

Review Article

Public health strategies to combat measles outbreaks in low-vaccination areas

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ABSTRACT

Measles outbreaks are particularly common in regions where vaccination coverage falls below the required thresholds for herd immunity. These outbreaks often result in high morbidity and mortality rates, especially among children. This review examines public health strategies to combat measles outbreaks, focusing on areas with suboptimal vaccination coverage. Public health strategies to combat measles outbreaks in low-vaccination areas include mass vaccination campaigns, community engagement, enhanced surveillance, and strengthening healthcare systems. Vaccination campaigns are highly effective, but challenges like vaccine hesitancy and logistical barriers need to be addressed. Surveillance and healthcare system strengthening are essential for timely outbreak detection and effective management, despite limitations in resources. The review also explores the barriers to vaccination, such as vaccine hesitancy, logistical issues, and socioeconomic factors, which contribute to low vaccination rates. Key strategies such as catch-up immunization programs, the use of social media to counter misinformation, and strengthening healthcare systems to support vaccination efforts are discussed. The review underscores the importance of comprehensive, multi-level interventions involving local communities, healthcare providers, and governments to prevent and control measles outbreaks. Recommendations for improving vaccination rates and outbreak preparedness in low-vaccination areas are also presented.

Keywords: Measles, Vaccination, Public health, Low-vaccination areas, Outbreak control

INTRODUCTION

Measles is a highly contagious viral infection that continues to pose a significant threat to public health worldwide, despite the availability of safe and effective vaccines. The disease is caused by the measles virus, which

primarily spreads through respiratory droplets from coughing or sneezing, making it easily transmissible in crowded conditions.¹ While measles was declared eliminated in many parts of the world following the introduction of widespread vaccination programs, recent years have seen a resurgence of outbreaks, particularly in regions where vaccination coverage has fallen below the

recommended thresholds. This resurgence is particularly alarming in low-vaccination areas, where inadequate immunization coverage puts large portions of the population at risk, often leading to large-scale outbreaks with severe consequences.²

The World Health Organization (WHO) recommends a vaccination rate of at least 95% to achieve herd immunity, which is necessary to prevent the spread of measles.³ However, many low-income countries and certain high-risk communities still experience significant gaps in vaccination coverage. A variety of factors contribute to these gaps, including vaccine hesitancy, limited access to healthcare, socio-political instability, and logistical challenges in vaccine distribution.⁴ Low-vaccination areas, including rural communities, refugee camps, and conflict zones, are particularly vulnerable to measles outbreaks due to these challenges. In these regions, the consequences of outbreaks are often devastating, leading to high morbidity and mortality rates, particularly among children under five years old and other vulnerable populations.

The impact of measles outbreaks extends beyond the immediate health consequences. The strain on local healthcare systems can be overwhelming, particularly in low-resource settings. The costs of managing outbreaks—ranging from healthcare expenses to lost productivity—can also burden the broader economy.⁵ These costs further exacerbate the challenges faced by countries already grappling with economic hardships and underdeveloped healthcare systems. Additionally, the occurrence of measles outbreaks in low-vaccination areas often leads to public fear and mistrust in vaccination programs, further complicating efforts to boost vaccination coverage.

In response to these challenges, public health strategies must focus on both immediate outbreak control and long-term prevention through vaccination. Effective strategies for combating measles in low-vaccination areas must be comprehensive, addressing both the health system's capacity to respond to outbreaks and the underlying factors that contribute to low vaccination coverage. These strategies include mass immunization campaigns, targeted vaccination for high-risk populations, strengthening surveillance systems, improving healthcare infrastructure, and addressing vaccine hesitancy through education and community engagement.⁶ This review aims to explore the various public health strategies designed to combat measles outbreaks, with a particular focus on low-vaccination areas.

METHODS

This study is based on a comprehensive literature search conducted on 07 December 2024, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the

previously listed papers as a starting point. We looked for valuable information in papers that discussed the public health strategies designed to combat measles outbreaks. There were no restrictions on date, language, participant age, or type of publication.

DISCUSSION

Measles and its impact in low-vaccination areas

Measles outbreaks are particularly common in regions where vaccination coverage falls short of the required thresholds for herd immunity. The WHO recommends a vaccination rate of at least 95% for the measles, mumps, rubella (MMR) vaccine to prevent the spread of the virus.⁷ However, many low-income countries and certain communities experience vaccination rates well below this target, creating conditions where outbreaks can easily occur. In addition to insufficient vaccination coverage, areas with overcrowding, poor nutrition, and limited access to healthcare services are more vulnerable to measles. These factors significantly increase the chances of disease transmission and complicate efforts to contain outbreaks.

