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Vitamin A Supplementation in Madagascar: Coverage and Multifaceted Analysis of Influencing Factors During Transition to Routine Mode

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Abstract

Vitamin A supplementation (VAS) is a key public health intervention to reduce child mortality and morbidity. In Madagascar, the VAS program has transitioned from a vertical program to integration into the routine health system (RHS). This study assesses the coverage of VAS and its associated factors during the last campaign mode and first implementation into routine. A national cross-sectional household survey selected 4410 households using multistage random sampling. After consent, mothers of children aged 6–59 months were interviewed using a pre-tested questionnaire. In addition to socioeconomic and program information from selected communities, 2,972 children aged 6-59 months were verified for vitamin A capsule uptake within the six months before the survey and during the April 2019 campaign. Bivariate analysis and multilevel mixed logistic regression were used to estimate VAS coverage and its associated factors. Overall, VAS coverage was 79.1% (CI 95%: 76.6%-82.0%) in the campaign and 50.6% (CI 95%: 47.7%-53.5%) in routine mode. In regression analysis adjusted for confounders, community exposure to mass media campaigns on VAS, Vitamin A knowledge, Antenatal care visits, household wealth index, and urban residence were positively associated with VAS uptake in routine mode. In contrast, the number of children under 5 per household and age was negatively associated. This study suggests that VAS coverage in Madagascar is suboptimal and that improving the identified socioeconomic and programmatic factors associated with VAS uptake is recommended. These findings can inform strategies to increase VAS coverage during the transition to the RHS.

Keywords: *Coverage, Madagascar, Vitamin A Supplementation, Vitamin A Deficiency*.

Introduction

Vitamin A deficiency (VAD) remains a global public health concern. WHO estimates that an annual 250,000 to 500,000 vitamin A-deficient children go blind, and half of them die within 12 months of losing their sight [1] and its impact has been documented in 204 countries and territories [2]. This silent deficiency has devastating consequences, including weakened immunity, increased susceptibility to infection, and preventable childhood blindness [1, 3, 4]. Combating VAD requires effective interventions, with vitamin A supplementation (VAS) being a fundamental strategy to prevent morbidity and mortality [5, 6].

In Madagascar, to address the problem of micronutrient deficiency, the Ministry of Health (MoH) initiated VAS campaigns for children aged 6 to 59 months and women who had recently given birth since 1998, as is the traditional approach in many countries. In 2005, a deworming campaign was combined with vitamin A supplementation campaigns. In October 2006, the MoH institutionalized

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Mother and Child Health Week (MCHW), held twice a year nationwide. This MCHW consisted of VAS, deworming and catch-up vaccinations for children, and screening for women with fistula. While the campaign mode achieved administrative coverage of over 95% of children aged 6-59 months in Madagascar, and more generally made significant progress in reducing the prevalence of vitamin A deficiency globally [5, 7], it raised concerns about long-term sustainability.

In October 2019, the MoH initiated a transition from campaign mode to routinization of VAS, following the completion in 2018 of an 18-month pilot of routine implementation in the health districts of Andramasina and Morondava in partnership with UNICEF. Unfortunately, studies before this transition have focused primarily on campaign performance and specific aspects of routine mode implementation and have not provided a comprehensive picture of the interrelated factors affecting coverage in both delivery models. This study aimed to determine post-campaign coverage in April 2019 and routine coverage in February 2020 at the national and sub-national levels, and to examine individual and community-level factors influencing VAS uptake in Madagascar to provide robust evidence to ensure a smooth transition from VAS to routine mode.

Research Methodology

Areas of Study

The study covered the whole country, with each of the six provinces (Tananarive, Diego-Suarez, Fianarantsoa, Majunga, Tamatave and Toliary) being representative. Thus, vitamin A supplementation coverage is estimated at the provincial level to account for regional disparities, as well as at the national level.

