



Essay



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Rotavirus surveillance and vaccination in Nigeria: current challenges and important next steps

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Abstract

Available rotavirus vaccines have proven to be most effective and safe in reducing rotavirus-associated mortality in a wide variety of settings. The World Health Organization (WHO) recommends countries worldwide to integrate rotavirus vaccines into their national immunization programs, especially countries with high disease burdens such as Nigeria. The introduction of the rotavirus vaccine has signaled renewed hope in the fight against the virus that has continued to take a toll on the health of under-five children. Rotavirus vaccine roll-out began from the northern region with higher disease burden to the southern region with lower disease prevalence. Also, surveillance sites were established across the country in order to develop a tailored approach in the fight against rotavirus. While the country hopes to reduce incidence and death rates associated with the virus in children below 5 years by at least forty percent, several factors such as low vaccine coverage, low healthcare-seeking behavior, poor supply chain management system, poor access to water, sanitation, and hygiene (WASH) and rotavirus vaccine cost, all constitute an important current and future challenge that can undermine the country's effort towards achieving this goal. There is a need for the government to scale up prevention strategies, and increase coverage and

uptake take of rotavirus vaccines. Also, the government must take proactive steps in implementing independent immunization strategies especially as the country is transitioning beyond Gavi support.

Essay

Human rotaviruses were discovered in the 1970s and have been known to be mostly implicated in infectious gastroenteritis in infants and children worldwide [1]. The virus is primarily recognized as the most occurring pathogen implicated in diarrhea in children below 5 years. Notably, diarrheal diseases constitute significant morbidity and mortality in children under 5, causing over 500,000 childhood deaths each year [2]. Globally, eight African countries including Nigeria account for 60% mortality due to rotavirus [3]. In developing countries, more than 75% of children are infected with rotavirus at least once before reaching one year [4]. In 2019, Nigeria was classified as the country with the global highest mortality due to rotavirus by the Institute for Health Metrics and Evaluation [2]. The country accounts for the second-highest number of deaths due to rotavirus diarrhea, constituting 14% of total childhood deaths due to rotavirus worldwide [5]. In 2017, the World Health Organization (WHO) advised all countries to introduce rotavirus vaccination into national immunization programs, especially highly vulnerable countries such as Nigeria with high mortality due to diarrhea in children [6]. Gavi, the global vaccine alliance has promoted the introduction of rotavirus vaccines in many developing countries [3]. In most Gavi countries (phase 2 and phase 3 countries eligible for Gavi vaccine support) in sub-Saharan Africa, rotavirus vaccines have either been introduced or are in the pipeline of integration into the national immunization schedule [3].

As of December 2020, nine countries in sub-Saharan Africa including Nigeria are yet to introduce the rotavirus vaccine into the national immunization schedule [3]. In Nigeria, effective

rotavirus vaccines were initially available in private clinics but were inaccessible especially to the poor in high-risk communities, resulting in low vaccine demand and uptake in a country in which over 40% live in poverty [6,7]. This situation coupled with has contributed to significant morbidity and mortality associated with the spread of the virus. In a bid to tackle morbidity and mortality due to diarrhea in children in Nigeria, the federal government was prompted to introduce rotavirus vaccination into routine immunization in the country, an initiative that led to the approval of the country's application for rotavirus vaccine support from Gavi in early 2020 [8]. As a result, several vaccine delivery strategies were put in place such as mobile sessions to cover hard-to-reach communities, integration of rotavirus vaccination into primary care, and diarrhea prevention services [9]. The launch and integration of rotavirus vaccination into the national immunization program reduced high out-of-pocket spending as well as increased the availability of the vaccine at no cost for infants aged 6, 10, and 14 weeks. In addition, several surveillance units were established across the country with the responsibility of recruiting and testing stool samples of eligible children for the presence of rotavirus antigen, sending stool samples to reference laboratories for genotyping, and sharing data with the Ministry of Health and WHO [7]. While Nigeria hopes to reduce morbidity and mortality associated with the virus in children under five years of age by at least 40% [10], the country is faced with setbacks in achieving this goal. This article aims to discuss the current state of rotavirus vaccination and surveillance and to recommend strategies that can be adapted to ramp up vaccination in under five children in Nigeria.

