

REVIEW

Infectious diseases: Addressing global challenges and prevention strategies for national health improvement

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ABSTRACT

Infectious diseases represent a critical threat to global public health due to the rapid evolution of pathogens, increased population mobility, and climate change, all of which contribute to their spread. While global efforts have been made to mitigate the impact of infectious diseases, there remains a pressing need for strategies that are adaptable to national contexts, particularly in regions with resource-limited health systems. In this study, we examined the global challenges posed by infectious diseases and identified adaptable prevention strategies for national health improvements. We also explored how the application of the health belief model (HBM) can help control diseases by influencing individual health behaviors. We conducted a review of peer-reviewed literature, global health reports, and case studies published from 2018 to 2024 with a focus on infectious disease outbreaks and prevention strategies. Key sources included data from the World Health Organisation, the Centers for Disease Control and Prevention, and regional health organizations. We assessed successful global interventions and evaluated their applicability to national health systems, particularly in low- and middle-income countries. Our review revealed significant progress in the global fight against infectious diseases, for example, through the development of vaccines, antiviral therapies, and improved disease surveillance systems. However, challenges, such as inequitable access to healthcare, vaccine hesitancy, and inadequate health infrastructure, persist in many regions. The prevention strategies that proved most effective were those that combined global guidance with localized implementation, including community-based interventions, targeted vaccination campaigns, and robust public health policies. Notably, the countries that invested in strengthening their health systems through partnerships with global organizations demonstrated greater resilience to disease outbreaks. Global solutions to mitigate the impacts of infectious diseases can only be fully effective when adapted to the specific needs of national health systems. Our study highlights the importance of integrating global expertise with local knowledge to create prevention strategies that are contextually relevant and sustainable. Strengthening health systems, enhancing disease surveillance, and promoting equitable access to healthcare resources are critical to improving national health outcomes and ensuring preparedness for future infectious disease threats. Our findings underscore the need for continued collaboration between global health organizations and national governments to address both current and emerging infectious diseases.

Key words: infectious diseases, emerging infectious diseases, global challenges, preventive strategies

INTRODUCTION

Infectious diseases represent a critical and ongoing threat to global health and are exacerbated by factors

such as pathogen evolution, increased international travel, and climate change. Despite significant advancements in medical science and public health, these diseases continue to challenge health systems worldwide,

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particularly in regions with limited resources. An infectious disease is defined as an illness caused by pathogenic microorganisms, such as bacteria, viruses, fungi, parasites, or other agents (e.g., protozoa, helminths, prions). These pathogens can spread directly or indirectly from one person to another *via* bodily fluids, respiratory droplets, contaminated surfaces, or vectors, such as insects.^[1] According to the World Health Organisation (WHO), "over 13 million people die each year from infection, one in two deaths in some developing countries. Poor people, women, children, and the elderly are the most vulnerable. Infectious diseases continue to be the world's leading killer of young adults and children".^[1] Socioeconomic, behavioral, and environmental factors as well as international travel and migration foster and increase the spread of infectious diseases. Vaccine-preventable, zoonotic, foodborne, healthcare-related, and communicable diseases pose significant threats to human health and may sometimes threaten international health security.^[2] According to Endy, infectious diseases have had civilization-altering consequences throughout history.^[3] As examples, an estimated 50–100 million humans worldwide succumbed to infection during the Spanish flu pandemic in 1918–1920, while rinderpest was in part responsible for the starvation and subsequent deaths of almost two-thirds of the East African Maasai population after the virus killed massive numbers of livestock. World Health Organization^[4] highlighted that over 30 new and emerging diseases have been identified, including coronavirus disease 2019 Legionnaires' disease, human immunodeficiency virus (HIV)/acquired immune deficiency syndrome, hepatitis C, several viral hemorrhagic fevers and, more recently, severe acute respiratory syndrome avian influenza, Ebola, and the Zika virus. They related the emergence of these diseases and the resurgence of old ones, such as tuberculosis and cholera, to various changes in human ecology, including rural-to-urban migration, which have resulted in high-density peri-urban slums, increased long-distance mobility and trade, the social disruption of war and conflict, and human-induced global changes, such as the widespread clearance of forests and climate change.^[4] This study therefore examined the global challenges posed by infectious diseases and identified adaptable prevention strategies for national health improvements. It also explored how the health belief model (HBM) can help control diseases by influencing individual health behaviors.

