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An Assessment of the 2017-2018 Post Measles Campaign Coverage Survey in the South-south Zone of Nigeria

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ABSTRACT

Introduction: The World Health Organization (WHO) recommends measles vaccination campaigns as an effective strategy that is required to halt and revert the burden of measles worldwide, especially in the African region. This is a review of the 2017/2018 measles campaign in South-south Zone, Nigeria. **Methods:** The WHO EPI cluster survey methodology was used to survey a total of 1260 households covering 1355 children aged 9-59 months, yielding a sufficient sample size to provide estimated zonal and state measles vaccine coverage. Data collection was done using census and survey program software and supplementary immunization activity module of vaccination coverage quality indicators while the analysis was run on Stata. **Results:** The measles vaccination and routine immunization coverage in the South-south zone of Nigeria were 87.6% and 67.6% respectively. While town criers/mobilizers (49.6%) were the commonest source of information for the campaign, the lack of awareness (28.4%) was the most important reason given by the mothers and care-givers for non-vaccination. Fever (6.6%) was the most commonly reported adverse event following the immunization. **Conclusion:** The zonal vaccination coverage was less than the WHO recommended coverage that would be needed to stop the measles epidemic in Nigeria. Town criers were very useful for information dissemination. The lack of awareness was a major reason for non-vaccination.

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INTRODUCTION

Measles is an acute vaccine-preventable viral disease that mostly affects children between the ages of 9 months to 15 years and can lead to severe health complications and death [1]. Globally, measles morbidity and mortality has persisted despite the availability of safe and effective vaccines [2]. Six countries in Africa and Asia contribute up to 75% of all measles deaths, as a result of chronic malnutrition and poor or no access to medical treatments [3]. This has led to the development and implementation of the Measles and Rubella Initiative which is a global partnership, committed to ensuring that no child dies from either measles or rubella [4].

Nigeria with an estimated total population of 198 million and 36 million children between the ages of 9 – 59 months has consistently remained the country with one of the greatest burden of measles worldwide [5]. In 2017, the World Health Organization (WHO) recorded that 3.3 million Nigerian children were infected with measles despite the intervention efforts of the United Nations Children's Fund (UNICEF) and other international partners [6]. This led to the planning and implementation of the 2017/2018 measles supplemental immunization activities in all the 36 states and the Federal Capital Territory with the aim of interrupting measles transmission and sustaining adequate herd immunity, required for the elimination of measles while strengthening routine immunization and surveillance in all the states of the country.

As at the time of this study, the Nigerian nation had neither launched nor implemented the measles second dose option for children in the second year of life. Nigerian children only received one dose of measles-containing vaccine at 9 months of age as a part of the National Program on Immunization. UNICEF supports and recommends that all nations should introduce and give all children at least two doses of measles

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vaccine at 9 and 15 months of age. When a second dose of the measles vaccine is given to children, it prevents the outbreaks and improves seroconversion by ensuring that approximately 15% of children who received the first dose but did not seroconvert are able to do so as well as to make sure those children who missed the first dose can get another opportunity to receive the measles vaccine [7].

The UNICEF's Multiple Indicator and National Coverage Survey (MICS/NICS) of January 2017 recorded a measles coverage rate of 46.5% nationally and 67.6% in the South-south zone, second only to the South-eastern region of the country with coverage of 71.3% [8]. The zone along with all the other 5 zones in Nigeria successfully implemented the 2017/2018 measles vaccination campaign in two phases with survey coverage of 88.7%. The aim of this study is to assess the vaccination coverage of the states in the zone, to identify the reasons for non-vaccination and to highlight the sources of information for parents and caregivers as well as to document all the common causes of adverse events, following the vaccination.

MATERIALS AND METHODS

Study Area

While Nigeria is divided into 6 geopolitical zones for ease of governance, the South-south zone has been defined as the economic nerve center of the country due to abundant natural resources that exists in the region, most especially the oil that gives the nation most of its external revenues. The South-south zone consists of 6 states; namely, Delta, AkwaIbom, Cross Rivers, Rivers, Bayelsa and Edo. The huge revenue generated from these states has not necessarily translated to better life or health for the citizenry, most especially as it concerns the women and children.