Despite being preventable through vaccination, measles often leads to severe complications, particularly in young children, the elderly, and individuals with weakened immune systems. These complications can include pneumonia, encephalitis, and even death.⁸ Beyond the direct health impacts, measles outbreaks also place substantial economic burdens on affected communities. The consequences of measles outbreaks in low-vaccination areas are particularly severe because of the limited resources available to manage and contain the disease.⁹ Health systems in these regions are often ill-equipped to handle large-scale outbreaks, and the resulting strain can have long-term effects on both individuals and communities. Additionally, the fear and stigma surrounding measles outbreaks can hinder future vaccination efforts, leading to a cycle of low vaccination rates and repeated outbreaks.

Public health strategies to combat measles outbreaks

Effective public health strategies are essential to combat measles outbreaks in low-vaccination areas. These strategies focus on improving vaccination coverage, addressing vaccine hesitancy, enhancing surveillance, and strengthening healthcare systems (Table 1). Several key approaches have proven effective in controlling measles in these regions.

Vaccination campaigns are one of the most direct ways to reduce the spread of measles. Catch-up immunization programs, including national immunization days (NIDs) and supplemental immunization activities (SIAs), aim to vaccinate individuals who have missed routine vaccinations, particularly children.¹¹ These efforts are essential in areas with low vaccination coverage. Mobile vaccination units also play a crucial role, particularly in

remote or underserved regions. These units travel to hard-to-reach communities, ensuring that vaccines are delivered to populations that might otherwise have limited access to healthcare services.

In addition to mass immunization efforts, targeted vaccination strategies are also effective in reducing transmission among high-risk populations, such as those in refugee camps or migrant communities.¹² Providing free or accessible vaccinations can significantly improve coverage. By focusing on vulnerable groups, public health authorities can limit the spread of the virus and prevent widespread outbreaks.

Addressing vaccine hesitancy is another critical component of combating measles. Misinformation, cultural beliefs, and mistrust in vaccines are significant barriers to achieving high vaccination coverage (Table 2). Public health campaigns that provide accurate, culturally relevant information about the safety and efficacy of vaccines are vital. Leveraging local health influencers and social media can also help to counteract misinformation and build trust in vaccination programs.¹³ Community health workers (CHWs), who are already embedded in local communities, can play an important role in educating people about the importance of vaccination and addressing concerns about vaccine safety. Educating caregivers and affected communities about the symptoms of measles, how to minimize its spread, and where to seek treatment is vital. Dedicated hotlines and informational materials can help in providing timely guidance.¹⁴

Enhanced surveillance systems are key to early detection and response during measles outbreaks. Strengthening disease surveillance allows public health officials to track vaccination coverage and detect potential outbreaks before they escalate. In many low-income regions, integrated disease surveillance and response (IDSR) systems have been successful in improving the detection and management of outbreaks.¹⁵ Developing early warning systems that rely on real-time data from health facilities and vaccination programs further strengthens the ability to respond quickly to emerging outbreaks. Analyzing measles outbreak data, alongside vaccination coverage, provides essential information to identify immunity gaps and implement necessary public health actions to prevent further spread of the disease. Effective communication and data-sharing with stakeholders are vital to ensure timely and targeted interventions.¹⁴

Strengthening healthcare systems is also crucial in combating measles outbreaks. A reliable vaccine supply chain ensures that vaccines are delivered to remote and underserved areas without delay. Improving logistics, infrastructure, and cold chain storage can prevent vaccine stockouts and ensure timely immunization efforts.¹⁶ Training healthcare providers is equally important, as frontline health workers play a critical role in diagnosing and managing measles cases. Providing training on recognizing the disease, administering appropriate

treatment, and following up on vaccination protocols can help mitigate the impact of outbreaks.

The role of international collaboration and support in combating measles outbreaks

Global immunization initiatives, such as the global vaccine safety initiative and the measles and rubella initiative (MRI), have been instrumental in driving efforts to control and eliminate measles worldwide.¹⁸ These initiatives provide a coordinated, global approach to improving vaccination coverage, particularly in low-income regions where the burden of measles is highest. Through these initiatives, countries can access vaccines, tools for surveillance and outbreak management, and best practices for implementing vaccination campaigns.

The global alliance for vaccines and immunization (GAVI), which works to increase access to immunization in low-income countries, has been pivotal in helping countries secure vaccines and financial resources to combat measles.¹⁹ By offering subsidies for vaccine procurement, training health workers, and improving supply chains, GAVI supports efforts to close immunization gaps and prevent outbreaks in underserved populations.

