



Research Article

Nigeria's Journey to Integration of Injectable Antigens in Mass Vaccination Campaign; Benefits and Challenges using the 2019 Meningitis A and Measles Integrated Campaign

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Abstract

Background: Campaign integration, which refers to the co-delivery of all or some of the campaign components has been one of the guiding principles of immunization strategies. Mass vaccination campaigns serve as critical interventions to address deficiencies in routine vaccination coverage, particularly within health systems facing challenges. Nigeria has been involved in many mass vaccination campaigns but mostly standalone though attempts have been made to integrate some with other health interventions. In 2019, Nigeria conducted an integrated measles and Meningitis A vaccination campaign in sixteen states in Northern Nigeria. Notably, this marked Nigeria's most extensive integrated campaign, involving the administration of two injectable antigens. This paper aims to chronicle the nation's progress towards the integration of injectable antigens within its immunization framework, drawing insights from the unique challenges and successes encountered during the implementation of this integrated campaign.

Methods: We documented the integration of the measles and Men A campaign from earlier planned standalone campaigns to reviewing decision making steps taken during the planned integration. We reviewed the coordination mechanism involved in the integration as well as the campaign budgets and post-campaign coverage survey report to document best practices, challenges, and recommendations for future integrations. **Results:** The findings reveal significant time savings, with the integrated approach. Decision-making involved extensive negotiation and collaboration at all levels, with stakeholder engagement crucial for successful integration. Cost-effectiveness analysis indicated remarkable savings in operational costs, attributed to the efficient resource utilization and prudent planning.

Conclusion: Through a detailed examination of this historic initiative, the paper contributes to the understanding of the complexities surrounding the integration of injectable antigens. It addresses the challenges associated with a crowded immunization calendar and resource limitations in developing countries. The lessons learned contributed to the understanding of campaign effectiveness and offered valuable considerations for future integrated health interventions.

Keywords: Integrated Campaign; Measles and Meningitis A Vaccination Campaign; Campaign Effectiveness; Nigeria

Introduction and Background

Mass vaccination campaigns are usually instituted to bridge the gaps of poor routine vaccination coverage usually associated with a weak health system. They are also an avenue to expediently fill delivery gaps, provide extra or booster doses of a vaccine to eligible persons, reach previously unreached with the particular antigen, and help attain program targets such as elimination or eradication goals of vaccine-preventable diseases [1-3].

Mass vaccination campaigns usually extend the coverage of the antigens to age groups outside those for Routine Immunization (RI) and as such can cover up to 10 times the number scheduled for RI within a period. Campaigns are also used to prevent or respond to disease outbreaks, and therefore require intensive planning, coordination, training of staff, mobilization of vaccines, documentation, safety surveillance and good execution to achieve the aims of the campaign [4,5].

Nigeria is a signatory to the many disease elimination and eradication goals such as measles elimination, polio eradication, eliminating yellow fever etc. and uses mass vaccination campaigns as one of its methods to achieve these goals. The country has yet

to attain high routine immunization coverage to sustain eradication and elimination goals and as such relies on mass vaccination campaigns to boost coverage and achieve herd immunity [6].

An integrated campaign refers to the co-delivery of all or most of the campaign components for two or more health interventions. It could be partial or full integration depending on which areas of the campaign are being integrated [7].

Integration has also been one of the guiding principles of Global Immunization strategies, from Global Immunization Vision and Strategies 2006-2015 (GIVS) to the Global Vaccine Action Plan 2011- 2020 (GVAP) and the recent Immunization Agenda 2030 (IA 2030), as a way to deliver multiple services especially at primary healthcare level in order to improve access through immunization [8-11].

Integration of health services is not new, especially in maternal and child health; advocacy has always been to provide as many interventions as possible when a child or mother presents to the health center, resulting in programs such as Integrated Management of Childhood Illness (IMCI). Kamatsuchi M, et al. documented that an average 100 integrated child health events take place in sub-Saharan Africa with about 154 events alone in 2010, these events are either child health days or immunization focused campaigns [12]. Many studies have been documented on using

mass measles vaccination campaigns as a platform for delivering other interventions especially Vitamin A and Polio [13,14].

The Maternal Neonatal Child Health Week (MNCHW) which has been in practice in Nigeria since 2010 as a biannual event following the recommendation of the National Council of Health delivers integrated maternal and child health services to all pregnant women and children less than five years of age [15,16]. Similarly, Periodic Intensification of Routine Immunization (PIRI), which is a routine immunization program fashioned to enhance routine immunization in areas with extremely weak infrastructure, security problems, or major geographic and resource challenges, has been in practice in Nigeria for some time now and it is used in integrated campaign mode to deliver services [17].

In terms of antigen integration as well as integration across interventions, Nigeria has vast experience in conducting partially integrated vaccination campaigns. Immunization Plus Days (IPDs) replaced the National Immunization Days (NIDs) in 2006 as a response to the community needs, and instead of administering the oral polio vaccine alone as was done in NIDs, a range of antigens (measles and DPT vaccines) are administered with the oral polio vaccines plus other child survival interventions such as anti-helminthics, Vitamin A, distribution of insecticide-treated nets etc. [18].

The integration of most vaccination campaigns in the country involved maternal health and child survival interventions with immunization services. Integration of injectable and non-injectable vaccinations (i.e. measles and polio) was conducted prior to 2019. The 2013 Integrated Measles Campaign (IMC) involved, measles vaccine and oral polio vaccines and in a few local government areas attempts were made to include long lasting insecticide treated nets. In 2014, two injectable vaccines (tetanus and meningitis A) were combined in some Local government Areas in three states [19,20].

Historically, Nigeria has been involved in stand-alone campaigns for meningitis and measles prior to the 2019 integrated measles Men A campaign. For measles, in 2005, the country carried out her first catch-up measles campaign targeting children 9 months to under 15 years and thereafter, stand-alone measles vaccination campaigns have been occurring every two or three years with that of 2013 integrated with oral Polio vaccine [21].