MATERIALS AND METHODS

For this review, we conducted a comprehensive search of published studies relevant to infectious diseases and national health strategies. We queried databases such as PubMed, Scopus, and Google Scholar using the

keywords including global infectious disease challenges, prevention strategies, national health improvement, disease surveillance, and intervention effectiveness. Our literature search was restricted to studies published between 2018 and 2024 to ensure the relevance and timeliness of the data.

Data collection process

The initial search was performed by the first author, who then collaborated with her co-author to screen the titles and abstracts to ensure the inclusion of relevant and original research while excluding duplicates and non-original articles (Figure 1). The selection criteria were focused on relevance to infectious diseases and national health strategies with an emphasis on global challenges and prevention strategies. Discrepancies in article selection were resolved through discussion among the authors until consensus was reached. The eligible studies were then reviewed, and the key findings were synthesized and organized into a review table for analysis (Table 1). The aim of this process was to identify effective prevention strategies and evaluate their applicability to national health systems for improved public health outcomes.

RESULTS

Global impact of emerging and reemerging infectious diseases on health systems

Emerging and reemerging infectious diseases pose significant challenges to global health, as they can spread rapidly and cause widespread outbreaks. Emerging diseases, such as Coronavirus Disease 2019 (COVID-19) and Ebola, often arise from novel pathogens or changes in existing ones, while re-emergent diseases, like tuberculosis and measles, reappear due to factors such as antimicrobial resistance or decreased vaccination coverage.^[5]

The global impact of infectious diseases on health systems and populations is both substantial and multifaceted, with far-reaching consequences that span various dimensions of public health and affect societal stability. Infectious diseases, which include both endemic conditions, such as malaria and tuberculosis, as well as emergent outbreaks, like COVID-19 and Ebola, significantly affect global health on multiple levels. These diseases contribute to high mortality rates, particularly in regions with inadequate healthcare infrastructure, and place immense strain on healthcare systems worldwide, which often results in resource depletion, compromised quality of care, and challenges in managing both routine and emergency health services. The economic impact of infectious diseases is significant and encompasses both direct (e.g., medical treatment, lost productivity) and indirect costs (e.g., long-term effects on economic stability and development). The burden of these diseases

Table 1: Infectious diseases—Addressing global challenges and prevention strategies for national health improvement

Item	Year	Study focus	Methodology	Key findings	Implications
WHO, Chan M.	2018	Public health threats from infectious diseases	Report by WHO	Infectious diseases remain a leading cause of death globally, with a significant impact on vulnerable populations	Strengthening global and national health systems is crucial for addressing the threat posed by infectious diseases, particularly in resource-limited settings
Bloom DE, Cadarette D.	2019	Infectious disease threats in the 21st century	Literature review	Highlights the need for strengthened global responses to tackle emerging and re-emerging infectious diseases	Global responses must be tailored to fit the specific challenges faced by individual nations, especially those with limited resources
Naguib MM, et al.	2021	Risk of disease emergence from live and wet markets	Trends in microbiology	Live markets are a potential source of emerging infectious diseases due to close contact between humans and animals	The regulation of live markets and improved surveillance systems are needed to mitigate the risk of emerging diseases
Lindahl JF, Grace D.	2015	Historical impact of infectious diseases	Historical analysis	Infectious diseases have historically had civilization-altering consequences. The Spanish flu and other pandemics have had devastating effects globally	Understanding the historical impact of infectious diseases can inform better preparedness and response strategies in current times
Begou P, Kassomenos P.	2023	Emergence of new infectious diseases	Epidemiological study	More than 30 new infectious diseases identified, including COVID-19 and Ebola, highlighting the ongoing threat of disease emergence due to ecological changes	Ecological and behavioral changes are significant drivers of infectious disease emergence, necessitating integrated approaches for prevention and control
CDC, US Dept. of Health	2018	Applied Epidemiology in Public Health Practice	Educational resource	Provides a framework for understanding disease transmission and intervention opportunities through the chain of infection	The chain of infection framework is essential for designing effective disease prevention and control strategies
WHO	2020	Modes of transmission for COVID-19	Scientific brief	COVID-19 transmission occurs through respiratory droplets, contact with contaminated surfaces, and close contact with infected individuals	Public health interventions should focus on breaking the chain of transmission through hygiene practices, social distancing, and vaccination
Tartari E, et al.	2021	IPC in global health	Situational analysis	IPC is crucial for patient safety and the prevention of healthcare-associated infections and pandemics	Strengthening IPC programs at national and healthcare facility levels is critical for mitigating the spread of infectious diseases
Yoon SJ, et al.	2018	Global strategies on infection prevention	Global strategy report by WHO	Effective IPC measures are integral to patient safety and health system strengthening	Integration of IPC into national health strategies is necessary to prevent the spread of infectious diseases and improve patient outcomes
Arceo E, et al.	2021	HBM and its application to COVID-19 prevention in the Philippines	Application of psychological model	HBM effectively increases awareness of risks associated with infectious diseases and promotes preventive measures like vaccination and hygiene practices	Public health interventions using HBM can lead to better adoption of preventive behaviors, contributing to effective disease prevention at the national level