Sample Frame

The 2017/2018 South-south zonal post measles campaign coverage survey (PMCCS) was part of the national survey coverage that was conducted by adapting the WHO EPI cluster survey. The National Integrated Survey of Households (NISH2) was used to develop sampling frame for the survey. A cross-sectional household-based survey was conducted on a probability sample of 1,260 households in 180 enumeration areas across the 6 states that make up the South-south region. Parents and caregivers of all children aged between 9 and 59 months in the selected households were eligible to participate in the phased implementation of the 2017-18 measles Supplemental Immunization Activities (SIA) survey..

Sample Design and Implementation

A stratified two-stage cluster sampling design was selected for the 2017/18 PMCCS. The first stage selection involved the selection of enumeration areas (EAs) in each state from the master sampling frame. A total of 30 EAs were selected using simple random sampling from the sampling frame. Following first stage sampling, the household listing was conducted in the selected EAs to identify households having eligible children within the age range of 9 and 59 months. Seven households with eligible children were randomly selected from each of the 30 enumeration areas in every state in the South-south zone.

Data Collection and Analysis

Data collection was done using Census and Survey Program (CSPro) software running on android computers. Data cleaning and analysis were performed on Stata version 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP) using the supplementary immunisation activity (SIA) module of Vaccination Coverage Quality Indicators (VCQI) software. All results presented in the report are based on the weighted data to account for the survey sampling design and survey non-response. Results of post measles campaign vaccination coverage, routine immunization coverage, reasons for non-vaccination, and adverse events following immunization (AEFI) were presented by residence, gender and zones. Wilson's 95% confidence intervals and upper and lower confidence bounds were computed throughout the report.

RESULTS

Measles Vaccination Coverage in the South-south Zone of Nigeria

The measles vaccination campaign coverage among the 1,355 sampled children in the zone as presented in Table 1 is as follows: a reported MVC coverage rate of 88.7% (95% CI: 85.8% - 91.1%). Vaccination coverage was defined as having received measles vaccination by card (54.3%), mother's recall (34.4%), or by finger-mark (33.4%) from the 6 states that make up the zone. Bayelsa (94.2%, 95% CI: 89.6%-96.8%) and Delta (93.8%, 95% CI: 87.5% - 97.0%) states had measles coverage above the zonal and the national coverage.

Routine Immunization Coverage in the South-south zone, Nigeria

The routine immunization coverage among the 1,355 sampled children in the zone as presented in Table 2 is as follows: sixty nine percent (95% CI: 64.9% - 73.6%) of all respondents in the South-south zone had received measles vaccine before the campaign from lots quality assurance surveys (15.6% had dates on cards and 53.8% by mother's recall). Akwa Ibom (78.7%, 95% CI: 68.7% - 86.2%) and Edo State (76.4%, 95% CI: 64.8% -85.0%) had reported rates above the zonal and the national estimates.

Adverse Events Following Vaccination in the South-south Zone of Nigeria

Adverse events following immunization among the 1,355 sampled eligible children in the zone as presented in Table 3 are as follows: approximately 19.6% of all the sampled children in the zone developed a reaction following the vaccination. Edo (32.4%), Akwa Ibom (20.9%) and Delta (20.0%) states reported AEFI rates in excess of the zonal prevalence. Fever between 7-12 days following vaccination (6.8%) was the commonest cause of AEFI reported in the zone. Cross-River (8.1%), Akwa Ibom (11.2%), and Edo (13.3%) states reported rates above the zonal and national average. All 6 states documented fever and pain at the injection sites as the more common side effects reported by the mothers. None of the states reported problems with hearing and vision, extreme drowsiness, easy bruising/bleeding and difficulty in breathing.

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Table 1. Proportion of children who received measles vaccine during the measles campaign

