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Challenges and strategies in implementing immunization schedules in rural communities: A systematic review

Desafíos y estrategias en la implementación de esquemas de inmunización en comunidades rurales: una revisión sistemática

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Abstract

The purpose of this systematic review was to identify the main barriers to the implementation of immunization programs in rural areas, evaluate the strategies used, and propose evidence-based recommendations to improve vaccination coverage and reduce inequalities in access to health care. Following the PRISMA protocol, an exhaustive search was conducted in databases such as PubMed, Scopus, and Latindex, using specific inclusion and exclusion criteria. After a rigorous selection and critical appraisal process, 18 studies were selected that provided valuable information on obstacles and effective strategies in rural contexts. The most common barriers included limited geographic accessibility, insufficient health infrastructure, socioeconomic inequalities, and cultural mistrust of health services, factors that affect both coverage and the continuity of vaccination schedules. In contrast, successful strategies were identified, such as the decentralization of services through mobile brigades and community vaccination centers, the strengthening of health education, and the integration of immunization with other primary care services. Finally, recommendations are proposed focused on strengthening trust between communities and health personnel, improving health infrastructure, and adopting comprehensive approaches that consider sociocultural and territorial specificities. These actions are essential to ensuring equitable, sustainable, and effective access to vaccination in rural areas.

Keywords: rural health accessibility, vaccination coverage, immunization strategies.

Resumen

Esta revisión sistemática tuvo como finalidad identificar las principales barreras en la implementación de programas de inmunización en zonas rurales, evaluar las estrategias aplicadas y proponer recomendaciones basadas en evidencia para mejorar la cobertura vacunal y reducir las desigualdades en el acceso a la salud. Siguiendo el protocolo PRISMA, se realizó una búsqueda exhaustiva en bases como PubMed, Scopus y Latindex, utilizando criterios específicos de inclusión y exclusión. Tras un riguroso proceso de selección y evaluación crítica, se seleccionaron 18 estudios que aportaron información valiosa sobre obstáculos y estrategias efectivas en

contextos rurales. Las barreras más recurrentes incluyeron la limitada accesibilidad geográfica, insuficiente infraestructura sanitaria, desigualdades socioeconómicas y desconfianza cultural hacia los servicios de salud, factores que afectan tanto la cobertura como la continuidad de los esquemas vacunales. En contraste, se identificaron estrategias exitosas como la descentralización de los servicios mediante brigadas móviles y puntos de vacunación comunitarios, el fortalecimiento de la educación sanitaria y la integración de la inmunización con otros servicios de atención primaria. Finalmente, se proponen recomendaciones enfocadas en fortalecer la confianza entre las comunidades y el personal de salud, mejorar la infraestructura sanitaria y adoptar enfoques integrales que consideren las particularidades socioculturales y territoriales. Estas acciones son fundamentales para garantizar un acceso equitativo, sostenible y eficaz a la vacunación en zonas rurales.

Palabras clave: accesibilidad sanitaria rural, cobertura vacunal, estrategias de inmunización.

Introduction

Immunization is a fundamental pillar of public health, as it contributes to halting the spread of communicable diseases and reducing global childhood mortality. However, its implementation in rural communities faces significant challenges that jeopardize its effectiveness. Among the primary obstacles are the lack of adequate healthcare infrastructure, a shortage of trained personnel, cultural resistance, misinformation, and logistical issues; all of which hinder achieving appropriate vaccination coverage (Galadima et al., 2021). This problem is exacerbated in contexts marked by poverty, inequality, and exclusion, where health policies often fail to coordinate effectively to provide a response that addresses gaps in access to healthcare services.

Numerous studies have highlighted the extent of this issue. In low- and middle-income countries, such as Ethiopia and Nigeria, vaccination rates remain below 60%, influenced by factors such as maternal education, employment, and distance to health facilities (Yibeltal et al., 2022). Even in developed regions like the United States, rural areas exhibit lower vaccination levels compared to urban ones, prompting the creation of specific public policies, such as community campaigns, school vaccinations, and partnerships with pharmacies to improve access (Calle et al., 2019). Nevertheless, the outcomes continue to be heterogeneous, reflecting inequalities that predominantly affect children, pregnant women, and vulnerable groups.