WHO, world health organization; IPC, Infection Prevention and Control; HBM, health belief model.

is measured by morbidity (illness and disability), mortality (death toll), and disability-adjusted life years, which combines premature mortality and years lived with disability to provide a comprehensive view of a disease's impact. According to the WHO, infectious diseases remain a leading cause of death worldwide, particularly in developing regions, where access to healthcare and preventive measures is limited.^[5] Infectious diseases encompass various conditions, such as respiratory infections, gastrointestinal infections, vector-borne and sexually transmitted infections, and emerging infectious threats, like COVID-19.^[6] Efforts to combat infectious diseases involve coordinated actions by international health organizations, governments, healthcare professionals, and researchers. Initiatives aimed at the prevention, control, and surveillance of infectious diseases is integral to mitigating their impact on global health. However, challenges, such as antimicrobial resistance (AMR), vaccine hesitancy, inadequate

healthcare infrastructure, and the emergence of novel pathogens, continually test the resilience of global health systems in addressing infectious diseases.^[5] In addition to the direct health consequences, infectious diseases have substantial economic and social implications. They disrupt healthcare systems, strain public health resources, impact workforce productivity, and create socioeconomic burdens in affected communities. Furthermore, infectious disease outbreaks can trigger widespread panic, societal unrest, and global economic instability.

Factors contributing to the global spread of infectious diseases

The chain of infection is a fundamental concept that delineates how infectious diseases spread and can be controlled. It encompasses six essential links: infectious agent, reservoir, portal of exit, mode of transmission, portal of entry, and susceptible host. Each link is crucial

