treatment of diseases (22). To address the growth of drug-resistant bacteria, public health officials can contribute by advocating for responsible antibiotic use and restricting the prescription of antibiotics when they are unnecessary.

Implementing environmental control measures can serve

as efficient preventive techniques against the emergence of fatal pathogenic microorganisms (23). Pathogens have the ability to persist and propagate in the surroundings, so it is crucial to uphold hygienic and sanitary settings in order to hinder their transmission. This includes activities such as sanitizing surfaces, guaranteeing the purity of water supplies, and managing vectors such as insects that can spread disease-causing agents (24).

Effective collaboration and cooperation among governments, health organizations, and researchers are crucial measures for preventing the spread of developing deadly pathogenic microbes (25). Through the act of exchanging information and pooling resources, stakeholders can collaborate in order to create and execute efficient preventive actions. This can involve the surveillance of global travel and commerce in order to identify and promptly address potential epidemics or pandemics.

Risk communication is a crucial method for preventing the spread of deadly new pathogens (26, 27). Public health officials are required to engage in communication with the general public regarding the potential dangers posed by newly identified disease-causing agents and the precautionary measures individuals might adopt to safeguard their well-being. Effective and prompt communication can foster trust and ensure that different countries comprehend the significance of preventive measures in conquering newly emerged fatal microbes (28, 29).

Research and innovation are essential measures for preventing the spread of developing deadly pathogenic microorganisms (30). Through allocating resources to study emerging pathogens and innovating new tools for detection and treatment, scientists can proactively outpace hazardous microorganisms (31). This encompasses the creation of novel diagnostic tools, treatments, and vaccinations with the aim of preventing and managing outbreaks.

In conclusion, to effectively prevent the emergence and spread of deadly pathogenic microbes, a comprehensive strategy is necessary. This strategy should encompass various aspects such as early detection, vaccination, practicing good hygiene, implementing quarantine measures, responsible use of antibiotics, controlling the environment, fostering collaboration, communicating risks, and investing in research and innovation. By effectively adopting these preventive techniques, public health professionals may save populations from the catastrophic consequences of new infections and guarantee the safety and welfare of communities worldwide. ■

References

1. Levitt AM, Khan AS, Hughes JM. Emerging and re-emerging pathogens and diseases. *Infectious Diseases* 2010; 2010:56-69. DOI: <https://doi.org/10.1016/B978-0-323-04579-7.00004-6>
2. Madhav N, Oppenheim B, Gallivan M, et al. Pandemics: Risks, Impacts, and Mitigation. In: Jamison

DT, Gelband H, Horton S, et al., editors. *Disease Control Priorities: Improving Health and Reducing Poverty*. 3rd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2017 Nov 27. Chapter 17. DOI: https://doi.org/10.1596/978-1-4648-0527-1_ch17

