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# Improving coverage of vitamin A supplementation through integration with seasonal malaria chemoprevention delivery

An implementation research study in rural and urban settings in Nigeria

## Malaria Consortium

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## Key messages

- High-dose vitamin A supplementation (VAS) delivered twice annually is a proven low-cost intervention that has been shown to reduce all-cause mortality in children.
- Integrating community interventions for multiple diseases increases coverage, improves health outcomes and is cost-effective.
- Integrating VAS with the seasonal malaria chemoprevention (SMC) platform resulted in increased coverage of VAS, without compromising the quality of SMC or its coverage.
- Stakeholder and caregiver engagement at all levels on behavioural expectation is critical to success.
- Integrating VAS with SMC is safe, feasible, acceptable to community members and implementers, and can be achieved at minimal additional cost.
- Integration of VAS with SMC can strengthen the health system for more equitable service delivery and provide a template for deployment in other health interventions.

## Background

Malaria, diarrhoea, and pneumonia are among the leading causes of death in children under five. In approximately 45 percent of cases,<sup>[1]</sup> malnutrition — including micronutrient deficiencies — is an underlying factor. Globally, about 190 million children under five are affected by vitamin A deficiency (VAD),<sup>[2]</sup> which is considered a major risk factor for child survival and increases fatality of common diseases such as acute gastroenteritis, pneumonia and measles.<sup>[3]</sup> Children with clinical signs of VAD are 3–12 times more likely to die than those who are non-deficient.<sup>[4]</sup> The World Health Organization (WHO) has recommended that high-dose VAS be given every 4–6 months to children 6–59 months who are at risk of VAD.<sup>[5]</sup> Vitamin A supplementation (VAS) protects children from visual disorders such as xerophthalmia, which can lead to blindness,<sup>[6]</sup> and has been documented to reduce the incidence of diarrhoea (RR 0.85, 95% CI 0.82–0.87) and measles (RR 0.50, 95% CI 0.37–0.67), with a 12–24% effect on all-cause mortality in children under five.<sup>[7]</sup>

VAD prevalence among children under five in Nigeria is a severe public health problem.<sup>[8]</sup> VAS administration campaigns have been delivered through the Maternal, Newborn and Child Health (MNCH) Weeks, which rely on fixed posts combined with community outreach; this implementation strategy has been largely ineffective in reaching eligible children.<sup>[9]</sup> In 2018, VAS coverage in Nigeria was 45 percent, with wide subnational variations. Most northern states fell below the national average, suggesting inequity in coverage.<sup>[10]</sup> This decline has been linked to policy and programme implementation (Nigeria operates a decentralised health system)<sup>[11]</sup> and to factors related to individuals and households: mothers' level of education, socioeconomic status, antenatal care attendance and geographic location.<sup>[12]</sup> Addressing the poor VAS coverage among children is crucial for their survival in Nigeria, and for universal health coverage.

There is evidence that integrating community interventions for multiple diseases increases coverage, improves health outcomes and is cost-effective.<sup>[12–14]</sup> VAS was previously co-delivered with the polio vaccine during the National Immunization Plus Days. The door-to-door delivery strategy was found to be far more effective in achieving higher coverage of both the vaccine and VAS than the current national strategy.<sup>[13,14]</sup> With the success of the Global Polio Eradication programme, this platform is no longer a viable option in Nigeria. Seasonal malaria chemoprevention (SMC), a strategy recommended by WHO to prevent malaria deaths and infection in the Sahel region,<sup>[15]</sup> has been implemented in Nigeria since 2013 and provides an existing viable and promising platform within which VAS could be fully integrated to achieve higher coverage.



Mother administers SPAQ to her child as directly observed treatment, supervised by community distributors, SMC VAS co-implementation study 2019, Sokoto state

This study aimed to provide additional evidence to support policy makers’ decision-making regarding full integration of VAS with SMC campaigns at scale and in diverse settings.