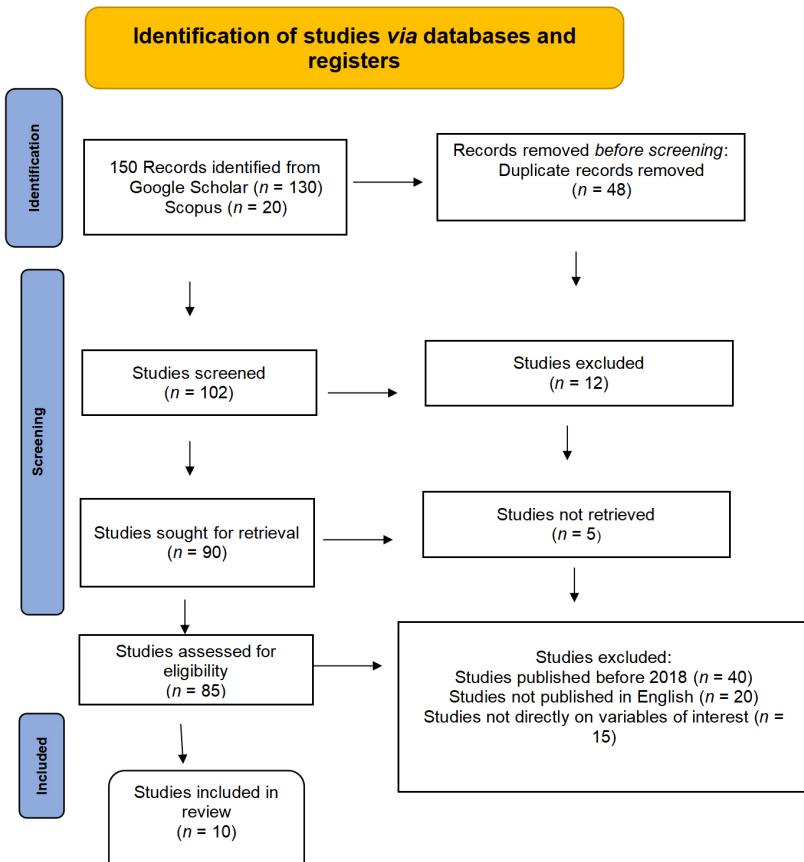


Figure 1. PRISMA Flow Diagram 2020 for system review for infectious diseases: addressing global challenges and prevention strategies for national health improvement.

for the transmission of infection and presents opportunities for interventions.^[6] The global spread of infectious diseases is influenced by numerous factors, including changes in pathogen characteristics, environmental conditions, and human behaviors. These factors contribute to the emergence of new infectious diseases and the reemergence of previously controlled ones, which highlights the need for a comprehensive approach to disease surveillance, prevention, and control. Some infectious diseases result from natural processes, such as the evolution of pathogens over time, but many are a result of human behaviors and practices. Notably, the interactions between human populations and the environment have changed, especially over the last century. Factors that have contributed to these changes are population growth, migration from rural areas to cities, international air travel, poverty, wars, and destructive ecological practices due to economic development and land use.^[3] For an emerging disease to become established, two key events must occur. First, the infectious agent must be introduced into a vulnerable population, either directly from another infected individual, from animals (as in zoonotic diseases), or through non-living reservoirs, such as contaminated water, surfaces, or

objects. Second, the agent must be capable of spreading easily from person-to-person, animal-to-person, or *via* contaminated non-living sources. Likewise, arthropods, such as mosquitoes, ticks, fleas, and sandflies, play a crucial role as vectors in the spread of diseases that pose significant threats to human health. For example, *Anopheles* mosquitoes transmit the malaria-causing *Plasmodium* species, and the subsequent infection results in symptoms like fever, chills, and organ dysfunction.^[7] *Aedes* mosquitoes, particularly *Aedes aegypti*, are responsible for spreading dengue fever, Zika virus, and chikungunya, which cause symptoms that range from high fever and joint pain to severe neurological complications.^[8] *Ixodes* ticks carry *Borrelia burgdorferi* and are thus vectors for Lyme disease, which can result in long-term complications, such as arthritis and neurological disorders.^[9] Moreover, sandflies transmit leishmaniasis, which is marked by skin sores and systemic complications, while fleas can spread bubonic plague, a historically devastating disease caused by *Yersinia pestis*.^[10] Implementing control measures against these vectors is vital for reducing the global burden of these diseases. In this study, we therefore examined the global challenges posed by infectious

diseases and identified adaptable prevention strategies for national health improvements. We also explored how the HBM can help control diseases by influencing individual health behaviors.

For an infection to sustain itself within a population, it must continue spreading to more and more individuals. A decline in vaccine coverage is a further factor that can lead to the reemergence of diseases. Even when a safe and effective vaccine is available, people may choose not to get vaccinated. This has become a particular issue with regard to the measles vaccine among growing numbers of people.^[11] Measles (rubeola), a highly contagious and serious infection, was eliminated from the US in 2000 and from the Western Hemisphere in 2016, but it has returned in certain areas due to an increase in non-medical vaccine exemptions based on people's personal and philosophical beliefs.^[12,13]

Preventive strategies for infectious diseases

According to the WHO, infection prevention and control (IPC) is a practical, scientific solution designed to prevent harm to patients and health workers caused by infection.^[14-16] Although IPC is a subset of epidemiology, it also serves essential functions in the study of infectious diseases, social sciences, and global health.^[8,17,18] Effective IPC is a public health issue that is fundamental to improving patient safety and strengthening health systems. The prevention of healthcare-associated infections, epidemics (e.g., *Ebola* virus disease outbreak in 2013–2016), and pandemics of international concern (e.g., 2009 flu pandemic, COVID-19) are rooted in effective IPC measures.^[9,19-21] IPC is a global issue, and many protocols and guidelines have been developed that can be followed to minimize the spread of infection between individuals, within a population, and globally.^[9,16-18] The first step in infection control starts at a community level with behavioral changes, such as regular hand washing, the appropriate use of face masks (to protect people from and prevent the spread of respiratory infections), ensuring routine vaccinations are up-to-date, participation in immunization programs, and compliance with health professionals' recommendations regarding prescribed medications, such as antibiotics.

