Zero-Dose LEARNING HUB

Nigeria Zero-Dose Situation Analysis

December 2023

Gavi The Vaccine Alliance

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THE GENEVA LEARNING FOUNDATION

Gavi Zero-Dose Learning Hub (ZDLH)

Funded by Gavi, the Zero-Dose Learning Hub (ZDLH) serves as the global learning partner and is led by JSI Research & Training Institute, Inc. (JSI) with two consortium partners, The Geneva Learning Foundation (TGLF) and the International Institute of Health Management Research (IIHMR). Together, the consortium enables sharing and learning across four Country Learning Hubs (CLHs) in Bangladesh, Mali, Nigeria, and Uganda to advance the uptake of evidence by synthesizing and disseminating key learnings. The ZDLH also focuses on improving immunization equity and reducing the number of zero-dose (ZD) and under-immunized children globally by facilitating high-quality evidence generation and uptake.

Recommended Citation

Gavi Zero-Dose Learning Hub. 2023. "Nigeria Zero-Dose Situation Analysis." https://zdlh.gavi.org/.

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ACRONYMS

AFENET	African Field Epidemiology Network
AHBN	Africa Health Budget Network
BCG	Bacillus Calmette-Guérin
CAPI	Computer-Assisted Personal Interviewing
CLH	Country Learning Hub
DHS	Demographic and Health Survey
DHIS2	District Health Information Software 2
FMOH	Federal Ministry of Health
IRMMA	Identification, Reach, Monitoring, Measurement, and Advocacy
LGA	Local Government Area
NDHS	Nigeria Demographic and Health Survey
MICS/NICS	Multiple Indicator Cluster Survey/National Immunization Coverage Survey
NERICC	National Emergency Routine Immunization Coordination Center
NPHCDA	National Primary Healthcare Development Agency
NSIPSS	Nigeria Strategy for Immunization and Primary Health Care System Strengthening
OIRIS	Optimised Integrated Routine Immunization Session
PAPA-LQAS	Performance Assessment for Programme Management and Action-Lot Quality Assurance Sampling
PHC	Primary Health Care
RMNCAH+N	Reproductive, Maternal, Newborn, Child, Adolescent Health, and Nutrition
RI	Routine Immunization
NSHDP II	Second National Strategic Health Development Plan
SMS	Short Message Service
SIAs	Supplemental Immunization Activities
SDG	Sustainable Development Goal
UI	Under-Immunized
UNFPA	United Nations Population Fund
WHO	World Health Organization
WUENIC	WHO/UNICEF Estimates of National Immunization Coverage
ZD	Zero-Dose
ZDLH	Zero-Dose Learning Hub

INTRODUCTION

There are approximately 36 million children under the age of five in Nigeria, representing more than 16 percent of its total population and one of the highest under five populations in the world.[1] While Nigeria has made progress in some child health-related indicators, such as reducing the under-five mortality rate from 182 deaths per 1,000 live births in 2000 to 111 deaths per 1,000 live births in 2021, additional efforts will be needed for the country to meet most of the child-related Sustainable Development Goal (SDG) indicators by 2030.[2,3]

In addition to being an important SDG indicator, increasing immunization coverage would contribute to reducing child mortality in Nigeria. For example, vaccines could help prevent diarrhea-related illnesses and measles and reduce respiratory infections, which combined caused 48 percent of deaths among children under five according to 2021 estimates.[2] Nigeria has improved vaccination coverage over the last two decades, with the percentage of children aged 12–23 months who have received their basic vaccination increasing from 23 percent in 2008 to 44 percent in 2021.[*4,5] However, additional efforts will be needed if Nigeria is to reach its national target of 80 percent coverage of all routine antigens by 2028.[†,6] As of 2022, there were an estimated 2.2 million children in Nigeria who had not been immunized (also known as zero-dose [ZD] children), the second largest population of ZD children in the world.[7,8]

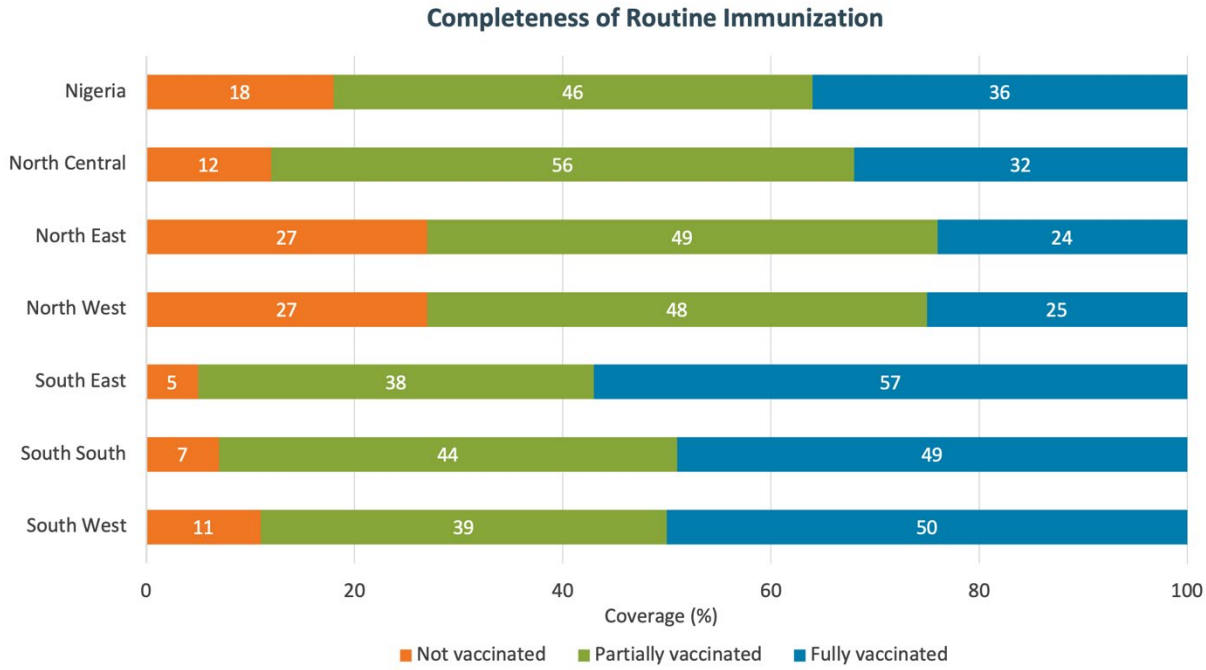
Based on figures from the 2021 Multiple Indicator Cluster Survey/National Immunization Coverage Survey (MICS/NICS), 70 percent of children aged 12–23 months had received the first dose of the pentavalent vaccine, or Penta1—a marked increase from the 2016/17 MICS/NICS results which found that 49 percent of children in the same age category had received Penta1.[‡,5] The vaccination coverage of other antigens varies, ranging from 78 percent for the first dose of the oral polio vaccine to 38 percent for the second dose of a measles-containing vaccine. As shown in Figure 1, only 36 percent of Nigerian children aged 12–23 months had received all the recommended vaccinations while 18 percent of children in the same age range had not received any vaccinations. RI performance varies across the country's regions: the South East and South South regions show high RI performance, while the North East and North West record the highest percentages of unvaccinated and partially vaccinated children.