Between 2011 and 2015, following Gavi's approval of Nigeria's proposal to conduct a preventive mass vaccination campaign using the meningitis A conjugate (Men. A) vaccine, in 26 high-risk states including the Federal Capital Territory, preventive mass vaccination campaigns were conducted in these states targeting the age group one year to 29 years in phased manner due to the high target population (81.5 million) and availability of

vaccine [22].

Nigeria, in keeping with global efforts to reduce the burden of vaccine-preventable diseases conducted several mass vaccination campaigns involving various antigens across the country in 2019. In the same 2019, the meningitis vaccine and measles second dose were introduced into the routine immunization schedule. A majority (16 out of 20) of the states in the North including the Federal Capital Territory (FCT) implemented the Integrated Measles and Meningitis A vaccination campaign (IVC). The integration was an innovation as both campaigns were earlier planned as stand-alone campaigns, and this was the first time, integration of injectable antigens was conducted on a very large scale in the country involving sixteen states.

This paper aims to showcase the actions and steps taken to plan and coordinate the implementation of the largest integrated injectable antigens mass vaccination campaign in 16 northern states of Nigeria and the Federal Capital Territory, mentioning some best practices observed during the integrated measles and meningitis A vaccination campaign. The paper also examines some of the benefits of integration and provides recommendations on how to plan and implement integrated vaccination campaigns.

Methodology

Study setting

The study is set in Northern Nigeria, which consists of 19 states and the Federal Capital Territory (FCT). Sixteen of these states and the FCT conducted an integrated vaccination campaign in 2019 except for Kano, Yobe who did stand-alone campaigns and Niger and Kogi states whose campaigns could not take place with the rest because of logistics issues bordering on the availability of the Men A vaccines.

The planning and implementation of the 2019 integrated Measles and Meningitis A vaccination campaign was coordinated by the Non-Polio Supplement Immunization Activities (NPSIA) of the Disease Control and Immunization Department of the National Primary Health Care Development Agency (NPHCDA) with the dedicated staff of WHO, UNICEF, CDC, AFENET, CHAI, NCDC nominated from their various offices to support non-polio supplemental immunization activities. The coordination of the 2019 integrated measles men A campaign used the same coordination platform that implemented the 2017/2018 measles vaccination campaign and operated from the National Polio Emergency Operation Center giving them a more dedicated approach to their work with government leading [23].

Oversight for the team was provided by a steering committee and Core Group made up of NPHCDA management and heads of both local and international partner agencies working in the

immunization space within Nigeria and external support came from the Country Working Group (CWG).

Proposals for 2019 Campaigns

In the 2018 Gavi proposal application window, Nigeria applied for support from Gavi to carry out:

1. A follow-up measles campaign in 2019,
2. A measles second dose introduction into the routine immunization schedule in 2019,
3. Yellow fever preventive mass vaccination campaign in four states of Katsina, Ekiti, Edo and Rivers states in 2019. A multi-year proposal (2019-2021)

These proposals were approved by the Gavi Independent Review Committee (IRC) in January 2019 and were all stand-alone though, the IRC recommended complementarity in some of the activities because there were other previously approved interventions that were earmarked for the same 2019. These interventions are the introduction of the meningitis A (Men A) vaccine into the routine immunization schedule earlier approved for 2016 after the completion of the phased preventive catch-up meningitis A campaign in 2015. This introduction is associated with a "mini catch-up Men A campaign" targeting the birth cohorts born after the mass catch-up campaign of 2011-2015 and before the introduction of Men A into the routine schedule. Thus, the Men A target age group varied across states based on the date of the last men A vaccination campaign in the state. Bauchi, Borno, Gombe, Jigawa, Kano Katsina and Sokoto States targeted children aged 1 to 7 years while the other states target group was children aged 1 to 6 years.

The Decision to Change from Stand-alone to Integrated Campaigns

The country immunization calendar for 2019, was crowded as it included two introductions of vaccines into the routine immunization schedule. The measles second dose starting with the seventeen southern states and meningitis A vaccine introduction starting in the nineteen Northern states as well as the FCT. In addition, measles follow-up campaign in the 19 northern states and the FCT, Yellow fever mass preventive campaign in Edo, Katsina, Ekiti and Rivers states as well as meningitis A follow up campaign in 25 states with variation in the target age group per state. The polio immunization programs (outbreak response and planned national and subnational polio campaigns) were also being carried out side by side with the crowded programs in line with the country's polio eradication efforts. In the same vein,

Maternal and Neonatal Tetanus Elimination campaigns across 108 Local Government Areas in the Northern and Southern states.

The Leadership of the National Primary Health Care Development Agency, the CORE Group made up of team leaders of immunization Partners in the country (WHO, UNICEF, CDC, AFENET, EU, BMGF, World Bank etc.), the Country Working Group (external support to immunization campaigns with Gavi and US CDC as alternate chair) all had various meetings to review the way forward to address the crowded immunization Agenda for 2019. Coincidentally, at the same time, the government of Nigeria was unable to provide her counterpart funds for the planned measles SIA due to the economic crunch in the nation following falling crude oil prices globally. This led to the decision to integrate Men A which, had operational funding with the measles campaign. The decision was taken by the country and backed by Gavi who pooled Gavi's in-country resources with WHO and UNICEF to mitigate the financial shortfall and the crowded immunization calendar. This led to the development of a revised chronogram.

Reviews

We reviewed the minutes of meetings and activities of all the technical working groups, NPSIA unit, steering committee, Core group and Country Working Group. These meetings were held at various levels:

1. High level meetings/engagement with global partners - Country Working Group (CWG), Gavi and United States Centre for Disease Control man the secretariat for the group.
2. Meetings with the Steering committee and the core group that was chaired by the Executive Director NPHCDA.
3. Technical working committee meetings (Training, Logistics, Advocacy, Communication, and social mobilization etc.)
4. Campaign coordinating committee activities and weekly meetings.

