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THE IMPLEMENTATION OF THE R21 MALARIA VACCINE IN NIGERIA

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THE IMPLEMENTATION OF THE R21 MALARIA VACCINE IN NIGERIA

Abstract

Malaria is a significant global public health burden with more than a million deaths reported every year, and large proportions of these come from Nigeria. Although significant strides have been made toward eradicating Malaria, challenges associated with implementing vaccines may hinder their efficacy. This review aims to discuss Malaria in Nigeria, the R21 malaria vaccine, anticipated challenges, and potential solutions. Studies published within the last five years using keyword searches indicated a 50% reduction in malaria mortality by 2023 in Nigeria. Major bottlenecks include the increasing wave of hesitancy caused by misinformation, funding constraints, logistical bottlenecks, inadequacies in the cold chain infrastructure, and staff shortages, among others, which were immediately identified as challenges for the implementers when WHO announced the RTS, S and R21/Matrix-M vaccines. Government leadership, supported by strong multisector collaboration and backed by improvements in healthcare infrastructure and community engagement, is a viable solution. The barriers must be addressed for the successful integration of malaria vaccination into Nigeria's immunisation program.

INTRODUCTION

Malaria is among the most significant challenges to global public health, with a higher burden in the sub-Saharan African region, mainly affecting children under five years of age and pregnant women. Nigeria is estimated to account for 26.8% of the total malaria cases worldwide-within its borders 76% of the population within its borders at annual risk of contracting this disease. Sustained efforts have been made through insecticide-treated nets (ITNs) and indoor residual spraying (IRS) programs, along with intermittent preventive treatment in pregnancy (IPTp), yet Malaria remains endemic in Nigeria. The situation leads not only to high mortality and morbidity rates but also creates an economic burden on the country because it strains its healthcare system.

In an effort to meet the challenge, Nigeria gave the go-ahead to the R21 malaria vaccine on April 17, 2023, becoming the world's second nation after Ghana to do so. The vaccine, a collaboration between the University of Oxford and the Serum Institute of India (SII), has demonstrated 75% efficacy in children aged five to thirty-six months, marking a significant leap forward in malaria prevention. In contrast to the RTS S vaccine, plagued by production bottlenecks and funding shortfalls, the newer R21 candidate is hailed as far more scalable for mass deployment. Still, with this step, a host of practical obstacles could impede its rollout across Nigeria, including logistical snags, entrenched vaccine hesitancy, financial constraints, and infrastructural shortcomings. This narrative review examines anticipated challenges in implementing the R21 malaria vaccine in Nigeria and proposes evidence-based solutions to address them. By identifying key obstacles such as poor vaccine logistics, cold chain constraints, healthcare workforce shortages, and misinformation, this review aims to inform policymakers, healthcare professionals, and Non-Governmental Organisations (NGOs) on strategies to enhance vaccine uptake and malaria eradication efforts. Ultimately, addressing these challenges will be crucial in ensuring that malaria vaccination is effectively integrated into Nigeria's immunisation program and contributes to the country's long-term malaria elimination goals.

2.0 Methodology

To provide a comprehensive overview of the existing literature, by providing a comprehensive overview of the existing literature on the challenges and solutions to malaria vaccine implementation in Nigeria.

2.1 Sources of Information

A literature search was conducted in May 2024 across various electronic databases, including PubMed, Scopus, Research Gate, Google Scholar, Embase, and Medline. Scholars used to review the grey literature from organisations such as the WHO, UNICEF, the Global Fund, and the World Bank.

2.2 Selection Criteria

Scholars prioritised studies from the past 5 years (2019–2024) to ensure the most up-to-date evidence. Scholars evaluated the older studies to determine whether they provided historical context or foundational knowledge. The theoretical and empirical studies were both considered.

3.0 Results

3.1 Malaria burden in Nigeria

Malaria remains a leading cause of morbidity and mortality in Nigeria, disproportionately affecting children under five and pregnant women. Over the past 5 years, the incidence of Malaria has fluctuated, reaching a peak in 2021, mainly due to disruptions in healthcare services caused by the COVID-19 pandemic. However, recent data indicate a downward trend in malaria-related deaths, with a 50% reduction by 2023, signalling progress in malaria control efforts. Despite this decline, Malaria remains a significant public health burden, underscoring the need for sustained intervention strategies, including vaccination.