Surveillance method and strength of surveillance of rotavirus in Nigeria: in 2010, a rotavirus surveillance team was put in place which maintained rotavirus surveillance as well as established and oversaw other surveillance units across the country to date. The rotavirus

surveillance team consists of six surveillance site representatives at Ilorin, Bauchi, Zaria, Benin, Enugu, and Lagos, trained epidemiologists from corresponding state Ministry of Health (MOH), corresponding state National Primary Health Care Development Agency (NPHDA) offices and corresponding WHO offices [11]. These efforts saw Nigeria placed on the WHO Global Map of Rotavirus Data Reporting Countries of the World in 2010 [11]. In addition, four surveillance sites were identified across the country such as Ahmadu Bello University Teaching Hospital (ABUTH), University of Nigeria Teaching Hospital, Enugu, University of Ilorin Teaching Hospital, and Abubakar Tafawa Balewa Teaching Hospital, Bauchi as the national surveillance sites in the WHO Global Rotavirus Surveillance Network. The responsibilities of these surveillance sites include monitoring the burden of rotavirus before vaccine introduction, determining the prevalence of common viral serotypes as well as monitoring the impact of the rotavirus vaccine following integration in the national immunization program. Other roles of the surveillance sites include recruiting eligible children and investigating their stool samples for the presence of rotavirus antigen, sending stool samples to reference laboratories for genotyping, and sharing information with the Ministry of Health and WHO [7].

Rotavirus vaccination: the technical expertise of WHO and financial aid from Gavi have been instrumental in the rapid uptake of rotavirus vaccines and the implementation of evidence-based decisions in African countries in the last decade [12]. In August 2022, Nigeria integrated the pre-qualified rotavirus vaccine, ROTAVAC RV1 into the National Expanded Program on Routine Immunization, an initiative that represents renewed hope in the fight against the virus that has continued to take a toll on the health of under-five children across the country [5]. The country was able to achieve this fit following approval of the extension of the country's transition phase 2 from 2022 to 2028 which will

see the country benefit from Gavi vaccine support until 2028 [13]. In addition, the vaccine roll-out was supported by Gavi including other partners such as the United Nations Children's Fund, the World Health Organization, and the Bill and Melinda Gates Foundation [10]. However, the financial support from Gavi is expected to reduce delivery of the vaccine by 10 million a year over 6-year period [14]. Rotavirus vaccine roll-out began in the northern region of Nigeria with the highest disease burden in order to streamline the vaccination approach to the southern region with a lower burden of disease [5]. The vaccine distribution is expected to avert more than 110, 000 deaths over the next decade, a projection that is anticipated to increase with integration of other diarrhea prevention and treatment strategies (Figure 1) [10].

Vaccination challenges: there has been a significant reduction in childhood death in childhood deaths from infectious diseases. However, the magnitude is still substantial in sub-Saharan Africa. While rotavirus vaccination has shown to be most effective in reducing morbidity and mortality due to rotavirus [15], challenges such as low vaccine coverage, low healthcare-seeking behavior [8], poor supply chain management system, and poor access to water, sanitation, and hygiene (WASH) [16], and weak funding for immunization program undermines efforts in the fight against the spread of the virus.

Poor access to water, sanitation and hygiene: preventable infectious diseases account for significant morbidity in sub-Saharan African Countries and health facilities represent important point-of-care. Despite the availability of effective treatment, poor health-seeking behavior represents a huge challenge in treatment [17]. According to a systematic review, health-seeking behavior for infectious diseases such as diarrhea remains very low in developing countries [18]. Also, having a father who is the head of the household has been reported to be significantly associated with low health-seeking behavior for diarrhea disease compared to having a mother as

the head in West Africa including Nigeria [19]. This situation threatens sustainable improvement in the rotavirus immunization program as well as disparity reduction in coverage and outcomes.

Low vaccination coverage: lower immunization coverage and higher incidence of rotavirus disease have been reported in children from rural areas, northern regions, and poorer households [20]. This disparity in vaccination coverage, if not addressed can have a significant negative impact on access to rotavirus vaccine, thus drawing back efforts gained in reducing the gap in rotavirus immunization in Nigeria.

Poor supply chain management system: immunization coverage in low and middle-income countries (LMICs) including Nigeria suffers several setbacks. The country has made significant efforts towards graduation from GAVI support. However, important challenges to overcome include poor cold chain and logistics, and poor data systems due to weak supply chain infrastructure [21,22]. Other challenges that have been found to be associated with the vaccine supply chain include weak policy, stock-out, poor supply chain practices, and inadequate human resources. While several strategies have been implemented such as national drug policy, Nigeria's supply chain policy for pharmaceuticals, national drug distribution guidelines, and regulation of human resource development [23], the country still suffers weak and inefficient supply chain due to weak implementation [24]. These issues constitute a huge gap between the current rotavirus vaccination status and the goal of averting more than 110, 000 deaths over the next decade. Although Nigeria has recorded impressive results by adopting best practices in the end-to-end supply chain [21], there is a need for improvement on various fronts such as vaccine arrival, storage capacity, temperature control, cold chain infrastructure, and distribution and information system