In Latin America and the Caribbean, the challenges of rural immunization have gained increasing relevance. Coverage has declined in recent years, influenced by factors such as political instability, insufficient funding for health services, and the logistical complexities of vaccine distribution (UNICEF, 2024). For instance, in Ecuador, concerning dropout rates in vaccination programs have been detected in rural communities within the province of Sucumbíos, with persistent difficulties in administering essential vaccines like BCG and Hepatitis B (Calle, 2019). These findings underscore the urgency to rethink and adapt healthcare delivery models for rural areas to ensure equitable access to immunization.

Addressing this challenge is based on the principles of health equity and universal access to essential services, as promoted by the World Health Organization (WHO). From a public health perspective, the primary care model is crucial for designing strategies that respond to the specific social, cultural, and geographical conditions of each community. In this regard, the review relies on the concepts of healthcare accessibility and community acceptance, which are fundamental tools for analyzing the variables impacting vaccination coverage and institutional responses to identified barriers.

Despite advancements in identifying factors that limit immunization, a considerable gap remains in studies specifically addressing the rural context. Most research focuses on urban settings or developed countries, limiting the applicability of their findings to rural realities in Latin America and other vulnerable regions. In light of this gap, this study aims to identify the primary challenges faced by immunization programs in rural areas, evaluate the strategies implemented, and assess their effectiveness through a comprehensive review of the specialized literature. Additionally, it seeks to formulate evidence-based recommendations to guide public policy decisions, with the goal of strengthening rural vaccination programs and reducing inequalities in access to healthcare.

Methodology

This systematic review was designed to identify and analyze the difficulties and strategies involved in implementing immunization programs in rural areas. To this end, a documentary and analytical approach was employed, aligning with the standards of the PRISMA protocol (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), allowing for a rigorous and organized selection of relevant scientific literature (Page et al., 2021).

The study followed a defined process that began with formulating clear objectives, which guided the search and selection of studies. Precise inclusion and exclusion criteria were established to identify articles that met the necessary conditions for analysis. The documentary search was conducted in recognized databases such as PubMed, Scopus, and Latindex, using key terms like "immunization in rural communities," "vaccination coverage," "barriers to vaccination," and "vaccination strategies," combined using the Boolean operators "AND" and "OR" to optimize results.