Participants

Participants in this study were primarily mothers of children aged 6-59 months for VAS-related coverage and individual-level profiles, and secondarily community health workers, health workers from health facilities covering the selected clusters, and community leaders for community-level information and perceptions of VAS implementation.

Inclusion criteria: All households agreed to participate in this study and had at least one child aged 6-59 months. Community agents, health workers, and community leaders from the identified households also agreed to participate in this study.

Exclusion criteria: Households that did not agree to participate in the study OR did not have children aged 6-59 months during data collection.

Sampling and Household Selection

This cross-sectional study is a subset of a national survey on micronutrient coverage and women's nutrition conducted in Madagascar in February 2020 (ENVNUT). The primary goal of this national survey was to determine household coverage for the following micronutrients: vitamin A, iron and/or folic acid, deworming of children and women, and iodine [8].

The minimal sample size (n) required for the ENVNUT at each level of representativeness was estimated using the following formula [5, 6]:

n = (z^2 × r×(1-r) ×deff) / (e^2 ×pb×AveSize ×RR).

Parameters: 95% confidence level; z2 = 1.96; anticipated percentage adjusted to 50% to maximize sample size. The design effect to account for the three-stage survey is deff=2.5; the margin of error linked to survey precision is e=7%; according to MICS 2018, the proportion of the target population (children under 5) is pb=15.3%; the average household size is AveSize=4.5; the predicted response rate is RR=97%. This sample size provided national representativeness in each of the country's six provinces, with 735 households per province (equivalent to approximately 36 villages of 20 houses), totaling 4410 households nationwide.

Using the inclusion and exclusion criteria, our study found 2514 households that met these characteristics and will be the focus of the data analysis.

Selection of Household in the Field

Households were selected using a province-stratified, three-stage sampling approach. First, one to three districts per area were randomly selected according to their size using 2018 census data, 31 districts in six provinces. Next, fokontanys (village names in the local language) were randomly selected with probability proportional to size using the MoH's Sectorization-2019 database and the Madagascar National Institute of Statistics' 2018 census data adjusted to 2020. Finally, authorized field enumerators numbered all houses in the selected clusters (fokontany). After a selection phase based on the total number of households and a random seed for each village, 20 households were chosen.

Data Collection

Data were collected from three target groups: mothers (child and mother questionnaires), community agents (community health workers' questionnaires), and community leaders (Fokontany questionnaire), after a ten-day training on data collection techniques and Level 2 sampling. It took place from February 29 to March 25, 2020. The survey procedures and questionnaires were tested in two clusters (40 households) to validate the instruments before the primary data collection, from February 1 to March 25, 2020, in the 223 clusters selected nationwide.

Outcome: VAS Status

The vitamin A supplementation status of all children aged 6-59 months was checked with their mothers, either on the mother's declaration of vitamin A receipt after showing her a vitamin A capsule or directly from the child's health record in each household selected for the study. During the shift from campaign to routine supplementation, it was essential to examine vitamin A receipt during the last campaign, in April 2019, using the same approach. The question additionally asked whether the child had received vitamin A (yes/no) and the period (month) since receipt. This enabled calibrating the outcome variable at the recommended frequency—six months before the survey for routine coverage and April 2019 for post-campaign coverage.

Independent Variables

The socio-demographic variables considered for this study included those related to the child and the mother, i.e., level 1:

1. child's sex, child's age, living environment (urban or rural), mother's education level, antenatal care visits during the last delivery, number of children under 5 in the household, household wealth index using the DHS approach based on principal component analysis [9], and distance of the household from the nearest health facilities.

Second, community-level variables, level 2: location where community health workers received drugs and supplies during the transition period.