[*] Both the Demographic and Health Survey and the Multiple Indicator Cluster Survey (which serves as Nigeria's National Immunization Coverage Survey) define basic vaccination as a child age 12–23 receiving the BCG vaccine, three doses of DTP-HepB-Hib, three doses of the polio vaccine, and one dose of measles.

[†] According to the Nigeria Strategy for Immunisation and PHC System Strengthening (NSIPSS), this target will be measured by the annual Penta 3 coverage. It should be noted that the certain sections of the strategy also refer to achieving an average national coverage of Penta 3 of 84 percent.

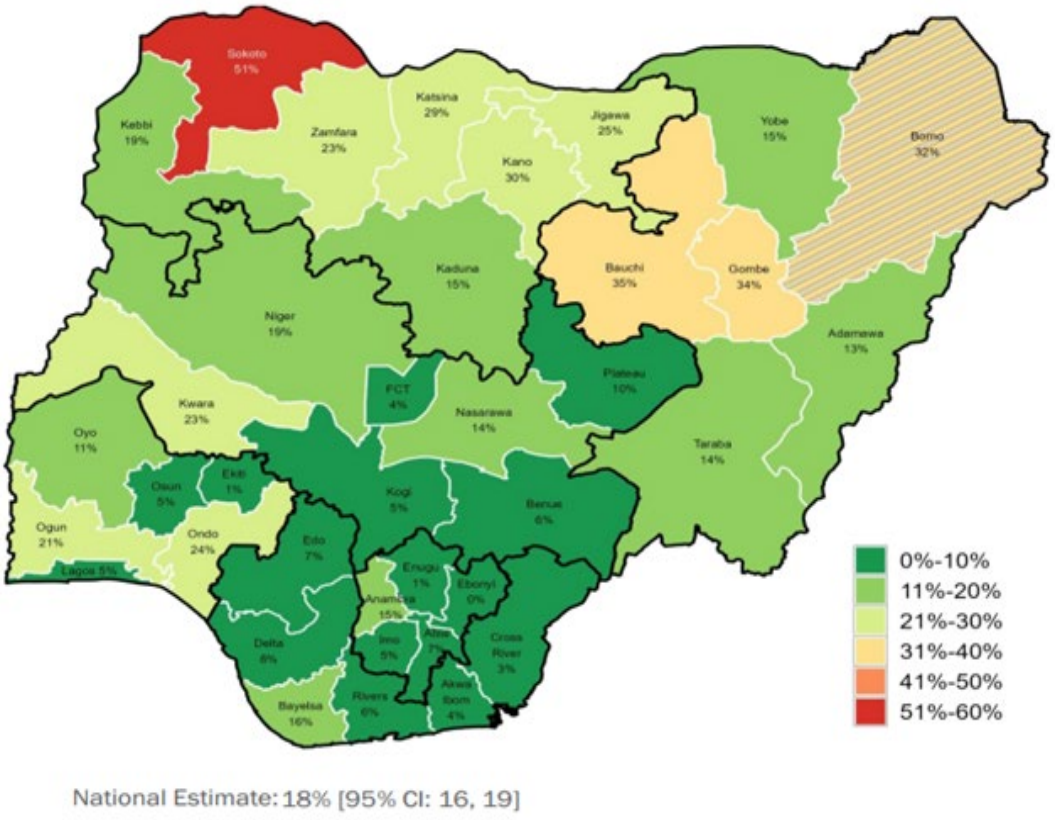
‡ Operationally, Gavi defines a ZD child as one who has not received a single dose of a diphtheria, tetanus, and pertussis-containing vaccine. Nigeria administers the Pentavalent (Penta) vaccine, which protects against diphtheria, tetanus, pertussis, hepatitis B, and Haemophilus influenzae type b (Hib). In Nigeria and for the purposes of this analysis, ZD children are defined as children who have not received a single dose of the Penta vaccine series.

Figure 1. Completeness of Routine Immunization (RI) at the National and Regional Levels in Nigeria, MICS/NICS 2021



The 2021 MICS/NICS mapped ZD populations in Nigeria based on the survey coverage data. Figure 2 below illustrates ZD prevalence by state, showing the highest prevalence of ZD children in the North West, followed by the North East and North Central.

Figure 2. Prevalence of Zero-Dose Children by State, MICS/NICS 2021 National Immunization Coverage Survey (NICS): Zero-Dose Brief



Through collaboration with partners and additional support from the University of Southampton, the National Primary Healthcare Development Agency (NPHCDA) under the Federal Ministry of Health (FMOH) has estimated ZD prevalence at the local government area (LGA) level and developed criteria to prioritize LGAs for intervention. States have been categorized into tiers based on priority for intervention under the National Immunization Recovery Plan:

- **Tier 1:** High priority: 100 LGAs across 18 states with 1,589,315 ZD and under-immunized (UI) children who will be targeted in Year 1.
- **Tier 2:** Medium- and low-medium priority: 289 LGAs across 20 states have a medium- and low-medium ZD children burden and will be targeted for intervention starting from Year 2 of implementation of the Immunization Recovery Plan (while continuing the interventions in the highest priority 100 LGAs).
- **Tier 3:** Low priority: the remaining 385 LGAs will be targeted in Year 3 concurrently with the interventions initiated in the first two years.

EFFECTS OF COVID-19 ON VACCINATION EFFORTS AND COVERAGE RATES

Although WHO and UNICEF estimates show that the national coverage estimates of Penta1 and Penta3 stayed the same or increased between 2019 and 2021, several studies have demonstrated the effects of the COVID-19 pandemic on childhood immunization.[9,10,11,12,13] The WHO estimates that 6.2 million children missed out on receiving basic vaccinations during the three years of the pandemic, indicating that although the country prevented further declines in national immunization coverage, disruptions in access to immunizations services resulted in an uptick in the number of ZD and UI children.[9,14] These disruptions were found to be significant in the first months of the pandemic.[11] A study from Shapira et al. estimated the number of children nationally who received a Penta3 vaccine decreased nine percent between March and July 2020. The decrease could be a result of restrictions on movement, which would have affected outreach and mass vaccination campaigns. Caregivers also reported challenges in accessing maternal and child health services due to lockdowns, health worker shortages, and fear of contracting COVID-19.[9,10]

To address the challenges brought on during the pandemic and accelerate efforts to reach ZD children, Nigeria is one of the 20 countries targeted in "The Big Catch-Up." This is a global initiative to reverse the declines in immunization coverage during the COVID-19 pandemic by reaching children who missed their vaccinations during 2019–2022, restoring current vaccination coverage for the 2023 birth cohort, and using primary health care approaches to strengthen immunization systems.[15] Identifying and reaching these children with immunization services will be paramount if Nigeria is to reach both its national and SDG targets for immunization coverage.

ZERO-DOSE LEARNING HUB

Gavi's Zero-Dose Learning Hub (ZDLH) is responsible for highlighting the work conducted by the four Gavi Country Learning Hubs (CLH) in Bangladesh, Mali, Nigeria, and Uganda with the objective of using this evidence to better understand the factors influencing the implementation and performance of approaches to identify and reach ZD and UI children as well as missed communities. The ZDLH consortium, led by JSI in partnership with the International Institute of Health Management Research (IIHMR) and The Geneva Learning Foundation (TGLF), aims to support the country learning hubs to implement the identification, reach, monitoring, measurement, and advocacy (IRMMA) framework; facilitate sharing and learning across the country learning hubs; contribute evidence to capture, synthesize, and disseminate the breadth of learning across the Alliance; and ultimately improve immunization equity and reduce the number of ZD and UI children globally by facilitating quality evidence generation and uptake.