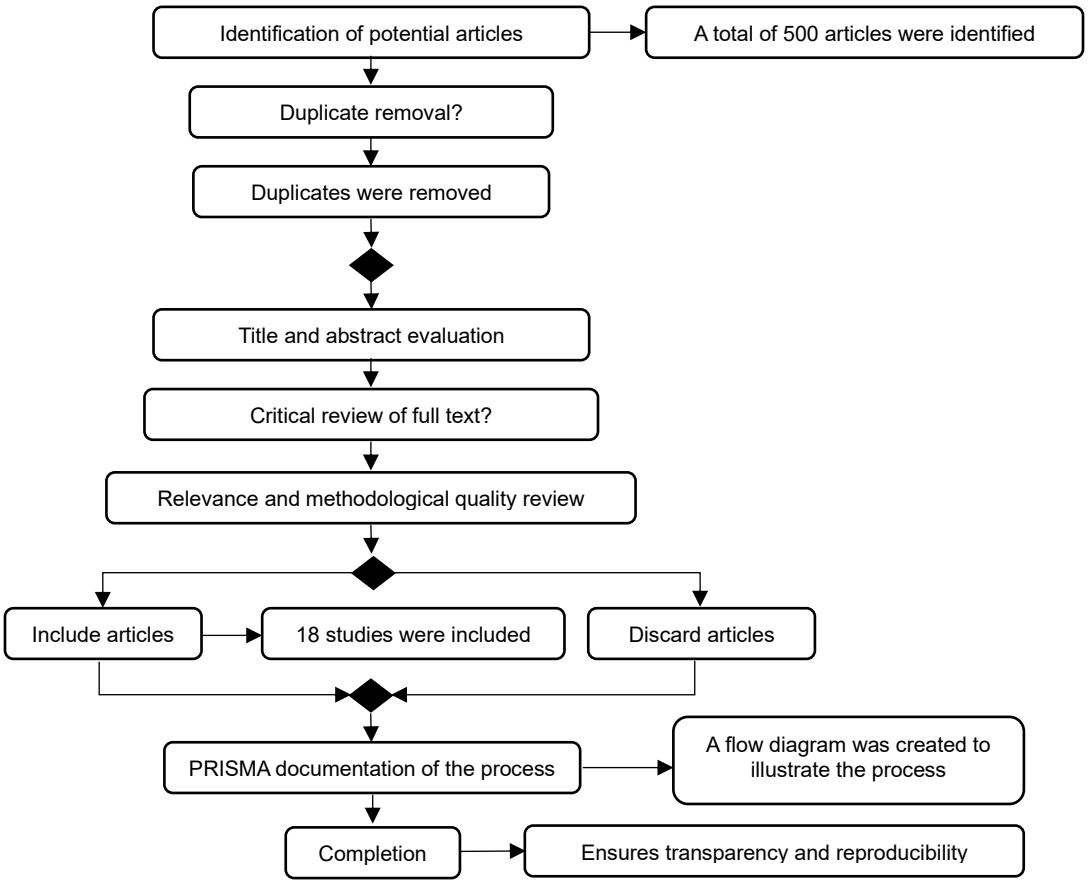
Inclusion criteria considered only publications in English or Spanish, peer-reviewed articles, studies conducted within the last ten years, and those focusing specifically on rural communities in low- and middle-income countries. Conversely, articles lacking empirical data, duplicates, and literature reviews without novel or relevant contributions to the topic were excluded.

Of the 500 articles initially found, after removing duplicates and reviewing titles and abstracts, 120 were selected for detailed analysis. Subsequently, a critical evaluation of the full texts determined that 18 studies met all inclusion criteria and provided pertinent information for the research.

Finally, to ensure transparency and facilitate the replication of the process, a flow diagram conforming to PRISMA (see Figure 1) was employed, thereby ensuring methodological coherence throughout the study.

Figure 1

Article selection process



After selecting the articles, the collected data were organized in tables to facilitate analysis, allowing for the identification of recurring patterns and trends in vaccination barriers, such as logistical problems, cultural resistance, and lack of resources. Effective strategies implemented in various rural communities were also recognized, including awareness campaigns and mobile vaccinations.

The analysis of the studies involved a rigorous evaluation of their methodological quality, considering the robustness of their results and their applicability in different geographic and socioeconomic contexts. Furthermore, findings were compared to assess the coherence of interventions and variations according to the specifics of each

context, which facilitated the adaptation of recommendations and approaches to the unique needs of each rural community.

Finally, the main findings were synthesized, and practical suggestions were offered to public policy makers and healthcare professionals responsible for implementing vaccination programs in rural areas. This aims to contribute to increasing vaccination coverage and reducing health disparities in these traditionally underserved regions.

Results and discussion

The results obtained from the systematic review reveal a complex network of factors that directly and indirectly influence the implementation of immunization programs in rural areas. The evaluation allowed for the organization of findings into three main categories: structural, cultural, and logistical difficulties that limit vaccination coverage; strategies applied by different health systems to overcome these obstacles; and, finally, evidence-based recommendations to optimize vaccination programs in these marginalized communities.

a) Barriers in immunization programs in rural areas

The review revealed that rural areas face multiple difficulties that severely affect the effectiveness of immunization programs, which go beyond mere service availability. Structural, socioeconomic, cultural, and institutional factors contribute to low vaccination rates and high dropout rates from established schedules. Thus, understanding the magnitude and complexity of these limitations is essential for designing public policies that adequately respond to the specific realities of each region.

