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ORIGINAL ARTICLE

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Feasibility of delivering vitamin A supplementation (VAS) and deworming through routine community health services in Siaya County, Kenya: A cross-sectional study

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Abstract

Vitamin A deficiency and soil-transmitted helminth infection are serious public health problems in Kenya. The coverage of vitamin A supplementation and deworming medication (VASD) provided through mass campaigns is generally high, yet with a cost that is not sustainable, while coverage offered through routine health services is low. Alternative strategies are needed that achieve the recommended coverage of >80% of children twice annually and can be managed by health systems with limited resources. We undertook a study from September to December 2021 to compare the feasibility and coverage of VASD locally delivered by community health volunteers (CHV) ("intervention arm") to that achieved by the bi-annual Malezi Bora campaign event ("control arm"). This comparative cross-sectional study was conducted in sub-counties of Siaya County using both qualitative and quantitative methods. VASD were offered through the CHS in Alego Usonga and through Malezi Bora in Bondo Sub-County. Coverage was assessed by a post-event coverage survey among caregivers of children aged 6–59 months ($n = 307$ intervention; $n = 318$ control). Key informant interviews were conducted with $n = 43$ personnel across both modalities, and 10 focus group discussions were conducted with caregivers of children aged 6–59 months to explore knowledge, attitudes and perceptions of the two strategies. VAS coverage by CHV was 90.6% [95% CI: 87.3–93.9] compared to 70.4% [95% CI: 65.4–75.4] through the Malezi Bora, while deworming coverage was 73.9% [95% CI: 69.0–78.7] and 54.7% [95% CI: 49.2–60.2], respectively. With sufficient training and oversight, CHV can achieve superior coverage to campaigns.

KEYWORDS
children, community health services, cost-effectiveness, coverage, deworming, Kenya, vitamin A

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1 | INTRODUCTION

1.1 | Background

Vitamin A deficiency (VAD) is a significant public health concern in Kenya. Approximately 9.2% of pre-school-aged children are deficient in vitamin A, and 52.6% are marginally deficient (World Health Organization, 2011). VAD is associated with increased severity in, and slower recovery from, preventable childhood diseases such as respiratory infection, measles and diarrhoea, as well as increased risk of premature death (World Health Organization, 2011). The 2022 Kenya Demographic Health Survey (KNBS & ICF, 2023) estimated that 17% of children under the age of 5 years had experienced a fever in the previous 2 weeks, 14% had experienced diarrhoea, and 2% had symptoms consistent with an acute respiratory infection, indicating high rates of childhood illness.

VAD can be prevented through the regular and adequate consumption of a diverse diet consisting of vitamin A-rich foods or fortified foods. In the absence of adequate dietary intake, vitamin A supplementation (VAS) can boost vitamin A reserves and provide short-term protection to children's immune systems. In Kenya, only about 31% of children aged 6–23 months receive a minimum acceptable diet (KNBS & ICF, 2023) as assessed by the indicators recommended by the (WHO & UNICEF, 2021). Eighteen percent of children under 5 years suffer from stunting (height-for-age *z*-score <−2SD WHO growth reference), 4.9% from wasting (weight-for-height *z*-score <−2 SD WHO growth reference), and 10.1% are underweight (weight-for-age *z*-score <−2 SD WHO growth reference) (KNBS & ICF, 2023).

Soil-transmitted helminths (STH), more commonly known as intestinal hookworms, whipworms, or roundworms, are also a serious public health problem in Kenya, with over eight million pre-school and school-aged children requiring preventive chemotherapy for STHs (World Health Organization, 2021). STH infections can impair nutritional status by causing internal bleeding leading to anaemia, intestinal inflammation, diarrhoea, and impaired nutrient intake, digestion, and absorption. Consequently, children with STH often have slower growth and development, and experience learning difficulties (Hall et al., 2008; Pabalan et al., 2018).

WHO recommends universal VAS for children 6–59 months old in populations at risk of VAD (World Health Organization, 2011). When delivered twice yearly to at least 80% of the target population of children aged 6–59 months, VAS can prevent childhood morbidities and reduce childhood mortality by up to 24% (World Health Organization, 2011). To combat STH, the WHO recommends an annual or bi-annual single-dose of Albendazole for children aged 12–59 months and school-age children aged 5–14 years (World Health Organization, 2017). The deworming of pre-school children is significantly associated with reduced stunting and anaemia (Lo et al., 2018).

In Kenya, VAS and deworming medication are currently offered through the bi-annual maternal and child health mass delivery events known as Malezi Bora campaigns, routine contact points at health facilities, community health units, and early childhood development centres (ECDC) which target pre-school-age children 4–5 years (Ministry of Health Kenya, 2017). Combining VAS and deworming (VASD) has both health and logistical benefits and makes delivery more cost-effective (World Health Organization, 2011). Coverage through Malezi Bora events is high, while routine delivery at health facility remains low, especially for children aged 12–29 months (KHIS, 2021). Malezi Bora events which employ top-down approach take place in a span of 2 weeks involving planning meetings at national and county level, followed by 1 day sensitization of volunteers, dispatching of supplies to volunteers, 1 day community mobilization followed by 2 days mass supplementation and deworming at community level and ECDC coupled with supervision by community health assistants (CHAs), county and subcounty health managers, national MOH staff and partner staff. However, it is resource-intensive, and although counties mobilize some internal funding, the amount needed for implementation creates a dependency on external support.