Figures 1 and 2 illustrate the trends in malaria incidence and mortality in Nigeria from 2019 to 2023. While there has been progress in reducing mortality rates, Malaria continues to account for a substantial disease burden, necessitating targeted efforts to enhance vaccine acceptance and accessibility.

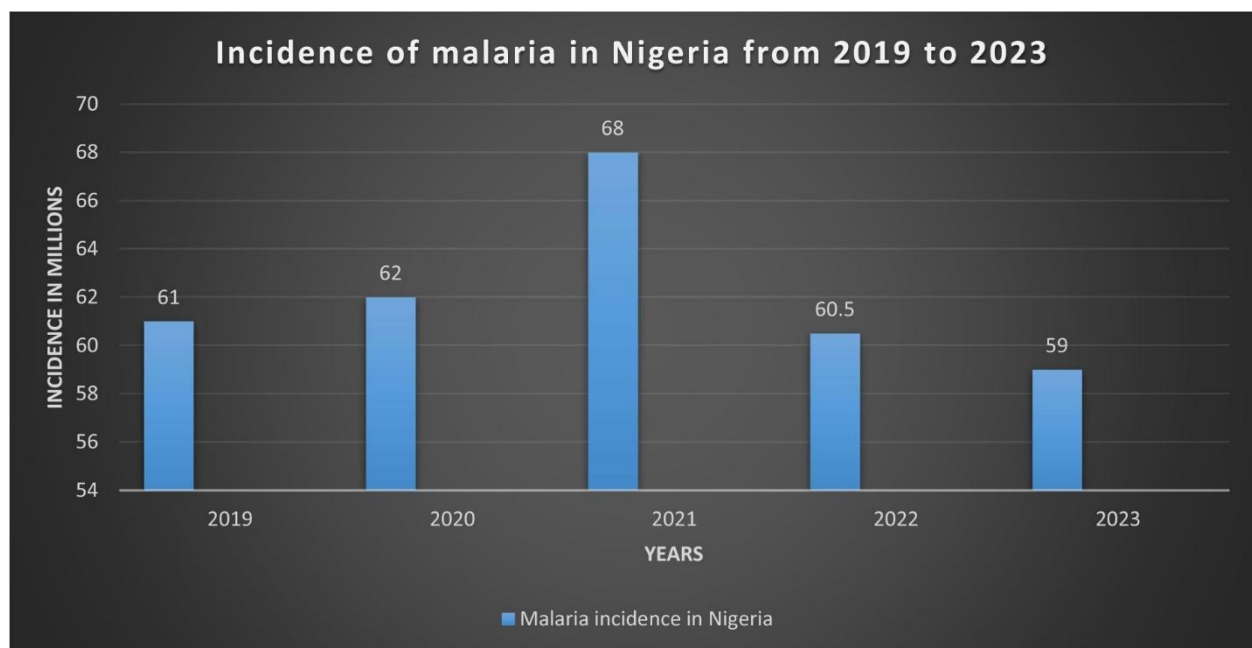


Figure 1: Yearly incidence of malaria in Nigeria from 2019 to 2023

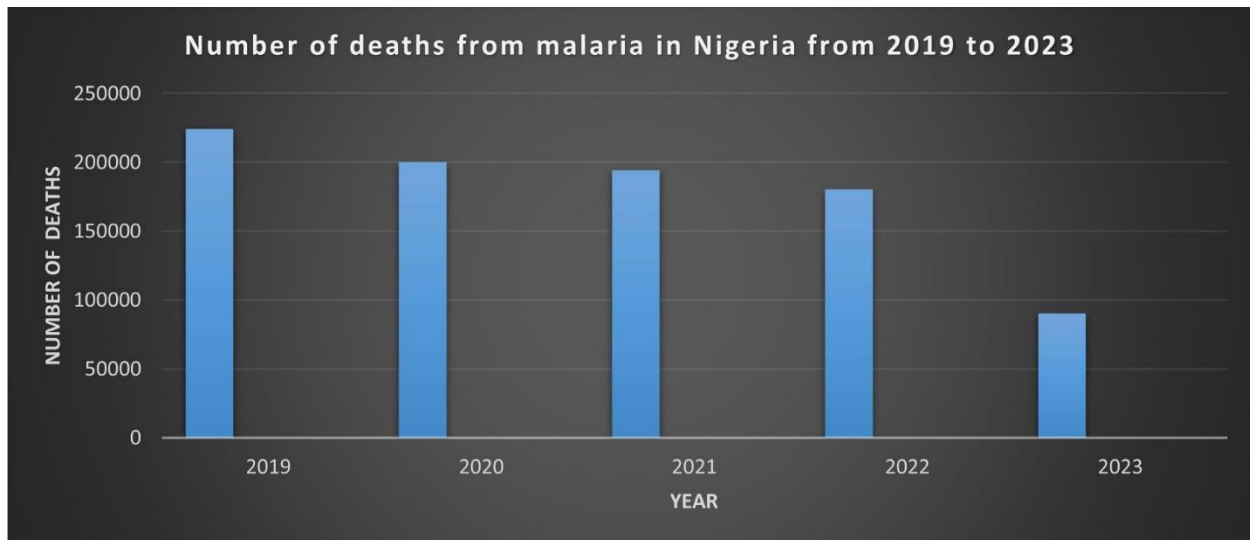


Figure 2: Yearly mortality from malaria in Nigeria from 2019 to 2023

3.2 Overview of the R21 malaria vaccine

The development of malaria vaccines has been a long-standing global priority, culminating in the approval of two vaccines: RTS, S and R21/Matrix-M. The R21/Matrix-M vaccine, developed by the University of Oxford and manufactured by the Serum Institute of India (SII), has demonstrated an efficacy rate exceeding 75% in clinical trials, surpassing the WHO's minimum target for malaria vaccines. In April 