In Nigeria, the CLH is implemented by African Field Epidemiology Network (AFENET) and Africa Health Budget Network (AHBN) and works to establish a structured framework that enables the timely generation of evidence from the implementation of IRMMA interventions and, in turn, guide program implementation, shape policies, foster accountability, and ensure sustainability. The AFENET-AHBN consortium works across four states in Nigeria: Kano and Sokoto located in the North West and Borno and Bauchi located in the North East. These states were selected because they contain 49 of the 100 LGAs prioritized by the National Emergency Routine Immunization Coordination Center (NERICC) for targeted and enhanced immunization programming based on their estimated number of ZD children. As such, they fall within Tier 1 priority states which will be targeted for intervention in Phase 1 of the

ZD Immunization Recovery Plan. In the four targeted states, AFENET prioritized eight LGAs for a rapid assessment of immunization actors, programs, and data systems at the local level which was carried out in October-November 2023.

Figure 3. Nigeria CLH Prioritized LGAs

#	States	Prioritized LGAs	Estimated Population of Zero-dose	Urban	Rural	IDPs Camps	Fragile
1	Bauchi	Bauchi	20,554	✓			
		Ganjuwa	15,039		✓		✓
2	Borno	Maiduguri	28,513	✓		✓	✓
		Jere	25,831	✓		✓	✓
3	Sokoto	Wammako	9,548	✓			✓
		Tambuwal	11,836		✓		✓
4	Kano	Kumbotso	12,650	✓			
		Sumaila	8,043		✓		✓

This situation analysis investigates the existing data collection, analysis, and reporting systems in the four priority states where the Nigeria CLH will be focusing its efforts – Kano and Sokoto in the northwest and Borno and Bauchi in the northeast – to understand any bottlenecks and lags in producing data about reaching ZD children in a timely manner for use at subnational levels and for reporting to the national level and to Gavi. In addition to generating and documenting evidence on the status of ZD children in Nigeria, this document will identify critical program barriers which must be addressed to ensure programs can successfully reduce the number of ZD children.

METHODS

This situation analysis draws on a desk review of selected literature and analyses of secondary data sources. The ZDLH team conducted the desk review to identify existing policy literature, project documents, and reports related to immunization, including information on data sources and systems for routine childhood immunization and other vaccination campaigns in Nigeria. The desk review consisted of targeted searches of the Nigerian FMOH and partner websites, including the World Health Organization (WHO), Gavi, UNICEF, and the World Bank. The ZDLH team also reviewed data sources and systems used to collect and analyze routine and periodic data and consulted data managers from the FMOH and partner organizations for further insight on how and how often these data are collected and used.

Where gaps in information remain, the team has relied on input from AFENET and will conduct key informant interviews with government stakeholders and partner organizations as part of the complementary political economy analysis that is forthcoming.

The secondary analyses used data from the national DHIS2 for 2018–2023 to generate estimates of ZD children in the four states and eight LGAs where the Nigeria CLH will be focusing implementation efforts. The ZDLH team plans to triangulate these findings with subnational data from the recent Performance Assessment for Programme Management and Action-Lot Quality Assurance Sampling (PAPA-LQAS) survey, conducted by NERICC, when that data becomes available for analysis. The team also conducted equity analyses at the state level using the Nigerian Demographic and Health Survey (DHS) from 2018 to analyze coverage for Bacillus Calmette–Guérin (BCG), DPT1, and measles in the AFENET priority states by demographic characteristics (residence, sex, wealth quintile, mother's education, and ethnicity).

RESULTS

DESK REVIEW

Table 1 shows a list of current and past national policies and strategy documents that guide the planning, organization, delivery, and monitoring and evaluation of immunization services in Nigeria. The Nigeria Strategy for Immunization and Primary Health Care System Strengthening (NSIPSS) and its complementary 2021–2024 NSIPSS 2.0 currently serve as the key documents outlining immunization-related priorities and programming in the country. Developed in 2017 by the NPHCDA under the FMOH in collaboration with a host of other government agencies and implementing partners, NSIPSS is 10-year strategy document that defines the country's plan to transition from Gavi support while working towards achieving a minimum of 80 percent equitable and sustained national immunization coverage for all antigens by 2028. To achieve this goal over the 2018–2028 period, the NSIPSS lays out key strategies for Nigeria's immunization and broader primary health care (PHC) system, along with accountability and monitoring and evaluation frameworks, while recognizing important challenges and lessons learned from past efforts in Nigeria. The NSIPSS' major objectives include developing sustainable and targeted strategies to improve equitable immunization coverage. The NSIPSS also aims to establish a framework to guide investments and foster mutual accountability among relevant government stakeholders, donors, and partners; to monitor and evaluate the impact of implemented strategies on immunization coverage; and to guide transitions from donor- to country-funded immunization programming.[5]

The NSIPSS includes an accountability framework developed to ensure that all stakeholders including the federal, state, and local governments, as well as donors and partners, fulfill their commitments in accordance with Gavi's "principles of engagement." The Gavi board set forth these essential principles to govern their collaboration with Nigeria and foster both financial and programmatic accountability. These principles include:

- Demonstrated commitment from the government, involving yearly increases in the health sector budget to sustain gains in immunization coverage beyond Gavi support.
- Development of a realistic transition plan aimed at achieving sustainable coverage and equity with a programmatic emphasis on reaching the most underserved and disadvantaged areas, particularly those with the lowest immunization rates.
- Engagement of stakeholders to ensure enduring implementation of the initiatives.
- Heightened attention to states with lower immunization performance and those with high numbers of ZD children.
- Establishment of mechanisms to facilitate rapid learning and the adoption of successful practices.
- Identification and mitigation of potential risks that could impede successful implementation.[5]

The complementary and updated NSIPSS 2.0 developed for the period of 2021–2024 provides a three-year roadmap for strengthening immunization programming based on experiences from and the

progress made in the first three years of the 2018–2028 NSIPSS, as well as to reposition the NSIPSS in the context of the COVID-19 pandemic and updated global immunization agendas (Immunization Agenda 2030 and Gavi 5.0).[16] The NSIPSS 2.0 also includes a revised national goal of achieving RI coverage of 90 percent for all antigens in at least 90 percent of LGAs. It also includes specific objectives to reduce the number of UI children by 20 percent by 2024 based on Penta3 coverage and the number of ZD children by 35 percent based on Penta1 coverage. Reducing the number of ZD children is considered in all of the objectives, strategies, and activities outlined in the strategy. Specific strategies for improving access to and use of immunization services for ZD children and missed communities include optimized integrated reproductive, maternal, newborn, child, and adolescent health, and nutrition (RMNCAH+N) and immunization sessions; a geospatial microplanning toolkit; and an integrated medical outreach program, among others. The NSIPSS 2.0 also considers the country's ZD reduction strategy and specifically mentions interventions to reach ZD children in humanitarian contexts, including those in areas affected by conflict.