The Government of Kenya at the national and county levels has invested heavily in the CHS to strengthen routine health services, increase household access to primary health care and information, and to advance the universal health care agenda. Under the National Community Health Strategy, community health units, serving approximately 5000 people, or approximately 1000 households, are based at the community level and consist of a CHA, a salaried extension worker connecting the health facility to the community, and approximately 10 community health volunteers managed by the CHA.[1] Each volunteer receives monthly supportive supervision from a CHA, at either the health facility or in the community which

Key messages

- Innovative strategies are needed to effectively deliver vitamin A and deworming to eligible children through routine health services.
- Kenya's community health volunteers (CHVs) provide diverse preventive services, but do not distribute VASD.
- Our four month quasi-experimental study in Siaya County utilized quantitative and qualitative methods to compare VASD added to the CHV package to the current bi-annual Malezi Bora campaigns.
- VAS coverage by CHVs was higher at 90.6% [95% CI: 87.3–93.9] compared to Malezi Bora at 70.4% [95% CI: 65.4–75.4]; deworming coverage was 73.9% [95% CI: 69.0–78.7] vs. 54.7% [95% CI: 49.2–60.2], respectively.
- Success factors included effective incentives, comprehensive training, and strategic planning and regular review meetings at county and subcounty levels.

[1]To avoid using too many similar acronyms, we will refer to community health assistants as 'assistants' and community health volunteers as 'volunteers'.

consists of mentorship, review of reports, and household visits with a CHA. Volunteer also receives training in 11 modules across health, nutrition, water, sanitation, and hygiene, and is expected to visit 100% of the 100 households in their catchment population every quarter. They bring essential preventive, and in some cases curative, health services to households that are economically vulnerable, have pregnant women and/or children under 5 years, or a person with a noncommunicable disease (Ministry of Health Kenya, 2019). In Siaya County, volunteers are given a monthly stipend equal to about US $25, are enroled in the National Health Insurance Fund, and are given priority when seeking health care for themselves. Despite national policy allowing for the delivery of VASD through the CHS platform, to date volunteers have not been able to distribute VASD in the routine health services offered when they conduct household visits, and their effectiveness has not yet been studied (Ministry of Health Kenya, 2017). They are recruited nationally to deliver VASD during the Malezi Bora.

1.2 | Research objectives

The study aimed to investigate the feasibility of routine delivery of VASD through the CHS and to identify key steps for the Ministry of Health to consider in planning, implementing, and monitoring VASD at the community level.

2 | METHODOLOGY

2.1 | Study design

This was a quasiexperimental study that employed quantitative and qualitative methods.

2.2 | Study location

The study was conducted in Siaya County from September to December 2021. Among the six subcounties, Alego Usonga and Bondo were purposively selected as the study sites due to their comparable population characteristics and size (population 6–59 months: Alego Usonga = 28,639; Bondo = 25,570), equal distribution of health facilities, 100% coverage by community health units, CHAs and community health volunteers who are supported by the county government. Both have high population density and are partly urbanized, with similar socioeconomic activities. The majority of the population practices mixed farming, with a few pockets of fishing communities.

For the purposes of this study, VAS and Albendazole were routinely distributed through the CHS platform (intervention arm) in two wards of Alego Usonga from September to December 2021, and via Malezi Bora (control arm) in six wards of Bondo subcounty in December 2021. Both arms of the study had 21 community health units. To minimize bias, the study adhered to standardized protocols for data collection, intervention delivery, and outcome assessment. Random selection was applied to both clusters and study participants. The study protocol underwent peer review, and the methods and results of the study were transparently reported.

2.3 | Intervention and control description

The intervention arm was testing the feasibility and effectiveness of VASD delivery via routine CHS while the control arm tested the feasibility and effectiveness of Malezi Bora campaign to deliver VASD.

2.3.1 | Forecasting, availability and management of VASD commodities

In the CHS (intervention arm), commodity management was bottom up. As part of their normal duties, each volunteer conducted a comprehensive census of the children aged 6–59 months in their catchment area to inform the forecasting of VASD commodities. Volunteers then sent these data to the CHAs they report to, who then transferred them to the link health facilities. At facility level, these data were compiled for all volunteers reporting to that facility and submitted to the subcounty health records officer for upload into the Kenya Health Information System (KHIS2). The data were also compiled at subcounty and county levels by health management team nutritionists who submitted orders for vitamin A capsules and deworming tablets to the National Program for Immunization and Vaccines. The vitamin A capsules and deworming tablets were stored with other essential drugs and were dispatched to health facilities within the intervention arm commensurate with the number of eligible children. At health facilities, the in-charges in liaison with CHAs were responsible for distributing supplies to volunteers according to the number of eligible children within their catchment. Their supplies were replenished monthly during the monthly review meetings. Health facility in-charges and assistants mentored volunteers on the appropriate storage and handling of their supplies and on waste management. Helen Keller provided each volunteer in the intervention arm two plastic containers with lids for storage.