The implementation of vaccination programs in rural areas is hindered by diverse issues that, while manifesting in different ways, share a common background of territorial inequality, institutional fragility, and a persistent history of exclusion. Among these obstacles, limited geographic accessibility stands out as one of the main challenges. For example, Chopra et al. (2020) documented that in 2018 approximately 19.4 million children under one year old did not receive the third dose of the DTP3 vaccine, many of whom resided in countries affected by armed conflicts or with vulnerable health systems. Additionally, deficiencies in data quality and persistent forms of discrimination based on gender and ethnicity further complicate equitable access to immunization. This reality aligns with the study by Akwataghibe et al. (2019) in Nigeria, which identified distance, lack of transportation, inadequate infrastructure, and scarcity of medical personnel in remote areas as limiting factors for vaccination coverage. Thus, the weakness of health systems, exacerbated by population dispersion and the lack of efficient logistical mechanisms, perpetuates health exclusion in rural areas.

The disparity between urban and rural contexts is clearly evidenced by studies such as that of Asmare et al. (2022) in southwestern Ethiopia. Their results indicated that the complete vaccination rate in urban children was significantly higher (74.3%) compared to that of rural children (59.2%), showing differences in the factors affecting access to immunization. While in urban areas, caregiver knowledge and place of birth primarily influence outcomes, in rural settings, distance to health centers and paternal involvement are determining factors.

In addition to geographic barriers, socioeconomic and demographic factors play a crucial role in limiting equitable access to vaccination. For instance, Siramaneerat and Agushybana (2021) identified that variables such as birth order, maternal age at delivery, paternal occupation, and access to prenatal care significantly impact child vaccination rates in Indonesia. Similarly, a study in Peru conducted by Aquino et al. (2022) found that adolescent mothers with low education levels, no health insurance, and multiple children had a high probability of not completing their children's vaccination schedules.

The relationship between unfavorable social conditions and negative public health outcomes highlights a persistent structure of inequality in many rural areas, where poverty is expressed not only in economic terms but also in limited access to information and community organization. Complementing this view, Muhoza et al. (2023) emphasized that continuity in vaccination during the second year of life is closely linked to positive prior experiences during the first year, maternal information levels, and active paternal involvement in childcare.

In this context, the institutional fragility of health systems represents a significant barrier to the effective implementation of vaccination programs. According to Sychareun et al. (2019), in a qualitative study in Laos, health services in semi-rural areas face issues such as lack of coordination among providers, unreliable record-keeping, and fragmented information systems. These deficiencies hinder appropriate vaccine tracking and generate distrust among the population, which perceives the services as inconsistent and unreliable. This situation is also reflected in Ecuador, where Grimaldi and Abreu (2023) identified that a lack of empathy from healthcare personnel and errors in population projections led to a high rate of missed vaccination opportunities, highlighting not only a shortage of technical training but also a disconnection from the real needs of the communities served.

On the other hand, cultural, symbolic, and historical barriers constitute another significant challenge. Vasudevan et al. (2020), in a study conducted in Tanzania, revealed that many rural mothers express distrust towards vaccines due to rumors about potential negative effects. This situation was corroborated by Kimera et al. (2024) in Uganda, where myths related to Hepatitis B and general ignorance about the disease negatively affected vaccine acceptance and completion. Cultural resistance was also observed in Ecuador, where Monar and Camacho (2023) noted that over 60% of caregivers were unaware of the benefits of vaccines, and more than 80% were ignorant of the diseases they prevent, in a context marked by low incomes, a nearly exclusive focus on agriculture, and limited formal education. Finally, De Oliveira et al. (2023) provide an intersectional perspective by highlighting the racial and ethnic inequalities faced by rural communities in Brazil, such as the quilombolas, whose low vaccination coverage is directly linked to the absence of home visits and a historical pattern of institutional neglect.

b) Strategies implemented in vaccination programs

In response to the diverse barriers identified, the reviewed studies have documented various strategies implemented to increase vaccination coverage in rural areas. These initiatives, driven by governments, international organizations, and community members, have shown varying degrees of success, although they share approaches focused on decentralization, community proximity, and citizen participation. Below are the main contributions from the analyzed authors.