2023, Nigeria became the second country to approve the R21 vaccine, following Ghana, marking a significant milestone in the fight against Malaria. The vaccine promotes the recruitment of antigen-presenting cells to the injection site and amplifies antigen presentation in regional lymph nodes. The vaccine comprises a protein derived from the parasite, the circumsporozoite, and a carrier protein sourced from the hepatitis B virus, which imparts potency.

Figure 3 presents the timeline of malaria vaccine development, highlighting key milestones leading to the approval of R21. The vaccines designed for children aged 5 to 36 months are administered in three doses, followed by a booster after 12 months, ensuring sustained immunity. Given its potential for large-scale implementation, the R21 vaccine represents a critical tool in Nigeria's malaria elimination strategy.

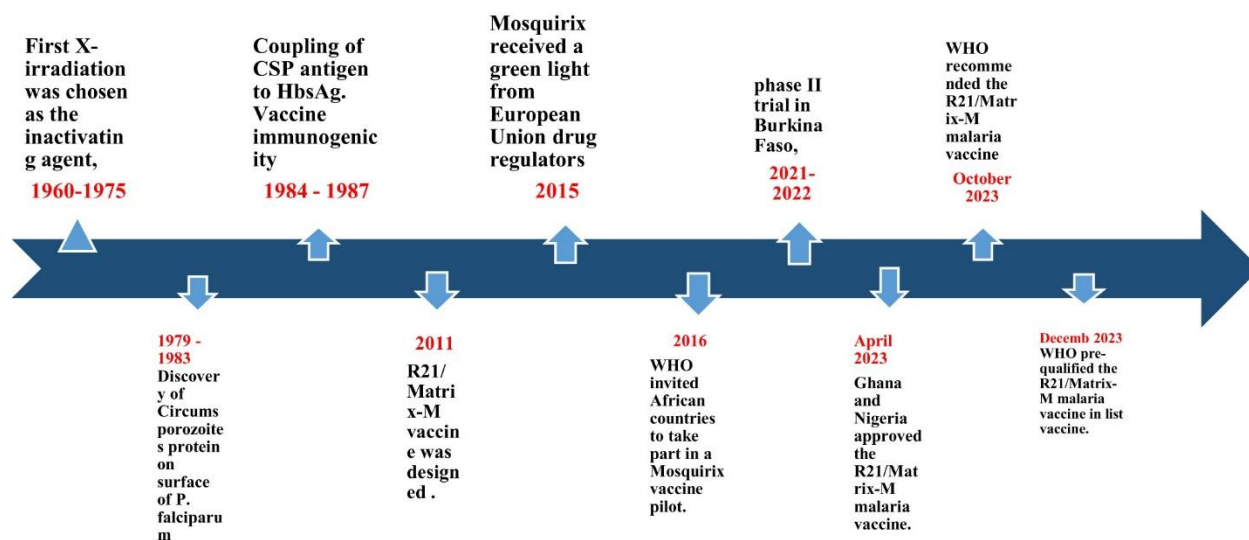


Figure 3: Timeline of development of malaria vaccine.

