

## Challenges to Routine Immunization in Nigeria: A Systematic Review

Running title: Immunization and its challenges

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### ABSTRACT

Despite significant investments in the immunization program, Nigeria's vaccination coverage has remained below predetermined levels. Lack of political will and commitment, a lack of funding, low community involvement and restricted scaling up of cost-effective interventions are a few of the difficulties. Parents of children under five may be reluctant to get their children vaccinated because they don't know enough about childhood immunizations, have irrational concerns about vaccine safety or don't have access to transportation. They might not understand the danger of diseases that can be prevented by vaccination or that there are safe and efficient vaccines to prevent these illnesses. The method employed here involved surfing the internet through Google, PubMed and Web of Science and over 80 articles within five years of publication were reviewed. It is crucial to lower Nigeria's child mortality indices by making sure that sufficient measures are implemented in all relevant areas and that every child is subsequently immunized. Immunization is an effective strategy that can improve child health and prevent morbidity and mortality. To improve the effectiveness and efficiency of routine immunization in Nigeria, key stakeholders must work together.

**Keywords:** Immunization, Nigeria, Vaccines, Mortality, Illness

### 1. Introduction

The most important public health measure to reduce childhood morbidity and mortality is childhood vaccination. According to WHO (2016), vaccination is an essential health benefit that shields susceptible kids against vaccine-preventable illnesses (VPD)<sup>1</sup>. To guarantee that women, children and adolescents

have access to routine childhood vaccinations, the World Health Organization launched the Expanded Program on Immunization (EPI) in 1976<sup>2</sup>. According to Madani (2020), these vaccines have been proven to be both safe and effective in protecting children from disease and death. They may even save up to three million lives a year or avert five fatalities every minute of the

day. Immunization is acknowledged as a fundamental aspect of the human right to health and as a duty of the state, society and person. Reducing childhood morbidity and death is a crucial and economical approach<sup>3</sup>.

The procedure of applying vaccines to a person to make them resistant to an infectious agent is known as immunization<sup>4</sup>. The body's immune system is stimulated when vaccinations are administered, protecting the recipient from illness. The process of injecting an antigen into the human body in order to promote the formation of antibodies is known as inoculation. As early as 2700 BC, the Chinese are credited with being the first to introduce vaccinations<sup>5</sup>. In 1796, Edward Jenner used the cowpox virus as a stimulant to create a smallpox vaccine, which marked the beginning of scientific vaccination<sup>6</sup>.

The Expanded Program on Immunization (EPI) was created by the World Health Organization (WHO) in 1976 to guarantee that mothers, children and adolescents could receive immunizations on a regular basis<sup>7</sup>. Vaccines covered by the EPI include the Measles Containing Vaccine (anti-Measles, Mumps and Rubella vaccine), Hepatitis-B, Pentavalent Vaccine, Bacillus Calmette-Guerin (BCG), Hepatitis-B and Tetanus and Pneumococcal Vaccine -13 (PCV 13). In addition to the associated logistical supports, such as disposable syringes and needles, refrigerators, cold boxes, vaccine carriers and vaccine transportation costs, all of these vaccines are freely given to children<sup>8</sup>.

Routine Immunization (RI) is the timely, regular administration of vaccines deemed necessary for a nation to lower morbidity and mortality. It necessitates that parents or guardian bring their children to the health facility so they can receive doses of the antigens that are appropriate for their age<sup>9</sup>. Considered one of the greatest public health triumphs of the 20th century, routine immunization is a very successful public health measure to prevent infectious illnesses, particularly in children. The elimination, eradication and control of illnesses in Nigeria have been greatly aided by immunization, a worldwide, economically viable public health method<sup>10</sup>. Smallpox was eradicated in 1980 as a result of routine vaccination (RI) against viral infections and measles, mumps and polio have even shown a decline in frequency and severity. According to Hammitt et al. (2016), RI against bacterial illnesses has significantly decreased childhood morbidity and mortality rates in both developed and developing nations<sup>11</sup>.