Table 1. National Policy and Strategy Documents Relevant to Immunization

Policy/Legislation	Year/s	Summary
Nigeria Strategy for Immunisation and PHC System Strengthening (NSIPSS)	2018–2028	The government's 10-year plan to improve and sustain immunization coverage and strengthen PHC service delivery. It also includes Nigeria's plan to transition the financial ownership of the immunization and PHC system in line with its graduation from Gavi support. The plan also establishes immunization objectives, including increasing the national coverage of Penta3 to 84 percent, and strategies for system improvement ranging from leadership and accountability to data systems.
Nigeria Strategy for Immunisation and PHC System Strengthening Version 2.0 (NSIPSS 2.0)	2021–2024	The NSIPSS 2.0 is a companion document to the 2018-2028 NSIPSS that provides a short-term, three-year roadmap for reducing the number of ZD children and optimizing RI in Nigeria based on the first three years of 2018-2028 NSIPSS implementation and shifts in the local and global immunization agenda, particularly following the COVID-19 pandemic. It presents a new target of at least 90 percent coverage for all antigens in the country 2024, as well as updated objectives related to key health system functions, such as leadership and governance and service delivery.
Second National Strategic Health Development Plan (NSHDP II)	2018–2022	The NSHDP II is the Government of Nigeria's comprehensive plan for health service delivery and systems strengthening. The plan builds upon the successes and challenges of NSHDP I (2010–2015) and aims to achieve universal health coverage. It includes strategic objectives and interventions for 15 priority areas organized under four strategic pillars. Several of these areas address immunization, including child health services and communicable diseases.
Nigerian Vaccine Policy	2021	Nigeria's first ever vaccine policy has the overall goal of encouraging the local production of vaccine to ensure self-sufficiency in vaccine availability. Developed by the Department of Food and Drug Services as a result of the COVID-19 pandemic, the policy details the objectives, targets, and implementation strategies to achieve local vaccine production and ownership of the vaccine supply chain.

National Health Policy	2016	Following policies developed in 1988 and 2004, the 2016 National Health Policy provides a framework to operationalize the National Health Act to enable the country to attain universal health coverage. It details the goals, objectives, and initiatives needed to strengthen the health system, particularly focusing on PHC and including interventions related to immunization and vaccine-preventable diseases.
National Health Act	2014	The National Health Act serves as the legal framework for the regulation and management of the health system in Nigeria. It sets standards and regulations for health care, including its basic organization. The Act also formally establishes the Basic Health Care Provision Fund to be used to provide a basic minimum package of health services, essential drugs and vaccines, facility and equipment maintenance, and human resources for health.
Minimum Standards for Primary Health Care in Nigeria	2015	This document, developed by the National Primary Health Care Development Agency, formally establishes the standards for PHC to enable the management of health services and improve quality of care. It includes guidelines on health infrastructure, human resources for health, and service provision for facilities at the LGA level, including which providers can administer immunizations and support immunization activities.
Primary Health Care under One Roof Policy	2011	The policy drives PHC implementation in Nigeria by providing a framework for integrating all PHC services under one authority and single management body. It formally mandates states to establish State Primary Health Care Boards (or Agencies) who are responsible for managing PHC, as well as LGA Health Authority Management Teams and Advisory Committees.

Existing Strategies to Target and Reduce ZD Children in Nigeria

Optimized Integrated Routine Immunization Session (OIRIS)

The NERICC was established as an arm of the NPHCDA in 2017. Prior to its establishment, Nigeria's Penta3 immunization coverage was low (33 percent), according to the 2016/2017 MICS/NICS report, and fluctuated significantly over the previous decade, with the majority of states with low immunization coverage located in the Northern region. The NERICC team prioritized 18 poor-performing states (Sokoto, Jigawa, Kaduna, Kano and Katsina, Borno, Gombe, Bauchi, Adamawa, Yobe, Zamfara, Kebbi, Kogi, Taraba, Nasarawa, Niger, Bayelsa, and Plateau) for implementation of strategic interventions.

To address poor performance, the NERICC and partners developed the Optimised Integrated Routine Immunization Session (OIRIS) strategy.[17] OIRIS is a multi-pronged, system-wide strategy for improving RI in poor performing areas. It focuses on improving the effectiveness and efficiency of fixed and outreach RI sessions and integrating these sessions into other PHC services to provide clients the opportunity to receive a wide range of interventions during their clinic visits.

The five key pillars of OIRIS are optimized RI sessions, integration of RI with other services, intensified RI supportive supervision, ownership, and accountability.[13] Through OIRIS, states and LGA health workers and managers are optimizing fixed and outreach immunization sessions by removing barriers to access.

Nigeria Zero-Dose Immunization Recovery Plan (2023–2028)

Guided by the Immunization Agenda's 2030 framework for action and the need to rebuild immunization programming in the wake of COVID-19 while focusing on reaching ZD children and missed communities, countries have been tasked to develop individual Immunization Recovery Plans.

The Nigeria ZD Immunization Recovery Plan (2023–2028) aims to catch-up, restore, and strengthen immunization services in the country.[18] It includes evidence-based strategies aimed at increasing immunization coverage while reducing the number of ZD children. Its goals are to achieve a 30 percent reduction (750,000 children) in the cumulative number of ZD children by the year 2025 and a 50 percent reduction by the year 2028. Achieving the 2028 goal in Nigeria would contribute to a six percent reduction of ZD children globally.[11]

Specific objectives included in the Nigeria ZD Immunization Recovery Plan include catch-up immunization efforts targeting children who were missed during the COVID-19 pandemic from 2019 to 2022, with a minimum of 50 percent reached through multi-antigen periodic Intensification of Routine Immunization; dedicated large campaigns and other interventions; and restoration of the full range of immunization delivery services (including outreach, new vaccine introduction, and supplemental immunization activities [SIAs]) to mitigate further backsliding; The plan also aims to reach ZD children by bolstering community and primary health care services while also expanding immunization activities and making them more efficient.[11]

Data Systems and Sources

The following section provides an overview of various routine and periodic data sources that collect, capture, and report data on ZD, including details related to which entity or organization manages the data system and how; frequency of data collection and reporting; level of disaggregation; any known data quality issues; availability/accessibility of data; and use of data or use cases. This situation analysis includes information on the DHIS2, short message service (SMS), Nigeria Demographic Health Survey (NDHS), Performance Assessment for Programme Management and Action-Lot Quality Assurance Sampling (PAPA-LQAS), Multiple Indicators Cluster Survey/National Immunization Coverage Survey, and WHO and UNICEF Estimates of National Immunization Coverage (WUENIC).

District Health Information Software 2 (DHIS2)

DHIS2 is an open-source software platform used for reporting, analysis, and dissemination of data across health programs. In Nigeria, DHIS2 is used to report monthly administrative data and captures data at the LGA level. DHIS2 is the most widely used reporting platform, tracking approximately 1,000 data elements, and generates a total of 85 summary indicators in Nigeria.[19,20] All health facilities offering RI are required to send monthly reports that LGA officers enter into DHIS2. The DHIS2 RI module is an online platform to enter, store, and analyze RI data from all health facilities in Nigeria that offer these services. The RI dashboard incorporates 20 indicators from the Accountability Framework for Routine Immunization in Nigeria to monitor the EPI performance and process at each health facility. Some of the ZD-related indicators captured by the DHIS2 RI module include coverage and dropout rates, number of RI vaccination sessions, number of supervisions, and disbursement of RI funding to health facilities. DHIS2 additionally houses information on vaccine logistics, stock management, and cold chain functionality in an effort to integrate logistics data management with the national HMIS as a single source for program planning and policy making.