4.0 Anticipated challenges associated with malaria vaccine implementation in Nigeria and possible solutions

Malaria vaccination has been identified solely as a significant initiative aimed at addressing the high mortality rate among children under the age of five in Africa. Fortunately, the development of the R21/Matrix-M malaria vaccine holds promise for the African continent. However, the Government must overcome several challenges to achieve widespread vaccine coverage. The following are the anticipated challenges in implementing the R21 malaria vaccine in Nigeria.

4.1 Vaccine hesitancy and misinformation

In Nigeria, the reluctance to receive vaccinations has traditionally been attributed solely to fear of adverse effects. This fear was evident during the rollout of COVID-19 vaccines and may also arise during the implementation of the Malaria vaccine, as it is a novel vaccine. A significant proportion of the Nigerian population remains hesitant about vaccines due to concerns over side effects and misinformation, fueled by past controversies such as the polio vaccine boycott. Public perception of vaccines as instruments of Western control further exacerbates hesitancy, highlighting the need for targeted awareness campaigns.

To address these concerns and misinformation, it is essential to implement strong community engagement, sensitisation, and awareness campaigns via various channels that can reach the community.

4.2 Financial constraints

The cost of the R21 vaccine is estimated to be between US\$2 and US\$4 per dose, making it more affordable than other vaccines, according to the World Health Organisation. However, for optimal effectiveness, the vaccine should be administered four times at specific intervals, resulting in a total cost of \$8 to \$16 for all four doses. In Nigeria, this cost would range from

₦11,000 to ₦22,000. While this may be affordable for some, it is still quite expensive in a country where the minimum wage is only ₦ 70,000.00 [US\$51] per month. It is worth noting that Nigeria relies on partners to finance routine immunisation. Similarly, funding will be necessary for the implementation of the malaria vaccine, including logistics, storage, and community mobilisation. Therefore, it is crucial to secure adequate funding for the implementation of the malaria vaccine, as emphasized.

4.3 Logistical and cold chain challenges

Nigeria's primary healthcare system, which is responsible for vaccine distribution, faces significant infrastructural limitations. Of the 30,000 primary healthcare centres (PHCs) in the country, only 20% are fully functional. Additionally, frequent power outages disrupt cold chain storage, potentially risking vaccine degradation before administration.

4.4 Poor cold chain maintenance

One of the significant obstacles that arises after procuring vaccines is maintaining the cold chain during transportation to and within last-mile health facilities. Several factors can cause cold chain disruptions, including the use of outdated or poorly managed refrigerators and freezers, sudden power outages due to unreliable electricity infrastructure, or poor adherence to cold chain procedures. Inadequate cold chain infrastructure, coupled with frequent power outages, presents significant challenges to vaccine storage and distribution in Nigeria. Poor storage may compromise vaccine quality, as seen during polio vaccination campaigns, where expired vaccines left individuals vulnerable to the virus.

4.5 Training and human resources

Additional local and district health care managers must undergo thorough training. Moreover, some frontline healthcare professionals have emphasized the importance of providing formal education to volunteers and nursing practitioners, as this would enable them to offer better support to the network sensitisation efforts. Furthermore, it suggested that district education sessions should happen more frequently to accommodate community health nurses (CHNs) who may have missed the initial education or joined the program after the training.

4.5 Complex dosing schedule and compliance issues

The vaccine requires approximately four doses administered at distinct intervals. The considerable number of doses has been a significant cause of non-compliance with several vaccines in Nigeria, including those for tetanus and hepatitis B. Consequently, this issue is also likely to arise during the implementation of the malaria vaccine in Nigeria.

5.0 Recommendations

The successful implementation of the R21 malaria vaccine in Nigeria requires a multi-sectoral approach that integrates strong government leadership, healthcare system improvements, financial sustainability, community engagement, and vaccine acceptance strategies. Addressing these key areas will be critical in ensuring effective vaccine rollout and long-term malaria elimination efforts.

5.1 Strengthening government leadership and policy commitment

A strong and committed government is fundamental to the success of malaria vaccination efforts. Countries that have successfully eradicated Malaria, such as China and Cape Verde, have demonstrated that political will, transparency, and multi-sectoral collaboration are crucial in eliminating the disease. To replicate such success, Nigeria must establish a national malaria vaccine task force to oversee implementation. Strict anti-corruption measures must be implemented to ensure that funds allocated for vaccine distribution reach the intended target audience. Additionally, strong policies and regulations should be implemented to ensure the proper storage, distribution, and administration of the vaccine. Developing a long-term malaria elimination roadmap with clear goals and accountability mechanisms will also be essential in tracking progress and maintaining momentum toward eradication.

