RESEARCH ARTICLE

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The impact on key indicators of reproductive and child health after changes in program modalities in Sierra Leone, 2019

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Abstract

Background and aims: In 2018, the transition to routine vitamin A supplementation (VAS) was integrated with caregivers' preparation of nutritious complementary food from local produce and confidential counseling and provision of modern contraceptives. In 2019, funding for complementary food ceased and Community Health Workers (CHWs) were trained to track defaulters, while national efforts to improve Health Management Information Systems, supply chains and reduce teenage pregnancies were intensified. We report on key indicators after these changes and in comparison, to those previously published.

Methods: The same Lot Quality Assurance Sampling methodology was used in both assessments: 19 villages were randomly selected in each of five lots in each of three districts then caregivers of children 6-59 months age randomly selected and interviewed.

Results: Coverage of VAS, Albendazole, and Pentavalent 3 before and after these changes was over 80%, 75%, and 80% respectively, equitable by sex, age, caregiver's religion, and educational status. Comparison with 2018 found more lots failed to reach 80% VAS by verbal affirmation (10 vs 2), and coverage in one district (Bo) had dropped (77.5% vs 92.3%). Fewer caregivers were aware that VAS should be taken every 6 months (27% vs 50%), that complementary feeding should start at 6 months (63% vs 77%) or were providing minimal dietary diversity (27% vs 45%). There was an increase in caregivers using modern contraception (45% vs 35%), obtaining information about contraception from a friend (14% vs 9%), while fewer thought country rope/herbs (traditional contraceptives) were "effective" (11% vs 21%) and stockouts of contraceptives at health facilities had dropped (24% vs 55%). Stipends for CHWs cost approximately $750 K vs complementary food: $112 K.

Conclusion: Overall coverage for VAS, Albendazole, and Pentavalent remained effective but VAS had dropped significantly in one district. Complementary feeding practices had declined. Awareness, uptake, and contraceptives supply chains had improved.

1 | INTRODUCTION

In 2018, the under-five mortality rate in low-income countries was 68 deaths per 1000 live births, almost 14 times the average rate in high-income countries (5 deaths per 1000 live births) and under nutrition continues to contribute to 45 % of child mortality in low-income countries.[1,2] Under nutrition can be reduced by targeting key stages of the life cycle: pre-pregnancy, prenatal, postpartum nutrition for the mother and optimal infant and young child feeding (IYCF): early and exclusive breastfeeding up to 6 months then appropriate complementary feeding with continued breastfeeding to 23 months.[3] This period from conception to 24 months of age (the first 1000 days) is a critical time to prevent under nutrition when adverse effects on physical growth and brain development are extensive and largely irreversible.[4] Good nutrition during these 1000 days has lasting benefits and can be best promoted through strong inter-sectorial coordination including the private sector.[5]

In 2012, an estimated 40% of pregnancies in developing countries were unintended and nearly 90% are preventable by modern contraception.[6,7] Increasing birth intervals to at least 36 months increases gestational growth, birth weight, and the potential time for breastfeeding while reducing maternal depletion, teenage pregnancies, and the number of children per household.[8,9] Babies born less than 2 years after a prior birth are more likely than those born after a longer interval to be premature or of low birth weight.[10] The infant mortality rate is 117 per 1000 live births when the interval is less than 2 years, compared with 64 when spaced 2-3 years apart and 47 when four or more years apart.[11]

Mass vitamin A supplementation (VAS) programs are some of the most cost-effective child survival strategies thought to reduce child mortality by 12%-24% depending upon context.[12] In 2014, vitamin A deficiency was found in 17%* of children 6-59 months of age in Sierra Leone[13,14] and from 2006 to 2017, mass VAS campaigns achieved effective, equitable coverage by district, age group, caregivers' religion and occupation.[15-17] Mass VAS campaigns are highly reliant upon vaccination campaigns which are phasing out as polio elimination targets are reached and integrating nutrition-specific interventions have been shown to help ensure efficient service delivery.[18]

From 2011-2012, universal access to VAS at 6 months was integrated as a pilot program within the expanded program on immunization schedule. To promote uptake, VAS was integrated with a package of other high-impact interventions: IYCF counseling with maternal participation in the preparation of a nutritious complementary food from a pre-roasted blend of locally available ingredients, and confidential FP counseling and provision of modern contraceptives.[19] By packaging these services, effective coverage was anticipated with additional benefits to improve complementary feeding practices and increase birth-spacing with greater efficacy on caregivers' time, costs, and effort. The study demonstrated that 75% of infants had received VAS at 6-7 months of age, and 96% had been fully vaccinated by 9 months. In addition, 75% of caregivers had prepared a complementary food and received FP counseling and 45% had started using a modern contraceptive.[20]

From 2015-2017, this integrated 6 months point of contact for VAS had been scaled up to 340 of the larger, better resourced Peripheral Health Units (PHUs) of 1280 nationwide. The capacity to insert and remove Jadelle hormonal implants that provide 4-5 years of reversible contraception was assured by extensive in-service training of health workers. The end-term evaluation found minimal dietary diversity (MDD) amongst children 6-23 months of age and the consumption of vitamin A-rich foods were significantly higher than national nutrition surveys.[21,22] In the catchment communities served, 97% of caregivers were aware of FP and 50% were using modern contraception.[23]