Despite the improvement in the scalability of the DHIS2, some of its drawbacks include untimely reporting on the DHIS2, especially at the facility level.[21,20] This may be a result of the lack of reliable internet connectivity and high staff turnover, leading to poor DHIS2 management skills at the LGA level. Additionally, inefficient management of the list of health facilities that offer RI has resulted in underreporting of vaccine coverage. To address unreliable internet connections, NPHCDA, in partnership with AFENET, introduced an SMS reporting system in 18 states to ensure RI data could be transmitted to the national level.

Short Message Service (SMS)

The SMS is an electronic database which serves as a real-time aggregator for RI implementation across 18 NERICC priority states in Nigeria: Adamawa, Bauchi, Borno, Bayelsa, Gombe, Jigawa, Kaduna, Kebbi, Kano, Kogi, Katsina, Nasarawa, Niger, Plateau, Sokoto, Taraba, Yobe, and Zamfara.[22] The database generates reports at the health facility level using simple alphanumeric texts to document selected immunization antigens. It tracks various parameters daily, including the number of planned and conducted fixed and outreach sessions, Penta1 and Penta3 vaccines administered, number of supervision sessions, and vaccine stockout.

On a monthly basis, RI performance in Nigeria is documented through reports from the SMS, which are reported on both the DHIS2 and SMS platforms. Data from these platforms are downloaded at the end of each month. The SMS reporting system offers insights into the RI system's performance and implementation, providing valuable feedback at the national and sub-national levels. Additionally, the SMS reporting system compares data from the DHIS2 and the SMS. A NPHCDA RI performance feedback report for April-June 2023 highlighted significant disparities between SMS and DHIS2 data in nine states on the number of children vaccinated with Measles1 and the number of fixed sessions conducted. Notably, Plateau, Nasarawa, and Katsina states reported higher numbers on SMS than the DHIS2 platform for children immunized and fixed and outreach sessions conducted.

Nigeria Demographic Health Survey (NDHS)

The NDHS is implemented by the National Population Commission in collaboration with the National Malaria Elimination Programme of the Nigerian FMOH, with funding from (USAID, Global Fund, Bill and Melinda Gates Foundation (Gates Foundation), the United Nations Population Fund (UNFPA), and WHO. The NDHS is conducted every five years and collects information on demographic and health indicators with a focus on children between 0–59 months. The previous NDHS was conducted in 2018, and field work and data collection for the 2023 survey will commence in October 2023.

The sample for the 2018 NDHS was selected using a stratified, two-stage cluster design and included a representative sample of approximately 42,000 households. The 2018 Nigeria DHS survey marked a significant milestone as it was the first time the survey employed computer-assisted personal interviewing (CAPI), resulting in more readily available data compared to previous surveys. The use of CAPI also contributed to enhancing the data's overall quality. Interested parties can access the survey data on the USAID Demographic and Health Survey Program website. The survey effectively covered 1,389 clusters, although 11 clusters were excluded due to deteriorating law-and-order situations during fieldwork. These areas were in Zamfara (four clusters), Lagos (one cluster), Katsina (two clusters), Sokoto (three clusters), and Borno (one cluster). In the case of Borno, 11 of the 27 LGAs were dropped due to security risks.

Performance Assessment for Programme Management and Action-Lot Quality Assurance Sampling (PAPA-LQAS)

The NPHCDA employs a household survey that adapts the principles of LQAS to assess the quality of RI and RMNCAH+N performance. The PAPA-LQAS survey uses age-specific indicators and focuses on three cohorts of children (0–11 months, 12–23 months, and 0–5 years), providing valuable insights for informing intervention strategies.

The PAPA-LQAS has been conducted quarterly since the last quarter of 2017, initially targeting RI indicators, and later expanded to include RMNCAH+N and malaria indicators. The integrated PAPA-LQAS is conducted in all 36 states and the Federal Capital Territory, with all LGAs in each state selected for implementation. Currently, the available information on the LQAS methodology used in Nigeria is incomplete. NPHCDA prepared a concept note prepared that indicates that specific clusters or settlements for the survey within each LGA are determined using probability proportional to size sampling where the probability of selecting a cluster is proportional to its size. Each cluster's sample size is 10 children for each of the three different age cohorts, resulting in total sample size of 60 eligible children (and their mothers) for each cohort in each LGA. However, more information is needed to understand the error terms, decision rule, and design effect associated with these sample sizes as well as the approach used for classifying and prioritizing the indicators at the LGA level.

The PAPA-LQAS includes several indicators related to ZD, such as the proportion of children (0–11 months) surveyed who are ZD; the proportion of children aged 9–11 months with no dose of any antigen; and the proportion of eligible children in the 0–11 months age group vaccinated with the first, second or third dose of the rotavirus vaccine. While the PAPA-LQAS data are not currently available on any platform, a summary of quarterly findings is shared with key stakeholders, including the Gates Foundation, WHO, Centers for Disease Control and Prevention (CDC), AFENET, World Bank, UNICEF, LGA and state governments, and at the health facility level. It is unclear the extent to which recommendations for improvements based on PAPA-LQAS findings are communicated and adopted at the health facility level. Any additional information uncovered through the forthcoming ZD political economy analysis will be added to this situation analysis.

Multiple Indicators Cluster Survey/National Immunization Coverage Survey

The MICS/NICS are combined surveys conducted by the National Bureau of Statistics as part of the Global MICS Programme.**Error! Bookmark not defined.** UNICEF provides technical support, with government funding and financial support from UNICEF, Gavi, and the Gates Foundation.

MICS/NICS collects data on vaccination coverage provided through the health system, in addition to information on child mortality; health; nutrition; water, sanitation, and hygiene; education; child and social protection; and women's health care and empowerment.[23] In 2016, the MICS sample was not sufficient to estimate vaccination coverage for children ages 12–23 months, so a supplemental data collection, known as the NICS, was undertaken in twenty states: Abia, Akwa Ibom, Anambra, Bayelsa, Benue, Cross River, Delta, Edo, Ekiti, Enugu, Imo, Kogi, Kwara, Ogun, Ondo, Osun, Oyo, Plateau, Rivers, and Abuja.[24] Since 2017, the NICS has been incorporated into the MICS.

The combined MICS/NICS is carried out every three years. Data from the survey is made available on the National Bureau of Statistics portal. The 2021 MICS used CAPI. The total target sample size for the 2021 MICS was 1,850 clusters and 37,000 households. A supplemental sample of 337 clusters and 6,740 households was selected for NICS. Only the household questionnaire and child immunization module

of the questionnaire for children under five were administered for this survey to increase the combined sample of children and improve the level of precision for the immunization indicators.

Since the introduction of CAPI devices in the 2016/2017 MICS, the quality of data collected has improved, as mentioned during consultations with UNICEF regional and headquarters office staff. One of the challenges of the MICS/NICS is insecurity in some parts of the country in the sample clusters. For example, in the 2021 MICS, 128 enumeration areas could not be visited because they were inaccessible; of these 95 enumeration areas were from the MICS sample and 33 from the supplemental NICS sample.

WHO and UNICEF Estimates of National Immunization Coverage (WUENIC)

WHO and UNICEF conduct an annual collaborative review of reports submitted by the Nigerian government on national immunization coverage, along with finalized survey reports and data from published and grey literature. They consider potential biases and consult local experts and, based on these considerations, jointly estimate the most likely coverage levels for Nigeria. The WUENIC relies on data and information of varying quality, some of which may be unknown. WUENIC data sources include administrative coverage, official coverage, and survey coverage.[25] Administrative coverage is reported by the FMOH and NPHCDA, based on aggregated administrative reports (e.g., DHIS2) from health service providers, and includes the number of vaccinations administered (numerator data) and reported target population data (denominator data). Both the numerator and denominator data may be inaccurate as a result of poor-quality recording or reporting, large population movements, underestimated population growth, and/or other factors.