Its objectives were to:

1. design and implement, in collaboration with key stakeholders, an integrated SMC plus VAS campaign at scale and in diverse settings (rural and urban) in Bauchi state as part of the existing SMC programme
2. assess the feasibility (including effectiveness, equity, safety and cost) and acceptability of integrating VAS with SMC among caregivers, community distributors, health workers and policy makers
3. provide policy makers and stakeholders with a body of evidence to inform decision-making about integrated SMC and VAS in Nigeria through a research uptake plan.

## Methods

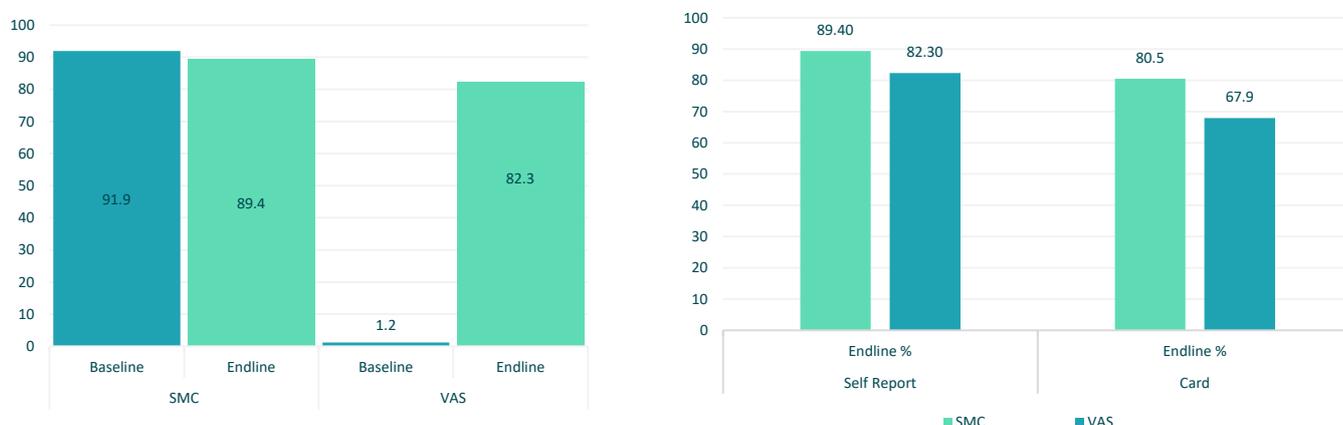
The study used a convergent mixed-methods approach to test the integration of VAS into an SMC programme on a larger scale. We carried out baseline (in September, after cycle 3) and endline (November, after cycle 4) household surveys to collect information on coverage, equity, safety and quality of SMC. Child SMC Cards were checked in addition to reported coverage of SMC and VAS. We also collected economic and financial cost data from project teams and implementers, and measured feasibility and acceptability through focus group discussions (FGDs) and key informant interviews (KIIs). The study sites were Giade and Katagum local government areas (LGAs) in Bauchi state in northeastern Nigeria. We selected Bauchi state based on poor indices recorded in the 2018 National Demographic Health Survey data. The population for the survey included children under five, with specific eligibility criteria for SMC and VAS (specifically, ages 3–59 months for SMC and 6–59 months for vitamin A). The effective sample size was 521. We rounded this up to 540 and used a multistage cluster sampling method to select clusters (wards), followed by settlements, households and eligible children. We held 12 FGDs in the two LGAs: five KIIs at the state level and seven at the national level. We adapted structured data collection instruments, as well as FGD and KII guides, from a similar study conducted in Sokoto state in 2019. <sup>[16]</sup> (See appendix for full methods).

