



## Key Drivers Towards the Achievement of High Vaccination Coverages in the 2019 Integrated Supplemental Immunization Campaign: A Case-Study of the Federal Capital Territory, Nigeria

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### Abstract

**Introduction:** Measles and Meningitis remain important global public health challenges as they continue to account for a high proportion of morbidity and mortality amongst under five children especially in countries in sub-Saharan Africa. While routine immunization is the main thrust for addressing these vaccine preventable diseases, mass vaccination campaigns remain an important strategy to improve coverage and achieve herd immunity against these childhood killer diseases. In line with global efforts to reduce the burden of these diseases, the Nigerian government conducted several mass vaccination campaigns involving various antigens across the country in 2019 including the Federal Capital Territory (FCT). This paper highlights the key drivers of FCT's performance in achieving greater than 90% vaccination coverage for both antigens.

**Methods:** We conducted a desk review of the documents of past campaigns in the FCT (2018 Measles vaccination campaign & 2018 Yellow Fever Mass Vaccination Campaign). We also reviewed documents from the 2019 integrated Measles and Men A vaccination campaign. The documents reviewed include: the readiness dashboard, the integrated campaign field guide, the daily call-in data, human resource inventory, cold chain inventory, chronogram, staggering plan, the in and end-process monitoring data, the tally sheet analysis and the post-campaign coverage survey results. We finally obtained and synthesized data and information across four main thematic areas: coordination, microplanning, human resource management and cold chain. These were further analyzed and used as the basis for this case study.

**Results:** Analysis of all the key performance indicators (Administrative coverages, End-process monitoring and Post campaign coverages) showed FCT had a coverage above 90% for each of the antigens.

**Conclusion:** This study highlights the key drivers towards achieving high coverages in the complex integrated Measles and Meningitis vaccination campaign conducted in the FCT in 2019. These are government ownership shown by the strong coordination and additional 354 teams funded by the state, validation of 100% of the ward micro plans which ensured that no settlement and eligible child was missed, analysis of human resource requirements and cold chain inventory leading to the development of a staggering plan.

**Keywords:** Measles; Meningitis A; Integrated; Vaccination; Campaign

## Introduction

Measles and meningitis remain important global public health challenges, as they continue to account for a high proportion of morbidity and mortality among children under five, especially in countries in sub-Saharan Africa [1]. For diseases that have clear solutions, such deaths are entirely needless because they are preventable through vaccination [2]. The MenAfriVac vaccine has been shown to significantly reduce the incidence and mortality due to group A meningococcal disease, which has caused large epidemics in the meningitis belt since 2010 [3]. Similarly, measles vaccination has been proven to be highly safe and effective in reducing childhood mortality, as it has prevented an estimated 2.3 million deaths between 2000 and 2018 [4]. Despite these gains in the fight against measles, over 140,000 children still died of measles worldwide in 2018 alone [4]. As part of efforts to reduce the burden of these diseases, the World Health Assembly, through the Global Vaccine Action Plan, has targeted the elimination of measles in five out of six WHO regions by 2020 [5]. Furthermore, immunization partners around the world are working toward the elimination of meningitis by 2030 [1]. While routine immunization is the main strategy for addressing these vaccine-preventable diseases, mass vaccination campaigns remain an important approach to improve coverage and achieve herd immunity against these childhood killers [6].

Nigeria, in line with global efforts to reduce the burden of these diseases, conducted several mass vaccination campaigns involving various antigens across the country in 2019. Most states in the North, including the Federal Capital Territory (FCT), implemented the Integrated Measles and Meningitis A Vaccination Campaign (IVC), which was innovative given that both campaigns were initially planned as stand-alone efforts. These campaigns were necessary due to the low routine immunization coverage rate of 31% in the country, resulting in low immunity and predisposing unvaccinated children to outbreaks of vaccine-preventable diseases, notably measles [7]. The suboptimal routine immunization coverage of MCV1 in the FCT (73.9%) implied that a large number of children had yet to receive their first dose to protect at-risk populations [7]. Hence, there was a need for the Measles Supplemental Immunization Activities (SIA), aimed at providing a second dose opportunity to eligible children irrespective of their previous vaccination status [8]. In addition, WHO (2020) recommends two doses of measles vaccines to ensure immunity and prevent outbreaks, as about 15% of vaccinated children fail to develop immunity following the first dose. Given that the Men A vaccine was newly introduced into routine immunization in Nigeria (August 2019), with the last SIAs for Men A in the FCT conducted in 2014, there was a need to conduct a catch-up mass vaccination campaign to vaccinate the accumulated cohort of unimmunized children with Men A vaccines.