One of the most effective strategies has been the operational decentralization of vaccination services, brought directly to communities through mobile brigades, health fairs, school vaccinations, and community points. Vanderpool et al. (2019) demonstrated in rural contexts in the United States that vaccination in pharmacies and schools, along with multichannel communication campaigns, significantly increased coverage rates, especially among groups with limited access to conventional clinics. This model has been successfully replicated in other regions, showing that flexibility in service delivery is key to overcoming logistical barriers.

Home visits by community health workers have also proven to be a highly effective strategy. In Brazil, De Oliveira et al. (2023) found that these visits increased child vaccination coverage in disadvantaged communities by facilitating direct dialogue with families, addressing their concerns, and strengthening trust between the community and the health system. This practice aligns with international recommendations that highlight the importance of proximity, empathy, and knowledge of the cultural context for success in public health.

Moreover, community health education has demonstrated to be a fundamental driver for improving vaccine acceptance. Guan et al. (2024) observed in a study conducted in China that those who received community notifications had significantly higher vaccination rates than those who were not informed. Communication, facilitated through local networks and community agents, not only transmits information but also legitimizes the intervention from the cultural perspective of the population. This approach, which promotes local ownership of the message, is essential for dismantling myths, correcting misinformation, and fostering a preventive culture.

Improving information systems and administrative processes is also highlighted as a crucial strategy for ensuring sustained coverage. According to Sychareun et al. (2019), the existence of reliable records and robust monitoring systems allows for effective planning of vaccination campaigns and anticipation of necessary resources. This aspect, often underestimated, is essential to avoid logistical failures, as noted by Grimaldi and Abreu (2023), who attributed significant coverage losses to poor estimation of the target population and inadequate territorial management.

Additionally, Aslam et al. (2022) identified several effective strategies for improving child vaccination in low- and middle-income countries. They emphasize the integration of immunization with other health services, such as prenatal check-ups and pediatric visits, which facilitates access in rural areas. They also highlight community mobilization through local leaders and health workers, as well as the use of reminders and personalized follow-ups as key tools for improving adherence. Furthermore, they recognize the value of economic or in-kind incentives to overcome financial barriers.

Finally, strengthening the healthcare workforce is presented as a transversal element in all strategies. It is essential that personnel not only have updated technical training but also possess skills in communication, intercultural management, and conflict resolution. The attitude of professionals can make the difference between seizing a vaccination opportunity or missing it, as evidenced by various studies conducted in Ecuadorian and Latin American contexts.

c) Recommendations for improving vaccination programs in rural areas

Based on the results obtained and the evaluated strategies, practical and evidence-based recommendations are derived to optimize immunization programs in rural communities. These suggestions

encompass logistical and operational aspects as well as principles of governance and health justice, emphasizing the importance of comprehensive approaches that combine accessibility, equity, education, and cultural respect. Incorporating these lessons into the design and management of public policies represents a key opportunity to reduce health inequalities and ensure the universal right to vaccination.

Firstly, it is crucial to close geographic and logistical gaps by implementing mobile units, rural brigades, and community vaccination centers. These actions should be coordinated with local dynamics, integrating into agricultural fairs, traditional festivities, and school activities to maximize community participation. Secondly, investing in continuous and accessible health education is a priority, using materials in native languages, participatory methods, and intercultural mediators that facilitate understanding and ownership of the health message. As Singh et al. (2022) indicate, educational interventions increase vaccine acceptance when they align with the community's worldview.

Thirdly, Maves et al. (2024) highlight the urgency of strengthening trust between rural communities and medical personnel, promoting primary care that is closer, continuous, and culturally competent. This trust is cultivated through lasting relationships with community physicians and health promoters, who play a crucial role in health education and demystifying vaccines. Additionally, the authors emphasize the need to simplify vaccination guidelines, making them understandable and accessible to the population to reduce confusion and hesitation arising from a lack of clear information.