1. Vitamin A knowledge was assessed by assigning a score of one according to whether the mother correctly answered the following four areas: i. Knowledge of vitamin A as a supplement, knowledge of foods rich in vitamin A such as orange vegetables (carrots, pumpkin and orange-fleshed sweet potato), animal foods such as liver or egg yolk; ii. The correct frequency of vitamin A supplementation; iii. The place where vitamin A is obtained and the age group for whom vitamin A can be recommended. The Vitamin A knowledge score (0-4) is the total points, the higher the score, the better the mother's VAS knowledge.

2. Community exposure to vitamin A mass media campaigns through sensitization and communication by local authorities, health workers covering the village, and community workers after the last Mother and Child Week (MCHW) campaign in April 2019, showing the transition from campaign to routine.

Statistical Analysis

The univariate analyses were used to determine proportions with confidence intervals for binary variables, particularly vitamin A supplementation coverage (with 95% confidence intervals). For multivariate analyses, we used multilevel mixed-effects models to consider the hierarchical nature of the latter, with a random effect at the grouping level, i.e., community. Thus, a two-level mixed-effects logistic regression of VAS status on the above-mentioned independents was used, regarding the binary character of the outcome and the two levels: individual (on child and mother) and community (media exposure, distance to the nearest health centre, fokontany drug supply location, etc.).

The "meglm" command of Stata ® 18 (StataCorp LP, College Station, TX, USA) [10] was implemented to perform regression with a Bernoulli family and logit function. Individual and community variables were independently regressed on the variable of interest, with p-values <=0.2 retained for adjustment. Proportional differences in variance (PCV=[VI-VM]/VI]*100, VI = initial model variance, and VM = model with more terms) were also determined, and their significance was assessed to retain the final model [11]. Results were presented in odds ratio (OR) format with a 95% confidence interval to examine the strength of the association between independent factors and outcome. All analyses were weighted by sampling weights to account for the complex survey design.

Ethical Considerations

The National Ethics Committee for Biomedical Research and the Ministry of Public Health of Madagascar gave full approval to ENVNUT in June 2018 (ref: 066/MSANP/CERBM-2018) before the research, which covers this sub-study component. Also, households and, more generally, all participants in the various administrative questionnaires (mothers, community health workers, and community leaders) voluntarily consented to the interviews after receiving an introductory session of informed consent from enumerators and of the voluntary nature of their participation, and participants could partially or completely retract at any time from the interviews.

Results

Sociodemographic and Community-Level Characteristics

The study included 2514 mothers with 2972 children. The median age of the children was 29 months (IQR:16-43), and three-quarters were older than 24 months. Participants were mostly rural (72%) and had completed only primary school (48%) or college (38.9%). 90.4% of the mothers had only one child, and 9.3% had two children under 5. They lived within 10 km of a hospital (76%), including 52% within 5 km. 72.2% of mothers used the antenatal care platform at the nearest health facility for at least four consultations during their last delivery. Most mothers (54.6%) had a "good" knowledge of vitamin A administration (e.g. being able to correctly answer at least 3 of the 4 domains checked). They were also frequently exposed to vitamin A communication campaigns during the transition period.

Table 1. Socio-demographic, *Maternal Health*, and *Community Characteristics* of *Mothers* of *Children Aged* 6-59 *Months*

Variables	Frequency (%)		Variables	Frequency (%)
Sex of children			**Distance to nearest health facility**	
Male	1427 (48 %)		<5 km	1309 (52.1 %)
Female	1545 (52 %)		5-10 km	660 (26.2 %)
			> 10 Km	546 (21.7 %)
Age of children (months)			**Mother education level**	
Median (IQR)	29 (16-43)		None	297 (11.8 %)
16-11	111 (3.7 %)		Primary	1211 (48.2 %)
12-17	239 (8.1 %)		College	978 (38.9 %)
18-23	491 (16,5 %)		High school and up	2 (0.1 %)
24-35	1037 (34.9 %)			
36-47	658 (22.1 %)		**Antenatal care (ANC) visits (4+)**	
48-59	437 (14.7 %)		No	699 (27.8 %)
Place of residence			Yes	1815 (72.2 %)
Rural	1958 (77.9 %)			
Urban	556 (22.1 %)		**Exposure to mass media communication about vitamin A**	
			No	1147 (45.6 %)
Vitamin A Knowledge Score			Yes	1367 (54.4 %)
Median (IQR)	2 (1-3)			
0	216 (8.6 %)		**Number of children under 5 per household**	
1	358 (14.3 %)		1	2273 (90.4 %)
2	569 (22.6 %)		2	234 (9.3 %)
3	1017 (40.5 %)		3	7 (0.3 %)
4	353 (14.1 %)			