Considering the similarities in the mode of administration of measles and Men A antigens, the microplanning process, and

the operational requirements, the national technical committee decided to use an integrated approach for these campaigns. The integration was initially confined to some components of the pre-implementation and post-implementation stages of the measles and Men A campaign in the FCT and sixteen northern states. These components mainly included microplanning processes, training, development and verification of microplans, monitoring, post-campaign coverage surveys, and waste management. The integrated approach added value by saving time and costs while maximizing resources such as human resources, cold chain equipment, and funds. In the following weeks of the pre-implementation stage, the national team conducted a further review of the integrated approach, leading to a decision to integrate all aspects of the campaign, primarily based on cost considerations. This meant that the implementation of the two campaigns (measles and Men A) would be conducted simultaneously, with both antigens administered to all eligible children at the same time.

The integration of these campaigns introduced a new implementation approach, additional revisions of training modules with an emphasis on vaccination team composition and layout, as well as new challenges. This paper aims to document the lessons learned in achieving a high-quality campaign in the FCT, marked by increased vaccination among eligible children who would have otherwise been missed for both measles and meningitis A antigens. We have also highlighted some best practices based on selected thematic areas identified as key drivers of the FCT's performance in achieving greater than 90% vaccination coverage for both antigens following the implementation of this novel, complex campaign.

## Methods

### Study Settings

The Federal capital territory is the capital city and the seat of power of the Federal government of Nigeria. It is a planned city formed out of the old Kwara, Niger, Plateau and Kaduna states. It has a land mass of 7315km<sup>2</sup>. It is a rapidly growing city with the highest growth rate in Nigeria of 9.3% with therefore an estimated population of 6,709,876 million persons based on the 2006 census. Administratively, the FCT comprises six area councils. These are Abaji, Bwari Gwagwalada, Kuje, Kwali, and Municipal Area Council. Each area council has ten political wards each except for the Municipal Area Council which has 12 political wards.

The Health and Human Services Secretariat oversees the health sector in the FCT. It is complemented by the Area Council Health Authorities in the six area councils of the FCT. The FCT Primary Healthcare board provides strategic oversight to the operations of primary healthcare activities in the FCT including immunization. These include both routine immunization services and the supplementary immunization activities. There are about 385 healthcare facilities comprising both public and private health facilities providing routine immunization services.

The implementation of the Measles and Men A vaccination campaign in FCT, was steered by the leadership of the FCT Primary healthcare board supported by partners such as WHO and UNICEF. The campaign was targeted at children 9 months to 59 months (17% of the population) with the Measles vaccine and 1 to 5 years (16% of the population) with the Men A vaccine respectively.

### Study Design and data collection method

We conducted a desk review of the documents of past campaigns in the FCT (2018 Measles vaccination campaign & 2018 Yellow Fever Mass Vaccination Campaign) which was used as a baseline to understand the existing structures, lessons learnt, best practices and challenges encountered across the levels of implementation of these campaigns in the state. The documents reviewed include the approved 2017/2018 FCT micro plans, training reports and campaign reports. The data from these reviews were triangulated to plan adequately for the campaign.

We also reviewed documents from the 2019 integrated Measles and Men A vaccination campaign. The documents reviewed include: the readiness dashboard, the integrated campaign field guide, the daily call-in data, human resource inventory, cold chain inventory, chronogram, staggering plan, the in and end-process monitoring data, the tally sheet analysis and the post-campaign coverage survey results. We finally obtained and synthesized data and information across four main thematic areas: coordination, microplanning, human resource management and cold chain. These data have been further analyzed and used as the basis for this case study.