In the Malezi Bora (control arm), planning was top down. Estimate of needs were based on national data for the target population and available supplies at health facilities. Vitamin A capsules were delivered from the national depot to Siaya County health headquarters, then to subcounties, and finally to the health facilities 2 weeks before commencement of Malezi Bora. Deworming tablets were already available at the health facilities. Where vitamin A capsule supplies were deemed insufficient, they were replenished in time for the campaign. For the campaigns, volunteers were provided capsules and deworming drugs in small clear plastic bags together with personal protective equipment from the link health facilities in quantities calculated to cover needs for both door-to-door and ECDC distribution. The remaining stocks were returned to the link health facilities after the exercise.

2.3.2 | Training

To prepare volunteers for routine distribution via CHS, the subcounty health team facilitated the training of 23 health facility workers and 20 CHAs in the intervention site using the Ministry of Health's curriculum for distributing VASD in the context of COVID-19. These staff then provided volunteers a 1-day training covering: the health benefits of VAS and deworming; correct verification of age of the target population for the two different doses of vitamin A and for deworming; the dosage and frequency of administration; documentation and tracking of capsules and deworming tablets and of doses administered; and COVID-19 protocols.

In the control arm, previously trained CHAs and health facility workers facilitated a 1-day training of volunteers covering: the benefits of VAS and deworming; their role in distribution and documentation; and COVID-19 protocols. In both arms, health workers were trained and supervised jointly by the county health teams and Helen Keller team.

2.3.3 | Community mobilization and household distribution of VAS and Albendazole

VASD distribution in the intervention arm continued over a 4-month period (September to December 2021) during volunteers' regular household visits. These visits allowed volunteers to spend more time with families explaining the benefits and timing of VASD than is possible during the 2-day Malezi Bora campaign. In the control arm, mobilization was conducted 1 day before distribution by community leaders and volunteers, who alerted households of the date and place for the event.

2.3.4 | Reporting protocols and tools

In the intervention arm, volunteers recorded the number of eligible children reached each day with VAS and with Albendazole on both MOH tally sheets and mother–child booklet, and submitted their tally sheets to CHAs during the monthly review meetings. The assistants, in turn, compiled the data on the number of children reached with VAS and Albendazole from all the volunteers within each community health unit, and these were subsequently submitted to the link health facility for uploading into the KHIS2.

In the control arm, the community health volunteers used MOH tally sheets to record the total number of children who received VAS and Albendazole drugs in each community health unit during their 2-day event. There was very little recording on the mother-child booklet. The tally sheets were submitted to the link health facilities, and these data were then transferred onto MOH summary sheets and shared with the subcounty health records team who subsequently entered the data into KHIS2.

2.3.5 | Monitoring and supervision of the activities during the study period

For the intervention arm, VASD was added to the other routine responsibilities of volunteers. Throughout the study period, from September to December 2021, CHAs supervised volunteers almost daily, either in-person or by telephone. The assistants also monitored the delivery of commodities to all participating volunteers. The assistants submitted supervision reports to their link health facility at the end of each month and received performance feedback from the facility staff during the monthly review meetings. In addition, the subcounty health management team, the research team, and Helen Keller team conducted monthly supervision. Supervision activities included visits to health facilities, households, and community health units to observe and check on implementation and to identify challenges and areas for improvement. Data quality assurance was conducted during meetings and in data review. For the control arm, because distribution was over 2 days, supervision was less structured, and was limited to spot checks by the county and subcounty health teams, community heath assistants, and Helen Keller team.

2.4 | Sampling strategy and sample size determination

2.4.1 | Quantitative component of the study

For both arms of the study, a postevent coverage survey (PECS) was conducted to assess VASD coverage and knowledge of caregivers of children aged 6–59 months. The survey used the WHO and UNICEF 30 by 7 cluster sampling methodology (USAID, 2001), or sample size of 210 caregivers and their children aged 6–59 months per study arm. This number was inflated by 10 households per cluster to account for nonresponse, resulting in 300 per study arm, or a total sample of 600 caregiver/child pairs. This sample size gives ±10% level of precision, which is considered reasonable to provide valid information for programming. The sampling unit/cluster was the Kenya National Bureau of Statistics Enumeration Area.

Selection of villages for the first stage of the sampling, enumeration areas (clusters; $n = 30$) was random based on probability proportional to population size (PPS) (USAID, 2001). In the second stage, a list of all households with children aged 6–59 months old per village obtained from the volunteers was used to select 10 households through simple random sampling using a random number generator application. The volunteers then identified the selected households, and a survey team visited each household and administered the questionnaire to the consenting caregivers. Households unwilling or unavailable to participate were replaced through a new random selection. In households with more than one child aged 6–59 months, all children were included in the coverage survey. The final sample was $n = 307$ intervention and $n = 318$ control.