International collaboration is also essential during measles outbreaks. When an outbreak occurs, international organizations can mobilize resources quickly, providing emergency vaccines, medical supplies, and technical expertise to affected regions.²⁰ For example, during a measles outbreak in a low-vaccination area, WHO and UNICEF may collaborate with national health authorities to organize and implement emergency vaccination campaigns, provide mobile clinics, and distribute essential medicines.²¹ This rapid, coordinated response can help to limit the spread of the virus and mitigate the effects of the outbreak. Another significant aspect of international support is the provision of funding to ensure that countries can effectively respond to outbreaks. Measles outbreaks often place immense pressure on public health resources, especially in low-income countries. Funding from international donors can help sustain vaccination efforts, improve healthcare infrastructure, and ensure that adequate resources are available for outbreak response.

Beyond immediate outbreak response, international collaboration is key to building long-term resilience against measles in low-vaccination areas. Strengthening healthcare systems, improving surveillance infrastructure, and training health workers are essential components of this effort.²² International organizations can assist countries in developing sustainable public health systems that are better equipped to handle future outbreaks. Capacity-building programs, which include training healthcare workers in disease detection, treatment, and prevention, are vital to ensuring that healthcare systems are prepared to respond to measles and other vaccine-preventable diseases.

Table 1: Summary of public health strategies for combating measles outbreaks.¹⁰

Strategy	Description	Key challenges	Effectiveness
Vaccination campaigns	Mass and targeted vaccination efforts, including catch-up programs.	Vaccine hesitancy, logistics, and access barriers.	High effectiveness in increasing coverage.
Community engagement	Educating the public and addressing vaccine concerns.	Overcoming misinformation and cultural barriers.	Essential for long-term acceptance of vaccines.
Surveillance and monitoring	Enhanced disease tracking and early outbreak detection.	Limited resources for surveillance infrastructure.	Critical for timely responses.
Strengthening healthcare systems	Improving vaccine supply chains and training healthcare workers.	Lack of infrastructure and trained personnel.	Improves overall outbreak management.

Table 2: Key barriers to measles control in low-vaccination areas.¹⁷

Barrier	Description	Potential solutions
Vaccine hesitancy	Misinformation and distrust in vaccines.	Community-based education and engagement programs.
Logistical and infrastructure challenges	Poor vaccine distribution and healthcare access.	Improve supply chains and local healthcare infrastructure.
Socioeconomic factors	Economic barriers to vaccination.	Provide free or low-cost vaccination programs and mobile units.

Furthermore, international collaborations can help advocate for stronger national policies and increased investment in immunization programs. Public health advocacy, supported by global health organizations, can influence government priorities, ensuring that vaccination is viewed as a critical component of health systems and national development agendas.⁶

While international collaboration has yielded positive results in combating measles, there are challenges to overcome. Political instability, conflict, and weak governance in some regions can hinder the implementation of global vaccination initiatives and outbreak control measures.²³ Additionally, the fragmentation of international aid efforts, where different organizations may operate independently or lack coordination, can sometimes result in inefficiencies and duplication of efforts.

Despite these challenges, there are numerous opportunities for strengthening international collaboration. Increased funding for immunization programs, greater coordination between international health organizations, and more active engagement with local governments and communities are critical steps toward improving global measles control efforts. Leveraging innovative technologies, such as mobile health applications and digital surveillance systems, can further enhance the ability of international organizations to respond to outbreaks swiftly and effectively.²⁴

Key recommendations for improving measles control include expanding catch-up immunization programs, strengthening community engagement efforts to address vaccine hesitancy, improving surveillance systems for early outbreak detection, and investing in healthcare infrastructure. By implementing these strategies and

addressing the underlying barriers to vaccination, public health authorities can reduce the burden of measles and prevent future outbreaks.

CONCLUSION

Public health strategies to combat measles outbreaks in low-vaccination areas must be comprehensive and multifaceted. Vaccination campaigns, community engagement, surveillance, and healthcare system strengthening are all crucial components of an effective response. However, challenges such as vaccine hesitancy, logistical barriers, and socioeconomic factors must be addressed to ensure the success of these strategies.