The government of Nigeria offers free vaccinations on the EPI and program services when they are given in public health facilities<sup>12</sup>. According to Nigeria's 2023 childhood routine vaccination schedule, seven trips to the medical institution are advised and include:

- Hepatitis B (Hep-B) oral polio vaccine (OPV) and BCG, administered during birth
- Streptococcus pneumoniae conjugate vaccine (PCV), pentavalent (diphtheria, pertussis, tetanus, Hep-B and Haemophilus influenzae type B) and three series of OPV vaccinations at 6, 10 and 14 weeks of age; moreover, inactivated polio virus (IPV) is given at 14 weeks.
- The first dose of vitamin A is given at 6 months, followed by a second dose of vitamin A and MCV at 15 months, Neisseria meningitidis meningitis, the first dose of the measles-containing vaccine (MCV) and yellow fever vaccinations at 9 months<sup>9</sup>.

The youngster should have these vaccinations within the first year of life. Appointment dates for the subsequent immunization are provided to the moms at each visit and are noted on the child's registration card. If a child has received all of the necessary basic doses of antigens at the appropriate times, they are considered completely immunized<sup>12</sup>.

Routine vaccination presents certain difficulties for many nations and groups, even with the availability of immunization services and the overwhelming evidence of RI effectiveness. These difficulties include a rise in mothers' reluctance or refusal to vaccinate their children, sporadic vaccine shortages, inadequate cold chain equipment or facility maintenance, a lackluster program and poor information management and communication<sup>13</sup>. Mothers' noncompliance has increased the morbidity and mortality rate among children under five, which has resulted in a high burden of vaccine-preventable diseases (VDPs). According to GebreEyesus et al. (2021), VPDs continue to be the cause of almost one-fourth of all deaths among children under five in underdeveloped nations each year. Millions of children in low- and middle-income countries (LMICs) remain unvaccinated despite tremendous progress in regular vaccination coverage over the years<sup>14</sup>. In many regions of Nigeria, regular vaccination antigen coverage rates continue to be below 50%. The benchmark used to assess the effectiveness of routine vaccine delivery systems is the Global Vaccine Action Plan (GVAP) criterion of 80% or more coverage of the diphtheria-tetanus-pertussis vaccine (DTP3/PENTA3)<sup>15</sup>. It shows that a child was able to get immunization services and that they used them, meaning they came back at least three times.

## 2. Principles of regular vaccination

Both natural and artificial immunization are possible. When a person develops active immunity by exposure to infectious diseases or passive immunity through interaction with pre-existing antibodies, such as when a nursing mother passes antibodies to her infant, this is known as natural immunization<sup>16</sup>. Active or passive immunity may also be provided by artificial immunization. Passive immunity is achieved by administering immunoglobulins, such as those used to treat snakebite, whereas active immunity is created by administering vaccinations to generate immunogenicity<sup>17</sup>. Exposure to antigenic organisms triggers the production of antibodies by the host, resulting in active immunity. On the other hand, passive immunity happens when people receive antibodies that have already been produced.

The vaccination coverage rate, which can be computed as follows, is a gauge of community use of health services:

The total number of immunized newborns x 100

Total number of babies in the region of interest

The dropout rate is a gauge of staff attitudes toward clients, service quality and accessibility to health care; if it exceeds 10%, it becomes problematic<sup>18</sup>. One can compute the dropout rate:

1 - 3 X 100 PENTA

PENTA 1

Vaccine wastage (%) = 100 - Vaccine utilization (%) is the formula used to determine vaccine waste as a percentage<sup>18</sup>. The number of doses given multiplied by 100 is the vaccine utilization rate (%). The quantity of dosages taken.

When a woman of reproductive age or an infant who needs vaccinations contacts a health center that provides immunization services but does not obtain the shot before the deadline, this is known as a missed opportunity<sup>19</sup>.

Nigeria employs a cold chain system that stores and distributes vaccines at a temperature that is suitable for cold storage between the manufacturing site and the client<sup>20</sup>.

### 3. Vaccine types

There are several kinds of vaccines, such as:

- Live-attenuated vaccines include those for measles oral polio, yellow fever and BCG.
- Vaccinations against cholera, pertussis, typhoid and inactivated polio
- **Toxoids:** tetanus and diphtheria
- **Pneumococcal conjugate vaccination:** a conjugate vaccine
- Hepatitis B and human papillomavirus vaccinations are examples of recombinant vaccines.