### Thematic areas reviewed

#### Coordination

We activated the FCT Measles and Meningitis A Technical Coordinating Committee (FTCC) and sub-committees with clear terms of reference. This was necessary to achieve maximum coordination of all activities towards the Measles and Men A vaccination campaign and drive the implementation of activities in each of the thematic areas of the SIA. The FTCC was made up of various stakeholders drawn from government and partner agencies such as WHO, UNICEF among others, and was chaired by the Acting Executive Secretary of the FCT Primary Healthcare Board. We met thrice weekly leveraging on the FCT Emergency Immunization Committee (FERRIC) meeting days to deliberate on issues that bordered on the Measles and Men A SIAs and make decisions. Each sub-committee came up with a work plan, presented it to the FCT and subsequently gave regular update on its implementation and challenges to the FTCC during the coordination meetings at all the phases of the campaign. This coordination mechanism was also replicated at the level of the 6 area councils in FCT to drive implementation activities at this level.

#### Integrated microplanning

The FCT team was able to coordinate the development of the integrated microplan for the Measles and Men A which was an in-

novation by the national. As part of the quality assurance processes for the development of microplans so that no settlement is missed and resources needed for the campaign are adequately estimated, we conducted both a desk review and field validation of the microplans. We began the state level microplan validation process with a desk review conducted by a team made up of government and partners. We triangulated several population sources and carefully examined their variations (2006 projected national census, most recent NIPDs, 2018 Yellow Fever Preventive Mass vaccination campaign and 2018 Measles Verified target population based on GIS maps) which helped to arrive at the state's target population. A thorough review of all LGA microplans was conducted highlighting areas for further assessment during the field validation. To ensure quality assurance of our microplans at the ward level, for the first time, FCT conducted 100% validation of its wards microplans compared to the usual 30% done in other campaigns using the ODK checklist. The national microplan verification process, which is another layer of a quality assurance process for the microplans was conducted by the national team which verified and approved FCT's target population with recommendations on how to improve the microplans [9]. We immediately developed a work plan to address all the outlined gaps identified by the national verifiers. The state team and partners followed up on the LGAs to effect corrections after which the corrected microplans were submitted to the national and given a final approval. The operational target population derived from the verified microplan for the measles antigen was 692,695 (children 9 -59 months) while that of Men A (children 12 months to 59 months) was 651, 946.

#### Human resource management

The nationally approved vaccination teams for the Harmonized Men A and Measles campaign was three hundred and ten (310). This was based on the verified microplan, which considered that 200 children were to be vaccinated per day by each team within ten days of implementation. However, given the peculiarities of FCT such as its high population growth rate of 9.3%, its topography and terrains with high influx of internally displaced families due to insurgency in bordering states as well as in the Northeast, increasing number of estates with gated apartments, large number of private schools and churches and travel time between settlements, this number of teams (310) was considered grossly inadequate by the state team.

Further analysis by the state technical team revealed the required number of vaccination teams based on the target population in FCT, the number of implementing days, the required number of children to be vaccinated per day at 150 children per team per day and arrived at 827 teams were needed for the campaign. We subsequently developed a plan on how to bridge this gap, this was presented to the FCT which led to a request for funding of additional state sponsored teams.

It was therefore obvious that to reach the target population, additional teams were absolutely necessary. This was paramount

given the massive daily influx of persons in the Nigerian capital city. As a result of this, FCT Administration through Save One Million Lives Performance for Results (SOML P4R) sponsored an additional 354 teams to enable FCT reach every eligible child during this campaign. These were a 7-man team made up of 2 healthcare workers, 2 recorders, one community leader, one crowd controller and one house-to-house mobilizer. These teams were distributed to Area Councils based on both target population and other considerations as stated above. These considerations also facilitated the national funding an additional 70 teams which were used for mop-up in the state. These teams were strategically positioned in high volume secondary health facilities up to a period of 2 weeks after the campaign while others mopped-up poorly covered settlements based on the end-process data.