In 2018, mass VAS campaigns ceased in three pilot districts and the transition to routine VAS known as the 6 monthly contact point commenced with the full package of interventions plus Albendazole (ALB) for children 12-59 months of age. Services were delivered at PHUs and during scheduled outreach sessions in remote catchment communities. In 2019, the donor considered the participatory approach to appropriate complementary feeding using the pre-roasted blend of locally available ingredients to be unsustainable. At the same time, a new cadre of paid community health workers (CHWs) was trained to actively trace immunization/VAS/ALB defaulters and refer them to the local PHU to alleviate the challenges of PHUs serving remote communities.[24]

Other changes included transfer of senior personnel including a new District Medical Officer in these pilot districts, and national efforts to improve Health Management Information Systems (HMIS). Messaging on FP were intensified by District Health Management Teams (DHMTs) targeting chiefdom-level opinion leaders in collaboration with religious leaders trained by a local NGO (FOCUS 1000) to sensitize men and the endorsement of the Reduction of Teenage Pregnancy program by the First Lady.[25] The weakness of the FP supply chain had been recognized by the MoHS and UNFPA and a national FP-Technical Working Group had been established to investigate and improve supplies of modern contraceptives from central to district medical stores and onward to PHUs as increasing access to modern contraceptives was prioritized.[26]

1.1 | Objective

To evaluate key indicators: VAS, ALB, Pentavalent 3 (Penta 3) immunization coverage, complementary feeding, and family planning practices in the pilot districts compared to the HMIS reports and LQAS findings in 2018.[27]

2 | METHODS

2.1 | Study design, setting, and sample size

The same lots quality assurance sample survey methodology used in 2018 was used again in 2019. As VAS coverage is expected to vary by the child's age, parallel sampling of children aged 6-11, 12-23, and 24-59 months of age was performed as before. Interviews were conducted using a sample size of 19 for each target age group in five lots in each of three districts. Each district (Bo, Kenema, and Koinadugu) was divided into lots comprising two to four chiefdoms each.[28] The total population of each lot was divided by 19 and a random number smaller than this determined the first location and so on until 19 locations had been selected.

2.2 | Participants, data sources/measurement

The same questionnaire used in 2018 was used again in 2019 (S 1). Slight modifications were made to include IYCF practices for children 12-23 months of age and for the health workers questionnaires to include stock-outs of child health cards as shown in Table 1. An interview for caregivers of children 6-11 months took about 30 minutes and for 24-59 months about 10 minutes. Interviewers were given vitamin A capsules (blue: 100 000 IUs and red: 200 000 IUs) and ALB tablets to show caregivers to prompt their recall as necessary. Verbal affirmation from a caregiver that the child had received VAS/ALB in the last 6 months was further explored by inspection of the child's health card and recorded separately.

The 24-hour caregivers recall of foods groups offered to children 6-23 months of age was classified according to the national nutrition survey as follows: (1) grains, white roots, tubers, and plantain; (2) pulses, nuts, and seeds; (3) dairy produce milk, cheese; (4) meat, poultry, fish, and egg; (5) vitamin A-rich foods, colored fruits, vegetables palm oil; and (6) other fruits and vegetables. MDD was classified as at least three food groups (in addition to breast feeding) and minimal meal frequency (MMF) defined as least two or more feeds times a day for child of 6 to 11 months of age and three or more for child for children 12-23 months in addition to breast feeding.†

Caregivers of children 6-11 months of age were asked if they were aware of "family planning" and methods of contraception. If so,

TABLE 1 Indicators collected during LQAS survey by the child's age group (months), health workers (HW) interviews, and program modalities by year