Similarly, we reviewed the approved budgets for the stand-alone campaigns – for Men A, the Measles vaccination campaign and the yellow fever campaigns approved by Gavi and also the later approved integrated campaign budgets for the northern states that integrated their Men A with measles.

We also reviewed some of the activities carried out during the integration in order to document best practices and challenges encountered during the integration. The integrated post-campaign coverage survey results for the measles and meningitis A in the study states (integrated and stand-alone campaigns) were also reviewed. This was to ascertain if there were any significant differences in the number of children reached based on integration that was worthy of documenting/sharing.

Results

Planning and Coordination

Minutes of Meetings of the Steering Committee, CORE Group and Country Working Group - Following the approval of the measles vaccination campaigns and the measles second dose introduction proposal, the campaign coordinating committee made up of Partners and the government made regular presentations on preparations for the campaigns as well as the measles second dose introduction to the above committees on a regular basis as detailed in Table 1.

Meetings	CORE Group	Steering Committee	Country Working Group	NPSIA Meetings	Teleconference with States	Stakeholder meetings
Monthly/weekly Frequency	As needed	Monthly then weekly	Weekly except public holidays and days of states engagement	Twice weekly from January to Nov 2019	Weekly (Wed, Thurs, Fridays 10 am - 3 pm (states were batched	Once
Total No of meetings held	6	24	29	60	12 meetings per batch	5 (integration meeting with Polio and the routine immunization committee)

Table 1: Frequency and number of coordinating meetings held during the 2019 integrated measles Men A campaign.

Presentations at these meetings were centered around the development of a chronogram of activities to cover the four (4) antigens, funding and financing updates for the campaigns, readiness, coordination at national and states, logistics, advocacy and social mobilization, human resource.

Development of one microplan and tool - Microplanning processes, which included training and the two-stage verification processes of the states' microplan for measles and the Men. A vaccination campaign was harmonized from the planning stage since it involved the same persons at the lower levels. It was cost and timesaving to have one microplan activity covering all the SIAs. The electronic copy of the tool was also integrated with routine immunization features, as the country was planning to introduce the second dose of measles onto the routine immunization schedule.

Micro plan verification, a part of the microplanning process stands out as one of the core components of pre-implementation activity is the final step before the plans are used. It is a 2-step process conducted at the state and entails physically confirming the details such as population by wards, terrain of targeted places, names of religious places, schools, influential persons in the community, required commodities (vaccines and devices) for implementation etc. that had been entered into the microplanning

tools at the state level. The verification is conducted after a desk review and field visit to selected Local Government Areas to ensure all the aspects of the microplanning tools are correctly filled. The Daily Implementation Plans (DIP) drawn from the microplan is used to inform and train state and LGA teams on the approach for integration [24].

One Advocacy, Communication, and Social Mobilization (ACSM)/Stakeholders plan – Advocacy, communication and social mobilization activities are key to generating demand, increasing uptake, and improving knowledge about vaccines whether during SIAs (Polio and Non-Polio) or RI implementation. A harmonized meeting was held with various stakeholders such as professional medical bodies, other Government Ministries, Department and Agency (e.g., education, National Youth Service Corps, Information, etc.,) Trade Unions, Development partners etc. informing the stakeholders of the integrated SIA and their roles to ensure a successful implementation.

Immunization Chronogram for 2019

Following the approval of the various immunization interventions for 2019, a chronogram of activities, especially the second half of the year when the majority of the planned interventions were to be implemented was developed as shown in Figure 1.

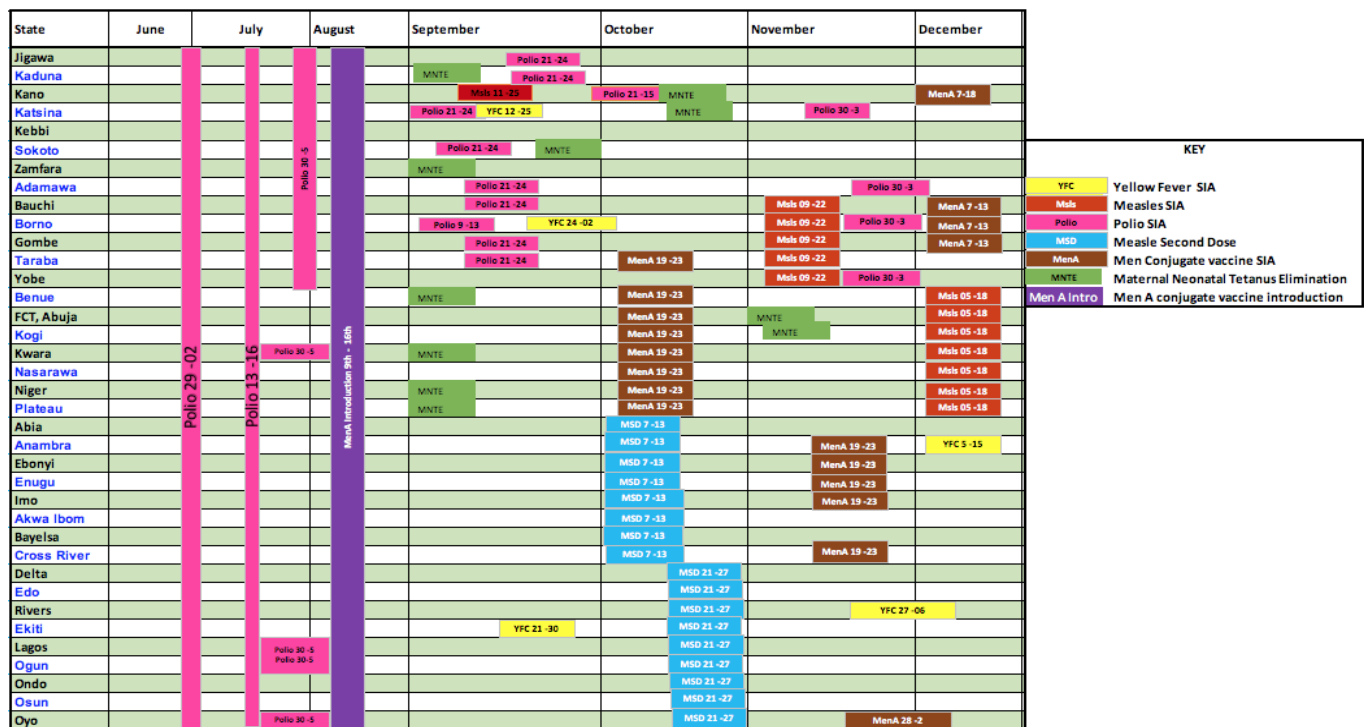


Figure 1: Immunization chronogram for 2019 based on the approvals.