**Cold chain inventory and analysis**

We conducted a detailed cold chain inventory twice prior to implementation of the integrated measles and Men A vaccination campaign. The first inventory was vital for identifying the existence and extent of cold chain gaps early enough, to seek ways to bridge these gaps for a quality implementation of the earlier planned stand-alone campaigns. Having identified these gaps, engagement meetings of key government officials were carried out where the cold chain requirements for both the Measles and Men

A campaigns were presented with gaps for the measles standalone campaign more prominent. In addition, brainstorming sessions were held at the level of the FCTTCC where several options to bridge these gaps were discussed. These included purchasing fast cold chain equipment, borrowing from nearby non-implementing states or staggering the campaign. Following the review of the national team to conduct an integrated campaign, an updated inventory was again necessary given an increase in the cold chain requirements for the IVC. An updated cold chain analysis revealed cold change gaps especially in ice-packs based on the revised composition of teams/healthcare workers (considering both national and state sponsored teams) required for the campaign, number of implementation days (8 days) and capacity for vaccine storage in FCT. FCT’s decision to stagger the campaign helped to bridge the gaps identified in the cold chain and this revised cold chain inventory was shared with the national team. Staggering was one of the innovations that was used in the 2017/2018 measles vaccination campaign to bridge the human resource and cold chain equipment shortfall.

**Results**

Table 1 shows what challenges were identified across microplanning, human resource and cold chain and what the state did differently to bridge the gaps.

**Table 1:** Key Strategies used to improve the implementation of the IVC in FCT.

Thematic Area	Challenge/current practice	What was done differently	Outcome
Microplanning	30% validation of microplans/Faulty and incompletely filled micro plans in previous SIAs	State validation of 100% ward micro plans against the usual 30%	There was a variance of 0% between the state validated and the national verified microplan
Human resource	Inadequate teams, shortfall of over 300 teams	FCT secured additional 354 teams	An additional 121777 children were vaccinated with the Measles antigen and 123588 with the Men A antigen
Cold chain	Inadequate cold fast chain equipment	Used a staggering approach.	The staggering approach bridged the gaps

Table 2 displays the verified total population of FCT, the target population of 692695 and 651946 for the Measles and Men A vaccination campaign respectively.

Table 3 highlights a disaggregation of health workers and cold chain needs based on the number of national and state teams.

Overall, there were gaps in health workers needed for the campaign in 2 LGAs which were easily filled up from the other LGAs as there was an excess of 698 healthcare workers at the state. The cold chain analysis mainly revealed gross gaps in 0.3/0.4Lice-packs across all the LGAs in the state which was the main reason to stagger the campaign into 2 phases with 35 wards implementing in phase 1 and 27 wards implementing in phase 2.

**Table 2:** FCT’s verified Target Population and Team profile.

LGA	Total population	Measles target	Men A target	National teams (10 man)	State teams (7 man)
Abaji	178745	30387	28598	20	31
Bwari	608241	103401	97318	64	58
Gwagwalada	540948	91962	86551	43	51
Kuje	415110	70569	66418	36	56
Kwali	272723	46363	43636	26	41
Municipal	2058909	350015	329425	191	117
Total	4074676	692695	651946	*380	354

\*The initial approved teams were 310, an additional 70 teams were approved which were used for Mop-up.

**Table 3:** Analysis of health workers and cold chain requirements for 2019 IVC.

**Table 3a:** Human resource requirement analysis.

LGA	Number of approved national teams	Number of HCWs needed for National teams (3 per team)	Number of approved state teams	Number of HCWs needed for State teams (2 per team)	Total Number of HCWs required	Total Number of HCWs available	Gaps
Abaji	14	42	31	62	104	108	2
Bwari	46	138	58	116	254	426	172
Gwagwalada	41	123	41	82	205	150	-55
Kuje	32	96	56	112	208	195	-13
Kwali	22	66	51	102	165	210	45
Municipal	156	468	117	234	702	1247	545
Total	310	930	354	708	1638	2336	698

**Table 3b:** Analysis of requirements of Cold Chain Equipment.

LGA	Total Rush needed	Total Rush Available	Gaps	Total Giostyle needed	Total Giostyle Available	Gaps	Total 0.3L ice-pack needed	Total 0.3L ice-pack Available	Gaps
Abaji	104	52	-52	45	72	27	776	413	-363
Bwari	254	280	26	107	186	79	1848	934	-914
Gwagwalada	205	143	-62	79	151	72	1476	1081	-395
Kuje	208	221	13	88	210	122	1536	1343	-193
Kwali	165	59	-106	72	45	-27	1236	739	-497
Municipal	702	782	80	273	424	151	4992	4255	-737
Total	1638	1537	-101	664	1088	424	11864	8765	-3099

Tables 4 illustrates the intra-LGA staggering plan for the FCT with 35 wards implementing in phase 1 and 27 in phase 2.