| Indicator collected Coverages	2018			2019			HW interview	
	6–11	12-23	24-59	6-11	12-23	24-59	2018	2019
Vitamin A supplementation	✓	✓	✓	✓	✓	✓		
Albendazole		✓	✓		✓	✓		
Penta 3		✓			✓			
Knowledge, awareness and practices								
Awareness that CF should start at 6 months	✓			✓	✓			
Minimum Dietary Diversity (MDD)	✓			✓	✓			
Minimal Meal Frequency (MMF)				✓	✓			
VAS should be given every 6 months	✓	✓	✓	✓	✓	✓		
Penta 3 should be given at 14 weeks		✓			✓			
Modern Contraception	✓			✓				
Practicing Family Planning	✓			✓				
Status of Health Facility								
Availability of HWs trained on 6 MlyCP							✓	✓
Availability of trained and retained CHWs							✓	✓
Availability of HWs trained on Jadelle							✓	✓
Stockouts of VAS and or ALB							✓	✓
Stockouts of modern contraceptives							✓	✓
Stockouts of Child Health Cards								✓
Program Modalities								
Weekly IYCF demonstrations in PHUs	✓	✓						
CHW defaulter tracing				✓	✓	✓		
Intensified HMIS reporting				✓	✓	✓		
Intensified supply chains for FP commodities				✓	✓	✓		
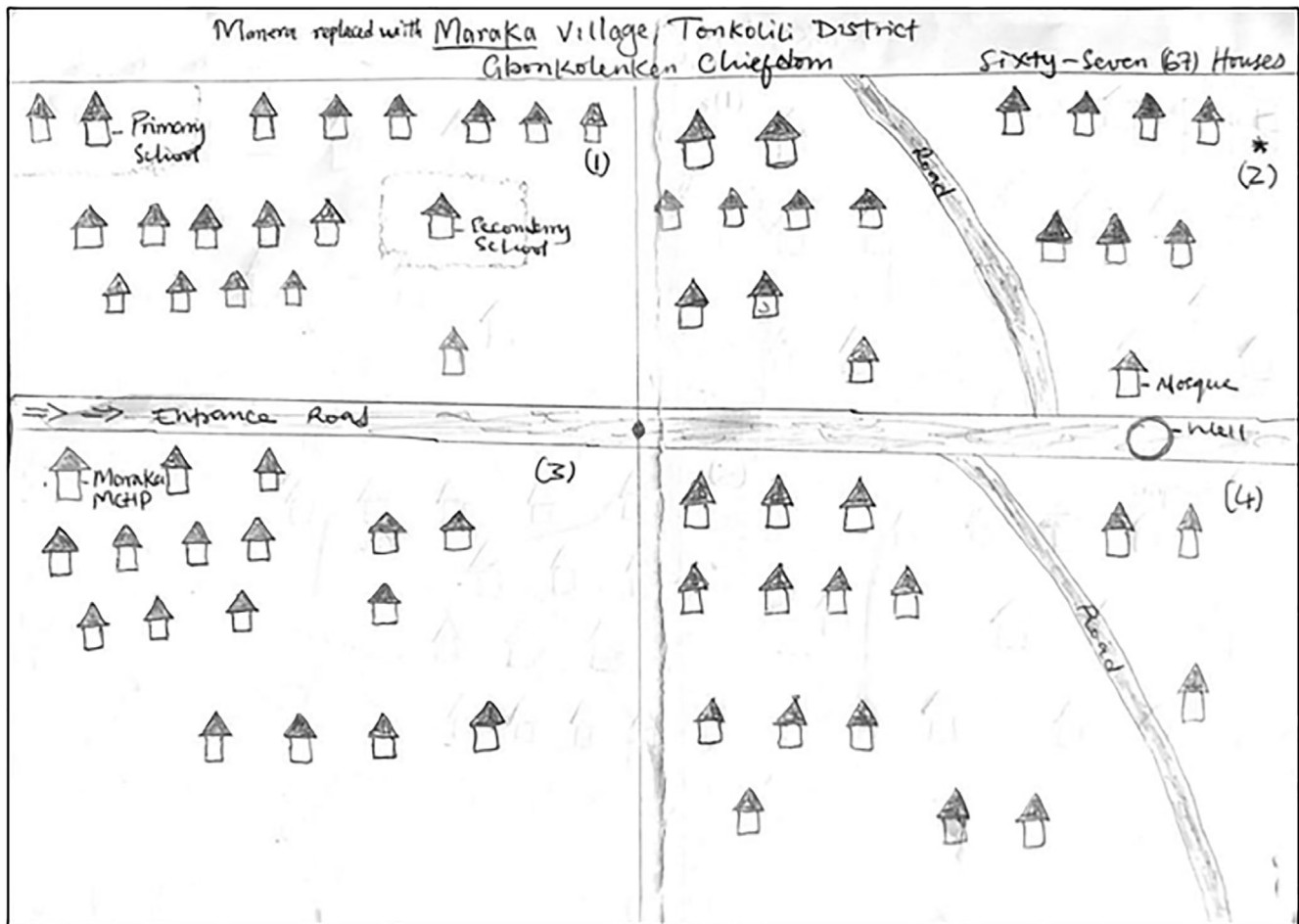
FIGURE 1 Sample map showing landmarks, segmentation, and randomly selected first household

they were asked to name which methods they have heard of and if they were currently using any contraception.

In addition, the "in-charge" of at least five health facilities serving the selected communities were interviewed to record their training status, stock outs of essential commodities at the time of the visit and the availability of trained CHWs. Questionnaires were programmed into Open Data Kit (ODK) with mandatory fields to check data completeness, were uploaded to a web-based platform, ONA.io and downloaded onto Samsung tablets. The authors confirm that the data supporting the findings of this study are available within the article and/or its Supplementary Materials. The raw data has now been supplied in Supplementary Materials.

2.3 | Training and field work

An external recruitment process for interviewers was led by Helen Keller in collaboration with the Directorate of Food and Nutrition (DFN). Undergraduates/postgraduates resident in the districts, fluent in local languages (Krio, plus Mende, Kuranko, Mandingo, or Fullah) with previous experience in surveys and mobile data collection were shortlisted. Training of 36 candidates included background, random sampling,

and research ethics, locating selected villages, questionnaires, role play and mobile reporting. An on-line post-test provided real-time transparent scores for all participants and the top 30 candidates were selected. The survey locations were not disclosed until deployment. A letter from the Chief Medical Officer to the District Medical Officers was sent to introduce the teams and seek local cooperation. The training took 3 days and the field work 5 days in November 2019.

2.4 | Village protocol, household, and respondent selection

The interviewers who worked in pairs introduced themselves to the village headman, explained the purpose of their visit, and requested one "helper" to map and number the households. In each location interviewers drew a map, if there were more than 20 habitable structures, it was divided into four sectors of a similar number of households using landmarks (road, river, school, mosque, church, well, playing fields). They then randomly selected one sector by ballot and numbered the households (regarded as a group of people who ate together from the same cooking pot) and randomly selected one household as the starting point using a random number table. A sample map is shown in Figure 1.

After household selection, if a child of an appropriate age was resident, they requested consent to conduct the caregiver interview if s/he had looked after the child for the last 6 months. They repeated the process in the nearest neighboring household on the left and so on until a caregiver of a child from each targeted age group had been interviewed. If a household had children in all age groups, the caregiver for each was interviewed and if there was more than one child of the same age group, one was selected by ballot. A child's age was verified from their health card whenever possible but if unavailable, estimated using a local event calendar: the period of 6 months corresponding to the Easter/Independence Day, April 2019.