The PECS questionnaire asked caregivers if the eligible child(ren) in the household had received VAS and/or Albendazole in the last

6 months and eight questions pertaining to the caregiver's knowledge about VAS and deworming. Composite knowledge scores were created with the possibility of scoring between 0 and 8 for VAS and 0 and 3 for Albendazole/deworming.

The coverage survey was administered utilizing the ODK Collect app on mobile phones. Study enumerators received rigorous training on data collection, the use of the app, and daily supervision to ensure the quality of interviews, data entry, and data checks.

2.4.2 | Qualitative component

Key informant interviews (KIIs)

In total, 46 KIIs were conducted, 23 per study arm. In each arm, the KII participants included 2 members from the county health management team, 2 subcounty nutrition coordinators, 2 community health service coordinators, 5 health facility workers, 5 CHAs, and 10 community health volunteers. The KII participants from the county and subcounty health management teams and the health workers were purposively selected according to the relevance of their job descriptions and key roles in the VAS and deworming programme.

The KIIs were conducted through face-to-face, telephone or internet platforms. The interview guides were structured around the following points: (1) knowledge of national policies and strategies on VAS and deworming; (2) assessment of the health system components of the VASD programme (governance, financing, services, human resources, procurement, and information system); (3) successes, best practices, and challenges in delivering VASD via the respective platform; and (4) recommendations for improving delivery of VASD. All the interviews were audio recorded then translated and transcribed in English, if needed, for analysis.

Focus group discussions (FGDs)

A total of 10 FGDs were conducted with caretakers of children 6–59 months; 4 in the intervention arm (two per ward); and 6 in the control arm (one per ward). Each was comprised of a convenience sample of 8–12 participants from households in the catchment area of the health facilities selected for the study. Discussions were conducted in *Dholuo*, the local language, and aimed to gather information on caregiver views on VASD services and experiences with the distribution modalities. All FGD were audio recorded, then translated and transcribed in English for analysis.

2.5 | Data analysis

For the quantitative data Statistical Package for the Social Sciences (SPSS) version 27 was used for analysis and frequency distributions and coverage were calculated, and a two-proportion *z*-test used to test for differences. For the qualitative data, the transcripts were analysed and coded thematically according to categories that were predetermined according to the objectives and scope of the study, using NVivo software. The themes were then examined for patterns to identify determinants of knowledge and receipt of VAS and Albendazole and to understand their experiences of the two different distribution modalities.

2.6 | Ethical considerations

Ethical clearance was obtained from the Maseno University Ethical Review Committee, and a research permit was granted by the National Commission for Science, Technology, and Innovation. Further clearance was sought from the Siaya County Health Management Team and from the Alego Usonga and Bondo Subcounty Health Management Teams, and from the local administration (chiefs) for the areas before study commencement. Eligible caregivers were enroled upon voluntary informed consent. Due to the COVID-19 pandemic at the time of data collection, all the safety precautions required by the MOH for social distancing, sanitizing, and wearing protective gear were observed.

3 | RESULTS

3.1 | Findings from the PECS

A total of 625 caregivers with children aged 6–59 months participated in the PECS, $n = 307$ intervention and $n = 318$ control. The demographic characteristics of the study sample are shown in Table 1. The great majority of caregivers in both arms were female, and just under 15% of children were in the 6–11-month age group.

3.2 | VASD coverage

Coverage with VAS in the intervention (routine CHS) arm was estimated to be 90.6% [95% CI: 87.3–93.9] of target children compared with 70.4% [95% CI: 65.4–75.4] in the control (campaign) arm. Deworming coverage was estimated at 73.9% [95% CI: 69.0–78.7] compared with 54.7% [95% CI: 49.2–60.2], respectively (Table 2). Coverage difference stem from different target groups and, consequently, different denominators for both VAS and deworming. The difference for both treatments was significant.

Administrative data from the KHIS2 illustrates that VASD provision through routine services at the health facilities is low. For example, the cumulative coverage from July 2021 to October 2021 was 12% for VAS and 7% for deworming treatment based on the KHIS2 data on the total eligible children reached through facility-based service delivery within the control arm. According to administrative data, VAS and deworming coverage in intervention arm increased gradually during the study period, from 33% in

TABLE 1 Demographic characteristics.

Variable	Alego Usonga subcounty (intervention) *N* = 307		Bondo subcounty (control) *N* = 318		*p* Value
Caregiver characteristics	***n***	**%**	***n***	**%**	
Sex of the caregivers					
Male	3	1	18	5.7	0.001
Female	304	99.0	300	94.3	
Relationship of respondent to child					
Father	2	0.7	13	4.1	
Grandmother	43	14	22	6.9	
Mother	258	84	279	87.7	0.002
Older sibling	0	0	1	0.3	
`Other	3	1	3	0.9	
	M	**IQR**	***M***	**IQR**	
Age of respondents (months)	29	12	29	10	
Index child characteristics					
Average age of child (months)	29.5	27	27	25	
Child age group (months)	***n***	**%**	***n***	**%**	
6–11 months Old	43	14.1	41	13	
12–59 months old	262	85.9	275	87	0.196
Age verified or not?					
Yes	254	82.7	286	89.9	0.011
No	51	17.3	31	10.1	
Source of age verification					
Mother–child booklet	181	71.3	219	76.6	
Birth certificate	16	6.3	25	8.7	
Events calendar	29	11.4	31	10.8	0.014
Birth notification	23	9.1	7	2.4	
Other	5	2	4	1.4	
Gender of index child					
Male	154	50.2	158	49.7	0.936
Female	153	49.8	159	50.3	

Abbreviations: IQR, interquartile range; *M*, median.