	Vaccinated during SIA					Unweighted count	Weighted
	By card	By recall	By finger-mark	By recall or finger-mark			
	(%)	(%)	(%)	(%)	95% CI	N	N
NIGERIA	51.2	36.3	16.8	87.5	(86.2, 88.7)	10,153	35,939,548
Sex of child							
Male	51.9	36.1	16.1	88.0	(86.5, 89.4)	678	18,096,164
Female	50.6	36.4	17.6	87.0	(85.4, 88.5)	657	17,843,382
Area							
Urban	47.0	42.0	20.9	89.0	(86.6, 91.0)	295	9,800,275
Rural	52.8	34.1	15.3	87.0	(85.3, 88.4)	1040	26,139,272
Age group							
9 to 11 months	41.2	34.3	11.8	75.5	(67.2, 82.3)	25	799,318
12 to 23 months	52.8	31.5	16.8	84.3	(81.9, 86.4)	286	7,626,271
24 to 35 months	51.3	36.9	17.0	88.3	(86.2, 90.1)	308	8,324,864
36 to 47 months	51.0	37.2	17.6	88.2	(86.2, 90.0)	319	8,762,618
48 to 59 months	51.1	38.6	16.4	89.7	(87.8, 91.3)	391	10,422,102
South South	54.3	34.4	33.4	88.7	(85.8, 91.1)	1,335	3,815,003
Akwa-Ibom	47.5	37.1	15.5	84.6	(77.9, 89.6)	278	781,527
Bayelsa	66.9	27.2	43.9	94.2	(89.6, 96.8)	251	328,723
Cross River	39.5	4.90	35.5	88.5	(81.4, 93.1)	179	703,251
Delta	63.5	30.5	22.9	93.8	(87.5, 97.0)	223	1,094,154
Edo	54.8	33.7	34.4	88.6	(79.2, 94.0)	231	384,935
Rivers	49.8	30.6	58.4	80.4	(67.0, 89.2)	173	1,073684

Abbreviations: CI=Confidence Interval
The results in this table are from weighted analysis and the CI calculation considers the sampling design & weights

Table 2. Proportion of children who received measles vaccine during the measles campaign

	Measles vaccination status before campaign				Received measles vaccine before campaign[1]			
	Yes, Date(s) on card	Yes, Recall /History	No	Do Not Know	Yes, by card or recall	95% CI		Weighted
	(%)	(%)	(%)	(%)	(%)	(%)	N	N
NIGERIA	16.3	38.8	41.9	3.1	55.0	(52.9, 57.2)	10,153	35,939,548
Sex of child								
Male	18.1	37.3	41.3	3.3	55.4	(52.6, 58.1)	678	18,096,164
Female	16.3	39.7	40.4	3.5	56.1	(53.3, 58.8)	657	17,843,382
Area								
Urban	17.8	46.3	30.7	5.2	64.1	(58.2, 69.6)	295	9,800,275
Rural	17.0	35.6	44.7	2.7	52.6	(49.8, 55.3)	1040	26,139,272
Age group								
9 - 11 months	18.4	27.3	52.4	1.9	45.7	(38.2, 53.4)	25	799,318
12 - 23 months	22.1	31.2	45.1	1.7	53.3	(50.0, 56.5)	286	7,626,271
24 - 35 months	17.1	36.9	42.2	3.7	54.0	(50.6, 57.4)	308	8,324,864
36 - 47 months	16.5	41.2	38.2	4.0	57.8	(54.3, 61.2)	319	8,762,618
48 - 59 months	14.3	43.6	38.1	4.0	58.0	(54.9, 61.0)	391	10,422,102
South-south zone	15.6	53.8	26.2	4.5	69.4	(64.9, 73.6)	1335	4,366,276
Akwa Ibom	13.8	65.0	19.9	1.4	78.7	(68.7, 86.2)	278	781,527
Bayelsa	15.3	51.1	26.5	7.1	66.4	(55.3, 76.0)	251	5,038,405
Cross River	14.8	51.9	20.4	12.9	66.7	(50.1, 80.0)	179	9,698,450
Delta	20.9	46.5	30.4	2.3	67.4	(57.0, 76.3)	223	3,815,003
Edo	15.5	60.8	22.4	1.3	76.4	(64.8, 85.0)	231	4,366,276
Rivers	12.6	41.7	42.4	3.3	54.3	(41.8, 66.3)	173	7,288,676

Abbreviations: CI=Confidence Interval
1 Proportion of children who had received measles vaccine before the campaign from other sources such as routine immunisation

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Table 3. Adverse events following the vaccination (AEFI) by selected background characteristics