With the decision to integrate the measles and men A vaccination campaigns in some states a new chronogram was developed as shown in Figure 2.

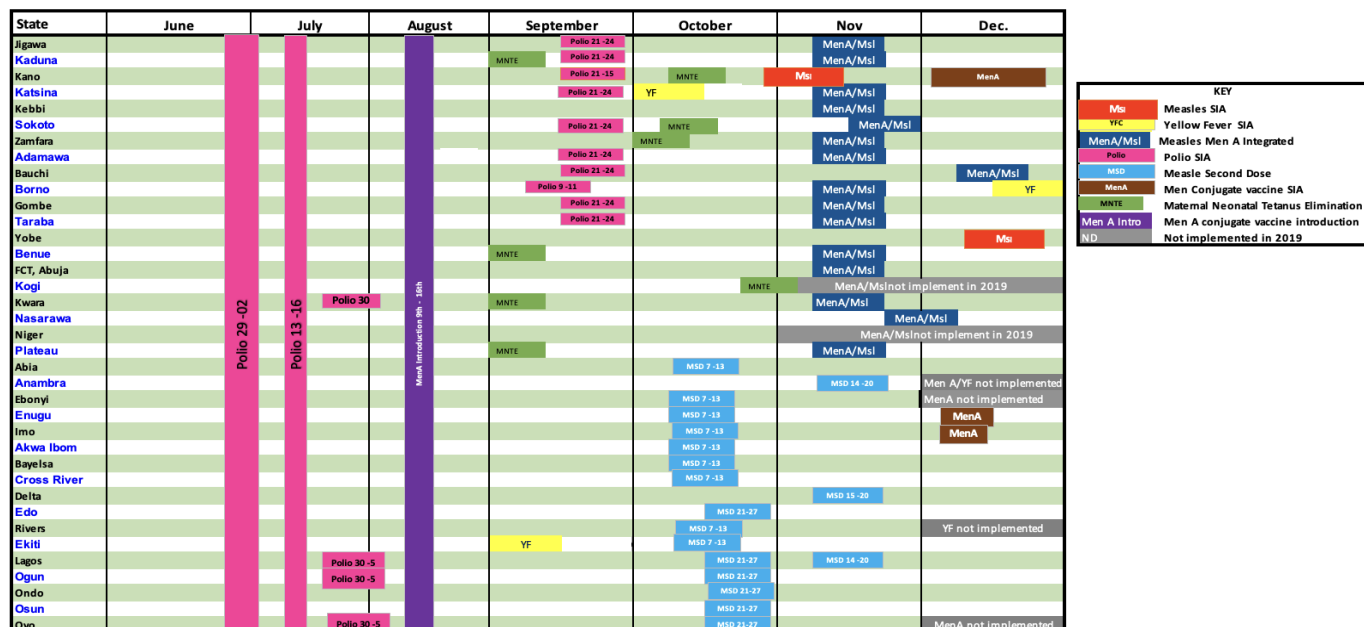


Figure 2: Revised chronogram of immunization activities for 2019.

Training plans

Training, is a major component of vaccination campaigns as health workers’ knowledge is critical for the effective delivery of immunization programs [25]. In the planning for a vaccination campaign, various trainings are carried out to ensure adequate knowledge of the health workers. For the 2019 integrated Men A and measles vaccination campaign, PowerPoint presentations for use at the subnational levels were developed by the National implementing team i.e. government and partners and these presentations covered all the thematic areas of the vaccination campaign; Coordination, planning and financing, cold chain and logistics, ACSM activities, monitoring, supervision and evaluation, data and management of AEFI and surveillance used in monitoring the preparation and readiness of the states using the campaign readiness dashboard [26].

With the integration of the antigens, there were some revisions to the earlier plans to ensure a seamless implementation of the integrated campaign. Some major additional topics introduced at the implementation training were:

- 1. **Vaccination Post Layout:** Since the integration involved a huge number of clients of different ages, there was a special need to guard against wrong administration of vaccines for age, for example, children 9 months to 11 months were to receive

only measles vaccination and could easily be mistakenly given meningitis A vaccine that was not intended for them similarly, a child could mistakenly receive two shots of same antigen in place of the two different antigens if the layout was wrong and the team members were not specially trained. This led to the development of a special training on vaccination post layout (Figure 3) and flow of clients including specified roles and responsibilities in the team composition (Figure 4). An animated video was developed which team members downloaded and shared in their mobile phones for ease of understanding the layout, team composition and client flow. <https://drive.google.com/drive/folders/1uOPVY47aO7zNs6YbEZhw8BtKGxlqE0E2?usp=sharing>

- 2. Special instruction was also passed down to ensure that cold boxes and other cold chain materials were specific in what antigens they contained to avoid mixing up the two antigens.
- 3. The sitting arrangement of the vaccinator and recorder was set in such a way that the measles team didn’t have anything to do with the meningitis team as depicted in the pictures showing best practices from Nasarawa state (Figures 5-9) and no person was allowed to swap or work for the other person to avoid confusion in the vaccination arrangement.