Official coverage represents the estimated coverage reported by FMOH and NPHCDA, reflecting their assessment of the most likely coverage based on a combination of administrative coverage, survey-based estimates, and other data sources or adjustments. Survey coverage is derived from population-based household surveys like NDHS and PAPAS-LQAS, targeting children aged 12–23 months or 24–35 months. These surveys review methods and results, collecting vaccination history from documented evidence or caregiver recall. The information obtained is applied to the appropriate birth cohort based on the period of data collection.

WUENIC captures several ZD-related indicators, including the percentage of births who received one dose of BCG vaccine, the percentage of surviving infants who received the first and third dose of DPT, the percentage of surviving infants who received the first dose of measles-containing-vaccine, the percentage of births that received a dose of hepatitis B vaccine within 24 hours of delivery, the percentage of surviving infants who received the third dose of polio containing vaccine.

Supplementary Immunization Activities (SIAs) for Measles

Despite substantial advancements in reducing morbidity and mortality associated with measles, the disease remains prevalent in various regions in Africa. SIAs are recognized as a crucial strategy to attain the WHO recommendation of 95% coverage rate with two doses of measles-containing vaccine and achieve the worldwide goal of eliminating measles by 2030.[26] Given the recurrence of measles outbreaks across Nigeria, the country has been implementing SIAs periodically since 2005 to bolster the immunity of the population against measles and ultimately eradicate the disease.[27] These SIAs can either be standalone campaigns or integrated with other initiatives. State and local governments develop microplans to accurately determine the target population and allocate resources accordingly. Administrative data also plays a pivotal role in monitoring the number of vaccinated children, the use of vaccines, and the availability and functionality of the cold chain. This data, especially when combined with supervisory and monitoring information, is instrumental in identifying the need for corrective actions during the SIAs.

SECONDARY DATA ANALYSIS

ZD ESTIMATES

The ZDLH team analyzed administrative data from 2018–2023 obtained through DHIS2 to extract the number of children vaccinated with Penta1 and Penta3 and subsequently calculate the Penta1 coverage rates, estimate the percentage of unimmunized or ZD children and compute the dropout rate from Penta1 to Penta3. We retrieved LGA-level population estimates of children under one year of age from DHIS2, which accounted for four percent of the total population of a given LGA. Total population projections for each year were calculated in DHIS2 by applying state-specific growth rates. Tables 2–5 below capture our findings for the four AFENET states, with the column for 2023 comprising pro-rated data from January through May of that year.

Table 2. Bauchi State Immunization Coverage Rates using DHIS2 Data from 2018–2023

State	Year	2018	2019	2020	2021	2022	2023*
Bauchi	Target	364,647	377,045	389,865	403,120	416,826	430,998
	Penta1	238,296	244,169	241,724	235,738	286,009	139,228
	% Coverage	65	65	62	58	69	32
	% Unimmunized	35	35	38	42	31	68
	Penta3	210,024	223,664	225,234	217,900	265,309	124,790
	Diff	28,272	20,505	16,490	17,838	20,700	14,438
	% Drop Outrate	12	8	7	8	7	10

*Available data for 2023 is from January–May.

In Bauchi, DHIS2 data reveal that the percentage of children who did not receive Penta1 was highest at 42 percent in 2021; while the dropout rate was highest in 2018 at 12 percent.

Table 3. Borno State Immunization Coverage Rates using DHIS2 Data from 2018–2023

State	Year	2018	2019	2020	2021	2022	2023*
Borno	Target	135,556	140,165	144,931	149,858	154,953	160,222
	Penta1	348,947	310,417	243,791	231,002	268,055	126,416
	% Coverage	257	221	168	154	173	79
	% Unimmunized	-157	-121	-68	-54	-73	21
	Penta3	303,647	276,142	218,167	204,891	242,907	113,801
	Diff	45,300	34,275	25,624	26,111	25,148	12,615
	% Drop Out rate	13	11	11	11	9	10

*Available data for 2023 is from January–May.

Borno surpassed its coverage targets from 2018 to 2022 and is on track to do the same in 2023, having recorded 79 percent coverage at the end of May 2023. The dropout rate for Penta3 was highest in 2018. Coverage rates of over 100 percent are likely a result of underestimated target population estimates, especially since Nigeria's last national census dates from 2006. Population projections can be inaccurate, in part because they typically apply uniform growth rates based on national estimates of birth, death, and migration, thereby failing to capture growth rate disparities.[28]

Table 4. Kano State Immunization Coverage Rates using DHIS2 Data from 2018–2023

State	Year	2018	2019	2020	2021	2022	2023*
Kano	Target	696,139	719,112	742,842	767,356	792,679	818,837
	Penta1	477,393	519,060	536,208	571,587	607,595	260,413
	% Coverage	69	72	72	74	77	32
	% Unimmunized	31	28	28	26	23	68
	Penta3	434,986	488,120	510,422	546,778	876,523	246,775
	Diff	42,407	30,940	25,786	24,809	-268,928	13,638
	% Drop Out rate	9	6	5	4	-44	5

*Available data for 2023 is from January–May.

With the exception of 2023, the highest number of ZD children was recorded in 2018, with declining numbers yearly in Kano State. The Penta3 dropout rate was also highest in 2018. In 2022, Penta3 coverage was noted to be significantly higher than Penta1, which might indicate issues with data quality.

Table 5. Sokoto State Immunization Coverage Rates using DHIS2 Data from 2018–2023

State	Year	2018	2019	2020	2021	2022	2023*
Sokoto	Target	230,857	237,783	244,916	252,264	259,832	267,627
	Penta1	175,402	166,450	632,313	180,236	200,716	74,688
	% Coverage	76	70	258	71	77	28
	% Unimmunized	24	30	-158	29	23	72
	Penta3	156,196	151,244	580,565	167,276	179,975	67,648
	Diff	19,206	15,206	51,748	12,960	20,741	7,040
	% Drop Out rate	11	9	8	7	10	9

*Available data for 2023 is from January–May.

Apart from 2023, the highest number of ZD children in Sokoto was recorded in 2019 (30 percent). Penta3 dropout rate was highest in 2018. Further disaggregation of coverage to the LGA level will be useful in identifying the LGAs contributing the highest numbers of unimmunized with Penta1 or ZD children and provide an evidence-base from which tailored interventions can be developed and implemented.

ZD Estimates in AFENET Priority States and LGAs

We estimated the number of ZD children under one year of age and across the four AFENET priority states and LGAs from 2018 through 2022. We used population estimates at the LGA level, which were established by a national body (e.g., NERICC and other technical partners) through census, GIS, and other national administrative data, and data from DHIS2 to determine the number of ZD children.

The results shown in Table 6 suggest that Borno state had a negative number of ZD children across all time points. Additionally, both LGAs in Kano had negative ZD estimates at several time points, though these numbers were more modest than those found in Borno. A negative number of ZD children indicates an error either in the documentation of the number of children receiving Penta1 vaccines (numerator) or in the estimates of the total number of children (denominator).