September to 100% of the eligible population reached through combined facility-based and community-based delivery in December 2021, while deworming rose from 28% in September to 96% in December.

3.3 | Knowledge of VAS

Over half of the respondents in each study arm (66% intervention; 56% control) stated that vitamin A contributes to healthy growth and resistance to infections (Table 3). A significantly higher percentage of caregivers in the intervention arm (62%) than the control group (48%) correctly answered that a child should receive VAS twice a year. Most respondents reported receiving information about VAS from the health facilities, equal proportions in the intervention (89.9%) and control (83.6%) areas; however, a significantly larger proportion of respondents from the intervention communities compared with control reported receiving information from volunteers (86.3% vs. 63.2%, respectively). A minority of respondents in both areas reported they felt the information

TABLE 2 Vitamin A supplementation and deworming coverage.

Variable	N (%)	95% CI		p Value
		Lower	Upper	
Vitamin A capsules coverage				
Control (campaign)	224 (70.4)	65.4	75.4	<0.01
Intervention (routine)	278 (90.6)	87.3	93.9	
Deworming coverage among children				
Control (campaign)	174 (54.7)	49.2	60.2	<0.01
Intervention (routine)	227 (73.9)	69	78.8	

received was not sufficient (36.5% intervention; 43.1% control). Specifically, they desired additional information on the advantages of supplementing their child with vitamin A, differences between VAS and multivitamins, and the age when children receive their first and last doses of VAS. Similar requests were expressed in the FGDs.

3.3.1 | Knowledge of deworming

Respondents in the intervention area also had a higher level of knowledge of the benefits of deworming compared with those in the control area; 69.9% and 56.7%, respectively, stated deworming prevents malnutrition, and 68.1% versus 54.4% reported it improves growth in children (Table 4).

A test of equality was conducted to detect significant differences in composite scores for VASD knowledge, and showed knowledge was significantly higher in the intervention compared with control area ($p < 0.05$) (Table 5).

3.4 | Qualitative findings

3.4.1 | Training

Overall, the findings suggest most respondents felt the training provided was adequate in both arms. Some members of the county and subcounty health management team, however, felt that the curriculum content was inadequate for the intervention arm. As one observed, 'We used a patched-up curriculum. There is need to have a tested and validated curriculum in future'. Another stated, 'The training did not include a capacity test [knowledge assessment] for the community health volunteers'.

On the other hand, health facility workers, CHAs, and volunteers in both arms indicated they felt the training was adequate. A few suggested more frequent refresher trainings. As one volunteer expressed it, 'I understood everything, but it should be redone. As a human being, there are times when after some time, the information slips the mind, so even if the training was adequate, there should be a refresher to remind us'. Specific topics mentioned were the health benefits of VASD, the frequency and age of administration.

3.4.2 | Community mobilization and household distribution of VAS and deworming

Qualitative data from both arms indicated that volunteers were perceived by all stakeholders to have distributed VASD efficiently and met their targets. According to a health care worker in one of the health facilities, 'At the community level, the CHVs [volunteers] are considered as the major eye to the health sector because they are the ones who have the reach to the community before any other person. The CHVs are very important in the distribution process of VASD since they offer their community sensitization skills to ensure that eligible children receive the service'. A CHA added, 'The CHVs are part of the health system community mobilization process that without their engagement, the VASD exercise would not have succeeded'. A FGD participant observed, 'To avoid over-deworming, a CHV will give the deworming tablets to the child and put a sticker in the booklet to show deworming has been done'.

3.4.3 | Reporting protocols and tools for the VASD

Informants in the intervention arm also reported that volunteers and assistants were able to document the use of VASD commodities satisfactorily using bin-cards located in the pharmacy or store at the link health facilities, and that records were accurate and done in a timely manner. They also reported that the health facilities kept accurate records of the commodities used and submitted this information to the subcounty Nutrition Coordinator and Health Records and Information Officer.

3.4.4 | Stakeholders' preferences for distribution platform

All county and subcounty health personnel informants in the intervention arm expressed preference for the routine distribution by volunteers and

TABLE 3 Knowledge of vitamin A.

