

Marburg virus in Tanzania: examining emergence, consequences, and mitigation approaches

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Abstract

The first-ever Marburg virus disease (MVD) outbreak in Tanzania serves as a stark warning of the vulnerability of the entire world to newly emerging infectious diseases. This article looks at the causes of Tanzania's susceptibility to MVD, containment efforts, and strategies to stop further outbreaks. The analysis emphasizes the significance of addressing socio-economic variables, environmental issues, and community participation in addition to healthcare infrastructure and surveillance systems for long-term health security. It highlights the requirement for a concerted effort on the part of governments, international organizations, and local communities, as well as ongoing financial support for public health infrastructure. The analysis also urges regional collaboration and coordination, as well as the adoption of a learning attitude to incorporate lessons from this and other outbreaks for enhancing and perfecting public health policies. We can contribute to global efforts to prevent and limit future infectious disease outbreaks and protect the health of communities around the world by adopting a thorough, proactive, and evidence-based strategy.

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Introduction

Marburg virus disease (MVD) is a highly virulent and often fatal infectious disease caused by the Marburg virus, a member of the Filoviridae family that also includes the Ebola virus.¹ In March 2023, the United Republic of Tanzania reported its first-ever MVD outbreak, with eight cases and five deaths (case fatality ratio [CFR]: 62.5%) in two villages in the Bukoba district, Kagera region.^{2,3} The outbreak has since been officially declared over On June 2, 2023.

Tanzania's vulnerability to Marburg virus outbreaks is multifaceted. Ecological factors, including zoonotic transmission from reservoir hosts such as Rousettus bats, contribute to this vulnerability. Additionally, challenges within the healthcare system, such as delays in case identification and nosocomial transmission, exacerbated the risk.² The need to understand and address these vulnerability factors and implement effective response measures is of paramount importance in managing future outbreaks. The Kagera region, where the outbreak originated, is characterized by porous borders, increased cross-border movement, regional trade, and economic activities around Lake Victoria. These factors, coupled with limited healthcare infrastructure, population density, urbanization, and socioeconomic challenges, contribute to the potential spread of the disease and other infectious diseases.² The emergence of the Marburg virus in Tanzania underscores the need for a proactive and comprehensive approach to outbreak prevention and containment.

In response to the outbreak, the Tanzanian government has deployed Rapid Response Teams to investigate and implement interventions in the affected areas, including contact tracing and risk communication activities.⁴ Collaboration with international organizations, such as the World Health Organization (WHO), Africa Centre for Disease Control (Africa CDC), and other global partners, is essential for sharing information, and best practices, and providing support during this critical time.² As the country grappled with its first MVD outbreak, the successes and challenges of containment efforts offer valuable insights and lessons for future preparedness and response measures.

This commentary aims to provide a comprehensive analysis of the 2023 Marburg virus outbreak in Tanzania, discussing the factors that rendered the country vulnerable to such outbreaks and the measures deployed in place to contain the virus. Additionally, the commentary will explore strategies for preventing future outbreaks, emphasizing the importance of strengthening healthcare infrastructure, enhancing surveillance and early warning systems, fostering community engagement and resilience, and addressing broader socioeconomic and environmental factors. As researchers not directly involved in managing the outbreak but with a keen interest in global public health and disease outbreaks, our ultimate goal is to highlight the signifi-

cance of a proactive and comprehensive approach to outbreak prevention and containment and to call for collective action and continued investment in Tanzania's public health infrastructure.

Why is Tanzania more vulnerable?