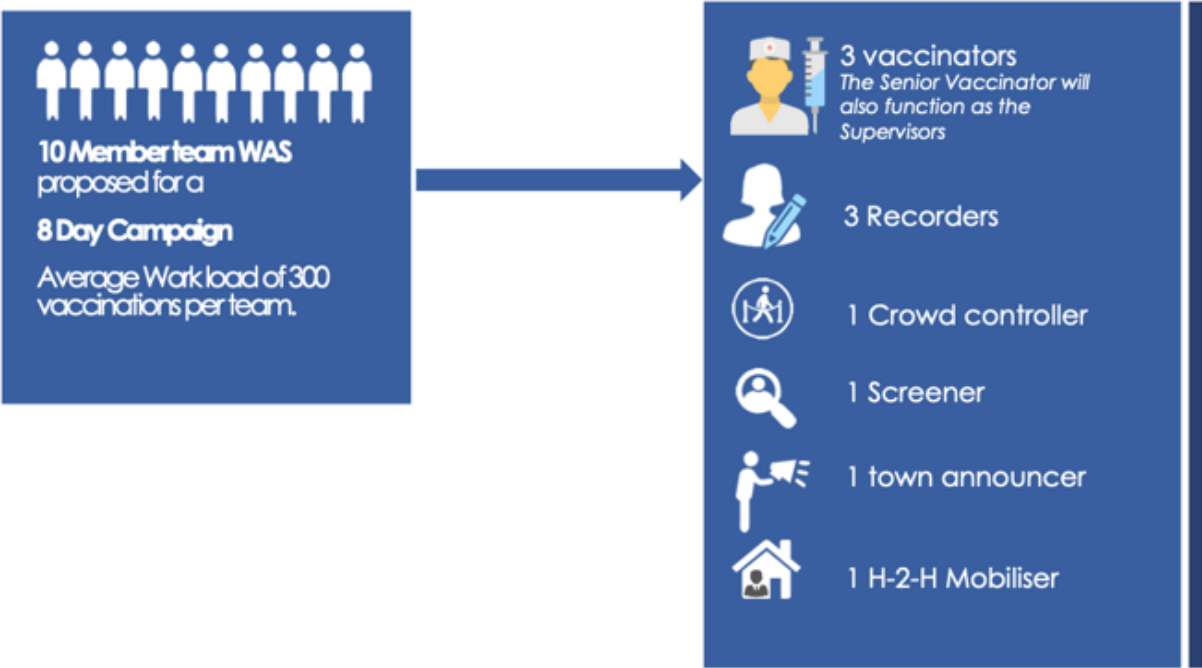


Figure 3: Team composition.

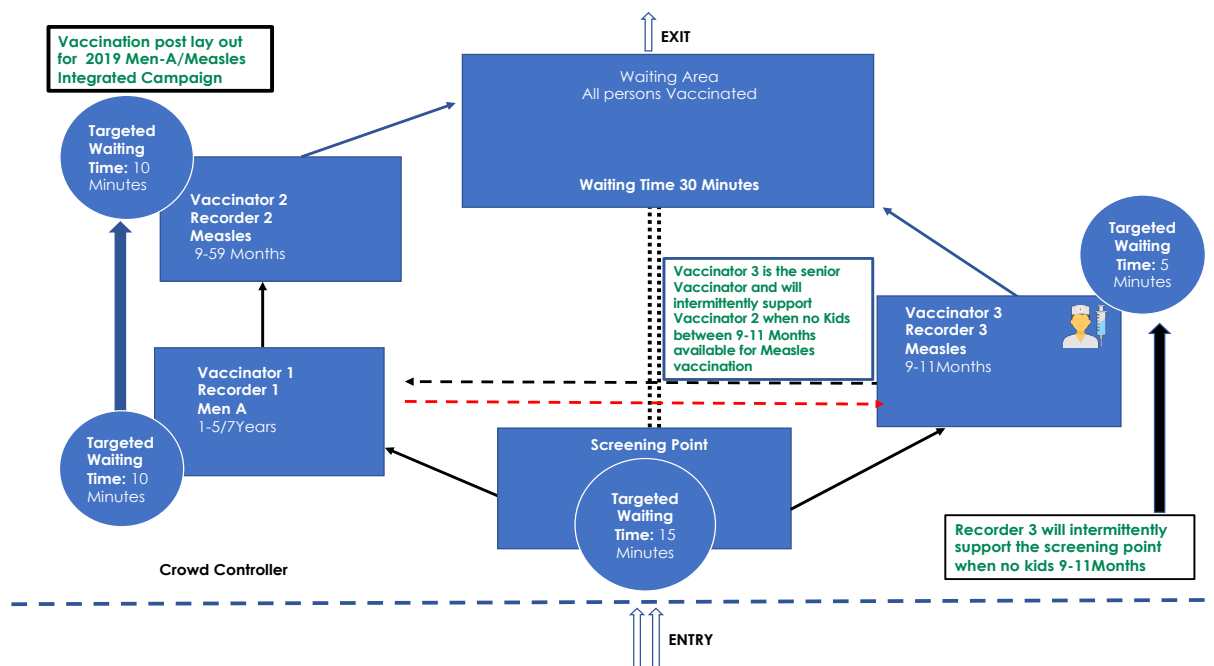


Figure 4: Vaccination post layout.



Figure 5: Orderly arrangement of vaccination post with children and caregivers queuing for their turn.



Figure 6: Sitting arrangement in a temporary fixed post showing the two different antigens with different vaccine storages and the two different recorders for each antigen.



Figure 7: Sitting arrangement of vaccinators and recorders made to prevent a child receiving one antigen twice in error. The cold boxes only store a particular antigen and diluents to avoid mix-up.



Figure 8: Showing orderly arrangement at a temporary vaccination post to avoid errors. Yellow circle - screening area, Pink and purple - vaccination points and Green - post vaccination waiting area.