Knowledge of vitamin A	Intervention (Routine)		Control (Campaign)		*p* Value
	N	%	*N*	%	
Health benefits of Vitamin A in the body					
To make them grow healthily	201	65.5	179	56.3	0.021
To resist infections	155	50.5	164	51.6	0.786
To ensure good eyesight	109	35.5	134	42.1	0.089
To build strong bones	112	36.5	113	35.5	0.805
Other	109	35.5	103	32.4	0.411
Number of times in a year children should receive VAS					
Once	7	2.3	9	2.8	
Twice	190	61.9	154	48.4	
Thrice	59	19.2	50	15.7	0.000
Other	10	3.3	14	4.4	
I don't know	41	13.4	91	28.6	
How often should child receive VAS					
Every 6 months	187	60.9	158	49.7	
Every 3 months	60	19.5	47	14.8	
Every 2 months	7	2.3	4	1.3	0.000
Other	12	3.9	27	8.5	
I don't know	41	13.4	82	25.8	
What age should receive VAS?					
Knowledge of minimum age in months	199	64.8	158	49.7	0.628
Knowledge of Maximum age in months	174	56.57	155	48.7	0.000
Source of information on VAS					
Health facility	276	89.9	266	83.6	0.021
Friends	0	0	18	5.7	0.000
Relatives	3	1.3	24	7.5	0.000
Outreaches	4	1.3	35	11	0.000
CHVs	265	86.3	201	63.2	0.000
Others	12	3.9	28	8.8	0.012
Is the information received on VAS sufficient?					
Yes	195	63.5	181	56.9	0.092
No	112	36.5	137	43.1	

the decentralized planning process. The reasons given included: higher coverage achieved by the decentralized planning and the continuous provision; improved knowledge of the health benefits of VASD among both caregivers and health workers; potential for sustainability of this less resource intensive approach; and increased referrals to other health services made by the volunteers due to their longer-term contact with clients. In the control arm, informants indicated that the volunteers focused on delivering VASD and had limited contact time with caregivers due to the time pressures of the campaign.

4 | DISCUSSION

This study investigated the feasibility and effectiveness of delivering VASD through the CHS, in terms of coverage, data quality, and community knowledge and demand, compared with the current main platform of Malezi Bora campaigns. Both quantitative and qualitative data favoured the routine CHS approach. This approach had additional benefits, such as the identification and referral of children with health problems

TABLE 4 Knowledge of deworming.

Variable	Intervention (Routine)		Control (campaign)		*p* Value
	n	%	*n*	%	
Benefits of deworming in children					
To prevent malnutrition	177	55.7	214	69.7	0.000
To improve the growth of children	173	54.4	209	68.1	0.000
Other (eliminate worms in the body, improve immunity)	128	40.3	102	33.2	0.073
Children's frequency of receiving deworming tablets					
Once a year	30	9.4	15	4.9	
Twice a year	39	12.3	116	37.8	
Every 3 months	148	46.5	130	42.3	0.000
I don't know	64	20.1	37	12.1	
Others	37	11.6	9	2.9	
Knowledge of minimum age for deworming children	160	50	160	50	0.006
Sources of information on deworming of children					
Health facility	253	79.6	278	90.6	0.000
Friends	28	8.8	1	0.3	0.000
Relatives	43	13.5	2	0.7	0.000
Outreaches	42	13.2	2	0.7	0.000
CHVs	199	62.6	268	87.3	0.000
Others (Chemist, ECDs and common knowledge)	29	9.1	9	2.9	0.001

TABLE 5 Test of equality of VAS and deworming mean knowledge scores.

Variable	Mean score	SD	*p* Value
Vitamin A			
Intervention	4.9511	0.1127	
Control	4.4717	0.1379	0.0075
Deworming			
Intervention	1.42671	0.03957	
Control	1.19497	0.05039	0.0003

to the health facilities who may not otherwise receive medical attention.

Many countries in sub-Saharan Africa are recognizing the need for more cost-effective delivery mechanisms for assuring children receive biannual VASD now that polio campaigns, which for two decades provided an ideal platform, have been phased out. Sierra Leone was one of the earlier countries to experiment with strategies to move towards routine delivery, innovating in 2011 the addition of a 6-month contact point into the schedule for the Expanded Program of Immunization to encourage families to come to the health facility for the first dose of VAS. Given its initial promise (Hodges et al., 2015), the government scaled up the approach nationwide, and created an integrated package with VAS, counselling and cooking demonstrations on the introduction of enriched complementary foods, counselling on modern family planning, and provision of long-term hormonal implants. The strategy also added monthly outreach visits from health facilities to more remote communities in three districts, bringing deworming treatment as well. As in our model, community health workers were engaged to support the activities. An evaluation conducted in 2018 of this expanded approach found that coverage for all children 6–59 months with VAS exceeded 80% by caretaker report and 70% by health card record, while deworming coverage exceeded 80% by caretaker report and 50% by health card record (Koroma et al., 2020). The authors noted that the performance in each district was positively correlated with the ratio of health units per capita, which also reduced the size of catchment areas. They did not present data to indicate what proportion of services were obtained at facilities versus outreach. Cooking demonstrations were a strong draw for caretakers but may

not be a sustainable activity. Nevertheless, Sierra Leone also is building an interesting model for routine VASD.