In 2018, ZD children in Bauchi, Sokoto, and Kano made up 40 percent of the total population of ZD children in Nigeria compared to 24 percent in 2022, based on DHIS2 data analysis. Of the four priority states, Kano has had the highest population of ZD children since 2018. There are no clear trends when looking at ZD totals across all states and LGAs. Sokoto, Bauchi, and their respective LGAs experienced an increase in the number of ZD children between 2020 and 2021, indicating that they may have been impacted by the COVID-19 pandemic. Each state and LGA, other than Wamakko and Tambuwal, experienced a subsequent ZD decline in 2022. ZD totals in both Wamakko and Tambuwal have increased steadily since 2018, with particularly significant increases in Wamakko from 2018 to 2020.

Table 6. Estimated Population of ZD Children in AFENET Priority States, LGAs, and Nationally, DHIS2 2018-2022

	Year				
	2018	**2019**	**2020**	**2021**	**2022**
Bauchi State	126,351	132,876	145,501	161,942	122,409
Bauchi LGA	14,486	16,234	20,880	24,339	18,903
Ganjuwa LGA	9,856	10,667	10,190	10,965	7,409
Borno State*	-213,391	-170,252	-99,842	-83,166	-116,227
Maiduguri LGA	-30,569	-23,010	-14,858	-13,450	-10,088
Jere LGA	-25,420	-27,893	-16,731	-8,545	-14,729
Sokoto State	55,455	71,333	54,519	70,560	56,852
Wamakko LGA	16	251	1,221	1,405	2,584
Tambuwal LGA	3,545	4,344	4,612	5,251	5,301
Kano State	218,746	200,052	202,320	186,881	171,351
Kumbotso LGA*	2,942	2,710	2,022	506	-745
Sumaila LGA*	507	-1,293	-471	3	-598
National	1,008,216	960,809	1,475,066	1,925,295	1,459,293

*Indicates states or LGAs with negative zero-dose estimates.

Equity Factors Influencing ZD Status in Nigeria

We analyzed MICS/NICS and NDHS data from 2021 and 2018, respectfully, to compare immunization coverage data by sociodemographic characteristics. Tables 7–9 present 2021 MICS data from three of the AFENET priority states (Bauchi, Kano, and Sokoto) for the number of children aged 12–23 months who received a vaccine (BCG, DPT1, and Measles1) at any time before the survey. While the 2021 MICS was conducted in all states in Nigeria, it was not representative at the state level in Borno, due to insecurity. Similar state-level analyses using 2018 DHS data are presented in Tables 10–13. If raw data from the recent PAPA-LQAS are made available and include sociodemographic variables, we will be able to carry out an equity analysis of vaccination coverage at the LGA level in the four states in future iterations of this Situation Analysis.

EQUITY ANALYSIS USING MICS 2021

Given small sample sizes at the state level, confidence intervals for the results are wide and most results are not statistically significant, but examining and reporting on general trends may be useful for informing programming efforts in the country.

Across the three states, immunization coverage for all antigens is higher in urban areas, when compared with rural areas. The greatest disparity between urban and rural coverage is seen in Sokoto; however, the population is largely rural, so urban sample sizes are particularly small. No clear trends emerge when looking at coverage by sex across the three states. Coverage across the three antigens is higher among female children in Bauchi and slightly higher among male children in Kano and Sokoto. Coverage by national wealth quintiles is difficult to interpret given that the majority of the populations in Bauchi, Kano, and Sokoto fall within the lower quintiles. With a few exceptions, immunization coverage tends to be higher among families with higher incomes. There is also a clear trend between immunization coverage and a mother's level of education. Children of mothers with primary or higher education report higher immunization coverage across antigens and states when compared with children with mothers who report no education. No clear trends emerge with regards to immunization coverage and ethnicity across the states or antigens.

When comparing the 2021 MICS/NICS data with the 2018 DHS data, the most obvious difference is that overall coverage is lower in 2021 compared with 2018 for all antigens at the state level. This may be the result of the COVID-19 pandemic, which briefly halted RI and outreach services in many states, resulting in missed opportunities for immunization, and is documented in the literature for Northern Nigeria.[§,29]

[§] The article cited focuses on Kaduna and Kano state and indicates that Penta1 coverage may have increased in Kano but that this may be an issue with data quality given that outbreaks of VPDs in the state and qualitative data suggest otherwise.

Table 7. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Bauchi State, MICS/NICS 2021

Bauchi					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		49.1	42.3	30.8	253
Residence	Rural	46.3	40.1	27.9	227
	Urban	73.9	62.7	57.4	25
Sex	Male	46	38.1	23.3	113
	Female	51.6	45.7	37	139
National Wealth Quintile	Poorest	38	32.3	25.5	125
	Poorer	57	51.4	31.2	79
	Middle	56.4	41.1	32.8	31
	Richer*	73.3	70.3	58.3	13
	Richest*	100	91.5	83.6	5
Mother's Education	None	40.4	32.8	22.3	186
	Primary or Higher	73.1	68.8	54.7	37
Ethnicity	Hausa	46.9	40.8	33.9	102
	Other	50.4	43.3	28.6	151

*Very small sample sizes (N<=20). Data should be interpreted with caution.

Table 8. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Kano State, MICS/NICS 2021

Kano					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		60.3	54.9	40.5	473
Residence	Rural	56.2	50.9	37	311
	Urban	68.3	62.7	47.1	162
Sex	Male	60.9	57.4	42.1	231
	Female	59.8	52.6	38.9	242
National Wealth Quintile	Poorest	40.7	41.9	32.3	118
	Poorer	58.1	46.8	33.6	160
	Middle	72	65	52	90
	Richer	69.3	68.7	32	62
	Richest	84.9	79.8	76.6	43
Mother's Education	None	53	48	32.6	260
	Primary or Higher	69.4	63.4	50.1	213
Ethnicity	Hausa	63.4	56.7	40.8	358
	Other	50.9	49.6	49.6	115

Table 9. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Sokoto State, MICS/NICS 2021

Sokoto					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		33.7	27.6	19.1	141
Residence	Rural	25.8	21	16.7	118
	Urban	74.7	61.9	31.5	23
Sex	Male	39.3	29.9	20.2	66
	Female	28.7	25.5	18.2	74
National Wealth Quintile	Poorest	15.3	12.9	8.5	79
	Poorer	41.4	47.2	37.4	24
	Middle*	59	39.1	35.6	20
	Richer*	87.5	87.5	52.8	6
	Richest*	74.7	39.2	10.1	12
Mother's Education	None	30.4	26.9	18.1	120
	Primary or Higher*	53.7	31.4	24.8	19
Ethnicity	Hausa	32.3	27.6	20.1	119
	Fulani	41.5	27.9	13.8	21

*Very small sample sizes (N<=20). Data should be interpreted with caution.

Equity Analysis Using DHS 2018

Tables 10–13 present immunization coverage (the number of children aged 12–23 months who received a vaccine at any time before the survey) for BCG, DPT1, and Measles1 in AFENET's four priority states by different background characteristics using DHIS 2018 data. For example, in Bauchi, 50 percent of children residing in rural areas received the BCG vaccine, while 69.1 percent of children in urban areas received the same vaccination. All four AFENET target states lag behind national average coverage rates on most antigens, with the lowest coverage among the four states found in Sokoto. BCG coverage ranged from 35.7 percent in Sokoto to 63.5 percent in Borno, compared with 67 percent nationally. Similarly, DPT1 coverage ranged from 24.7 percent in Sokoto to 59.7 percent in Kano, compared with 65.5 percent nationally. Measles coverage in Kano (56.1 percent) was slightly higher than the national average of 53.6 percent, but coverage in Sokoto was substantially lower at 19.1 percent.