Figure 1 is the staggering plan for FCT displaying the implementing wards in phase 1 and 2 in each LGA.

**Table 4:** FCT Staggering plan for integrated Measles and Men Vaccination Campaign.

Intra-LGA Staggering Plan		
LGA	Number of Wards	
	PHASE 1	PHASE 2
Abaji	8	2
Bwari	4	6
Gwagwalada	7	3
Kuje	3	7
Kwali	5	5
Municipal	8	4
Total	35	27

Table 5 shows that all the LGAs had administrative coverages of above 90% for both measles and Meningitis A antigens across the LGAs. For Measles vaccine, Abaji had the highest coverage of 111.6% while Municipal Area Council had the least coverage of 101.3%. For Meningitis A, Bwari Area Council had the highest coverage of 113.8% and Kwali LGA had the lowest coverage with 100.3% coverage.

Figure 2 shows the proportion of children vaccinated by the state and LGA teams. The 354 additional teams sponsored by the state vaccinated 228,052 (32.9%) children 9-59 months with measles vaccine and 218550 (33.5%) children 12-59 months with Men A vaccine who may have otherwise been missed.

Table 6 shows the performance of FCT based on key performance indicators. All the indicators showed FCT had a coverage above 90% for each of the antigens.

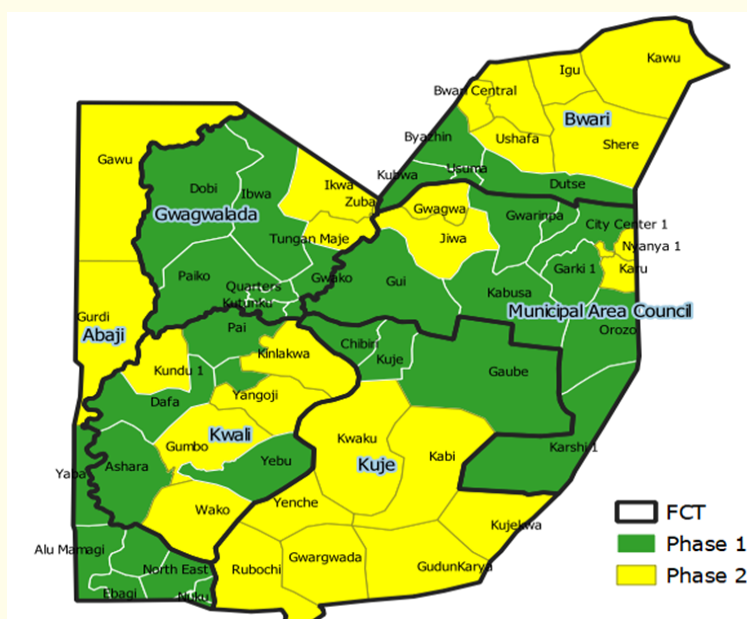


Figure 1: Intra-LGA staggering plan for 2019 Integrated Measles and Men A Vaccination Campaign in FCT.

Table 5: FCT measles and men A administrative coverage by LGA.

Ward	Measles			Men A		
	Target Pop	TOTAL Measles	% coverage	Target Pop	Total Men A	%coverage
ABAJI LGA	30386	33904	111.6	28598	31596	110.5
BWARI LGA	103402	113061	109.3	97318	110792	113.8
Gwagwalada	91961	101017	109.8	86551	95073	109.8
KUJE	70569	77753	110.2	66418	70930	106.8
Kwali	46362	46966	101.3	43636	43768	100.3
AMAC	350015	354234	101.2	329425	336852	102.3
FCT	692695	726935	104.9	651946	689011	105.7

Figure 1: Proportion of children vaccinated with measles vaccine by the state and national sponsored teams