## Results

### Effectiveness: Coverage of SMC and VAS

Overall, 170,681 children received both SMC and VAS during the integrated campaign, whereas 157,876 received VAS only. VAS coverage increased from 1.1 percent at baseline (without SMC integration) to 82.3 percent at endline (with SMC integration), in both project LGAs (**Figure 1**). **Figure 2** compares self-reported coverage with verified coverage using child SMC cards and vitamin A stickers. According to the latter, VAS coverage was 67.9 percent compared to self-reported coverage of 82.3 percent at endline. Card-verified coverage for SMC (proportion of children who received SMC medicines on day 1 of the course) was 80.5 percent, compared to 89.4 percent for self-reported coverage. Integration did not adversely affect the coverage of the SMC campaign. There was no marked difference in coverage between baseline and endline, which was 91.9 and 89.4 percent, respectively (**Figure 1**).

Figure 1: Percentage of eligible children receiving SMC and VAS at baseline and endline



### Quality and safety

The proportion of children who received the first dose of SMC as directly observed treatment (DOT) increased from 77.1 percent at baseline to 85.9 percent at endline (**Table 1**). Adverse drug events were reported in only 4.1 percent of children who received SMC and 1.6 percent of children who received VAS (**Table 2**). There was no difference between the types of adverse events reported at baseline compared to endline.

Table 1: Proportion of eligible children who received first dose of SMC as directly observed treatment

First dose SMC given as DOT	Baseline	Endline	P-value
	<b>n (%)</b>	<b>n (%)</b>	<b>&lt;0.0001</b>
No	114 (22.9)	68 (14.1)	
Yes	384 (77.1)	414 (85.9)	
Total	498 (100)	482 (100)	

Table 2: Adverse drug events reported by caregivers at endline for SMC and VAS

First dose SMC given as DOT	Endline		P-value
	SMC	VAS	
	<b>n (%)</b>	<b>n (%)</b>	<b>&lt;0.0001</b>
No	462 (95.9)	435 (98.4)	
Yes	20 (4.1)	7 (1.6)	
Total	482 (100)	442 (100)	

## Equity

To measure equity, the background characteristics of children who received SMC and VAS at endline were compared with those who did not receive either SMC or VAS (**Table 3**). Demographic characteristics included: the child’s age, sex, household religion, caregiver’s level of education, occupation and wealth index. We found no difference between the children that received SMC at endline and those who did not receive it, when analysed against these demographic characteristics. This was similar for VAS; however, we discovered that children living in urban areas were less likely to be reached with either SMC or VAS.

## Cost analysis

The total cost per child receiving only SMC at baseline was \$0.94 (₦385.6), while the total cost per child receiving both VAS and SMC at endline was \$1.18 (₦483.71). In both instances, the costs excluded design and start-up costs; the main cost drivers for both campaigns comprised cost of distribution, medicines and training. Integrating VAS into the usual SMC cycle introduced a minimal additional unit cost of \$0.24 (₦98.11) per child (**Figure 4**).

## Feasibility and acceptability

Caregivers were happy with the intervention because of the perceived health benefits to their children. Community distributors, caregivers and some stakeholders believe the integration is feasible and likely to continue. Some community distributors, however, expressed concerns about the 30-minute wait time between SMC administration and VAS.

**“We feel like lifting her up because of happiness... We have four children in the house that have eye problem[s]... we were happy that it will cure the eye problem even before she gave us [VAS].”**