After collecting and analyzing the results they were presented to the DHMT at a debriefing meeting with the interview teams. The teams shared their maps, findings and challenges with the DHMT, Helen Keller, and the DFN. Date on HMIS reporting was obtained direct form the DHMTs.

2.5 | Quantitative variables and statistical analysis

Data analysis used Microsoft Excel 2010 and SPSS version 21 and VAS, ALB and Penta 3 coverages by verbal affirmation were weighted by Probability Proportional to Size.[29] The GPS of all locations was recorded as well as the time taken by teams to conduct each interview. Card confirmation is reported as crude coverage only. Confidence intervals were calculated by SPPS and statistical significance by chi-test $P < 0.05$.

2.6 | Ethical considerations

The survey was approved by the Sierra Leone Ethics and Scientific Review Committee. A letter from the Chief Medical Officer was sent to District Medical Officers and other key officials to introduce the survey teams and request their cooperation. Copies were made
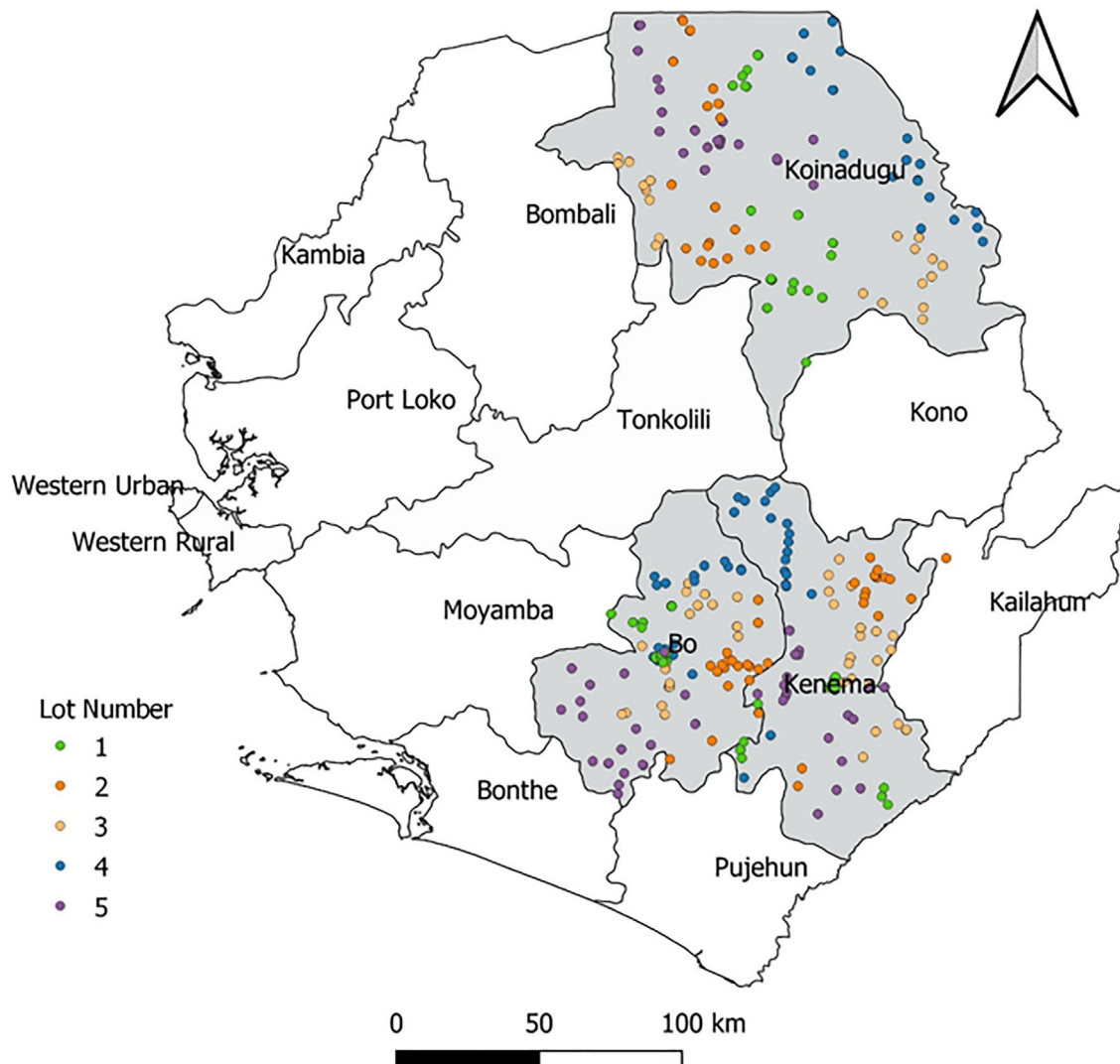

FIGURE 2 GPS location of villages where interviews were conducted, 2019

available to the interviewers to enable cooperation at village level. Informed verbal consent (translated into the local language) was obtained before any individual was interviewed. Participants had opportunities to have their questions answered or decline to respond to a question. There was no compensation and no direct benefits for participation. All data were anonymized and remain confidential.