Figure 9: Sitting arrangement in a vaccination post between care givers, vaccinator and recorders. Note caregiver sits across from 2 vaccinators. First one administers menA, then mother turns child and 2nd vaccinator injects MCV. Recorders sitting next to them hand cards to caregiver after both injections complete.

The training modules were developed and vetted for use at the implementing sub-national level by the Steering Committee.

Budgets

Table 2 shows the summary of the operational cost of the campaign by reviewing the budget for the measles and the Men A stand-alone and that of the integrated campaign in the implementing states. The operational cost is arrived at by summing up all the cost related to activities such as implementation trainings at the states, LGAs and ward levels, campaign waste management, ACSM activities including ACSM tracking and job aids. Others are personnel allowances national, states and LGA supervisors, stipends for transportation of vaccination team, LGA team, independent monitors as well as transportation and logistics for the campaign. The operational cost for the earlier planned measles stand-alone and the men. A vaccination campaign for the study states was 2,666,198,363.66 Naira and 1,839,553,529.36 Naira respectively, totaling 4,505,751,893.02 Naira while the integrated measles and Men A operational cost was 2,112,533,935.92 Naira a difference of 2,393,217,957.10 Naira. The average percentage cost saving with the integration of the two vaccination campaigns was 45.83 with FCT savings being the lowest at 39.66% while savings from Borno was 53.56%.

		Difference btn					
	STATE	Integrated Campaign Op. Cost	Stand-Alone Measles Campaign	Stand Alone Men A campaign	Total Cost of Stand- alone campaign	Combined Stand- alone and IC	% Savings with integration
1	Adamawa	89,389,718.95	129,954,814.11	90,443,077.08	220,397,891.19	131,008,172.24	40.56
2	Bauchi	173,219,408.57	189,043,988.69	173,477,527.63	362,521,516.32	189,302,107.75	47.78
3	Benue	111,890,810.38	165,852,418.42	114,851,751.20	280,704,169.62	168,813,359.24	39.86
4	Borno	231,917,870.50	269,505,059.36	163,500,811.38	433,005,870.74	201,088,000.24	53.56
5	FCT	65,854,411.82	112,272,558.16	53,776,273.79	166,048,831.95	100,194,420.13	39.66
6	Gombe	87,224,741.85	100,469,237.93	80,881,334.35	181,350,572.28	94,125,830.43	48.10
7	Jigawa	191,928,679.10	209,790,796.82	159,459,792.16	369,250,588.98	177,321,909.88	51.98
8	Kaduna	178,114,184.80	267,056,973.72	140,921,477.50	407,978,451.22	229,864,266.42	43.66
9	Katsina	258,546,106.91	286,865,375.70	211,242,054.86	498,107,430.56	239,561,323.65	51.91
10	Kebbi	103,087,930.88	154,116,605.69	93,790,615.27	247,907,220.96	144,819,290.08	41.58
11	Kwara	65,851,307.57	79,940,264.29	72,306,488.84	152,246,753.13	86,395,445.56	43.25
12	Nasarawa	77,343,388.50	115,735,863.38	56,762,040.92	172,497,904.30	95,154,515.80	44.84
13	Plateau	116,587,104.59	167,453,347.46	105,416,318.96	272,869,666.42	156,282,561.83	42.73
14	Sokoto	175,071,482.89	193,904,357.84	138,466,377.23	332,370,735.07	157,299,252.18	52.67
15	Taraba	81,823,451.30	106,209,684.70	75,437,314.91	181,646,999.61	99,823,548.31	45.05
16	Zamfara	104,683,337.31	118,027,017.39	108,820,273.28	226,847,290.67	122,163,953.36	46.15
	TOTAL	2,112,533,935.92	2,666,198,363.66	1,839,553,529.36	4,505,751,893.02	2,393,217,957.10	** 45.83
		** Average for the 16 states					

Table 2: Summary budget for standalone and integrated campaign for the states.

Post Campaign Coverage Survey

Table 3 shows the post-campaign coverage survey results for both antigens including the coverage for Kano state that conducted two stand-alone campaigns. For Men A, the state with the least coverage at 78.5% was Kebbi while the highest was Kwara with 95.4% coverage. For the measles vaccine, Kebbi had the lowest coverage of 80.6% while Kwara state also had the highest coverage of 95.9%. Comparing coverage between the two antigens, in the PCCS, Kano state which conducted two stand-alone campaigns had a range of 6.8% while for the states that targeted children 12-83 months for Men A, Zamfara state had a range of -4.8%, while Gombe and Sokoto states was -1.8%. For states that targeted children 12 months to 59 months, Taraba state had a range of -2.4% while Benue was 0.1%.

2019 post campaign coverage survey result					
STATE	Target Age (Measles)	Target Age (Men A)	2019 Survey Coverage (Measles)	2019 Survey Coverage (Men A)	Difference Between Both Antigens
Adamawa	9 - 59 months	12 - 59 months	84.9	85.1	0.2
Bauchi	9 - 59 months	12 - 83 months	84.6	81.4	-3.2
Benue	9 - 59 months	12 - 59 months	85.2	85.3	0.1
Borno	9 - 59 months	12 - 83 months	89.5	87.4	-2.1
FCT Abuja	9 - 59 months	12 - 59 months	91.8	92.5	0.7
Gombe	9 - 59 months	12 - 83 months	89.8	88	-1.8
Jigawa	9 - 59 months	12 - 83 months	91.2	88.3	-2.9
Kaduna	9 - 59 months	12 - 59 months	91.2	90.3	-0.9
Kano *	9 - 59 months	12 - 83 months	89.7	96.5	6.8
Katsina	9 - 59 months	12 - 83 months	88.6	91.1	2.5
Kebbi	9 - 59 months	12 - 59 months	80.6	78.5	-2.1
Kwara	9 - 59 months	12 - 59 months	95.9	95.4	-0.5
Nasarawa	9 - 59 months	12 - 59 months	90.6	90.2	-0.4
Plateau	9 - 59 months	12 - 59 months	94	93.4	-0.6
Sokoto	9 - 59 months	12 - 83 months	83.2	81.4	-1.8
Taraba	9 - 59 months	12 - 59 months	92.1	89.7	-2.4
Yobe **	9 - 59 months		95.1		NA
Zamfara	9 - 59 months	12 - 83 months	89.2	84.4	-4.8

* Did stand alone campaign

** Did only measles SIA

Table 3: 2019 Post campaign coverage survey result for Measles and Men A vaccines.