Caregiver, Katagum



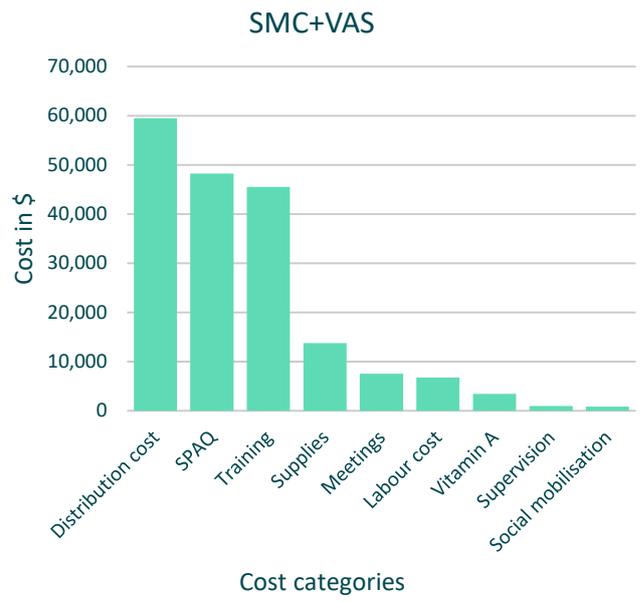
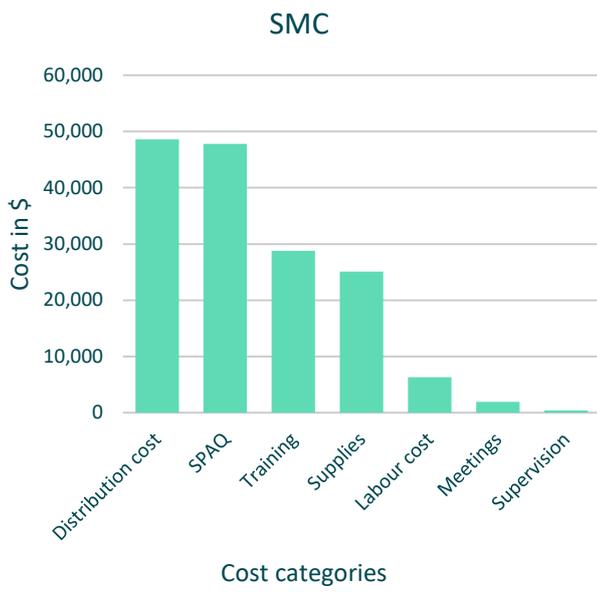
**“Combining them both is stressful. This is because we were told that you would have to wait 30 minutes after SMC has been administered to administer VAS and this wastes a lot of time**

Child receives VAS from community distributor, Bauchi state, 2021

Table 3: Proportion of children who received and did not receive SMC and VAS at endline

Background Characteristics	Vitamin A			SMC		
	No n (%)	Yes n (%)	P-value	No n (%)	Yes n (%)	P-value
<b>Child's age</b>						
6-11months	11 (11.6)	40 (9)		8 (14.0)	43 (8.9)	0.211
12-59months	84 (88.4)	402 (91)		49 (86.0)	439 (91.1)	
<b>Child's sex</b>						
Female	55 (57.9)	189 (42.8)	0.064	30 (52.6)	215 (44.6)	0.149
Male	40 (42.1)	253 (57.2)		27 (47.4)	267 (55.4)	
<b>Household religion</b>						
Christianity	3 (3.2)	4 (0.9)	0.126	3 (5.3)	4 (0.8)	0.190
Islam	92 (96.8)	438 (99.1)		54 (94.7)	478 (99.2)	
<b>Wealth index</b>						
Lowest	39 (40.2)	158 (35.7)	0.838	27 (47.4)	170 (35.3)	0.683
Middle	30 (30.9)	145 (32.8)		16 (28.1)	159 (33.0)	
Upper	28 (28.9)	139 (31.4)		14 (24.6)	153 (31.7)	
<b>Occupation of household head</b>						
Farming	52 (63.4)	188 (48.1)	0.149	23 (52.3)	217 (50.3)	0.476
Trading	9 (11.0)	85 (21.7)		6 (13.6)	88 (20.4)	
Cattle rearing	2 (2.4)	22 (5.6)		1 (2.3)	23 (5.3)	
Fishing	1 (1.2)	2 (0.5)		1 (2.3)	2 (0.5)	
Civil Servant	5 (6.1)	35 (9.0)		4 (9.1)	36 (8.4)	
Technician	15 (18.3)	59 (15.1)		9 (20.5)	65 (15.1)	
Total	82 (100)	391 (100)		44 (100)	431 (100)	
<b>Caregiver's highest education level attended</b>						
No Formal Education	78 (82.1)	344 (78.0)	0.474	45 (79.0)	379 (78.6)	0.200
Pre-primary	0 (0)	1 (0.2)		0 (0)	1 (0.2)	
Primary	5 (5.26)	45 (10.4)		6 (10.5)	45 (9.3)	
Secondary	7 (7.37)	40 (9.0)		2 (3.5)	45 (9.3)	
Higher	5 (5.26)	11 (2.5)		4 (7.02)	12 (2.5)	
<b>Locality</b>						
Urban	58 (61.1)	211 (47.7)	0.023	46 (80.7)	225 (46.7)	<0.0001