5.2 Strengthening healthcare infrastructure and workforce capacity

Beyond strong leadership, improvements in Nigeria's healthcare infrastructure are essential for ensuring a smooth vaccine rollout. Many healthcare facilities, especially in rural areas, face logistical challenges that may hinder vaccine storage and administration. Currently, only 20% of Nigeria's 30,000 primary healthcare centres (PHCs) are fully functional, leaving significant gaps in vaccine accessibility. Strengthening the country's cold chain system by investing in solar-powered storage solutions will ensure vaccines remain potent despite frequent power outages. Additionally, healthcare workers need comprehensive training on vaccine administration and storage protocols. Deploying mobile vaccination teams to hard-to-reach communities can further bridge the gap in healthcare access and improve vaccination coverage.

5.3 Ensuring financial sustainability and resource mobilisation

Financial constraints continue to be a significant hurdle to vaccine implementation. While the R21 vaccine is relatively affordable at \$8–\$16 per complete regimen, this cost may still be prohibitive for many Nigerians, particularly those in low-income communities. To address this, the Nigerian Government must allocate dedicated funding for the procurement and distribution of the malaria vaccine. Partnerships with private-sector organisations, international donors, and NGOs such as the WHO, UNICEF, and the Global Fund will be essential to ensuring financial sustainability. Subsidising vaccine costs for low-income individuals and ensuring free distribution in high-burden areas will further enhance vaccine accessibility and uptake.

5.4 Enhancing community engagement and public awareness

A key component of malaria vaccine success is community engagement, as vaccine adoption largely depends on public trust and confidence in the vaccine. Past vaccination campaigns in Nigeria, such as the polio vaccine rollout, faced resistance due to misinformation and cultural misconceptions. To combat this, the Government must launch a public awareness campaign across radio, television, social media, and community health forums to provide accurate information on vaccine safety and benefits. Engaging religious and traditional leaders as advocates can also build public confidence in the vaccine, as many Nigerians trust these figures more than government officials. Additionally, peer-led education programs, where vaccinated individuals share their experiences, can further reinforce positive perceptions of vaccination. Mobile technology can also play a role, with SMS reminders and WhatsApp groups being used to inform parents about vaccination schedules and locations.

Furthermore, the Government should provide antimalarial medication free to every individual living with or near a person with a confirmed case of malaria infection, or to every individual exposed to Malaria at the same time and place.

5.5 Addressing vaccine hesitancy and combating misinformation

Closely linked to community engagement is the challenge of vaccine hesitancy, which remains a significant threat to the success of malaria vaccination. Many Nigerians remain skeptical of vaccines due to fear of side effects, religious concerns, and conspiracy theories that have spread through social media and word-of-mouth. Addressing this issue requires a well-coordinated effort to debunk myths and misinformation by disseminating scientifically accurate, culturally sensitive information. Engaging celebrities, social media influencers, and respected community leaders to publicly endorse the vaccine can further improve public trust. Incentives, such as free mosquito nets or transportation allowances, may also encourage vaccine uptake. Incorporating malaria vaccine education into school health programs can help reinforce positive attitudes toward vaccination among young parents and future generations.

6.0 Conclusion

The approval of the R21 malaria vaccine presents a critical opportunity for malaria control in Nigeria. However, the successful implementation depends on strong leadership, improvements in healthcare infrastructure, and financial sustainability. While malaria-related mortality has declined, logistical challenges, vaccine hesitancy, and funding constraints persist as barriers.

Addressing vaccine hesitancy through public awareness campaigns and trusted community engagement is crucial to overcoming misinformation. Additionally, strengthening healthcare infrastructure, including cold chain systems and workforce training, will ensure the efficient distribution of vaccines. The government funding must also be prioritised, including Financial sustainability through international donor support and subsidy programs to improve accessibility.

Nigeria must effectively integrate the R21 vaccine into its national immunisation strategy while learning from the experiences of successful malaria-free countries. With this sustained commitment, transparent governance, and coordinated interventions, Nigeria can make substantial progress toward eliminating Malaria and reducing its public health burden.

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