We examined immunization coverage by residence, sex, wealth, mother's education, and ethnicity. In all four states and across all three antigens, coverage was lower in rural areas compared with urban areas. The differences in coverage between urban and rural areas were highest in Bauchi and Kano states. BCG and measles coverage in urban areas of Bauchi exceeded coverage in rural areas by 20 percentage points. Similarly, BCG and DPT1 coverage in urban areas of Kano exceeded coverage in rural areas by nearly 20 percentage points. Coverage was most equally distributed between rural and urban areas in Sokoto, but it should be noted that the urban sample size in Sokoto is low.

A clear trend does not emerge when looking at immunization coverage by child's sex across states. Within states, immunization coverage was largely equal with a few exceptions. Coverage was largely equal between male and female children in Bauchi, with the exception of measles, for which higher coverage was found among girls (40.1 percent) compared to boys (31.8 percent). The inverse was found in Borno, where measles coverage was slightly higher among male children (51 percent) than female children (42.6 percent). Coverage across the antigens was similar for male and female children across all antigens in Sokoto, but data from Kano indicated that BCG, DPT1, and measles coverage was slightly higher among female children compared with male children.

Analysis of immunization coverage by wealth quintiles indicate a number of trends across the states. Primarily, since the national wealth quintiles were used, the results demonstrate that the residents of the four AFENET priority states are, nationally, situated largely within the lowest three wealth quintiles. According to the 2018 DHS, nearly 90 percent of households in Sokoto and Bauchi fall within the lowest three national quintiles. Borno and Kano are slightly wealthier with 75–80 percent of households falling within the lowest three national quintiles. Wealth and coverage trends from the DHS indicate that across all three antigens, coverage improves with wealth. As noted above, sample sizes are smaller in the wealthiest two quintiles, so caution should be taken when interpreting the results. The most inequitable coverage was found in Borno and Kano, where immunization coverage in the poorest households lagged behind the wealthiest households by as much as fifty percentage points.

Immunization coverage by mother's education followed clear trends across antigens and states. Children from households where mothers had no education had lower immunization coverage rates for all antigens when compared to children from households where the mother completed primary school or higher. Overall, the greatest disparities were seen in Borno, Bauchi, and Kano for BCG and DPT1 immunizations. In Borno, for example, 48.3 percent of children of mothers with no education received the BCG vaccine compared with 92.4 percent of children of mothers who completed primary school or higher education. Disparities were less extreme in Sokoto, but the data are difficult to interpret due to small sample sizes.

Finally, we examined immunization coverage by ethnicity in the four priority states. All four states are located in the northern half of the country and are similar in that they include a substantial proportion of Hausa, particularly in Bauchi, Sokoto, and Kano. Fulani and Kanuri populations also live in communities of various sizes in each of the states. Disaggregated analyses of immunization coverage are most useful in states that are ethnically diverse. The DHS data from Sokoto, for example, is largely Hausa with a very small Fulani population surveyed, rendering further analyses and interpretation less useful than in states with more heterogeneous populations. Data from Bauchi indicate that immunization coverage across antigens is lowest among the Fulani, followed by Hausa and "other" ethnic groups, which includes small populations of Igala, Tiv, Yoruba, and "other" unspecified groups. In Borno, Kanuri are the majority ethnic group, and report slightly higher immunization coverage for BCG than the Fulani, but otherwise trail Fulani populations in DPT1 and measles coverage. This may be related to the use of health facilities to give birth, but requires further analysis. The "other" ethnic groups in Borno, which include Yoruba and "others," report the highest coverage across antigens, as in Bauchi. Finally, in Kano, coverage is higher among the Hausa when compared with other ethnic groups for BCG and DPT1, but lower for measles. It is important to note, however, that while we are able to examine immunization trends, given the small sample sizes, results should be interpreted with caution and trends should not be interpreted as statically significant.

Table 10. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Bauchi State, NDHS 2018

Bauchi					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		52	47.9	35.6	278
Residence	Rural	50	46.7	33.5	249
	Urban	69.1	58.5	53.5	30
Sex	Male	53.9	49	31.8	150
	Female	49.9	46.6	40.1	128
National Wealth Quintile	Poorest	39.7	37	23.3	135
	Poorer	57.4	53	39.4	74
	Middle	63.3	61.3	53.7	42
	Richer*	81.4	66.1	67.5	19
	Richest*	81.1	71.5	41.3	9
Mother's Education	None	37.9	36	27.6	184
	Primary or Higher	79.4	71	51.3	95
Ethnicity	Fulani	35.4	26.6	26.5	83
	Hausa	52.4	52	35.5	126
	Other	71.4	66.2	46.9	69

*Very small sample sizes (N<=20). Data should be interpreted with caution.

Table 11. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Borno State, NDHS 2018

Borno					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		63.5	57.2	47.1	221
Residence	Rural	56.5	50.2	42.7	112
	Urban	70.7	64.4	51.5	109
Sex	Male	62.8	58.2	51	118
	Female	64.4	56	42.6	103
National Wealth Quintile	Poorest	42	31.5	30.1	46
	Poorer	39	37.3	27.3	37
	Middle	73.8	67	54.3	64
	Richer	71.1	73.5	62.8	50
	Richest	100	77.2	58	24
Mother's Education	None	48.3	43.2	34.6	145
	Primary or Higher	92.4	83.8	70.8	76
Ethnicity	Fulani	52.6	50.1	45.9	32
	Kanura	57.7	45.9	33.9	101
	Other	74.2	72.8	62.7	88

Table 12. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Kano State, NDHS 2018

Kano					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		61.2	59.7	56.1	431
Residence	Rural	53.9	52.1	50.6	261
	Urban	72.4	71.5	64.7	170
Sex	Male	58.5	54.8	53	226
	Female	64.2	65.2	59.6	205
National Wealth Quintile	Poorest	45.6	41.9	50.3	121
	Poorer	50.3	51.7	45.6	122
	Middle	71.6	70.6	45.2	78
	Richer	76.7	72.4	80.9	61
	Richest	91.1	91.1	83.4	49
Mother's Education	None	51.1	51.6	48.3	285
	Primary or Higher	80.8	75.5	71.4	146
Ethnicity	Hausa	61	60.5	55.2	391
	Other	63.4	52.1	65.4	40

Table 13. BCG, DPT1, and Measles1 Coverage by Demographic Characteristics, Sokoto State, NDHS 2018

Sokoto					
		BCG	DPT1	Measles1	Total number of children 12–23 months in the sample
		%	%	%	N
State-level Coverage		35.7	24.7	19.1	177
Residence	Rural	34.8	23.2	18.8	152
	Urban	41.3	33.4	20.9	25
Sex	Male	36.2	25.1	17.8	96
	Female	35.2	24.2	20.7	81
National Wealth Quintile	Poorest	32.2	20	17.6	100
	Poorer	37.7	31.4	19.3	51
	Middle*	34.6	18.5	16.6	15
	Richer*	77.1	57.7	41.5	7
	Richest*	34.2	24.7	24.7	5
Mother's Education	None	33.8	23.3	19	165
	Primary or Higher*	62.0	42.7	20.8	13
Ethnicity	Hausa	37.3	25.5	20.1	166
	Other*	11.4	11.4	4.1	11

*Very small sample sizes (N<=20). Data should be interpreted with caution.

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