Figure 4: Main campaign cost drivers



## Promising practices

Adopting a co-design approach to develop the strategy that informed the study protocol provided the opportunity to identify and address potential bottlenecks to the integration. We adjusted community distributors' daily targets by factoring in a 30-minute wait after administering SMC medicines, before giving VAS. We reduced daily targets from 70 children per day to 56 children per day and added an implementation day to avoid compromising quality.

Harmonising VAS and SMC implementation tools (such as tally sheets, referral forms and summary sheets) and aligning these with the national district health information system (DHIS) Growth Monitoring Register — the reporting system for vitamin A — helped to test the feasibility of feeding campaign data into the national reporting platform, with promising results. The number of children reported on the DHIS platform to have received VAS increased during implementation (September–October), from 1,118 to 53,253 in Giade, and from 1,631 to 91,699 in Katagum.

## Lessons learned

- Early, collaborative microplanning (which integrated VAS requirements into SMC implementation micro plans) and targeted community engagement were needed to achieve high VAS coverage. This involved the active engagement of all key stakeholders.
- Adequate supply chain preparedness was critical to ensuring vitamin A and SMC medicines were available and co-packaged for distribution from the central medical stores to the health facilities.
- Door-to-door distribution proved to be more effective than the current national strategy in achieving higher VAS coverage. Community distributors were able to reach almost every household, irrespective of distance.
- Using adequately supervised, existing community distributors, selected from their communities and already trained in/familiar with SMC implementation, ensured a seamless integrated delivery.
- Additional training on VAS delivery within an SMC campaign using pictorial algorithms and standard operating procedures reduced difficulties among community distributors in applying the slightly different age bands for the two interventions.
- Effective monitoring and supportive supervision of field personnel ensured compliance with integration and intervention guidelines. Prompt correction of errors by supervisors using the 'sandwich' method boosted community distributors' confidence and ensured protocol adherence.

## Implications for policy, practice and future research

1. **Conduct early and all-inclusive stakeholder engagement** to ensure consensus on the integrated campaign implementation strategy before the start of campaign.
2. **All stakeholders for both programmes, malaria and nutrition, must be involved during microplanning** to ensure inputs, processes and expected outputs are agreed.
3. **Identify existing coordination platforms** comprising key decision makers to provide campaign oversight and coordination, sign off on the implementation strategy and troubleshoot/help resolve bottlenecks.
4. **Use quality data from the micro plans for commodity supply management.** State governments should source vitamin A and ensure sufficient quantities are available for integrated campaigns, using existing safe storage. Governments should factor in lead time for supply of commodities into distribution plans and campaign start dates.
5. **Incorporate key messages into the SMC communication strategy** about the benefits, effects and side effects of vitamin A to create awareness at all levels.
6. **Consider increased workload of the additional intervention** in determining daily targets for community distributors to ensure protocol adherence, without compromising the quality of delivery. In the event of campaign scale-up, increase the number of days allocated to delivery.
7. **Use existing government-owned platforms to capture campaign data.** Where no existing community-based health information system is in place, or it is inadequate, implementers should provide support to develop harmonised and sustainable data capturing tools.
8. **Train and properly equip all staff in pharmacovigilance.**
9. **Pay personnel remunerations promptly,** through appropriate institutional structures, to encourage optimal staff performance.