Vitamin A Supplementation Coverage

Looking at coverage data using both vaccination cards and maternal recalls, we can see that after the MCHW campaign in April 2019, coverage was 79.1% (CI 95%: 76.6%-82.0%). While in February 2020, when vitamin A supplements were routinely administered, coverage was only 50.6% (CI95%: 47.7%-53.5%).

There were notable differences in coverage according to gender, with girls receiving more vitamin A capsules than boys (routine 53.3% vs. 47.8%; and campaign mode 81.6% vs. 76.5%). The VAS coverage was also higher for children residing in urban areas compared to

rural areas (routine 57.4% vs. 48.6%; and rural mode 82.1% vs. 782%). There was also a decrease in coverage as the child got older, with the youngest children aged 6-11 months having 97.2% coverage (CI95%: 91.8%-99.1%), while the oldest children aged 48-59 months had 50.6% coverage (CI95%: 42.6%-58.0%) in routine mode. Coverage in the five provinces (Antsiranana, Fianarantsoa, Mahajanga, Toamasina and Toliary) was relatively homogeneous, varying between 46%-49%, while the province of Antananarivo, which includes the capital, has a higher coverage of 58.3% (CI95%: 51.9%-64.8%).

Map 1. VAS coverage per sub-national areas (Province)

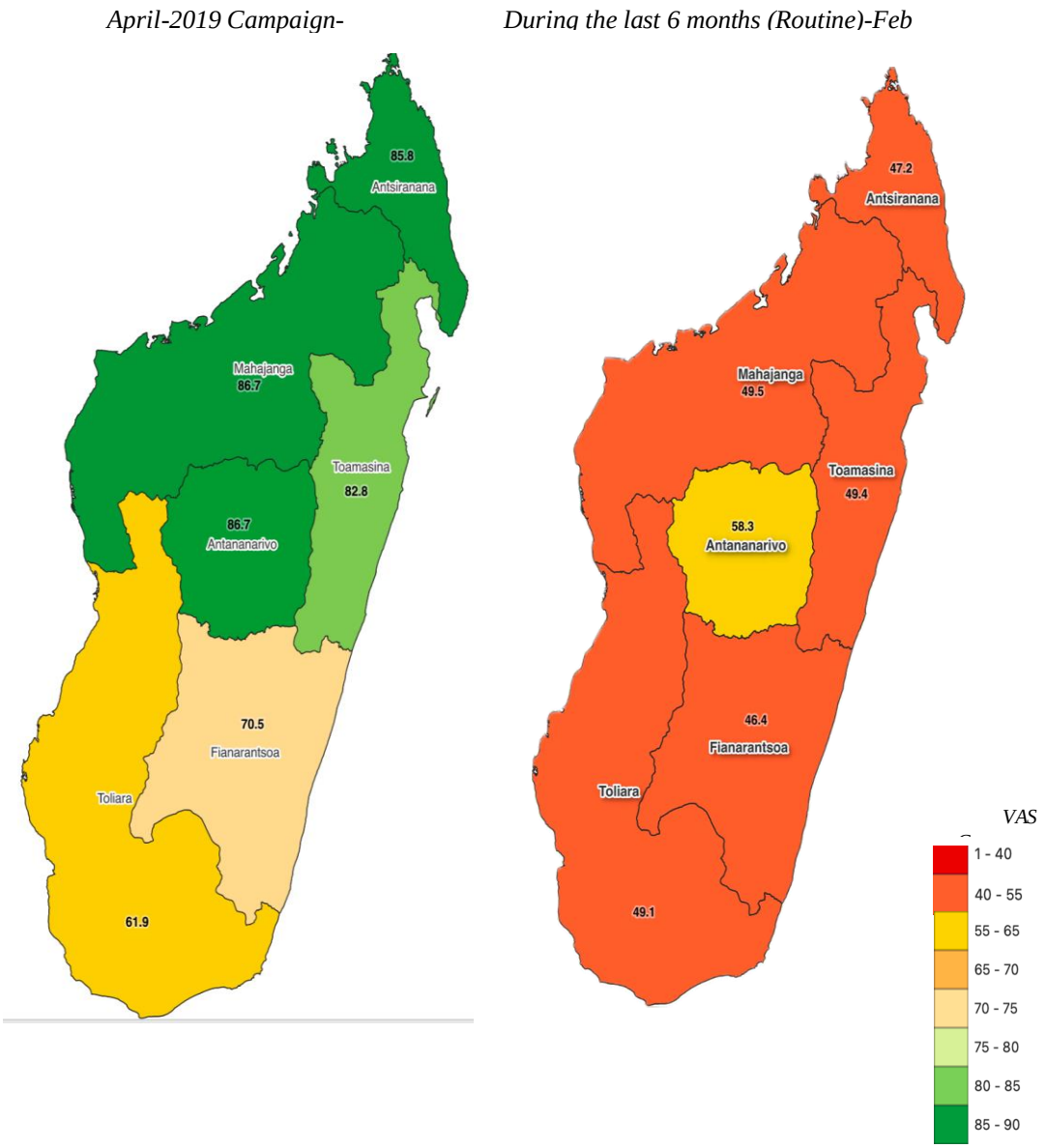