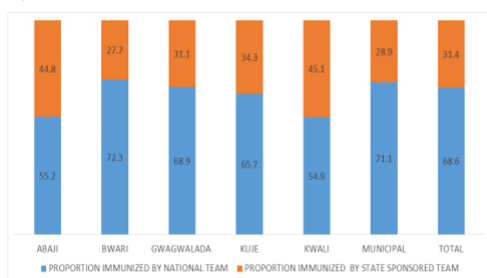


Figure 2: Proportion of children vaccinated with Men A vaccine by state and national sponsored teams

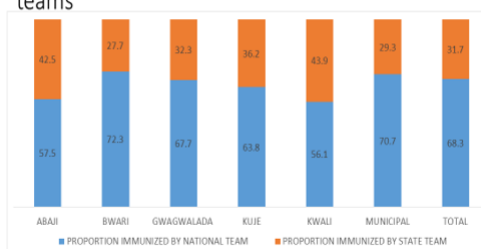


Figure 2: Proportion of children vaccinated with Measles and Men A by the state and national sponsored team.

**Table 6:** Overview of FCT’s coverage performance in 2019 Integrated Vaccination Campaign.

Key performance indicators	Measles (%)	Meningitis a (%)
Administrative coverage	104.9	105.7
End-process	97.5	97.5
Post-campaign coverage survey	91.8	92.5

**Discussion**

In this study, we found the key drivers towards the achievement of high vaccination coverages in the implementation of this complex integrated supplemental immunization campaign in the FCT. These were government ownership, innovative approaches to the mitigation of shortfall in human and cold chain equipment and availability of quality microplans which ensured no settlement or eligible child was missed.

**Ownership**

Our study shows that for a campaign to attain its purpose of reaching the targeted children, states must contribute their part to augment the resources provided by the national. From table 2, we reported the additional number of teams provided by FCT to augment the approved teams used by the FCT to implement the integrated campaign. The extra 354 teams deployed by the FCT to add to the 380 teams provided by the national may have contributed to FCT reaching a significant proportion of the targeted children. This is significant when you review the 2019 PCCS for measles and observe that 34.7% of children reached during the campaign in FCT were zero dose children (PCCS). This demonstration of ownership is one of the core principles of the Immunization Agenda 2030 and very necessary for sustainability of immunization programs [10]. This demonstrated ownership by the state government in ensuring the availability of adequate human resources in the conduct of the integrated campaign to ensure all eligible children are reached and missed opportunities for vaccination is reduced aligns with Manten and Cherian 2019 study which emphasized that in building a better immunization system within a country, every level of governance has to be engaged [11]. In the same vein, Ismail, *et al.*, 2022 conducted study that concluded that country’s vaccination program leverages strongly on the strength and ability of the various tiers of government to implement contextual strategies for its success [12]. This strongly aligned with our research finding that puts some responsibilities on states in bridging logistics and other gaps.

**Mitigation of short fall in resources**

In our study, the analysis of the Cold chain inventory and human resource, showed that there were gaps in the availability of health-care workers in two Local Government Area (LGAs) and in cold chain equipment (mainly 0.3/0.4L ice-packs across all the LGAs). These were critical areas which needed to be carefully reviewed because they had the potential to compromise the quality of the campaign. Inadequate number of ice-packs could compromise

the potency of the vaccines while insufficient number of qualified healthcare workers to administer the vaccines which were injectables could result to prolonged campaign days, increase workload and fatigue amongst the healthcare workers.

This therefore informed the decision of the FCT technical coordinating team to stagger the campaign in two phases. Thus, an intra-LGA staggering plan was then developed by clustering adjacent wards (as depicted in figure 2) such that, 35 wards implemented in phase 1 and 27 wards in phase 2. This enabled the LGA team to pool the entire human resources and cold chain equipment in an entire ward, that is from non-implementing wards to implementing wards in phase 1 and vice-versa in phase 2.

