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Editorial: Vaccine-preventable diseases in times of climate change, economic crisis, and pandemic preparedness — a call for new approaches and global equity

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Editorial on the Research Topic

Vaccine-preventable diseases in times of climate change, economic crisis, and pandemic preparedness — a call for new approaches and global equity

As we navigate the complex interplay of climate change, economic instability, and the aftermath of the COVID-19 pandemic, the burden of infectious diseases continues to afflict millions, with particularly high prevalence in low- and middle-income countries (LMICs). The emergence of new diseases like Mpox and re-emergence of well-known diseases like cholera are compounded by the rise of antimicrobial resistance (AMR), particularly in the treatment of tuberculosis, creating a public health crisis that demands urgent action.

The implementation of sustainable infrastructure is critical in addressing the root causes of most infectious diseases. Access to healthcare, safe water, sanitation, and hygiene remains limited in many regions. Unfortunately, efforts put in place to improve access and mitigate disease burden have not succeeded in lasting sustainability. Investments are essential, particularly in rural areas to create resilient healthcare systems capable of enduring and adapting to the climate crisis and its socio-economic and disease burden consequences. The authors of *Implementing a provisional overarching intervention for COVID-19 monitoring and control in the Brazil-Colombia-Peru frontier* report on the implementation of a COVID-19 monitoring, capacity building, and vaccination program (Contreras et al.). The initiative provided education, healthcare, diagnostics, and vaccination services while emphasizing the importance of local capacity building for sustained impact. The project demonstrates how multilateral efforts can mitigate the effects of COVID-19 in underserved areas and contribute to long-term healthcare improvements.

While crucial educational and healthcare delivery are facing challenges, the spread of antimicrobial resistance and vaccine hesitancy are adding to the issue. Antibiotic

stewardship programs in healthcare facilities in high-income countries may have made strides, although they are still operating below optimal levels. However, in most LMICs, the high prevalence of infectious diseases and limited diagnostic tools result in antibiotic overuse, making the need for comprehensive strategies that promote informed antibiotic use and infectious disease prevention across all settings. The waning acceptability of vaccines, especially post-COVID-19, necessitates innovative communication strategies to rebuild trust in communities and encourage vaccine uptake across childhood immunization and receptiveness toward new vaccines (1, 2). The article, *Making clinical trials a public norm for health decisions in sub-Saharan Africa (SSA)*, notably describes the issue of sub-Saharan African's burden of neglected infectious diseases and the need for sustainable, locally driven clinical trial capacities to produce context-relevant data and inform public health decisions (Agnandji et al.). Expanding drug and vaccine manufacturing in SSA can strengthen African scientific discovery. If research and development of a vaccine were to take place in Africa from start to finish, this could boost vaccination acceptance and thus, be a promising step toward the efficient reduction of vaccine-preventable diseases.

The COVID-19 pandemic has indicated where vulnerabilities in our health systems exist and highlighted the disparities intensified by war and political instability. In regions with conflict, such as Pakistan and Afghanistan, vaccination campaigns against polio have been severely disrupted. The tragic resurgence of polio in the Gaza Strip illustrates the perilous conditions under which vaccination efforts take place (3, 4). Administration of vaccines to children in remote areas puts healthcare workers at risk, demonstrating the dire need for stable governance and ceasefire agreements for the protection of public health initiatives.

As global temperatures are on the rise, both the distribution of disease vectors and the populations at risk are changing. For example, vector-borne diseases like dengue and chikungunya are expanding into previously unaffected areas, threatening new populations. The mosquito species *Anopheles stephensi* for example, native to parts of South Asia, has invaded sub-Saharan Africa, increasing the risk of contracting malaria parasites and complicating prevention and intervention measures as its behavior differs from the originally native mosquito populations in Africa (5). The article, *Addressing health care disruption in rural Mozambique due to extreme climate events: mobile units tackling cyclones, vaccine-preventable diseases, and beyond*, shows how extreme events related to the climate crisis act as a trigger for inequalities and disproportionately affect the most fragile countries with weak adaptation systems and populations in vulnerable situations (Rossi et al.). Considering the escalating incidence of extreme climatic events in certain regions, like Mozambique, there is a pressing need to allocate additional resources to preparedness plans and population education in order to enhance adaptation.

Despite these challenges, we are witnessing remarkable advances in vaccine development. New vaccines are being engineered against previously untreatable pathogens, yet equitable distribution remains a critical concern. It is imperative that vaccine

access extends beyond travelers or sporadic exposures to ensure that high-risk populations—especially those in endemic regions—receive adequate protection. The article, *Mitigating the effects of climate change on human health with vaccines and vaccinations*, highlights that climate-responsive vaccine strategies should include refined mapping of climate-sensitive diseases—a crucial step in addressing the impact of climate change on health (Kim et al.). Of particular impact could be the suggested incorporation of combination vaccines to significantly bolster immunization efforts in LMICs.

The article, *Scenario-based assessment of emergency management of urban infectious disease outbreaks*, identifies key factors influencing urban outbreaks and evaluates emergency management strategies (Yuan et al.). The findings include two main conclusions: (1) Scenario-based models are effective in simulating the progression of urban infectious diseases, and (2) the establishment of an emergency command center and isolating and observing individuals exposed to infectious diseases are essential for managing urban outbreaks.

As we reflect on the interplay of these issues, it is crucial to assess whether governments are learning from past lessons. A multi-disciplinary approach, informed by past challenges and guided by principles of global equity, is essential for bending the curve on infectious diseases in the context of climate change, economic constraints, and political uncertainties.

At the time of writing this editorial, healthcare is under growing pressure. The convergence of infectious disease burden, climate crisis, and political and socio-economic instability requires a comprehensive, coordinated response across countries and regions that prioritize equity and especially sustainability to ensure no one is left behind.

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Conflict of interest

Author AH was employed by the company Prevent Infect.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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