	Did the child develop a reaction in the months following the vaccination (%)	Fever between 7 and 12 days following vaccination (%)	General rash between 7 and 10 days following vaccination? (%)	Pain at the site of injection (%)	Fussiness, irritability, crying for an hour or longer (%)	Itching, especially of feet or hands (%)	Hives (other itching or irritation)? (%)	Seizure (black-out or convulsions); or High fever (within a few hours or a few d (%)	Pain or tiredness of eyes, swelling, or a lump where the shot was given (%)	Headache (severe or continuing) (%)	Confusion or dizziness? (%)	low fever; joint or muscle pain? (%)	Other (specify) (%)	N	Weighted N
NIGERIA	19.1	8.8	1.2	7	0.6	0.9	0.1	0.4	0.3	0.5	0.1	2.2	0.6	10,153	35,939,548
Sex of child															
Male	20.1	8.9	1.4	7.6	0.6	1.1	0.1	0.5	0.4	0.5	0.0	2.3	0.9	5157	18,096,164
Female	18.0	8.6	1.1	6.4	0.6	0.7	0.1	0.2	0.3	0.6	0.1	2.2	0.3	4996	17,843,382
Area															
Urban	14.8	6.1	2.1	5.2	0.7	1.0	0.3	0.4	0.5	0.3	0.1	1.5	0.4	2244	9,800,275
Rural	20.7	9.8	0.9	7.7	0.6	0.8	0.1	0.4	0.3	0.6	0.1	2.5	0.7	7909	26,139,272
Age group															
9 to 11 months	19.5	7.8	1.6	8.7	0.0	0.7	0.5	0.5	0.5	1.4	0.0	2.5	0.0	237	799,318
12 to 23 months	20.4	9.3	1.2	7.4	0.7	0.7	0.2	0.2	0.3	0.3	0.2	2.3	0.8	2177	7,630,645
24 to 35 months	18.7	8.9	0.8	6.6	0.8	1.5	0.2	0.6	0.6	0.5	0.0	2.6	0.8	2341	8,324,864
36 to 47 months	18.9	9.0	2.0	7.0	0.5	1.0	0.1	0.4	0.2	0.9	0.0	1.9	0.3	2425	8,762,618
48 to 59 months	18.5	8.2	0.8	7.0	0.5	0.4	0.1	0.3	0.3	0.4	0.1	2.1	0.6	2973	10,422,102
South South Zone	19.6	6.6	2.2	6.4	1.7	0.6	0.1	0.1	0.7	0.6	0.1	2.5	0.4	1335	4,366,276
Akwa Ibom	20.9	11.2	4.8	0.8	0.0	0.7	0.0	0.0	0.0	0.6	0.0	4.9	0.0	278	781,527
Bayelsa	17.2	3.7	2.1	3.9	0.0	0.7	0.0	0.7	0.0	0.0	0.0	4.0	3.1	251	328,723
Cross Rivers	15.7	8.1	1.2	3.6	0.0	1.4	0.0	0.4	0.0	0.3	0.0	3.2	0.0	179	703,251
Delta	20.0	2.4	3.2	8.0	6.8	0.3	0.3	0.0	2.5	0.0	0.0	1.3	0.0	223	1,094,154
Edo	32.4	13.3	2.1	14.6	0.0	0.3	0.0	0.0	0.3	0.3	0.9	0.9	1.9	231	384,935
Rivers	16.8	5.0	0.0	8.6	0.0	0.4	0.0	0.0	0.0	1.7	0.0	1.5	0.0	173	1,073,684

Note: This measure is a population estimate that incorporates survey weights. The CI is calculated with software that takes the complex survey design into account.

Sources of Information for the Vaccination Campaign in the South-south Zone of Nigeria

The sources of information from the caregivers of the 1,355 sampled children in the zone as presented in Table 4 were as follows: a low proportion of mothers (3.8%) sampled in the zone had not heard about the measles campaign. Three states namely: Rivers State (4.6%), Akwa Ibom (5.8%) and Edo States (6.9%) had rates higher than the zonal average. The most common source of obtaining information about the campaign in the zone was through the town criers/mobilizers (37.3%). In Akwa Ibom (49.6%) and Bayelsa (49.8%) States, town criers were the most effective tool for conveying information with estimates more than the zonal estimates.

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Table 4. Sources of information about the campaign by background characteristics.