Immunization serves as the cornerstone for nations to control and eradicate diseases that can be prevented by vaccination and to give access to life-saving vaccines<sup>21</sup>. In order to lower morbidity and mortality from diseases, a nation must regularly and promptly immunize its citizens with vaccinations<sup>22</sup>. The vaccination process is made possible by a nation's health system, which is maintained by a collection of managerial subsystems for the efficient supply of scheduled vaccines, safety monitoring, population coverage control and epidemiological impact measurement<sup>23</sup>.

The Expanded Program on Immunization (EPI), currently known as the Essential Programme on Immunization WHO (2023), was started by the World Health Organization (WHO) in 1974<sup>24</sup>. Launched in Nigeria in 1979, EPI underwent revisions in 1984 before being renamed the National Programme on Immunization (NPI) in 1996 to reflect program ownership<sup>25</sup>. **(Figure 1)** It targets children under 59 months, women between the ages of 15 and 49 who are pregnant, international travelers, at-risk groups, particularly during outbreaks and those visiting endemic areas. Generally speaking, unless there are medical contraindications, no eligible person should be refused vaccination<sup>26</sup>.

### 4. Methods for Performing Regular Immunizations

Routine vaccination system strengthening can be achieved through four key tactics or approaches, which include:

- Optimizing reach entails identifying and reaching the unreached, designing services to fairly reach each person, increasing the capacity of managers and vaccinators, guaranteeing the quality and availability of vaccines, integrating immunization efforts and fostering collaboration with specialized vaccination initiatives<sup>27</sup>.
- Program management entails organizing, allocating funds and coordinating resources; establishing program policies; solidifying political commitments and alliances; and practicing good governance<sup>28</sup>.
- Engaging communities is crucial, as is generating demand; addressing vaccine reluctance and erroneous beliefs about individuals; and organizing and communicating for a vaccination program<sup>29</sup>.

- Tracking progress entails keeping an eye on disease incidence and program success in addition to assessing the program through surveys and reviews<sup>30</sup>.

The National Immunization Schedule in Nigeria						
Vaccine	Doses	When to give (Age)	Disease Prevention	Route of Administration	Dose	Vaccination site
BCG	1	At Birth or as soon as possible till one year	Tuberculosis	Intradermal	0.05ml	Left Upper Arm
Oral Polio Vaccine (OPV)	4	At birth and at 6, 10 and 14 weeks	Polio	Oral	2 drops	Oral
Pentavalent	3	At 6, 10 and 14 weeks	Diphtheria, Tetanus, Pertussis, Hepatitis B and Hemophilus influenza type b	Intramuscular	0.5ml	Left Outer Thigh
Hepatitis B	1	At birth or as early as possible within 2 weeks of age	Hepatitis	Intramuscular	0.5ml	Left Outer Thigh
Measles	1	At 9 months of age	Measles	Subcutaneous	0.5ml	Right Upper Arm
Yellow Fever	1	At 9 months of age	Yellow Fever	Subcutaneous	0.5ml	Right Upper Arm
Vitamin A	2	9 months & 15 months	Improvement of Sight	Oral	100,000IU 200,000IU	Oral
Inactivated Polio Vaccine* (IPV)	1	14 weeks of age	Polio	Intramuscular	0.5ml	Right Outer Thigh
Pneumococcal Conjugate Vaccine (PCV)	3	At 6, 10 and 14 weeks	Pneumonia	Intramuscular	0.5ml	Left Outer Thigh
Rota***	2	At 6 and 10 weeks	Diarrhoea diseases	Oral	1.2ml	Oral

IPV\*: For now at 14 weeks  
Rota\*\*: This will be introduced in the schedule by 2018

**Figure 1:** Nigerian Routine Immunization Milestones.

Stoppage of the spread of polio: On September 25, 2015, WHO removed Nigeria from the list of countries where polio was endemic<sup>30</sup>. In light of this, Nigeria began administering the pneumococcal vaccination in July 2016 and changed from tOPV to bOPV on April 18, 2016<sup>31</sup>. However, after Nigeria was taken off the WHO's list of countries with endemic polio and was awaiting certification as a free nation, two new cases of polio were reported in war-torn Northeast Nigeria on August 11, 2016. On August 22, 2022, the rotavirus vaccine was added to the current regular vaccination schedule and administered orally at 6, 10 and 14 weeks, respectively.