3 | RESULTS

We are presenting the LQAS 2019 results in full before making comparisons with significant findings with LQAS 2018 that have already been published. Overall 855 caregivers were interviewed (100% response rate) from 285 locations (Figure 2), describing themselves as mother: 94.0%, married: 89.0%, Muslim: 83.9%, no education: 57.7%, primary education: 17.8%, secondary/tertiary education: 23.7%, farmers: 58.8% and "employed": 26.9%. The mean age of respondents was 27.1 years (range 15-69) and the children were male: 52.4%, female: 47.6%. In addition 83 health workers at the local health facilities were interviewed (target 75). There were no missing data for verbal affirmation for VAS, ALB, or Penta 3. When

requesting confirmation from a child health card, missing data are clearly illustrated in Table 2. Missing responses to questions related to VAS and contraception are clearly illustrated in Figures 3 and 4, respectively.

By verbal affirmation 10 failed lots (of 45) failed for VAS and 8 lots failed for ALB (of 30) as shown in Table 3. By card confirmation 30 lots failed for VAS and 20 lots failed for ALB.

Overall VAS coverage by verbal affirmation for children 6-59 months was 84.2%, ALB for 12-59 months: 82.5% and Penta 3 for 12-23 months: 83.5%, equitable by age group, sex, caregiver's religion, and educational status (Table 2). In 2019, Bo did not reach 80% for VAS or Penta 3.

Overall VAS coverage by card confirmation for children 6-59 months of age was 63.7%, ALB: 60.3% for children 12-59- months and Penta 3:72.0% in children 12-23 months with higher VAS and ALB coverages in Kenema vs Koinadugu (P < 0.001, P < 0.05, respectively).

Overall VAS coverage was significantly lower in 6-11 months old vs 12-23 and 24-59 months (P < 0.001 each), (Table 2). Overall ALB coverage reached over 75% in both age groups with significantly lower coverage in 12-23 vs 24-59 months (P < 0.05).

TABLE 2 VAS, ALB, and Penta 3 coverage by verbal affirmation, weighted by PPS and VAS and ALB by card confirmation and age group (crude coverage), 2019

Verbal	VAS (N = 285)		ALB (N = 190)		Penta 3 (N = 95)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Bo	221	77.2 (68.885.6)	156	80.6 (72.2-89.0)	72	76.2 (71.2-81.2)
Kenema	261	90.8 (85.0-96.6)	160	83.9 (76.5-91.3)	82	84.5 (76.5-92.5)
Koinadugu	240	84.2 (77.1-91.3)	157	83.1 (75.7-90.5)	83	89.9 (84.7-95.1)
Overall	722	84.2 (77.1–91.3)	473	82.5 (74.8-90.2)	237	83.5 (76.9-90.1)
Card	VAS		ALB		Penta 3	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Bo	179/263	68.1 (65.2-70.1)	108/173	62.4 (58.8-66.1)	66/89	74.2 (69.6-78.8)
Kenema	218/270	80.7 (78.3-83.1)	137/173	79.2 (76.1-82.3)	77/89	86.5 (82.8-90.2)
Koinadugu	152/259	58.7 (55.6-61.7)	100/165	60.6 (56.8-64.4)	79/86	91.9 (88.7-95.0)
Overall	549/792	69.3 (67.7-71.0)	345/511	67.5 (65.4-69.6)	222/264	84.1 (81.8-86.4)

VAS, ALB coverage by verbal affirmation, card confirmation by age group

VAS	6–11 months		12-23 months		24-59 months	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Verbal	225/285	*78.9 (77.8-80.2)	258/285	*90.5 (89.5-91.6)	239/285	*83.8 (82.8-84.9)
Card	172/266	*64.7 (61.7-67.6)	214/265	*80.8 (78.3-83.2)	163/261	62.5 (59.5-65.4)
Albendazole			12–23 months		24-59 months	
			n	% (95% CI)	n	% (95% CI)
Verbal			226/285	79.3 (78.3-80.4)	249/285	87.4 (86.4-88.5)
Card			178/264	67.4 (64.6-70.3)	167/247	67.6 (64.7-70.6)

Note: The weighting coverages varied by less than ±1.3% with the crude coverage. VAS coverage was significantly lower in 6–11 months old vs 12-23 and 24-59 months (*P < 0.001 each). VAS coverage by card confirmation was significantly higher in in Kenema vs Koinadugu (P < 0.001). ALB coverage by card confirmation was significantly higher in Kenema vs Koinadugu (P < 0.05).

(A) Sources of knowledge for VAS amongst caregivers of children 6-59 months of age, 2019

- Health worker/CHW (189)
- Talk at clinic (112)
- Mothers/word of mouth (38)
- Announcer with loudspeaker on motorcar (36)
- Radio (31)
- Community leaders (23)
- Headman (6)
- Others (22)

Total responses =457 (Non responders 398)