Weak funding for immunization program: in Nigeria, funding for immunization services is the

collective responsibility of the three tiers of government through the statutory budget allocation. Other sources of funding include international donors, development partners, the private sector, and the community [25]. Over the years, GAVI has grown to become the largest external contributor to immunization support [26]. However, there have been competing priorities in healthcare budgetary allocation due to rising demands in healthcare. Despite the increase in the healthcare budget to 5.75% of the total budget allocation in 2023 [27], the country is still short of the Abuja threshold declaration of 15% [28]. In 2021, Nigeria was scheduled to graduate from GAVI support, but the country was granted an extension due to the lack of resources required to shoulder the cost of vaccination programs [29]. If this situation is not addressed, other challenges such as rotavirus vaccine cost, demand, and production capacity can pose significant barriers to the long-term sustainability of the rotavirus vaccination campaign especially in Nigeria that have been scheduled to graduate from Gavi financial aid.

Recommendations

Proactive implementation of independent immunization strategies: Nigeria needs to take advantage of the current extension period to plan and implement strategies geared towards a sustainable supply of rotavirus vaccine as well as other co-financed vaccines after the transition period in the fully self-financing phase. This will ensure an effective and efficient vaccine supply when the country transits into the fully self-funded phase. There is a need for the government to review and increase healthcare spending in order to meet the increasing demand and prepare the country for the transition from Gavi subsidies.

Scale-up prevention strategies: according to WHO, approximately 80% of diarrheal diseases worldwide are associated with unsafe water and poor sanitation and hygiene practices. Implementing interventions that focus on specific risks of rotavirus infection in children can reduce

the number of incidents and deaths associated with the virus. Water, sanitation, hygiene (WASH), and breastfeeding are cost-effective interventions for the prevention of the spread of rotavirus and hence diarrhea associated with the virus. Limited access to clean water, poor hygiene and sanitation, malnutrition, and non-exclusive breastfeeding are important risk factors for rotavirus pathogenicity. Integration of diarrhea prevention and treatment strategies into the rotavirus national immunization program has been projected to significantly contribute to averting morbidity and mortality associated with rotavirus over the next decade [30]. There is a need for the Nigerian government to scale up WASH and exclusive breastfeeding programs across the country such as the promotion of hand washing practices, effective sanitation intervention, effective educational interventions as well as construction of hand washing facilities in schools and communities that lack access to them. Also, there is a need to implement systems further evaluating the effectiveness of these interventions and implement effective approaches in specific areas that require intervention.

Increase coverage and uptake of rotavirus vaccine: low vaccination coverage, especially in rural communities, is not a new phenomenon. Certain factors such as household characteristics and population geography have been associated with low vaccine coverage and increased risk of rotavirus infection [20]. There is a need for the government to promote strategies towards the scale-up of vaccination coverage to rural sub-populations to save the lives of vulnerable children who need rotavirus vaccines in Nigeria. Awareness and public access to data and information have been described to contribute to increased vaccine coverage. The government needs to put in place measures that ensure effective communication via intensifying strategies that promote targeted public education and access to accurate information about the rotavirus as well as the benefits of vaccination. This can be achieved through public announcements, advertisements,

and community sensitization programs, with particular emphasis on parents and community leaders to tackle the spread of conspiracies and increase vaccine demand, particularly in rural communities.

Strengthen national investment in immunization: the vaccine Alliance was established to provide international funding support for improving universal access to vaccines in LMICs including Nigeria. In 2021, Nigeria was scheduled to graduate from GAVI financial aid, but the country was granted an extension due to lack of resources required to shoulder the cost of vaccination programs. As Nigeria looks to transition from GAVI support in 2028, there is a need for the government to invest in a healthy future through increased domestic funding for immunization. In addition, there is a need for the government to review the current immunization financing structure to ensure improved release of designated funds, increased accountability, improved accountability and political will across all levels of government especially as the country prepares to transition from GAVI support.

Promote and strengthen effective supply chain strategy: an effective vaccine supply chain strategy is an important factor in achieving success in immunization coverage. The government must ensure effective and efficient coordination and collaboration among the different sectors of the rotavirus vaccine supply chain network. In addition, there is a need to strengthen the implementation of relevant existing policies and develop and implement context-specific approaches for vaccine distribution and delivery.