Nigeria's Immunization Situation Measles, pneumonia and tuberculosis are among the vaccine-preventable diseases that kill a large number of children under five in underdeveloped nations like Nigeria<sup>32</sup>. Approximately 31 million children under the age of five are afflicted with these illnesses each year<sup>33</sup>. Nigeria is one of the five nations that account for two-thirds of all zero-dose children worldwide, together with Ethiopia, Pakistan, India and the Democratic Republic of the Congo<sup>33</sup>. Thirty percent of children under five who are immunized worldwide are from Nigeria. Nigeria topped the WHO's 2019 list of nations with the highest rates of fatalities among children under five, according to UNICEF (2020)<sup>34</sup>. The under-five mortality rate reported by the Nigerian Demographic Health Survey is significantly greater than the aim of 25 per 1,000 live births set forth in the Sustainable Development Goal (3.2.1). Overall, 1 out of every 8 Nigerian children dies before turning 5 (NPC & ICF 2019)<sup>34</sup>. Only 13% of children had received all of the core vaccines, despite a significant improvement in coverage since 2003, according to NPC & ICF 2019. The percentage of children who have not had any immunizations has decreased from 21% in 2013 to 19% in 2018, despite an improvement in the basic vaccination coverage<sup>35</sup>. Over the past ten years, government initiatives to increase regular vaccination coverage and lower child mortality have not been very successful. Nigeria's rural-urban split is growing significantly and this is being maintained by a number of issues.

## 5. Challenges to routine immunization in Nigeria (Figure 2)

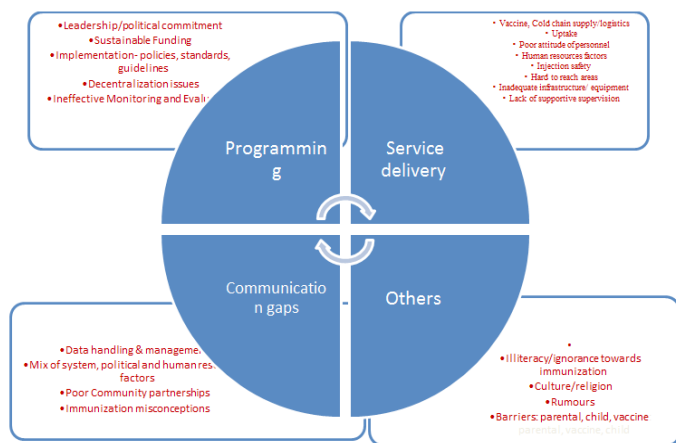


Figure 2: The program’s challenges<sup>36</sup>.

- Although routine immunization is primarily the duty of individuals, communities and governments, the national government is tasked with directing and supervising its implementation. It can be difficult to keep all partners actively represented and to maintain the emphasis on routine vaccination. Achieving targeted, time-bound events, including mass campaigns, the introduction of new vaccines or training initiatives, is the top priority for external partners<sup>36</sup>.
- A significant problem in Nigeria is the lack of commitment to immunization policy and leadership. Routine immunization funding and technical assistance are also focused on externally required results. Several departments within the ministry of health/NPHCDA handle the managerial and technical aspects of immunization, such as creating standards and guidelines, ensuring vaccine supply and distribution, creating training materials and supervisory tools and carrying out training. They also gather, analyze and report on vaccine coverage, disease surveillance and budget execution. This has an impact on the efficacy and efficiency of program links and functions<sup>37</sup>.
- It’s also challenging to keep up contacts with peers in external agencies. In theory, decentralization of the health system makes RI very strong, but in reality, public services lack qualified administrators. Additionally, programs are not being monitored or evaluated effectively<sup>38</sup>.