Fourthly, Yibeltal et al. (2022) recommend expanding health services in remote areas through community centers and mobile brigades to reduce geographic gaps in vaccination coverage. They also underline the importance of improving healthcare infrastructure, enhancing training for personnel in rural areas, and establishing monitoring systems with disaggregated data that allow for more equitable and efficient planning. They warn that without structural interventions, coverage will continue to be insufficient and call for adopting multisectoral approaches tailored to territorial contexts to achieve sustainable results.

Moreover, it is essential to strengthen human capital in the health sector through continuous training programs that address not only technical aspects but also rights-based approaches, intercultural communication, and humanized care. This measure should be complemented by incentives for those working in rural areas and mechanisms to evaluate their performance. From an institutional perspective, it is crucial to optimize information systems, incorporating appropriate digital tools, training administrative staff, and ensuring accurate and updated distribution of coverage by jurisdiction. Finally, it is essential to promote an equity-focused and community participatory approach in which vaccination public policies are designed collaboratively, acknowledging territorial particularities, local organizational forms, and ancestral knowledge. Only by implementing strategies adapted to each context will it be possible to achieve universal, effective, and sustainable coverage in the most vulnerable rural areas.

Conclusions

Based on the findings of this systematic review, a critical and analytical stance can be adopted regarding the factors influencing the implementation of immunization programs in rural communities, avoiding repetitions and subjective judgments. Firstly, the accumulated evidence reveals that addressing rural vaccination from a single standard perspective is insufficient, as its effectiveness depends on multiple interconnected factors—structural, institutional, cultural, and socioeconomic—that require contextualized and differentiated treatment. Although traditional emphasis has been placed on improving physical infrastructure to increase coverage, the studies analyzed show that access is conditioned not only by distance but also by trust in the healthcare system, health education, and cultural appropriation of vaccination.

In this regard, it can be concluded that low coverage levels do not solely derive from a lack of services but from a structural mismatch between the existing care model and the real living conditions of rural communities. Such a mismatch is reflected in the absence of intercultural and participatory approaches in health policies, as well as in the precariousness of healthcare personnel and the fragmentation of information systems. Therefore, improvements limited to quantitative increases—such as more health centers or vaccines—prove insufficient unless accompanied by organizational and institutional reforms that incorporate local voices, needs, and knowledge.

Moreover, the effectiveness of strategies such as mobile brigades, home visits, community notification, and local participation in educational campaigns demonstrates that a close relationship and a territorial approach are essential for overcoming traditional barriers. These initiatives have increased coverage and restored public trust, a key factor for the success of public policies. However, many of these interventions have been designed as isolated projects or pilots, limiting their structural impact. Thus, the current challenge is not only to create new

strategies but also to ensure their sustainability, intersectoral collaboration, and scalability within national health systems, which requires political commitment, funding, and a transformative vision of public health.

Furthermore, the evidence supports that health equity will not be achieved without a profound transformation of the rural care model, shifting from a vertical, fragmented, and purely service-oriented approach to one that is comprehensive, community-based, and rights-based. This new paradigm must recognize communities not as passive recipients but as active participants in the formulation of culturally relevant immunization policies. In this context, health education positions itself as a strategic tool, not only to inform but also to socially empower and foster civic co-responsibility.

Finally, this study highlights several outstanding challenges that open avenues for future research. Despite advancements, significant gaps remain in the long-term evaluation of the impact of applied strategies, as well as in comparative analyses between rural contexts across different continents. Methodological weaknesses were also identified, particularly in the integration of qualitative data with epidemiological indicators. Therefore, it is recommended that future studies employ mixed, interdisciplinary, and participatory approaches to better understand local dynamics and design sustainable strategies that transcend the immediate context to become structural policies. The pending task is to transform isolated experiences into policies grounded in health justice, territorial equity, and intercultural respect.

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