10. Carry out a budget impact analysis and explore funding options for an integrated campaign to scale up the intervention.

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# Appendix

## Methods

### Study design and location

The study used a convergent mixed-methods approach to test the integration of VAS into an SMC programme on a larger scale. We carried out baseline and endline household surveys to collect information on coverage, equity, safety and quality of SMC. We further collected economic and financial cost data from project teams and implementers, and measured feasibility and acceptability through focus group discussions (FGDs) and key informant interviews (KIIs). The study sites were Giade and Katagum local government areas (LGAs) in Bauchi state in northeastern Nigeria. We selected Bauchi state based on poor indices recorded in the 2018 NDHS survey data. The population for the survey included children under five, with specific eligibility criteria for SMC and VAS (specifically, ages 3–59 months for SMC and 6–59 months for vitamin A).

### Sample size and sampling

For the household survey, using the formula for comparing proportions of two surveys, the effective sample size was 521. We rounded this up to 540 and used a multistage cluster sampling method to select clusters (wards), followed by settlements, households and eligible children. Participants for the qualitative aspect of the study were selected at LGA, state and national levels. We conducted a total of 12 FGDs in the two LGAs (i.e. six in each LGA, comprising interviews with two caregivers, community distributors and supervisors). Five KIIs were conducted at the state level and seven KIIs at the national level making a total of 12 key informant interviews conducted in this study.

### Data collection

We adapted structured data collection instruments, as well as FGD and KII guides, from a similar study conducted in Sokoto state in 2019.<sup>[1]</sup> We pretested instruments before deploying them for the main study, and trained data collectors on the protocol, tools and how to conduct Computer-assisted Personal Interview (CAPI) using SurveyCTO. Using feedback from the pretest, we revised and finalised the topic guides and made modifications to the survey tools. We collected baseline data during the third SMC cycle, while endline data and qualitative data collection were carried out during the fourth cycle (in November 2021). We used ATLASTi version 9 to conduct thematic analysis of transcripts from interviews.

### Research ethics

Approval for the study was received from the Bauchi State ethics review committee and National Health Research and Ethics Committee.

## Acknowledgements

We acknowledge the National Malaria Elimination Programme, Primary Health Care Development Agency, Bauchi State Government, Vitamin Angels, field staff of Malaria Consortium, all health workers, community distributors and caregivers of study participants.

The Health Campaign Effectiveness program (HCE) thanks the following content reviewers: Annette Imohe, Nutrition Specialist, UNICEF; Jim William Wirngo, Malaria Program Specialist, USAID; and David Gittelman, Global Health Consultant. HCE team members are acknowledged for contributing to the research brief template, web page design, award management, and editing of the brief, including Hallelujah Anteneh, Eva Bazant, Jessica Cook, Ahmed Haji-Said, Vivek Patel, Aimee Rivera, Kristin Saarlus, Allison Snyder and Lucia Wetherell.

## Funding Attribution

This work was supported, in whole or in part, by the Bill & Melinda Gates Foundation -- Grant Number INV-01076 to the Task Force for Global Health's Health Campaign Effectiveness Program. Under the Foundation's grant conditions, a Creative Commons Attribution 4.0 Generic License has already been assigned to the Author Accepted Manuscript version that might arise from this submission. The findings and conclusions contained within are those of the authors and do not necessarily reflect the positions or policies of the Bill & Melinda Gates Foundation.

## Citation

Oresanya O, Phillips A, Ikechukwu E, Ogunmola O, Ibinaiye T, Muhammad K, Shekarau E, Fadipe J, Abubakar U, Onwu N, Akalonu O, Counihan H and Achan J. Improving coverage of vitamin A supplementation through integration with seasonal malaria chemoprevention delivery: An implementation research study in rural and urban settings in Nigeria. Research Brief, 2022. Task Force for Global Health's Health Campaign Effectiveness Program.

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