Conclusion

There is a need for the government to scale-up prevention strategies, and increase coverage and uptake take of rotavirus vaccines. Also, the government must take proactive steps in implementing independent immunization

strategies, especially as the country is transitioning beyond Gavi support.

Competing interests

The authors declare no competing interests.

Authors' contributions

Chizoba Umunna: writing, reviewing editing, and final approval of the manuscript. Eunice Oriotor, Sil-Ana Salissou, Esther Oyeyemi, Folasade Rebecca Bamidele, Olufunso Opeyemi Bamidele, Ayomide Sina-Odunsi, Adedayo Olutoye, Nathaniel Oladapo Oladunni: writing, reviewing editing, and final approval of the manuscript. All authors read and approved the final version of the manuscript.

Figures

Figure 1: rotavirus disease burden in Nigeria adapted from Nigeria Demographic Health Survey, 2018

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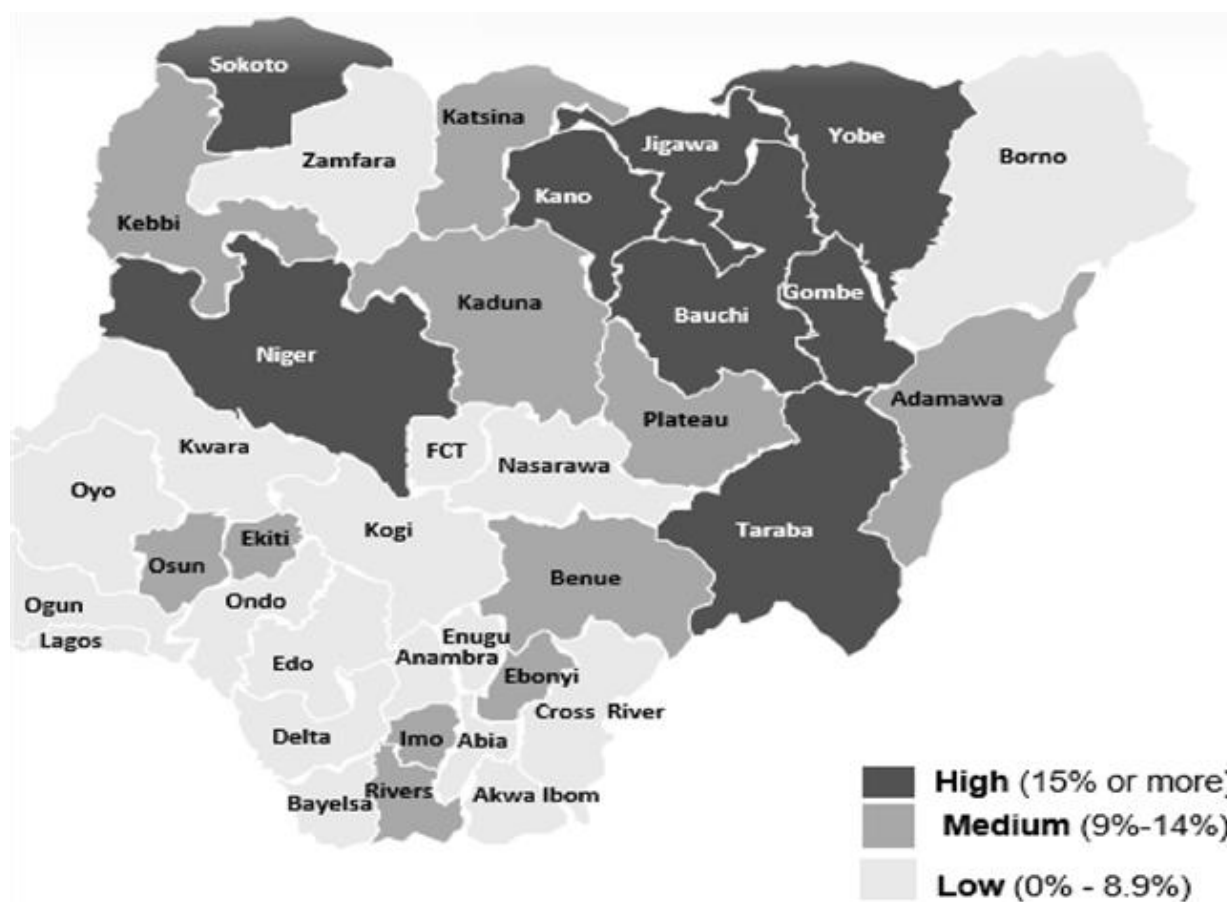


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