In Burkina Faso, a recent qualitative study examined the acceptability and challenges of delivering VASD in a similar approach to Kenya's, using the government's newly recruited community-based health workers (CBHW) (Ouédraogo et al., 2022). In rural areas, CBHW were trained to distribute VASD and other health services to children in their catchment areas going door-to-door over the course of 1 month, while in urban areas distribution by CBHW was conducted over 4 days. That study also found high acceptability of the approach by all stakeholders and lower operational costs compared with those of campaigns. Routine distribution was able to maintain coverage above 90%. Challenges highlighted were irregular supervision, delays in and uncertain source for payments to CBHW, and risks of overloading CBHW with too many interventions and long distances to travel. Ethiopia currently uses three strategies to deliver VAS, two of which are campaign based, and one via the routine Health Extension Program, in which salaried health extension workers (HEW) supported by volunteers provide VAS through fixed facilities, locally organized outreach, and home visits. A mixed methods study conducted in the Amhara region to compare the routine approach to Child Health Day campaigns found that both approaches-imposed hardships on HEW, including long distances to travel by foot, bicycle or motorbike, and that campaign funding, although not sustainable, continues to provide more support to ease the burdens, including more supervision and training. Most mothers reported preferring the child health days, which bring supplements to them, especially if they have multiple children (Gatobu et al., 2017). Another, quantitative, study was conducted in a district in the south of the country to explore barriers and facilitators of children receiving supplements through routine services (Kassa et al., 2020). It found that mothers who received information about the benefits from HEW were more likely to accept supplements than those receiving that information from facility workers. This suggests that frontline health workers have gained the trust of their clients, and with appropriate support could reach satisfactory coverage. However, as each is responsible for an average of 2500 households, some of which are very distant, and is delivering as many as 16 different service packages for modest compensation, a strong support system will be needed to sustain their motivation and performance. Finally, a study conducted in Senegal in an early stage of the transition compared the performance of routine delivery to biannual campaigns (Horton et al., 2018). Campaigns deliver a package of services using salaried health staff and volunteers who receive incentives. The routine approach provides VAS to children brought to health huts and health posts for other services, but also organizes efforts to mobilize communities to visit health facilities or outreach sites, and mini campaigns to reach unsupplemented children. The authors noted that while the campaigns are still highly cost-effective at only $1.25 per child reached, external partners cover almost 60% of the costs. The study reported considerable drops in coverage, from the overall 98% achieved in campaigns to 54% in the five regions using routine services. The authors questioned whether routine delivery can remain cost-effective given the weaknesses of the health system, but their findings provided important information on ways to strengthen primary health service delivery and build community demand.

In our context, we can posit several possible explanations for the higher coverage achieved through CHS. Volunteers received more detailed training on both the value of VASD and on proper administration, as well as on other related health and nutrition topics. Using their routine visits, volunteers had more time to spend with each household to explain the benefits of VASD, and they also received ongoing supportive supervision and from CHAs. The intensive, participatory planning and implementation with the county and subcounty management teams may have also contributed, as well as the monthly meetings with a data quality review. This approach is also a strategy for strengthening the community health care system.

A limitation of our study is that in both arms, external partners provided important support to the government for financing, logistics, capacity building, monitoring and supervision. It will be important to evaluate the CHS approach again in contexts where external support is lighter. It is also important to note that the subcounties chosen for the study have above average performance within the Kenyan health system. Siaya County also offers attractive benefits for its volunteers as well as regular supervision, something other counties are starting to emulate. Nevertheless, further local system strengthening may be required for the model to achieve targets in areas of the country where conditions are more challenging. And nationally, the supply chain for vitamin A capsules and Albendazole needs to be integrated into the more highly functioning vaccine supply chain. Both fall under the jurisdiction of the Kenya Essential Programme for Immunization (KEPI), so integration is rational.

5 | CONCLUSIONS

Our study showed that the distribution of VASD by community health volunteers supervised and supported by CHAs working in well-functioning community health units is feasible and can potentially achieve high coverage. Elements of success likely included the good incentive structure provided by Siaya County, deliberate planning cascaded from the county level to the subcounty level, training of health facility workers, assistants and volunteers on the distribution modality, good communications between assistants and volunteers, uninterrupted supply, and availability of vitamin A capsules, Albendazole tablets, and data reporting tools, and regular implementation review meetings at different levels.

AUTHOR CONTRIBUTIONS

Julius Korir, Fridah Mutea, Asa Lelei, David Doledec, and Caleb Ombati conceived and designed the study. Caroline Chebet, Fridah Mutea, Asa Lelei, Julius Korir, and Caleb Ombati supervised the study. Julius Korir, Melissa M. Baker, Asa Lelei, and Caleb Ombati drafted the analytical framework and Caleb Ombati and Julius Korir conducted all analysis. Melissa M. Baker, Asa Lelei, and Jennifer Nielsen drafted the first version of the manuscript and David Doledec, Fridah Mutea, Sophie Ochola, and

Esther Njeri verified the study findings, provided valuable contributions in interpreting findings and further developing the discussion sections of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

This study was conducted according to the guidelines established by the National Commission for Science, Technology, and Innovation (Ethical clearance number NACOSTI/P/21/12513) and ethical clearance obtained from the Maseno University Ethical Review Committee (Reference number MSU/DRPI/MUERC/00990/21) and further clearance by the Siaya County Health Management Team and local administration. Voluntary informed consent was witnessed and documented from the research participants.