Medical interventions for infectious diseases

Antibiotics, antivirals, and vaccinations have been shown to speed up recovery, slow down disease progression, and in some cases, eradicate infectious diseases from entire populations.^[22] Antibiotics are prescribed for bacterial infections because they assist the body's natural defense system in eliminating disease-causing bacteria. They work in two main ways: bactericidal antibiotics kill bacteria directly by disrupting essential processes, such as cell wall synthesis, thus leading to bacterial death. Bacteriostatic antibiotics, on the other hand, inhibit the

growth and reproduction of bacteria, which reduces the bacterial load and gives the immune system more time to respond effectively. Accordingly, antibiotics make it easier for the body's immune system to clear infection and ultimately restore health. However, the poor use of antibiotics, over-prescribing, and bacterial mutations have led to the development of antibiotic-resistant bacteria.^[11] In these cases, either stronger doses or a combination of one or more antibiotics are required.

Vaccines are designed to improve immunity to a particular disease. They work by introducing small amounts of the disease-causing virus or bacteria into the host and allowing them to build up natural immunity. The introduction of regular vaccines has significantly slowed the spread of many diseases and, in some cases, led to the near eradication of certain diseases, such as polio, smallpox, and measles. However, while the incidence of other diseases, like mumps and whooping cough, has been reduced, it has not been completely eradicated. Vaccines are also available for chickenpox, but they are not given routinely and are reserved for those at risk of spreading the disease to people with weakened immune systems.^[12] This is because chickenpox is prevalent in children under 10 years of age, and the symptoms are usually mild. This vaccination method allows children to build up natural immunity and contributes to improving the immunity of their communities.^[13,23,24] This type of protection is known as herd immunity.^[14,25]

Global collaborative efforts and interventions against infectious diseases

The WHO plays a central role in coordinating global responses to infectious diseases and providing technical expertise, guidance, and support to member states on disease prevention, surveillance, and response.^[26] The Centers for Disease Control and Prevention (CDC), a key agency in the United States, conducts research and surveillance, provides technical assistance globally to combat infectious diseases, and offers guidance and resources for disease control and prevention.^[27,28] The Global Outbreak Alert and Response Network (GOARN), which is facilitated by the WHO, is a global network of institutions and experts that respond to international public health emergencies, enhance preparedness, and coordinate rapid responses.^[28,29]

Challenges to the prevention and control of infectious diseases

Rising AMR, which is threatening the effectiveness of antibiotics, is creating challenges in the treatment of infectious diseases and raising concerns about increased mortality rates.^[30] Unequal access to healthcare services exacerbates disparities in disease prevention and control, thereby affecting vulnerable populations in particular

and hindering timely interventions.^[31] Insufficient resources and inadequate healthcare infrastructure in certain regions further impede effective disease prevention strategies and impact the overall global health landscape.^[32,33] The HBM provides a framework for understanding how individual health behaviors are influenced by perceived risks and benefits and can help address disparities in disease prevention and control by informing targeted interventions and improving healthcare accessibility and infrastructure.