Tanzania's susceptibility to Marburg virus outbreaks stemmed from a complex interplay of ecological, healthcare, and population factors. The recent outbreak highlighted the significance of zoonotic transmission, particularly from the widespread *Rousettus* bats, which served as carriers of the virus.⁵ This direct or indirect transmission highlighted the pivotal role of ecological factors in disease emergence, exacerbated by human activities that increased contact with these reservoir hosts. Following the initial human infection, the transmission of the virus escalated through human-to-human contact, necessitating robust public health measures to prevent and contain outbreaks.⁶ However, the emphasis on ecological and environmental factors provided a more accurate framework for understanding the risk factors associated with Marburg virus outbreaks in Tanzania. As such, focusing on human-wildlife interactions and reservoir species, public health strategies could be tailored to address the root causes of zoonotic disease emergence and spread. Yet, the presence of a low-resource healthcare setting significantly impacted the epidemiological landscape of Marburg virus outbreaks.⁷ Challenges such as low clinical suspicion and limited infection control measures contributed to delays in case identification and nosocomial transmission, amplifying outbreak dynamics.

Despite these challenges, it was essential to recognize that the inherent limitations of low-resource healthcare systems did not directly initiate outbreaks. Rather, they rendered countries more vulnerable to experiencing larger outbreaks once the virus gained a foothold. Therefore, strengthening healthcare infrastructure and investing in research were crucial components of a comprehensive approach to disease prevention and control.⁸ Tanzania's experience with the Marburg virus outbreak highlighted the critical need for a multifaceted public health strategy that not only addresses immediate healthcare challenges but also takes into account the broader ecological and environmental determinants of disease. The outbreak has served as a poignant reminder of the interconnectedness of human, animal, and environmental health, reinforcing the importance of the One Health approach.

Public health interventions

In response to the Marburg virus outbreak in Tanzania, the government has launched a series of coordinated initiatives aimed at containing the spread of the disease while minimizing its impact on affected communities.^{1,9} To promptly identify and manage potential cases of Marburg virus disease (MVD), the Tanzanian government has bolstered its surveillance and *early* detection capabilities. Rapid Response Teams have been dispatched to affected areas to investigate and implement targeted interventions. These teams work closely with local health officials to enhance contact tracing efforts, monitor individuals exhibiting symptoms, and actively seek out new cases in both community settings and healthcare facilities.² Similarly, to curb the spread of MVD, the government has implemented quarantine measures for individuals who have been in close contact with confirmed cases. These measures involved isolating and monitoring contacts for 21 days, allowing

for early detection and treatment of potential cases.² Additionally, travel restrictions have been imposed in affected areas to minimize the risk of MVD transmission to other regions of Tanzania or neighboring countries.

The Tanzanian government has initiated risk communication activities to raise public awareness about MVD, its transmission pathways, and the protective measures individuals can adopt to reduce exposure to the virus.² These campaigns emphasize the importance of personal hygiene, safe burial practices, and prompt reporting of suspected cases to healthcare facilities. By empowering communities with accurate information and practical guidance, the government aims to foster a proactive and collaborative approach to outbreak containment.

Recognizing the value of global partnerships in addressing public health crises, Tanzania has sought the assistance and expertise of international organizations to strengthen its response to the MVD outbreak.² The World Health Organization (WHO) is working closely with the Tanzanian Ministry of Health to provide technical assistance, resources, and expertise in managing the MVD outbreak. This support includes guidance on surveillance, case management, infection prevention and control, laboratory testing, and risk communication. Other global partners, such as non-governmental organizations and donor agencies, have also contributed to the response efforts by providing financial and logistical support.

In the spirit of international cooperation, Tanzania has engaged in the exchange of information and best practices with other countries that have experienced MVD outbreaks.² This collaboration fosters a collective learning process, enabling Tanzania to build on the successes and lessons learned from previous MVD response efforts and adapt its strategies accordingly.