Discussion

The ever-increasing burden of limited resources to carry out health campaigns was a driver for integrating the many mass vaccination campaigns that were slated for 2019 in Nigeria. Personnel, funds, time etc. were in short supply in an unusually busy immunization year. From our results, we would discuss some of the findings in integrating the measles and Men A vaccination campaign: **Time saved.**

From the chronograms in Figures 1 and 2, all the twelve months of the country had an immunization activity across all the states, and it was obvious that without the decision to integrate the measles and the Men A vaccination, it could have been impossible to effectively carry out the 2019 Gavi approved interventions. This became more pertinent as, at least twenty-eight days could have been needed to administer two live vaccines if not administered at the same time [27], and that time could have further stretched the immunization calendar further into the following year. Anambra

state was scheduled to carry out integrated Men A and Yellow fever campaign, but this could not happen because when the mandatory twenty-eight days interval needed for injecting another live vaccine after the measles second dose introduction in the state was projected, their campaign fell into the Christmas season, and this was not advisable. Based on lessons learnt, December being holiday season is not the best of time to schedule any major health intervention as the quality will not only be poor, some, of the targeted clients would have been missed because of travels as found in other studies on holiday migration [28].

Decision, Coordination and Collaboration

Integration of the Men A and measles campaign did not just fall from the rooftop. It involved a lot of thorough thinking and negotiation before arriving at the decision to integrate. Negotiation to integrate was done at the highest level as proposed in the Health Campaign Effectiveness Coalition Decision guidelines [29]. From our study, the importance of good coordination and

collaboration among stakeholders at both National and subnational levels cannot be over emphasized. All the relevant stakeholders (partners, donors, implementers, religious and Traditional leaders, national and subnational government) were engaged early enough as soon as the decision to integrate was taken to get their buy-in. The government played a leading role in the decisions to integrate amongst the stakeholders. The coordination and collaboration seen in this study are similar to the findings of Chehab, et al. in their review of best practices from the integration of Vitamin A and Polio campaign in five African countries of Angola, Chad, Cote d'Ivoire, Tanzania and Togo, and Bazant et al. in their promising practices for the collaborative planning of integrated health campaigns from a synthesis of case studies [30,31]. The team appreciated the complexity of integrating both antigens since there were children under one year who were taking only the measles vaccine and some children above 59 months that were taking only the Men A vaccine. This complexity resulting from age and antigen-specific differences amongst the target population as well as the dynamic iterative process involving the numerous relevant stakeholders was noted, respected and considered in the planning and coordination of the integrative campaign as recommended by Cathain, et al., in their guidance on how to develop complex interventions to improve health and healthcare [32].

While the decision to co-administer immunization antigens was left with the policymakers and program managers, decision for vaccine co-administration was provided by the National Immunization Technical Advisory Groups (NITAG), who used well reviewed and tested evidence to recommend to the policymakers and program managers. Nigeria's equivalent - the Nigeria Immunization Technical Advisory Group (NGI- TAG) had severally assisted the immunization program with decisions on vaccine types, formulations but for the 2019 integration of measles and men A antigens, NGI-TAG applied the principle of use of previous studies to approve the integration [33].

Cost-effectiveness and efficient use of resources

From the budget Table 2, there was remarkable savings in the operational cost of delivering the integrated vaccines when compared to the earlier stand-alone budgets. The average 45.83% saved from the sixteen states based on integration could have been more as the additional birth cohort due to the one-year delay of the earlier approved men. A mini catch-up campaign added to the target population. The mini catch-up targeted children that were born after the major menafri vac campaigns between 2012-2015 that happened in phases. The savings from the integration was not unconnected to the efficient use of resources and more prudent planning. For example, in the integrated budget House-to-house mobilisers were reduced from 10/ward to 1/ward. The number of teams was reduced based on the increased number of days for the

campaign (integrated campaign – 8 days and standalone – 5 days). The measles campaign projected a vaccination rate of 35 persons/hour compared with the 60 persons/hour projection of both the Standalone Men-A and integrated campaign budgets. Still on prudent planning, one major challenge that campaigns in Nigeria has had is the issue of target population which is derived from the population of the states. Prior to the 2017/2018 measles vaccination campaign, proposals were developed using projections from the 2006 national census and that had contributed to over budgeting as some of the population figures were not accurate due to the differences in growth rate since the census in 2006. The 2017/2018 measles campaign afforded the immunization team the opportunity of getting a more accurate target population as Geographic Information System (GIS) was used in arriving at the population used for the Northern states while the southern states did a household enumeration for the target population [34]. The exercise gave the team a near accurate population for subsequent immunization interventions, this was applied in reworking the earlier approved men A catch up campaign for these 16 states leading to more savings. These and other detailed savings have been documented by Anne Eudes Jean Baptiste et al, who documented the cost savings between the stand-alone and the integrated strategy [35].