HBM

One of the most widely applied theories of health behavior, the HBM, was developed in the 1950s by the social psychologists Irwin M. Rosenstock, Godfrey M. Hochbaum, S. Stephen Kegeles, and Howard Leventhal at the US Public Health Service.^[34,35] The HBM is a psychological model that is used to understand and predict health behaviors by examining individual beliefs and attitudes towards health threats and preventive measures. Several factors that influence an individual's decision-making process regarding health-related behaviors can be assessed *via* the HBM.^[36] It comprises six constructs to predict health behaviors: risk susceptibility, risk severity, benefits to action, barriers to action, self-efficacy, and cues to action.^[36-39] In the context of infectious diseases, the HBM emphasizes that individuals are more likely to adopt preventive measures if they perceive themselves as susceptible to a disease. Understanding how individuals perceive their susceptibility to various infectious diseases globally can help tailor prevention strategies to increase awareness and motivate people to take preventive actions.^[37] The model highlights that perceived severity influences behavior change. Accordingly, identifying how individuals perceive the severity of infectious diseases (*e.g.*, COVID-19, malaria, tuberculosis) in terms of their impact on individual health and society can aid in communicating the seriousness of these diseases and promoting proactive prevention strategies.^[38] Assessing people's perceptions regarding the benefits of preventive actions (*e.g.*, vaccination, hygiene practices) and the barriers that hinder them from adopting these measures provides insights that can be used in the design of interventions. Strategies can focus on emphasizing benefits and addressing barriers to encourage adherence to preventive measures.^[37-40] By enhancing people's confidence in their capacity to engage in preventive behaviors interventions can boost self-efficacy and encourage sustained adherence to these measures (Figure 2).

Application of the HBM to address infectious diseases

The HBM offers a structured approach to understanding and influencing individual health behaviors in relation to infectious diseases. By focusing on components such as

perceived susceptibility and severity, public health interventions can be designed to effectively increase awareness of the risks associated with diseases like influenza, tuberculosis, and COVID-19. Educating individuals about their vulnerability and the serious consequences of these diseases can foster a greater sense of urgency and motivate preventive actions, such as vaccination and adherence to hygiene practices. The model's emphasis on perceived benefits also supports the promotion of preventive measures by illustrating how taking action can significantly reduce the risk of disease and improve health outcomes. Furthermore, the HBM addresses perceived barriers by identifying obstacles to preventive behaviors, such as cost and accessibility issues. By targeting these barriers through policy changes, improved healthcare access, and education, health initiatives can become more accessible and effective. Incorporating cues to action, such as reminders for vaccinations and health screenings, as well as enhancing individuals' self-efficacy (*i.e.*, their confidence in their ability to engage in health-promoting behaviors) further supports the adoption of preventive practices. Applying the HBM in the context of infectious diseases ensures that interventions are tailored to address the specific needs and challenges faced by different populations and can thereby ultimately contribute to more effective disease prevention and national health improvements.

DISCUSSION

Emerging and reemerging infectious diseases, such as COVID-19, Ebola, tuberculosis, and measles, continue to pose significant challenges to global health systems, particularly in regions with limited healthcare infrastructure.^[41] These diseases not only contribute to high mortality rates but also impose a substantial economic burden through both direct medical costs and the long-term impacts on economic stability.^[42] Bloom *et al.* similarly emphasized that the economic ramifications of infectious diseases extend beyond healthcare expenses and can affect productivity and societal growth.^[42] Human behaviors, including migration and international travel, as well as environmental changes, like deforestation, exacerbate the spread of infectious diseases.^[43] Notably, Weiss and McMichael found that ecological disruptions and rapid urbanization significantly drive the emergence and resurgence of infectious diseases.^[18,44]

The study also highlighted the crucial role of breaking the chain of infection through preventive strategies, such as vaccination programs and hygiene practices. Similar to the findings of WHO reports, it was noted that the widespread implementation of IPC measures, such as routine handwashing and mask-wearing, at both community and healthcare levels is essential to mitigate

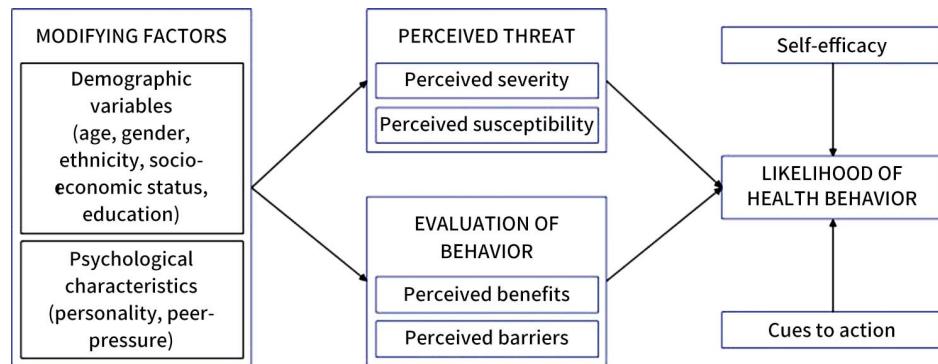


Figure 2. Hochbaum and Rosenstock's illustration of the health belief model.^[40]