(B) Major reason for not receiving VAS, 2019

- Don't know (25)
- CHW did not come (16)
- Child not around (16)
- Distance to PHU too far (20)
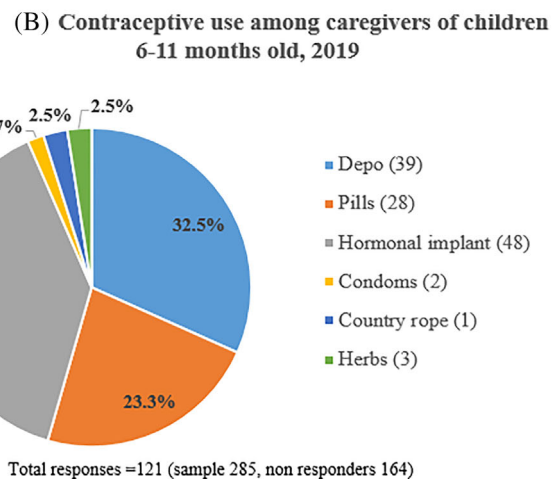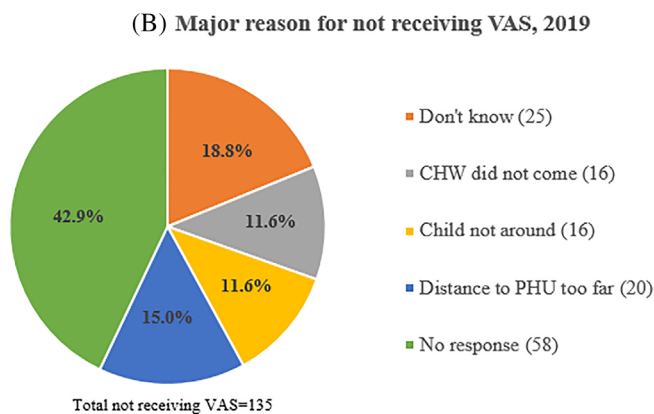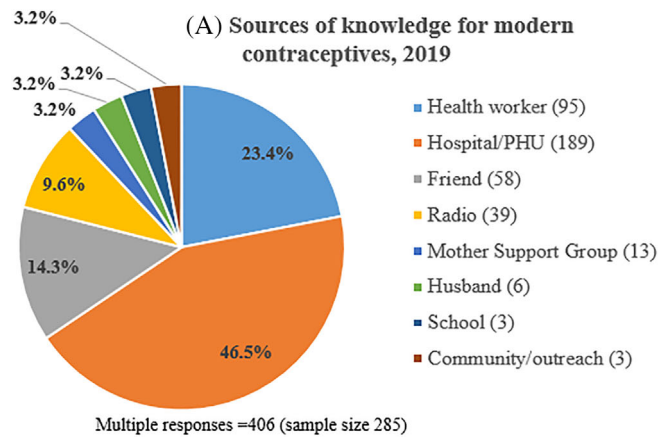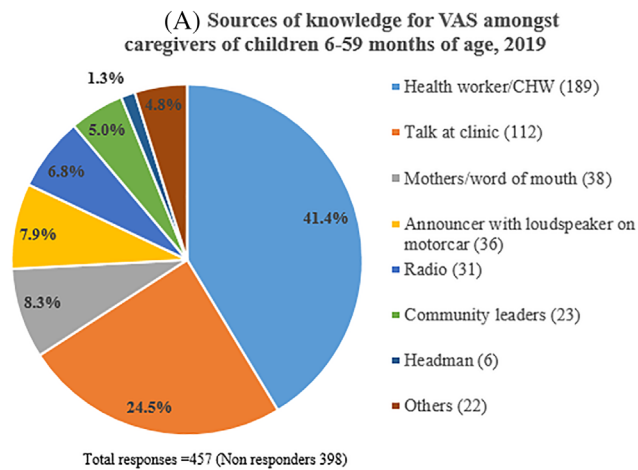- No response (58)

Total not receiving VAS=135

FIGURE 3 A, Sources of knowledge for VAS, 2019. B, Major reason for not receiving VAS, 2019

(A) Sources of knowledge for modern contraceptives, 2019

- Health worker (95)
- Hospital/PHU (189)
- Friend (58)
- Radio (39)
- Mother Support Group (13)
- Husband (6)
- School (3)
- Community/outreach (3)

Multiple responses =406 (sample size 285)

(B) Contraceptive use among caregivers of children 6-11 months old, 2019

- Depo (39)
- Pills (28)
- Hormonal implant (48)
- Condoms (2)
- Country rope (1)
- Herbs (3)

Total responses =121 (sample 285, non responders 164)

FIGURE 4 A. Sources of knowledge for modern contraceptives, 2019. B, Contraceptives use among caregivers of children 6-11 months old, 2019

There was significantly higher proportion of children in 6-11 months old obtaining VAS at a static centre (Hospital/PHU/Under-fives clinic) compared to 24-59 months old (88.4% v. 72.8%), ($P < 0.05$). The most frequent sources of information for VAS are shown in (Figure 3) and reasons for not taking VAS in (Figure 3B). These findings were not significantly different from 2018.

Knowledge that complementary feeding should commence at 6 months was found in 63.2% of carers of children 6-11 months of age as shown in Table 4. As expected, minimum dietary diversity (3 or more of 6 food groups) was significantly higher in the older vs the younger age group and 84.7% of caregivers of children 6-23 months had provided minimum meal frequency over the last 24 hours.

Overall 44.5% (95% CI: 41.5-47.5%) of caregivers were using modern contraception (Table 4). equitable by caregivers educational status, religion and occupation but was significantly higher in Bo and Kenema vs Koinadugu ($P < 0.05$). Awareness and utilization of contraception amongst caregivers of children 6-11 months of age was mixed (Figure 4,B). Although commodities are provided by UNFPA and the Reproductive and Child Health Program of the MoHS, caregivers frequently reported that they were had to pay health workers between SLL 5000 and 25 000.

The "in-charges" from 83 PHUs were interviewed (compared to 106 in 2018) and stock-outs were: Vitamin A: 13.2%, ALB 10.8%, FP commodities ranged from 1.2%-24.1%, most notably there were zero Jadelle stock outs, child health cards: 40.9%. The number of health facilities with health workers trained on the 6MlyCP was 71.1% and retaining trained CHWs was 89.9%.