The state showed a commitment to implementing a quality campaign, first by 100% validation of all the microplans at the ward level which highlighted the extent of the cold chain gaps and the decision to stagger the campaign. The implementation of the intra-LGA staggering plan was facilitated by the lessons learnt from the implementation of previous non-polio campaigns in the state such as the 2018 Yellow Fever Mass vaccination campaign in the FCT, also from the Polio campaigns and guidance from the national team. Accountability mechanisms, which in previous studies have been shown to drive high performance was implemented by the FCT in the form of a readiness dashboard which also highlighted availability of an updated cold chain inventory [13]. The dashboard revealed the status of preparedness at every given point as regards to pre-implementation activities which encompassed the availability of human resource and cold chain equipment amongst others. The dashboard tells what percentage of the pre-campaign thematic areas have been achieved by the state at a particular number of weeks to the campaign date, this has to meet the expected proportion before the state is allowed to implement [14]. The staggering plan enabled the FCT meet up with the expected proportion of 90% across the pre-implementation activities.

Despite the shortfall, through the phasing of the SIA into two, we were able to bridge identified cold chain and human resource gaps through staggering of the campaign. This further aligns with research conducted by Ihebuzor, *et al.*, 2022 that highlighted within the immunization program especially during campaigns, there are always issues related to shortfalls especially cold chain and human resources which their study mitigated using campaign staggering [15]. This further emphasizes the need to conduct a holistic inventory in planning these vaccination exercises in order to achieve a quality SIA.

### Attained vaccination coverage

We found from the analysis of the administrative data, the measles vaccine reached 104.9% of the verified target for children aged 9-59 months, while the Men A vaccine reached 105.7% of the verified target for children aged 12-59 months. These administrative coverages align with that of the end-process data as well as that of the Post-Campaign Coverage Survey (PCCS) [16]. This alignment of coverages is not unrelated to the fact that the target population was derived from a quality microplanning process. This is evident from the triangulation of the various coverage sources showing minimal variations across the three data source (7-12%). In previous campaigns and other immunization health interventions, where we relied solely on the estimate from the national census figures, we have had a great margin between administrative coverage and survey findings [17]. The study findings suggest that the vaccination campaign coverages were high and imply a higher level of protection against these diseases.

Our findings are similar to that of Rodrigues and Plotkin, 2020, which showed that the achievement of herd immunity through a mass vaccination campaign led to not just protection against infectious diseases but had an impact on the economic and social wellbeing [18]. Our analysis showed that the proportions of eligible persons reached with the measles and Men A vaccines aligned closely with the proportions required for seroconversion of measles 95% and Men A 80% [19]. These coverages indicate a high population immunity amongst the eligible children and suggest that the probability of measles and Meningitis outbreak diseases spreading within the FCT is low. This is further corroborated by a conclusion reached by WHO, 2022 which stated that immunization coverages are a direct reflection of impact of vaccination exercise as it can be used to ascertain infectivity of diseases [20].

### Study limitations

This study was based on the administrative coverage emanating from the call-in data used to monitor performance during the immunization activity in FCT hence the competence of data officers at the LGAs and ward level was critical to ensuring accuracy of the aggregated LGA call in data to reflect state performance. However, this gap was mitigated by triangulating the administrative data with the end-process and the coverage of the Post campaign coverage survey which showed minimal variation.

Overall, the research results suggest that the FCT's measles and Men A vaccination campaign was of high quality demonstrated by the high coverages which were consistent across the administrative data, the end-process and most importantly the post-campaign coverage survey.

### Conclusion

This study highlights the key drivers towards achieving high coverages in the complex integrated Measles and Meningitis vaccination campaign conducted in the FCT in 2019. These are government ownership shown by the strong coordination and additional

teams funded by the state, quality microplanning process strengthened by the state validation of 100% of ward level micro-plans which ensured that no settlement and eligible child was missed, analysis of human resource and cold chain inventory leading to the development of a staggering plan. We therefore recommend that the national support states to strengthen these key drivers in all future campaigns in order to reach every eligible child with these lifesaving vaccines.

### Ethical Consideration

The data used in this study was generated as part of activities of the Measles Rubella Initiative in Nigeria. The consultation of the ethical review committee is not required for analysis of data which are secondary in nature. The data used in this study are domiciled within the FCT Primary Healthcare Board and the National Primary Healthcare Development Agency.