	Not informed	Radio	TV	Internet	Criers / mobilisers	Community health workers	School	Family	Neighbour or friend	Village chief	Religious leader	Community mobiliser	Other (specify below)	
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	N
NIGERIA	3.9	9.6	0.7	0.1	21.7	27.4	4.3	0.8	3.6	12.3	7.2	8.2	0.4	10,153
Sex of child														
Male	3.8	9.4	0.6	0.0	21.8	27.5	4.0	0.8	3.6	12.7	7.1	8.3	0.3	5157
Female	3.9	9.7	0.9	0.1	21.7	27.2	4.6	0.7	3.5	11.8	7.2	8.1	0.5	4996
Area														
Urban	4.1	14.8	2.6	0.0	12.6	32.7	8.3	1.1	5.9	4.0	4.9	8.5	0.6	2244
Rural	3.8	8.1	0.2	0.1	24.3	25.9	3.2	0.7	2.9	14.6	7.8	8.1	0.3	7909
Age group (months)														
9 to 11	4.6	11.0	0.8	0.0	21.9	24.9	2.1	1.3	3.0	14.3	7.2	8.9	0.0	237
12 to 23 months	4.8	9.7	0.5	0.1	22.6	27.2	2.1	0.6	3.7	11.7	7.4	9.1	0.4	2176
24 to 35	3.3	9.4	0.9	0.0	20.8	28.4	3.8	1.0	4.4	11.9	7.6	8.2	0.3	2341
36 to 47	4.0	8.9	0.7	0.1	22.1	27.2	5.2	0.7	3.6	12.8	6.8	7.2	0.7	2425
48 to 59	3.4	10.1	0.8	0.1	21.4	27.0	5.8	0.8	2.9	12.4	6.9	8.3	0.2	2973
South South zone	**3.8**	**6.3**	**1.3**	**0.3**	**37.3**	**25.2**	**4.4**	**1.4**	**4.7**	**3.4**	**6.8**	**4.7**	**0.3**	**1355**
Akwa Ibom	5.8	6.1	0.0	0.0	49.6	11.5	3.2	0.4	1.4	5.0	15.5	1.4	0.0	278
Bayelsa	1.2	8.8	1.2	0.0	49.8	20.7	2.4	0.4	4.8	0.8	1.6	8.0	0.4	251
Cross River	2.2	9.5	1.7	0.0	31.3	23.5	2.2	3.4	3.9	0.0	7.8	13.4	1.1	179
Delta	1.8	1.8	2.7	0.0	17.0	54.3	3.6	1.8	8.1	0.4	4.9	3.6	0.0	223
Edo	6.9	8.2	2.2	0.0	36.4	23.4	7.8	0.0	4.3	3.9	3.9	2.6	0.4	231
Rivers State	4.6	2.9	0.0	2.3	32.9	20.8	8.1	4.0	6.9	11.0	5.8	0.6	0.0	173

Note: This measure is an un-weighted summary of proportions from the survey sample.
Denominator (N) is the total number of respondents.

Reasons Children Were Missed During the Campaign

Of the 1166 eligible children in the nation that missed the vaccination from the sampled population, Table 5 reveals that: 141 (12.1%) were reported to have missed the vaccination in the zone. The primary reasons reported by mothers for not vaccinating their children were being unaware (28.4%) and unavailable (18.4%) during the period of the campaign. While the commonest reasons for non-vaccination in Akwa Ibom (27.5%), Cross-Rivers (29.4%), Edo (42.9%) and Rivers States (37.0%) were the lack of awareness of the campaign, fear of injection (18.8%) and fear of developing side effects (30.8%) were the main reasons in Bayelsa and Delta States. Mothers whose children were between the ages of 9-11months were more likely to be missed for unspecified reasons (26.5%).

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Table 5. Main reason for non-vaccination in the campaign by zone.