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REFERENCES

Gatobu, S., Horton, S., Kiflie Aleyamehu, Y., Abraham, G., Birhanu, N., & Greig, A. (2017). Delivering vitamin A supplements to children aged 6 to 59 months: Comparing delivery through mass campaign and through routine health services in Ethiopia. *Food and Nutrition Bulletin*, *38*(4), 564–573.

Hall, A., Hewitt, G., Tuffrey, V., & de Silva, N. (2008). A review and meta-analysis of the impact of intestinal worms on child growth and nutrition. *Maternal & Child Nutrition*, *4*(Suppl. 1), 118–236.

Hodges, M. H., Sesay, F. F., Kamara, H. I., Nyorkor, E. D., Bah, M., Koroma, A. S., Kandeh, J. N., Ouédraogo, R., Wolfe, A. C., Katcher, H. I., Blankenship, J. L., & Baker, S. K. (2015). Integrating vitamin A supplementation at 6 months into the Expanded Program of Immunization in Sierra Leone. *Maternal and Child Health Journal*, *19*(9), 1985–1992. https://doi.org/10.1007/s10995-015-1706-1

Horton, S., Blum, L. S., Diouf, M., Ndiaye, B., Ndoye, F., Niang, K., & Greig, A. (2018). Delivering vitamin A supplements to children aged 6–59 months: Comparing delivery through campaigns and through routine health services in Senegal. *Current Developments in Nutrition*, *2*(4), nzy006.

Kassa, G., Mesfin, A., & Gebremedhin, S. (2020). Uptake of routine vitamin A supplementation for children in Humbo district, southern Ethiopia: Community-based cross-sectional study. *BMC Public Health*, *20*(1), 1500.

Kenya Health Information System (KHIS). (2021). Accessed June 2023. https://hiskenya.org/dhis-web-commons/security/login.action

Kenya National Bureau of Statistics and ICF. (2023). Kenya Demographic Health Survey 2022. *Key Indicators Report*.

Koroma, A. S., Conteh, S. G., Bah, M., Kamara, H. I., Turay, M., Kandeh, A., Macauley, A., Allieu, H., A Kargbo, A., Sonnie, M., & Hodges, M. H. (2020). Routine vitamin A supplementation and other high impact interventions in Sierra Leone. *Maternal & Child Nutrition*, *16*(4), 13041.

Lo, N. C., Snyder, J., Addiss, D. G., Heft-Neal, S., Andrews, J. R., & Bendavid, E. (2018). Deworming in pre-school age children: A global empirical analysis of health outcomes. *PLoS Neglected Tropical Diseases*, *12*(5), e0006500.

Ministry of Health, Kenya. (2011). *The Kenya National Micronutrient Survey*. Accessed June 2023. The Kenya National Micronutrient Survey 2011. pdf (nutritionhealth.or.ke)

Ministry of Health, Kenya. (2017). *Ministry of health vitamin A supplementation multiyear plan 2017–2022*.

Ministry of Health, Kenya. (2019). *Kenya community health strategy final signed off 2020–2025*.

Ouédraogo, O., Zeba, A. N., Kaboré, S., Berthé, A., Drabo, K. M., Ouaro Dabiré, D. B., Bambara, E., Ouédraogo, H., Ilboudo, T. P., Konaté, C., Garnier, D., Boussery, G., Kiburente, M., & Zagré, N. M. (2022). Acceptance and challenges of the introduction of the routine community-based vitamin A supplementation strategy: The case of Burkina Faso. *Public Health Nutrition*, *25*(5), 1355–1364.

Pabalan, N., Singian, E., Tabangay, L., Jarjanazi, H., Boivin, M. J., & Ezeamama, A. E. (2018). Soil-transmitted helminth infection, loss of education and cognitive impairment in school-aged children: A systematic review and meta-analysis. *PLoS Neglected Tropical Diseases*, *12*(1), e0005523.

USAID. (2001). Knowledge, practices and coverage survey 2000+. *Field Guide*. http://s3.ennonline.net/attachments/314/annex-4-kpc-survey-field-guide-(care)(1).pdf

World Health Organization. (2011). *Guideline: Vitamin A supplementation in infants and children 6–59 months of age*.

World Health Organization. (2017). *Guideline: Preventive chemotherapy to control soil-transmitted helminth infections in at-risk population groups*.

World Health Organization. (2021). *Preventive chemotherapy data portal*. Accessed June 2023. https://www.who.int/data/preventive-chemotherapy

World Health Organization and the United Nations Children's Fund (UNICEF). (2021). *Indicators for assessing infant and young child feeding practices: Definitions and measurement methods*.

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