At the debriefing meetings with enumerators, Helen Keller and the DHMTs discussed the implementation of the CHW program in the study period which appeared to be working better in Kenema and Koinadugu (despite challenges with road networks, and long distances) than Bo where stipend distribution had been delayed and problematic.

3.1 | Significant differences between the LQAS findings in 2019 vs 2018

The composition of the two cohorts was similar and only significant differences in findings are shown in Table 5. In 2019, 10 lots failed for VAS by verbal affirmation compared to two lots in 2018. Reporting of

TABLE 3 Lots results by age group, 2019

District	Indicator	Lots Month	1	2	3	4	5	#	1	2	3	4	5	#
			Verbal affirmation						Card confirmation					
Bo	VAS	6-11	**12**	**13**	18	18	**9**	7	9	**11**	**14**	16	**13**	10
		12-23	**14**	**11**	19	19	18		10	12	15	15	17	
		24-59	**13**	7	15	17	18		5	9	3	12	18	
	ALB	12-23	16	**14**	17	17	**11**	3	10	12	12	12	10	8
		24-59	**13**	18	17	16	17		5	16	4	10	17	
Kenema	VAS	6-11	15	15	19	17	17	0	9	11	14	16	13	7
		12-23	19	16	19	19	19		17	16	19	15	17	
		24-59	17	18	18	18	15		14	18	17	11	11	
	ALB	12-23	15	**12**	16	18	18	3	14	**10**	17	15	15	4
		24-59	18	**13**	19	18	**13**		15	**12**	17	11	11	
Koinadugu	VAS	6-11	17	15	**13**	15	**12**	3	8	10	6	13	9	13
		12-23	17	17	16	18	17		12	12	7	15	15	
		24-59	18	**14**	18	15	18		9	6	11	11	8	
	ALB	12-23	16	14	**12**	17	**13**	2	14	8	5	13	11	8
		24-59	17	16	17	18	17		7	8	10	14	10	

Note: Bolded lots failed to meet performance threshold for VAS (≥15 positives) or ALB (at ≥14 positives) by age group and or failed for VAS (≥45 positives) for 6–59 months or ALB (at ≥28 positives) for 12-59 months.

TABLE 4 Complementary feeding and family planning practices, 2019

	6-11 months (N = 285)		6-23 months (N = 570)	
Complementary feeding	n	% (95% CI)	n	% (95% CI)
Knew to introduce at 6 months	180	63.2 (57.48-68.84)	352	61.8 (57.66-65.81)
Provided 3 or more food groups of 6 (MDD)	77	27.0 (21.77-32.26)	233	40.9 (36.77-44.98)
Provided Minimum Meal Frequency (MMF)[a]	246	86.3 (82.21-90.42)	483	84.7 (81.72-87.76)
Using modern contraceptives[b]	117	44.5 (41.5–47.5)		

Note: Contraceptives use was significantly higher in Bo and Kenema vs Koinadugu (*P* < 0.05).
[a]MMF defined as 2 or more times a day for children 6-11 months and 3 or more times a day for 12-23 months of age.
[b]Missing responses 22.

VAS through HMIS had improved (71.9% vs 55.9%). but VAS coverage in Bo had declined (77.5% vs 92.3%).

In 2019, VAS and ALB coverage by card confirmation was higher in Kenema vs Koinadugu in contrast to 2018 when it had been higher in Bo vs both Kenema and Koinadugu. In 2019, a higher proportion of older children were obtaining VAS in a static facility compared to 2018:12-23 months of age (80.9% vs 63.7%) and 24-59 months of age (72.8% vs 48.2%).

In 2019, there was a significant drop in knowledge that VAS should be taken every 6 months (27% vs 50.2%) and that Penta 3 should be given at 14 weeks (7.4% vs 19.6%). Fewer caregivers of children 6-11 months of age knew that complementary foods should be introduced at 6 months (63.2% vs 77.2%) or were providing three or more (of six) food groups (27.0% vs 44.9%).

In 2019, more caregivers of children 6-11 months of age were currently utilizing a modern contraceptive (44.5% vs 37.5%), were obtaining contraceptive information from a "friend" (14.3% vs 9.1%) and fewer considered "country rope/herbs" (traditional contraceptive methods) to be an effective (10.5% vs 20.6%). In 2019, stock-outs of FP commodities had reduced significantly for various commodities most notably for Jadelle hormonal implants (0% vs 27%) and charges for commodities by health workers had increased (in line with devaluation and inflation).

At the debriefing meetings in 2018 the implementation of the CHW program had appeared to be working best in Bo and not so well in Kenema where stipend distribution had been problematic, this situation had reversed in 2019.