	Did not Know about the campaign (%)	Confused with other vaccines (believes that child has already been vaccinated) (%)	Subject or parent or guardian were missing (%)	Fear of injection (%)	Lack of confidence in vaccine (%)	Fear of side effects (%)	Site of vaccination not known (%)	Site of vaccination too far (%)	Time of vaccination unsuitable (%)	Waited too long at vaccination site (%)	Missing vaccinator at the site (%)	Not authorised by head of household (%)	Religious beliefs (%)	Sick at time of vaccination (%)	Absent during time of campaign (%)	Too busy to take child (%)	Child ill (%)	Mother ill (%)	Child already received measles vaccine (%)	Other (specify) (%)	N
NIGERIA	21.6	3.1	2.1	3.7	3.3	3.9	1.5	1.3	3.3	1.7	5.0	4.5	0.3	5.4	21.6	4.5	1.0	0.3	2.6	9.2	1,166
Sex of child																					
Male	20.4	2.3	2.8	4.4	3.7	4.4	1.4	1.4	3.5	1.7	4.7	4.4	0.5	5.4	19.9	4.5	0.7	0.5	2.3	11.2	573
Female	22.8	3.9	1.3	3.0	3.0	3.4	1.7	1.2	3.2	1.7	5.2	4.7	0.2	5.4	23.3	4.4	1.3	0.2	2.9	7.3	593
Area																					
Urban	24.9	5.0	3.1	2.7	6.1	3.1	1.9	1.5	5.0	0.0	3.4	6.9	0.0	3.4	15.7	3.8	1.5	0.0	4.2	7.7	261
Rural	20.7	2.5	1.8	4.0	2.5	4.1	1.4	1.2	2.9	2.2	5.4	3.9	0.4	6.0	23.3	4.6	0.9	0.4	2.1	9.6	905
Age group (months)																					
9 to 11	24.5	2.0	0.0	0.0	0.0	4.1	2.0	0.0	4.1	0.0	8.2	4.1	0.0	6.1	10.2	0.0	0.0	0.0	8.2	26.5	49
12 to 23	20.1	5.5	1.0	2.9	3.2	4.5	1.6	1.6	3.2	1.6	3.6	5.8	0.3	4.9	23.4	3.6	1.3	0.6	2.6	8.4	308
24 to 35 months	24.3	1.5	2.7	3.1	3.9	3.5	1.5	1.9	4.2	1.2	5.0	3.9	0.4	6.2	20.8	5.8	1.9	0.4	1.5	6.2	259
36 to 47	19.9	1.5	4.1	4.5	4.1	4.1	0.4	1.1	4.1	2.2	5.2	4.1	0.7	4.9	22.1	4.5	0.7	0.4	1.1	10.1	267
48 to 59	21.9	3.5	1.1	4.9	2.8	3.2	2.5	0.7	1.8	2.1	5.7	4.2	0.0	5.7	21.9	4.9	0.4	0.0	3.9	8.8	283
South South zone	28.4	3.5	2.8	2.8	3.5	9.2	0.0	1.4	3.5	0.7	2.1	3.5	0.0	4.3	18.4	5.7	0.7	0.7	1.4	7.1	141
Akwa Ibom	27.5	10.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	2.5	5.0	2.5	0.0	5.0	22.5	10.0	2.5	0.0	5.0	2.5	40
Bayelsa	0.0	0.0	12.5	18.8	6.3	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	12.5	31.3	6.3	0.0	0.0	0.0	6.3	16
Cross River	29.4	0.0	5.9	0.0	5.9	5.9	0.0	0.0	17.6	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0	29.4	17
Delta	15.4	0.0	0.0	0.0	7.7	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	15.4	15.4	0.0	0.0	0.0	7.7	13
Edo	42.9	0.0	3.6	3.6	7.1	3.6	0.0	0.0	7.1	0.0	0.0	7.1	0.0	0.0	17.9	3.6	0.0	0.0	0.0	3.6	28
Rivers	37.0	3.7	0.0	0.0	0.0	25.9	0.0	0.0,,	0.0	0.0	3.7	3.7	0.0	3.7	14.8	0.0	0.0	3.7	0.0	3.7	27
Note: This measure is an unweighted summary of proportions from the survey sample.																					
Denominator (N) is the number of unvaccinated children.																					

DISCUSSION

The measles vaccination coverage for the south-south zone was 87.6%. This was slightly higher than the national coverage of 87.5%; however, lower than the WHO recommended coverage of at least 95% that is required to halt and revert the measles epidemic in a country like Nigeria [7]. It is important to note that despite the numerous measles vaccination campaigns that have been carried out in Nigeria every two to three years since 2005, the country and the zones have been unable to attain the WHO minimum requirement to interrupt transmission. As at the time when this survey was conducted, Nigeria and its geopolitical zones were still giving children only one dose of measles vaccine at 9 months of age. This may not provide all infants the opportunity of getting proper vaccination. Although unlike in the Northern part, relative peace and security exist in the southern part of Nigeria, occasional security unrest occurs due to the peculiarities of the zone which may also be a contributing factor to the documented coverage. In a similar study carried out in Cross River and Bauchi States in South-south and North-east Nigeria, respectively, among children aged 12-23 months, the vaccination coverage was 81.2% and 41.3%, respectively [9]. This report further proves that the relative peace and security in the South-south zone is the reason for the fair vaccination coverage.