disease transmission.^[45] While antibiotics, antivirals, and vaccines have proven effective in controlling infectious diseases, challenges like AMR and vaccine hesitancy persist.^[32] As argued by Naguib *et al.* poor antibiotic stewardship and public reluctance toward vaccination have been significant barriers to reducing the prevalence of infectious diseases globally.^[43]

Global collaborative efforts led by organizations such as the WHO and CDC play a central role in combating infectious diseases. These organizations provide technical support, coordinate responses to outbreaks, and enhance disease surveillance.^[26] Studies, such as that by Downey *et al.* have highlighted the importance of global networks like the GOARN in facilitating rapid international responses to public health emergencies.^[46] However, challenges such as unequal access to healthcare and inadequate infrastructure continue to hinder disease prevention efforts, especially in low-resource settings.^[47] This is emphasized in the work of Assefa *et al.* who argued that without addressing healthcare disparities and strengthening infrastructure, global disease control efforts will remain insufficient.^[28] The HBM was used in this study as a framework to understand and develop recommendations to influence individual behaviors related to infectious diseases.^[39] By targeting factors such as perceived susceptibility and severity, public health interventions can increase adherence to preventive measures, such as vaccinations. The model's application is supported in different studies, such as that by Arceo *et al.* who found that using the HBM in the context of COVID-19 led to improved public adherence to hygiene practices and vaccination efforts in the Philippines.^[39] Overall, the findings of this our study align with the broader literature, which reinforces the need for comprehensive, global-to-local approaches in tackling infectious diseases and improving health outcomes.

CONCLUSION AND PERSPECTIVES

Infectious diseases pose a persistent challenge to public

health globally and affect diverse populations across geographical boundaries. Our analysis of past studies and current research revealed that the emergence and spread of these diseases are driven by complex factors, among them, globalization, AMR, limited healthcare access, and varied behavioral patterns. The effective management and control of infectious diseases require coordinated efforts from international organizations, like the WHO and CDC, as well as robust collaboration between nations. These collective actions have been pivotal in enhancing disease surveillance, prevention, and control strategies. To improve national health, it is essential to integrate these global insights with localized approaches to address the specific challenges and opportunities within individual countries.

We recommend several key actions to address the global challenges of infectious diseases and augment national health improvements.

Strengthen global surveillance systems: Develop and expand global surveillance networks to enhance the monitoring of infectious diseases, enable early detection, and facilitate prompt responses to emerging threats. This includes integrating data from various sources to improve global situational awareness.

Promote vaccination campaigns: Implement widespread vaccination campaigns that target prevalent infectious diseases to boost population immunity and reduce transmission rates. Effective campaigns should focus on increasing vaccine coverage and addressing barriers to vaccination.

Improve hygiene practices: Enhance hygiene promotion programs by ensuring access to clean water and proper sanitation facilities. These measures are crucial for preventing the spread of waterborne and fecal-oral diseases and improving overall public health.

Foster international collaboration: Strengthen partnerships between countries, international organizations, and

non-governmental organizations to share information, resources, and best practices. Collaborative efforts are essential for effective disease prevention and control.

Develop robust pandemic preparedness plans: Create comprehensive preparedness plans, which include rapid response mechanisms, the stockpiling of medical supplies, and clear communication strategies. These plans should aim to manage global outbreaks effectively and mitigate their impact.

Enhance public education on vaccinations: Engage healthcare professionals, including nurses, in public education initiatives to inform communities about vaccine safety and efficacy. Address vaccine hesitancy and work to increase immunization rates to prevent the spread of infectious diseases.

DECLARATIONS

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Author contributions

Falodun MO: Methodology, Software. Olorunfemi O, Irinoye OO: Conceptualization, Writing—Original draft, Writing—Review and Editing. All authors have read and approved the final version of the manuscript.

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Ethics approval

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Conflict of interest

The authors declares no conflicts of interest.

Data availability statement

No additional data.

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