### Credit Authorship Contribution Statement

- **Jenny Momoh:** Conceptualization, Methodology, Formal analysis, Writing - Original draft, Writing - Review and editing, Visualization - Tables and figures.
- **Joseph Oteri:** Conceptualization, Methodology, Formal analysis, Writing - Original draft, Writing - Review and editing, Visualization - Tables and figures.
- **Okoronkwo Chinedu:** Methodology, Writing - Review and editing.
- **Razak Momoh:** Writing - Review and editing, Visualization - Tables and figures.
- **Furera Zakari:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures.
- **Anne Eudes Jean Baptiste:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures
- **Mary Mathew:** Methodology, Writing - Review and editing. Dan Apagu Gadzama: Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures.
- **Salome Tor:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures.
- **Chuks Okoli:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures.
- **Tanko Tchadwafa:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures
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- **Itua Peter:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures.
- **Ebere Muoghalo:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures
- **Sabastine Ndubisi Esomonu:** Conceptualization, Methodology, Writing - Review and editing, Visualization - Tables and figures



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## Research Data for this Article

Some of the data sets used in this paper are publicly available via the sources referenced in the manuscript. Other data was generated as part of the activities supporting the measles elimination strategy and SIA.

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## Bibliography

1. World Health Organization". Measles (2019).
2. Paules CI., *et al.* "Measles in 2019 - going backward". *The New England Journal of Medicine* (2019).
3. Fall A., *et al.* "Elimination of epidemic meningitis in the African region: progress and challenges: 2010-2016". *Journal of Immunology Research* (2018).
4. World Health Organization". *Measles* (2019).
5. Durrheim DN., *et al.* "Measles - the epidemiology of elimination". *Vaccine* (2014).
6. Uddin MJ., *et al.* "Evaluation of impact of measles rubella campaign on vaccination coverage and routine immunization services in Bangladesh". *BMC Infectious Diseases* (2016).
7. National Population Commission. 2006 population and housing census of the Federal Republic of Nigeria. Official Gazette of the Federal Republic of Nigeria (2009).
8. Portnoy A., *et al.* "Impact of measles supplementary immunization activities on reaching children missed by routine programs". *Vaccine* (2018).
9. Hamisu M., *et al.* "Microplanning verification and 2017/2018 measles vaccination campaign in Nigeria: lessons learnt". *Vaccine* (2021): 39-C53.
10. Wonodi C., *et al.* "Country ownership as a guiding principle for IA2030: a case study of the measles and rubella elimination programs in Nepal and Nigeria". *Vaccine* (2023).
11. Mantel C and Cherian T. "New immunization strategies: adapting to global challenges". *Gesundheitsforschung - Gesundheitsschutz* 63 (2020): 25-31.
12. Ismail AS., *et al.* "Strengthening vaccination delivery system resilience in the context of protracted humanitarian crisis: a realist-informed systematic review". *BMC Health Services Research* 22 (2022): 1277.
13. Momoh J., *et al.* "Ensuring accountability in implementation of supplementary immunisation activities: a case study of the 2017/2018 measles vaccination campaign in Nigeria". *Vaccine* 39.3 (2021).
14. Minkop TR., *et al.* "Planning for supplemental immunization activities using the readiness assessment dashboard: experience from the 2017/2018 measles vaccination campaign, Nigeria". *Vaccine* 39.3 (2021).
15. Ihebuzor C., *et al.* "Campaign Staggering": a way to bridge resource gaps in supplemental immunization activities - Lagos State 2018 measles vaccination campaign's experience". *Journal of Community Medicine and Public Health* 6.3 (2022).
16. Oteri AJ., *et al.* "Journey to integration of injectable antigens in mass vaccination campaigns: benefits and challenges using 2019 Meningitis A and measles integrated campaign in Nigeria". *Journal of Community Medicine and Public Health* 7 (2023): 392.
17. Etamesor S., *et al.* "Data for decision making: using a dashboard to strengthen routine immunisation in Nigeria". *BMJ Global Health* 3.5 (2018).
18. Rodrigues CMC and Plotkin SA. "Impact of vaccines: health, economic, and social perspectives". *Frontiers in Microbiology* 10 (2020): 1526.
19. Pandey A and Galvani AP. "Exacerbation of measles mortality by vaccine hesitancy worldwide". *Lancet Global Health* 11.4 (2023): e479.
20. World Health Organization. Immunization coverage (2023).