### 5.1. Service Delivery challenges

Human resources factors: health professionals’ poor attitude, lack of training and retraining and low understanding of vaccination administration and dilution<sup>38</sup>. Cold chain equipment failures and inadequate electricity supply, frequent stockouts resulting from poor forecasting, reduced or limited vaccine production, inadequate funding for service delivery and supervision at the state and local government levels, missed opportunities and an excessive reliance on vaccine importation are some of the other problems with the vaccine supply chain. Poor road access, a shortage of project cars, inaccessible riverine locations and areas with broken bridges can all contribute to hard-to-reach areas, which can result in low vaccination coverage. Transferring money to different purposes since the government can have other interests<sup>39</sup>.

### 5.2. Communication Gaps

Data handling and management issues include double counting of administered doses, falsifying reports and mixing doses for infants and older children<sup>40</sup>. Inaccurate denominator (population) data are frequently based on out-of-date census data or inaccurate projections that do not reflect current growth. Additional problems with data management include the absence of regular immunization data tools and vaccination cards for coverage survey evidence, which result in inadequate data collection and low data quality. Individual misconceptions about the quality and safety of vaccines, the preventative value of immunization, the accessibility of services and their unreliability are the main causes of vaccine reluctance. The communities do not believe that routine vaccinations are a successful intervention. The successful implementation of routine immunization may also be hampered by the community’s lack of participation in standards, policymaking and guideline creation<sup>41</sup>.

### 5.3. Other challenges of Routine immunization in Nigeria

Vaccination-related rumors include the following: OPV contains cancer agents and contraceptives; natural immunity or eating a healthy diet is preferable to vaccinations; the measles vaccine kills while drinking coconut water prevents it; premature children shouldn’t be vaccinated; and many vaccinated children still get sick and die. Poor immunization coverage has also been caused by war and terrorism, particularly in Northern Nigeria, where people are displaced and their fundamental necessities take precedence over vaccination. Other obstacles consist of:

- Parental barriers such as failure of parents to present their children due to lack of transportation, long waiting times at clinic, inconvenient clinic hours.
- Child barriers - when a child is sick or malnourished.
- Vaccine barrier- vaccine potency, genetic change and causative agent, management of large doses of vaccines leading to missed opportunities, also contribute to the routine immunization issues in Nigeria.

Ignorance and illiteracy towards the main objective of immunization is an impediment to routine immunization in Nigeria. Despite strong demands for immunization, sometimes parents express displeasure towards it. Some think it’s a way of controlling fertility or a source of side effects. Mahachi, et al discussed culture and religion are also challenging to routine immunization of which Muslims are mostly affected thus resulting in low immunization coverage<sup>26</sup>.

## 6. Conclusion

Immunization is a powerful tool for enhancing child health and lowering rates of illness and death. To increase the efficacy and efficiency of routine immunization in Nigeria, cooperation from pertinent stakeholders is needed. It is crucial to lower Nigeria’s child mortality indices by making sure that sufficient policies are implemented in all relevant sectors and that all children receive vaccinations.

## 7. Recommendations

### 7.1. To the Government -

- Advocacy to prioritize child health/immunization in budgets, especially at state and local government levels
- Track immunization Programme expenditures to ward

levels to improve budget and resource allocation

3. Linkage of key technical and advisory bodies for routine immunization
4. Detailed micro-plans at district level as recommended by WHO
5. Formation of interagency coordinating committees which would a mechanism for adequate coordination, collaboration and cooperation between government and partners
6. Establish legal frameworks to achieve country ownership
7. Community engagement and involvement in policy-making and implementation.

## 7.2. To the health workforce -

1. Build capacity and professional development of health workers through preservice training, retraining, use of eHealth technologies and supportive supervision
2. Find under-vaccinated and unvaccinated persons through microplanning by health facilities of how to reach all vaccine-eligible children in catchment areas
3. Adequate health worker-client synergy or interaction to improve delivery of services

## 7.3. On communication strategies -

1. Expand disease surveillance activities and risk communication
2. Local use of programmatic data to improve programmes performance and services
3. Foster information feedbacks to all levels of the health system summarizing Programme outputs, cold chain performance etc.
4. Use of better tools like vaccine registries for data collection and analysis for better decision making and better health outcomes

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