3. Williams BA, Jones CH, Welch V, True JM. Outlook of pandemic preparedness in a post-COVID-19 world. *NPJ Vaccines* 2023; 8(1):178. DOI: <https://doi.org/10.1038/s41541-023-00773-0>
4. Arthur RR, Leduc JW, Hughes JM. Surveillance for emerging infectious diseases and bioterrorism threats. *Trop Infect Dis* 2006; 2006:195-200. DOI: <https://doi.org/10.1016/B978-0-443-06668-9.50020-X>
5. Koopmans M. Surveillance strategy for early detection of unusual infectious disease events. *Curr Opin Virol* 2013; 3(2):185-91. DOI: <https://doi.org/10.1016/j.coviro.2013.02.003>
6. Trebesch C, Konradt M, Ordoñez G, Herrera H. The political consequences of the Covid pandemic: Lessons from cross-country polling data. *VoxEU*, November 06, 2020. Last access: July 02, 2024. Available at: <https://cepr.org/voxeu/columns/political-consequences-covid-pandemic-lessons-cross-country-polling-data>
7. Kerr J, Panagopoulos C, van der Linden S. Political polarization on COVID-19 pandemic response in the United States. *Pers Individ Dif* 2021; 179:110892. DOI: <https://doi.org/10.1016/j.paid.2021.110892>
8. Jain S, Venkataraman A, Wechsler ME, Peppas NA. Messenger RNA-based vaccines: Past, present, and future directions in the context of the COVID-19 pandemic. *Adv Drug Deliv Rev* 2021; 179:114000. DOI: <https://doi.org/10.1016/j.addr.2021.114000>. Erratum in: *Adv Drug Deliv Rev* 2022; 189:114501. DOI: <https://doi.org/10.1016/j.addr.2022.114501>
9. Demongeot J, Fougère C. mRNA COVID-19 vaccines-facts and hypotheses on fragmentation and encapsulation. *Vaccines (Basel)* 2022; 11(1):40. DOI: <https://doi.org/10.3390/vaccines11010040>
10. Aygün I, Barciszewski J. The forerunners and successful partnerships behind the BioNTech mRNA vaccine. *J Appl Genet* 2024; 65(1):47-55. DOI: <https://doi.org/10.1007/s13353-023-00793-5>
11. Rodrigues CMC, Plotkin SA. Impact of vaccines; health, economic and social perspectives. *Front Microbiol* 2020; 11:1526. DOI: <https://doi.org/10.3389/fmicb.2020.01526>
12. Clemens SAC, Clemens R. The need and challenges for development of vaccines against emerging infectious diseases. *J Pediatr (Rio J)* 2023; 99 Suppl 1(Suppl 1):S37-S45. DOI: <https://doi.org/10.1016/j.jped.2022.11.002>
13. Vandegrift R, Bateman AC, Siemens KN, Nguyen M, Wilson HE, Green JL, Van Den Wymelenberg KG, Hickey RJ. Cleanliness in context: Reconciling hygiene with a modern microbial perspective. *Microbiome* 2017; 5(1):76. DOI: <https://doi.org/10.1186/s40168-017-0294-2>
14. Mathur P. Hand hygiene: Back to the basics of infection control. *Indian J Med Res* 2011; 134(5):611-620. DOI: <https://doi.org/10.4103/0971-5916.90985>
15. Tognotti E. Lessons from the history of quarantine, from plague to influenza A. *Emerg Infect Dis* 2013; 19(2):254-259. DOI: <https://doi.org/10.3201/eid1902.120312>
16. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Population Health and Public Health Practice; Board on Health Sciences Policy; Committee on Evidence-Based Practices for Public Health Emergency Preparedness and Response; Downey A, Brown L, Calonge N, editors. *Evidence-Based Practice for Public Health Emergency Preparedness and Response*. Washington (DC): National Academies Press (US); 2020 Jul 14. 7, Implementing Quarantine to Reduce or Stop the Spread of a Contagious Disease. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK563999/>
17. Singh S, Roy D, Sinha K, Parveen S, Sharma G, Joshi G. Impact of COVID-19 and lockdown on mental health of children and adolescents: A narrative review with recommendations. *Psychiatry Res* 2020; 293:113429. DOI: <https://doi.org/10.1016/j.psychres.2020.113429>
18. Onyeaka H, Anumudu CK, Al-Sharify ZT, Egele-Godswill E, Mbaegbu P. COVID-19 pandemic: A review of the global lockdown and its far-reaching effects. *Sci Prog* 2021; 104(2):368504211019854. DOI: <https://doi.org/10.1177/00368504211019854>
19. Seidenbecher S, Dobrowolny H, Wolter S, Klemen J, Meyer-Lotz G, Gescher DM, Steiner J, Frodl T. Consequences of the lockdown: Domestic violence during the COVID-19 pandemic. *Adv Exp Med Biol* 2023; 1412:53-72. DOI: https://doi.org/10.1007/978-3-031-28012-2_3
20. Shrestha J, Zahra F, Cannady, Jr P. *Antimicrobial Stewardship*. [Updated 2023 Jun 20]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024 Jan. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK572068/>
21. Khadse SN, Ugemuge S, Singh C. Impact of antimicrobial stewardship on reducing antimicrobial resistance. *Cureus* 2023; 15(12):e49935. DOI: <https://doi.org/10.7759/cureus.49935>
22. Habboush Y, Guzman N. *Antibiotic Resistance*. [Updated 2023 Jun 20]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024 Jan. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK513277/>
23. Ellwanger JH, Veiga ABG, Kaminski VL, Valverde-Villegas JM, Freitas AWQ, Chies JAB. Control and prevention of infectious diseases from a One Health perspective. *Genet Mol Biol* 2021; 44(1 Suppl 1):e20200256. DOI: <https://doi.org/10.1590/1678-4685-GMB-2020-0256>
24. Hutton G, Chase C. *Water Supply, Sanitation, and Hygiene*. In: Mock CN, Nugent R, Kobusingye O, et al., editors. *Injury Prevention and Environmental Health*. 3rd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2017 Oct 27. Chapter 9. DOI: https://doi.org/10.1596/978-1-4648-0522-6_ch9
25. Drexler M; Institute of Medicine (US). *What You Need to Know About Infectious Disease*. Washington (DC): National Academies Press (US); 2010. IV, Prevention and Treatment. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK209704/>
26. Recchia V, Aloisi A, Zizza A. Risk management and communication plans from SARS to COVID-19 and

beyond. *Int J Health Plann Manage* 2022; 37(6):3039-3060. DOI: <https://doi.org/10.1002/hpm.3545>

27. Dickmann P, Strahwald B. Ein neues Verständnis von Risikokommunikation in Public-Health-Notlagen [A new understanding of risk communication in public health emergencies]. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. 2022; 65(5):545-551. German. DOI: <https://doi.org/10.1007/s00103-022-03529-8>
28. Holroyd TA, Oloko OK, Salmon DA, Omer SB, Limaye RJ. Communicating recommendations in public health emergencies: The role of public health authorities. *Health Secur* 2020; 18(1):21-28. DOI: <https://doi.org/10.1089/hs.2019.0073>
29. Reddy BV, Gupta A. Importance of effective communication during COVID-19 infodemic. *J Family Med Prim Care* 2020; 9(8):3793-3796. DOI: <https://doi.org/10.4103/jfmprc.jfmprc.719.20>
30. Elbehiry A, Marzouk E, Abalkhail A, El-Garawany Y, Anagreyah S, Alnafea Y, Almuzaini AM, Alwarhi W, Rawway M, Draz A. The development of technology to prevent, diagnose, and manage antimicrobial resistance in healthcare-associated infections. *Vaccines (Basel)* 2022; 10(12):2100. DOI: <https://doi.org/10.3390/vaccines10122100>
31. National Institutes of Health (US); Biological Sciences Curriculum Study. NIH Curriculum Supplement Series. Bethesda (MD): National Institutes of Health (US); 2007. Understanding Emerging and Re-emerging Infectious Diseases. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK20370/>

Received: July 18, 2024 | Revised: July 23, 2024 | Accepted: July 25, 2024
