

Abstract

Artificial Intelligence (AI) is increasingly applied in public health and epidemiology to predict disease outbreaks, optimize healthcare resources, and design effective interventions for population well-being. By processing massive datasets from electronic health records, mobility data, and social media, AI models enhance surveillance, accelerate response times, and support evidence-based policymaking. This article examines applications of AI in infectious disease modeling, chronic disease management, health policy, and global health security, while addressing challenges of data ethics and equity.

1. Introduction

Public health faces rising challenges from global pandemics, chronic diseases, and demographic changes. Traditional epidemiological tools, while effective, often lack the speed and scalability required in today's interconnected world. AI, through machine learning and predictive analytics, provides powerful tools for analyzing health data and enabling proactive interventions (Topol, 2019).

2. AI in Infectious Disease Surveillance

Machine learning models analyze case reports, climate variables, and travel data to predict outbreaks of influenza, dengue, and COVID-19. Natural language processing tracks early-warning signals from online news and social media, supplementing traditional surveillance networks (Xu et al., 2020).

3. Chronic Disease Management

AI identifies risk factors and predicts the onset of chronic diseases such as diabetes, cardiovascular conditions, and cancer. Predictive analytics enables early interventions, reducing healthcare costs and improving patient outcomes (Rajkomar et al., 2019).

4. Resource Allocation and Health Policy

AI-driven decision support systems optimize the allocation of hospital beds, ventilators, and vaccines during health crises. Models also evaluate policy scenarios, helping governments choose effective interventions with minimal social disruption.

5. Global Health Security

AI enhances international collaboration by integrating diverse datasets across borders. Systems like BlueDot and HealthMap use AI to track emerging infectious diseases globally, enabling faster international response (Bogoch et al., 2020).

6. Ethical and Equity Considerations

The use of AI in public health raises issues of privacy, informed consent, and potential bias in algorithms. Equitable access to AI-driven health tools is essential to avoid exacerbating health disparities between high- and low-income populations.

7. Future Directions

Next-generation AI in public health will focus on real-time global data sharing, explainable AI models for policymakers, and integration with wearable technologies for individual-level population monitoring.

8. Conclusion

AI in public health and epidemiology holds transformative potential for predicting outbreaks,

managing chronic diseases, and strengthening health systems. Its success will depend on interdisciplinary collaboration, ethical governance, and ensuring equitable benefits for all populations.

Keywords

Artificial Intelligence, Public Health, Epidemiology, Disease Surveillance, Health Policy

References (APA 7th Edition)

- Bogoch, I. I., Watts, A., Thomas-Bachli, A., Huber, C., Kraemer, M. U., & Khan, K. (2020). Potential for global spread of a novel coronavirus from China. *Journal of Travel Medicine*, 27(2), taaa011. <https://doi.org/10.1093/jtm/taaa011>
- Rajkomar, A., Dean, J., & Kohane, I. (2019). Machine learning in medicine. *New England Journal of Medicine*, 380(14), 1347–1358. <https://doi.org/10.1056/NEJMr1814259>
- Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44–56. <https://doi.org/10.1038/s41591-018-0300-7>
- Xu, B., Gutierrez, B., Mekaru, S., Sewalk, K., Goodwin, L., Loskill, A., ... & Brownstein, J. S. (2020). Epidemiological data from the COVID-19 outbreak: Early descriptions from publicly available data. *Scientific Data*, 7(1), 106. <https://doi.org/10.1038/s41597-020-0448-0>