Our findings are not different from other studies that showed that integration of interventions reduces cost when compared to individual interventions. In Bosselli, et al., a study in Lao PDR, a ten times reduction in the cost of deworming individuals was observed when the deworming program was integrated with an existing immunization program [36]. Savings from appropriate implementation of health interventions have been linked with efficiency and have been recommended in Baraimi, et al. study as a way of expanding the fiscal space for the health care system [37]. In the same vein, Lankester, et al. in their study on integrated health delivery platforms, targeting Soil-Transmitted Helminths (STH) and canine-mediated human rabies, demonstrated that integrated delivery resulted in a lower cost per dose delivered than if each intervention had been delivered independently [38]. However, in a study by Immunization Costing Action Network in Nigeria, there was no significant difference in financial cost per targeted individual when they compared the two states that did stand-alone yellow fever campaign with a state that integrated yellow fever with meningitis vaccine [39]. This observation may be due to the differences in the delivery strategies and the timing of the campaign. The integrated campaign came up post-COVID-19 pandemic while the stand-alone campaigns were pre-COVID19. Vaccination campaigns in Nigeria and other low- and medium-income countries have been associated with disruption of routine services as health facilities are almost shut down to other services because the few available health workers are deployed for the campaigns [40,41].

Therefore, integration which reduces the number of campaigns could be seen as a means of reducing the disruption of services associated with multiple campaigns. The efficient use of resources, reduction in fragmentation of programs, improvement in collaboration amongst stakeholders and programs associated with integration have been demonstrated by Wirtz, et al., Engel et al. and Morgan et al. studies that looked at integrating the Human Papillomavirus vaccination program with enhanced cervical cancer screening and treatment, promoting adolescent health and other life course services [42-44].

Reaching More Targets

From our study, looking at the difference in the percentage coverage of the antigens in the post-campaign study, the difference in coverage between the states that integrated was small compared to Kano state that conducted two stand-alone campaigns. This could mean the integration probably led to more reach of clients when compared to when they were given separately. Studies on antigens preference by caregivers in Nigeria are not available but from the most recent National Immunization Cluster Survey report, antigens given at the same time showed no significant difference in coverage, for example the third dose of Oral Polio Vaccine, Pentavalent vaccine and the Pneumococcal conjugate vaccine taken same time were 56%, 57% and 55% respectively [45], meaning clients don't select what antigen they are willing to take. In other integrated interventions, especially between different but related interventions, the extent to which the intervention reaches the target population (REACH) is usually on the positive. HIV services integrated with family planning, antenatal care, and tuberculosis screening have all shown positive reach in both integrated services [46,47]. For integrated antigens, more research may be needed to ascertain if integration has any effect on the number of clients reached per antigen based on the integration. However, vaccine coadministration practices which have been shown to be cost-effective in facilitating the introduction of new vaccines into the immunization programs has also been shown to improve coverage rates [48].

In summary, this article has thrown some historical perspective on the integration of health campaigns in Nigeria and the integration of the measles and Men A vaccines in the 2019 supplementary immunization activity has demonstrated some of the benefits of integrating antigens amid a crowded immunization activities calendar as usually witnessed in most developing countries where routine immunization alone does not provide the needed herd immunity for addressing vaccine-preventable diseases. However, it is pertinent to note that dedication to details in the planning of a huge integrated campaign is necessary as some Nuts-and-Bolts issues such as differences in target age group, number of vaccine doses, immune response, and safety of

coadministration as well as unintended consequences are worth paying attention to for successful integration.

Strength and Limitations

The utilization of meticulously documented meeting minutes stands out as a significant strength in this study, reducing reliance on informant interviews and thereby minimizing the potential for recall bias. This methodological choice significantly bolsters the credibility and reliability of the study's findings.

However, the study is not without its limitations. The expansive scope covering 16 northern states and the Federal Capital Territory (FCT) presented a challenge in delving into specific details at the state level where interventions were implemented. This limitation may impact the depth of insights and impede the ability to capture nuanced variations in implementation practices across different states. Another noteworthy limitation is the absence of guidelines, including definitions, from the Health Campaign Effectiveness Coalition for integrating campaigns at the time of the 2019 integrated campaign. These guidelines and definitions were not used to guide the integration of the antigens. However, some members of the study team have been contributors to the development of these global guidelines and experiences from the Nigeria' 2019 integrated campaign were used in drafting the guidelines.

Recommendations

From our study, integration of antigens in a vaccination campaign is possible and it should be encouraged for resources (human and finance) limited settings. Factors that determine the success of such integration include good coordination and planning with a single planning, coordination, and funding source paramount with all the relevant stakeholders carried along in the decision making, that is from conception through to post implementation. It is recommended that the funders of some of these campaigns at the Global level such as Global Fund and Gavi need to collaborate in ensuring integration is considered while approving country proposals for support. Enablers and facilitators of integration within and across health interventions are well elaborated in the campaign integration decision toolkit of the Health Campaign Effectiveness Coalition [49].

Credit Authorship Contribution Statement

Adejoke Oladele Kolawole: Conceptualization, Methodology, Formal analysis, Writing – Original draft, Writing – Review and editing, Visualization – Tables and figures. Avuwa Joseph Oteri: Conceptualization, Methodology, Formal analysis, Writing – Original draft, Writing – Review and editing, Visualization – Tables and figures. Samuel Ibizugbe: Review and editing, Visualization – Tables and figures, Methodology,

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Writing – Review and editing. Samuel Bawa: Conceptualization, Methodology, Writing – Review and editing, Visualization – Tables and figures. Fred Moge kwu: Conceptualization, Methodology, Writing – Review and editing, Visualization – Tables and figures. Chidinma Amara Nwachukwu: Writing – Review and editing, Visualization. Chinedu Okoronkwo: Review and editing. Boubacar Dieng: Review and editing, Validation. Anne Eudes Jean Baptiste: Conceptualization, Writing – Review and editing, Visualization – Tables and figures. Nadia Lasri: Review and editing, Validation. Nneka Onwu: Review and editing, Validation.

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Authors' Contribution

AOK, AJO, FM, and SB conceived of the study idea, contributed to the study design and literature search and analysis of findings. CBN, SI, CO, BD, AEJB, NL and NO contributed to data collection, preparation of figures and tables, and performed the analysis. All contributed to interpretation and writing.

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 measles elimination strategy and Supplemental Immunization Activities. Campaign budget data are available on request from the corresponding author.

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