The routine measles vaccination coverage for the zone from this survey was (69.4%). This coverage is greater than the national reported coverage of 55.0%. The UNICEF's Multiple Indicator Coverage Survey, as well as the 2018 Nigeria National Demographic Health Survey, have consistently reported that routine immunization coverage are better in the South-south zone than the national estimates [8,10]. This finding can be

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attributed to numerous factors including acceptance of vaccination, better education and lower ignorance levels, lower poverty index and relative peace and security in the southern part of Nigeria, among others [11.] A look at the Kenyan Demographic Health Survey (DHS) of infants born during 2012-2013 revealed a routine immunization coverage of 87%. This relatively high coverage of vaccination could have resulted from implementation of the measles second dose in 2013 among Kenyan children which provides the children a second opportunity at vaccination for all those who have missed the first dose or have failed to seroconvert after receiving the second dose [12]. In 2018, developed countries like the USA, (92%) United Kingdom (92%) and Russia (98%) reported routine immunization rates above the WHO Global Vaccine Action Plan recommended coverage of 90% [13].

Based on this survey, the commonest sources of information about the measles campaign for mothers in the zone was by the town criers/mobilizers (37.3%) and community health workers (25.2%). The finding that town criers were the most common source of information dissemination in the zone is not surprising owing to the fact that these town criers are influential persons in their communities and have always been used in the past as a consistent and effective means of passing information in their communities. However, national estimates put community health workers as the commonest avenue for passing information. This disparity between the national and zonal estimates can be a result of different traditional practices in different parts of Nigeria. While a study carried out in Kenya on innovations in communication technologies for measles supplemental immunization activities, found out that home visits by community mobilizers (70%) were the most common source of obtaining information from mothers. Moreover, another study carried out on measles–rubella vaccination campaign coverage in 47 counties in Kenya revealed that radio (32%), was the most frequent reported source of information [12,14].

This survey identified lack of awareness of the campaign (28.4%), fear of injection (18.8%), and unavailability of mother and infant during the campaign (18.4%) as the common reasons for children missing the vaccination. This is similar to what was documented in the national estimates. In similar studies carried out in Nigeria, poor maternal knowledge and attitudes towards vaccination were reported to be related to non-vaccination of children which are consistent with our findings [15,16]. Similar studies done in Nigeria, Germany and the USA identified have individual socio-economic factors, accessibility to the health facility, fear of side effects, lack of confidence in the vaccine, convenience, complacency, place of residence, number of siblings and vaccination sceptics as notable reasons for children missing vaccination during a campaign [17-23].

This survey reported that the incidence of AEFI in the zone was 19.6%. This was slightly higher than national estimates; however, similar to hospital findings from studies carried out in Puducherry, India (19%) and Kwara State of Nigeria (19.3%) [24,25]. The commonest adverse events following immunization reported in this survey was fever (6.6%). A study done in Enugu, Nigeria reported fever (90.4%), as the commonest AEFI, in nourished (79.8%) and malnourished infants (95.2%), respectively [26]. This finding, however, is not consistent with a similar study carried out in Kano, Nigeria were pain/swelling around the vaccination site among nourished (29.3%) and malnourished infants (47.6%) were the commoner causes of AEFI [27]. The different presentations of AEFI in these studies could be attributed to programmatic or immunization related errors. Parents or caregivers should therefore be well-informed about the different presentations of AEFI and in the event of an AEFI should always report it to a hospital or clinic.

In conclusion, the measles vaccination and routine immunization coverage in the zone were 87.6% and 67.6%, respectively which were both less than the WHO recommendation rates required to end the measles epidemic in Nigeria and its geopolitical zones. The most frequently-reported source of information for mothers during the campaign was the town criers/mobilizers. Furthermore, the commonest reason for non-vaccination was the lack of awareness of the campaign while the most common reported AEFI was fever. To improve SIA and routine immunization coverage in the zone and the nation at large, innovative strategies must be put in place to increase awareness of vaccinations during campaigns and routine immunization sessions. Town criers and community health workers must be sensitized and used effectively. In order to increase the vaccination uptake rates, efforts by the media, the government and its implementation partners must be put in place to successfully counter the negative perceptions and rumours about the vaccination.

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CONFLICT OF INTEREST

The authors declare they have no conflict of interest.

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