Successes and challenges in containing the outbreak

The successful containment of the MVD outbreak in Tanzania's Kagera region declared on March 16, 2023, and officially ended by June 2, 2023,⁴ stands as a testament to effective public health response. Under the leadership of President Dr. Samia Suluhu Hassan, Prime Minister Kassim Majaliwa, and Health Minister Ummu Mwalimu, Tanzania, in collaboration with the Africa CDC and partners like WHO, MSF, US CDC, and others, rapidly mobilized to address the outbreak.⁴ This swift action resulted in the containment of the virus within 78 days, limiting it to nine confirmed cases and six deaths. Key to this success was the integration of existing health programs, robust multi-sectoral partnerships, regular strategic coordination, and a motivated health workforce.⁴ The approach emphasized transparency, accountability, and international cooperation, demonstrating the efficacy of a coordinated, multi-faceted response strategy in managing and overcoming public health emergencies, providing valuable insights for future outbreak management. However, challenges such as low-resource healthcare infrastructure, cross-border movements, and public awareness gaps highlight the need for continued investment in public health preparedness and resilience. These challenges further illuminate the necessity for enhanced transparency in public health efforts—a measure that cannot be overstated. Additionally, they emphasize the critical reliance on partnerships, showcasing the indispensable role of collaborative efforts in bolstering health systems and ensuring effective response mechanisms are in place.

Preventing future outbreaks

A robust and well-funded healthcare infrastructure is crucial to prevent future Marburg virus outbreaks.⁷ This requires significant investment in building and maintaining hospitals, clinics, and laboratories, ensuring that they are equipped with the necessary resources and technology to effectively diagnose, treat, and contain infectious diseases. In addition to investing in healthcare facilities, it is essential to prioritize the training and retention of healthcare professionals and those who are in pre-service training. By providing education, training, and ongoing support, the healthcare workforce can be better prepared to identify and manage cases of the Marburg virus disease and other infectious diseases, thereby preventing the escalation of future outbreaks.

Utilizing technology and data-driven approaches can significantly improve the effectiveness of surveillance and early warning systems. Integrating real-time data collection and analysis, advanced diagnostics, and predictive modeling can help identify potential outbreaks early, allowing for rapid response and containment efforts.¹⁰ Enhanced regional cooperation and coordination among neighboring countries are essential for the timely sharing of information and resources in the event of an outbreak.¹¹ By establishing strong networks and communication channels, countries can work together to monitor and respond to potential outbreaks, thus preventing their spread across borders.¹¹ Empowering communities through education and awareness campaigns is critical to preventing future Marburg virus outbreaks. By providing accurate and accessible information on the virus, its transmission, and the necessary precautions, individuals can be better equipped to protect themselves and their communities. Implementing community-based interventions and establishing support networks can help build resilience and encourage local ownership of disease prevention and control measures. These initiatives may include targeted programs for at-risk populations, engagement with local leaders and the private sector, and the establishment of community health worker networks to dispel misinformation and promote disease awareness and prevention strategies. Addressing the root causes of vulnerability to infectious diseases requires tackling broader socioeconomic challenges, such as poverty and limited access to essential services. Implementing poverty reduction and social welfare programs can help improve living conditions and promote overall health and well-being, thereby reducing the risk of disease transmission.

Climate change and environmental factors can contribute to the emergence and spread of infectious diseases like the Marburg virus disease. By adopting and implementing climate change adaptation and mitigation strategies, countries can reduce the impact of environmental factors on disease dynamics and improve overall public health outcomes.^{12,13} These strategies may include promoting sustainable land use, preserving ecosystems, and investing in early warning systems for climate-sensitive diseases.

Conclusions

The Marburg virus disease outbreak in Tanzania highlights the critical importance of proactively addressing public health threats and the interconnected nature of various factors that contribute to vulnerability. The outbreak serves as a stark reminder that emerging infectious diseases are an ongoing challenge, requiring constant vigilance, adaptability, and collaboration across multiple sectors and disciplines. The key takeaways from the analysis of the

outbreak and response measures emphasize the need to enhance Tanzania's public health infrastructure and regional cooperation to prevent future outbreaks. Furthermore, addressing the root causes of vulnerability, including poverty, climate change, and disparities in access to healthcare, is vital for fostering long-term resilience and equity. As we move forward, stakeholders must adopt a learning mindset, integrating the lessons from this outbreak and others to continuously refine and optimize public health strategies. By embracing a comprehensive, proactive, and evidence-based approach, we can contribute to global efforts to prevent and contain future infectious disease outbreaks and safeguard the well-being of populations worldwide.

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