4 | DISCUSSION

Overall there were no significant changes for VAS, ALB, or Penta coverage in 2019 compared to 2018, despite the significant drop in

TABLE 5   A summary of statistically significant findings in the LQAS 2019 vs LQAS 2018

	2019	2018	P value
Coverages			
Failed VAS lots by verbal (45)	10	2	<0.05
District level VAS coverage in Bo	77.5%	92.3%	<0.05
VAS static venue 12-23 months	80.9%	63.7%	<0.05
VAS static venue 24-59 months	72.8%	48.2%	<0.0005
HMIS reports for VAS	71.9%	55.9%	<0.0001
Knowledge awareness and practices			
VAS should be every 6 months	27.0%	50.2%	<0.0001
Penta 3 should be given at 14 weeks	7.4%	19.6%	<0.0001
Complementary feeding			
Knowledge of introduction of CF at 6 months	63.2%	77.2%	<0.05
Minimal Dietary Diversity in children 6–11 months old	27.0%	44.9%	<0.0005
Family planning			
Information from a friend	14.5%	9,1%	<0.005
Believe country rope an effective contraceptive	10.5%	20.6%	<0.005
Using modern contraception	44.5%	37.5%	<0.05
Supply chain management			
Cost of FP commodities in SL Leones	5000-25 000	4000-10 000	
Stock outs contraceptives	1.2%-24.1%	10.4%-54.9%	<0.001
Stock-outs Jadelle hormonal implants	0%	27.0%	<0.0001

performance in Bo district. There had been a decline in complementary feeding practices and an improvement in FP commodities supply chain and practices compared to the study in 2018.

There was a slight variation in indicators collected in 2019 vs 2018 (MMF and stockouts of child health card). Collecting data based upon verbal recall from a caregiver can be unreliable if the recall period is unclear. In both surveys, a local calendar of event was identified to mitigate this error. Basing coverage on card confirmation is equally problematic in the context where a caregiver may be interviewed in a house where her card is not stored or she may have lost her card or not have been given one in the first instance. Obtaining information relating to FP practices is obviously sensitive especially in traditional settings. These limitations apply to both 2018 and 2019 surveys.

Kenema was the best performing district for VAS coverage in 2019 attributed to a higher number of CHWs being retained after the delay with their remuneration in 2018 had been rectified. Whereas Bo had been the best performing district for VAS coverage in 2018, but then had similar problems with delayed CHW remuneration in 2019. Overall, all coverages had reached recommended thresholds. The higher proportion of older children receiving their VAS at static centers in 2019 could be attributed to CHW contact tracing and referral but perhaps at the expense of reduction in the youngest age group or perhaps better reporting by age groups.

There remains a significantly lower coverage by card confirmation which could be attributed to the high rate of stock-outs of child health cards at PHUs, caregivers having misplaced these cards at the time of the survey or health workers not recording and not reporting the service. The HMIS should be the main source of information for health service delivery; however, there was still a lack of a suitable reporting tool at PHU-level for VAS data collection for older age-groups. The HMIS will continue to under-report VAS coverage until an appropriate reporting tool is introduced, disseminated and health workers trained on its utilization. Overall VAS coverage for children 6-59 months reported by the HMIS in 2019 was closer to the survey findings.

The need for twice yearly ALB distribution for children 12-59 months of age is declining as the prevalence intensity of soil transmitted helminths (STH) comes under control.[30] District-wide Bo and Kenema have reached control levels in multiple age groups.[31]

Supplementary feeding programs are considered cost-effective interventions in food insecure populations.[32] Food insecurity in Sierra Leone increased from 78% in 2014-16 to 81% in 2017-19 and the attraction of the participatory approach to IYCF was considered a strong motivation for PHU attendance in 2018.[33] The integration of FP and IYCF programs are mutually beneficial and harnessing these synergies represents an important step in achieving optimal nutrition outcomes.[34]

It appears that investing in rural economies with CHW stipends in 2019 came at the expense of access to public health market for mostly women farmers and processors who had been supplying commodities to these health facilities for the complementary feeding and the reduction in knowledge awareness and practices regarding complementary feeding amongst caregivers on children 6-11 months of age.

Supply chain inefficiencies significantly affect availability of modern contraception commodities in low and middle-income countries especially in rural public facilities.[35] Supply chains for modern contraceptives had improved significantly since 2018. Interestingly more caregivers are getting information about modern contraception from a friend which is of especially importance amongst younger caregivers possibly as a result of the push to reduce teenage pregnancies including the promotion of peer to peer counseling.[26]

5 | RECOMMENDATIONS

The transition from mass to routine VAS should be closely monitored with these and/or other modified protocols. Improved complementary feeding practices and attendance should be encouraged with the participatory approach to IYCF especially in PHUs serving hard-to-reach, vulnerable communities. A cost-benefit analysis should be performed to compare the costs of the participatory approach to IYCF vs the CHW approach. Remuneration of CHWs by DHMTs and supply chains for VA, ALB and child health cards needs to improve. Tools for recording VAS in older age groups should be finalized to enable reliable HMIS recording. Fees for FP services should be monitored and discouraged by DHMTs.

6 | CONCLUSION

Overall, effective VAS has been maintained although the 5-fold increase in the number of failed lots (by verbal affirmation) suggests that this is somewhat fragile and dependent upon CHW performance which in turn is dependent on donor funding for their remuneration and effective distribution of their stipends by the DHMTs. Complementary feeding practices have significantly declined, and other funding streams could be sought to restart this component. Awareness and accessibility to modern contraceptive have increased since 2018.

CONFLICT OF INTEREST
The authors state that there is no competing interest and the contents are the responsibility of the authors and do not necessarily reflect the views of the Irish Aid, UNICEF, UNFPA or the Canadian Government. Habib I. Kamara affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

TRANSPARENCY STATEMENT
I, Habib I. Kamara affirm that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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Habib I. Kamara had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available on request from the corresponding author.

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ENDNOTES
* Corrected for inflammation.
† Sierra Leone National Nutrition Survey, 2017, investigated dietary diversity amongst children of 6-23 months of age using six food groups.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.