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REFERENCES

1. Moss WJ, Griffin DE. Paramyxoviruses: measles. *Viral infections of humans: Epidemiology and control*. Springer. 2023: 1-29.
2. Abad C, Safdar N. The reemergence of measles. *Curr Infect Dis Rep*. 2015;17:1-8.
3. Plans-Rubió P. Vaccination coverage for routine vaccines and herd immunity levels against measles and pertussis in the world in 2019. *Vaccines*. 2021;9(3):256.
4. Holmberg C, Blume S, Greenough P. *The politics of vaccination: a global history*. Manchester University Press; 2017.
5. Pike J, Melnick A, Gastañaduy PA, Kay M, Harbison J, Leidner AJ, et al. Societal costs of a measles outbreak. *Pediatrics*. 2021;147(4):e2020027037.

6. Orenstein WA, Hinman A, Nkowane B, Olive J, Reingold A. Measles and rubella global strategic plan 2012–2020 midterm review. *Vaccine*. 2018;36:A1-A34.
7. Bester JC. Measles and measles vaccination: a review. *JAMA Pediatric*. 2016;170(12):1209-15.
8. Perry RT, Halsey NA. The clinical significance of measles: a review. *J Infect Dis*. 2004;189(1):S4-S16.
9. Shakoor S, Mir F, Zaidi AK, Zafar A. Hospital preparedness in community measles outbreaks—challenges and recommendations for low-resource settings. *Emerg Health Threat J*. 2015;8(1):24173.
10. Gastañaduy PA, Banerjee E, DeBolt C, Bravo-Alcántara P, Samad SA, Pastor D, et al. Public health responses during measles outbreaks in elimination settings: Strategies and challenges. *Hum Vaccin Immunother*. 2018;14(9):2222-38.
11. Koehlmoos TP, Uddin J, Sarma H. Impact of measles eradication activities on routine immunization services and health systems in Bangladesh. *J Infect Dis*. 2011;204(1):S90-7.
12. Charania NA, Gaze N, Kung JY, Brooks S. Interventions to reduce the burden of vaccine-preventable diseases among migrants and refugees worldwide: A scoping review of published literature, 2006–2018. *Vaccine*. 2020;38(46):7217-25.
13. Lo NC, Hotez PJ. Public health and economic consequences of vaccine hesitancy for measles in the United States. *JAMA Pediatrics*. 2017;171(9):887-92.
14. Gastañaduy PA, Banerjee E, DeBolt C, Bravo-Alcántara P, Samad SA, Pastor D, et al. Public health responses during measles outbreaks in elimination settings: Strategies and challenges. *Hum Vaccin Immunother*. 2018;14(9):2222-38.
15. Anetor GO. Review of measles notification data within the integrated disease surveillance and response (IDSR) in Nigeria (2012-2016). *Niger Health J*. 2019;19(1):1-16.
16. World Health Organization. Immunization supply chain and logistics. 2014. Available at: <https://www.who.int/teams/immunization-vaccines-and-biologicals/essential-programme-on-immunization/supply-chain>. Accessed on 12 October 2024.
17. Enitan SS, Iduh MU, Itodo GE, Adole AR, Asekun-Olarinmoye IO, Udeh EO, et al. Combating Measles in Nigeria: Epidemiological Trends, Drivers, Barriers and Public Health Interventions. *Afro-Egyptian J Infect Endemic Dis*. 2024;14(4):375-95.
18. World Health Organization. Global measles and rubella strategic plan: 2012. 2012. Available at: <https://www.who.int/publications/i/item/9789241503396>. Accessed on 12 October 2024.
19. Bustreo F, Okwo-Bele J, Kamara L. World Health Organization perspectives on the contribution of the Global Alliance for Vaccines and Immunization on reducing child mortality. *Arch Dis Childhood*. 2015;100(1):S34-7.
20. World Health Organization. Measles outbreak guide. 2022. Available at: <https://www.who.int/publications/i/item/9789240052079>. Accessed on 12 October 2024.
21. World Health Organization. Implementation guide for vaccination of health workers. 2022. Available at: <https://www.who.int/publications/i/item/9789240052154>. Accessed on 12 October 2024.
22. Andrus JK, Cochi SL, Cooper LZ, Klein JD. Combining global elimination of measles and rubella with strengthening of health systems in developing countries. *Health Affairs*. 2016;35(2):327-33.
23. Spiegel P, Abraham O, Altare C, Rajashekharaiiah H. Public Health in Settings of Conflict and Political Instability. *Manson's Tropical Diseases*, Fourth Edition. Elsevier. 2023;25-32.
24. Pavia G, Branda F, Ciccozzi A, Romano C, Locci C, Azzena I, et al. Integrating Digital Health Solutions with Immunization Strategies: Improving Immunization Coverage and Monitoring in the Post-COVID-19 Era. *Vaccines*. 2024;12(8):847.

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