Table 2. VAS coverage during the February 2020 routine and last campaign before the switch

		During the last 6 months (Routine)-%				April-2019 Campaign-%			
		Card	**Mother's recall**	**VAS coverage (Card/ Recal)**	**Number of children aged 6-59 months**	**Card**	**Mother's recall**	**VAS coverage (Card/Recal)**	**Number of children aged 6-59 months**
Total		**19.3**	**31.3**	**50.6**	**2972**	**38.9**	**40.2**	**79.1**	**2226**
Sex**	Male	20.2	27.6	47.8	1457	39.5	37	76.5	1104
	Female	18.5	34.8	53.3	1515	38.3	43.3	81.6	1122
Place of residence**	Rural	18.5	30.1	48.6	2310	41	37.1	78.2	1722
	Urban	22.1	35.3	57.4	662	31.6	50.6	82.1	504
Province	Antananarivo	25.6	32.7	58.3	578	36.9	49.8	86.7	442
	Antsiranana	12.4	34.8	47.2	333	37	48.7	85.8	255
	Fianarantsoa	21.5	24.9	46.4	351	35.7	34.8	70.5	271
	Mahajanga	11.6	37.9	49.5	493	56.4	30.4	86.7	358
	Toamasina	19.8	29.6	49.4	578	51.2	31.6	82.8	442
	Toliary	21.3	27.8	49.1	639	16.5	45.4	61.9	456
Age (Months) **	6-11	50.9	46.2	97.2	414	na	na	na	na
	12-17	23.5	64.2	87.7	397	(*)	(*)	(*)	20
	18-23	8.6	31.8	40.4	337	41.2	33.8	75	337
	24-35	10.8	28.7	39.5	686	43	34.3	77.3	686
	36-47	27.4	25.5	52.8	600	32.6	49.3	81.9	600
	48-59	31.6	18.9	50.5	538	34.9	52.6	87.5	583

(*) Based on less than 25 unweighted cases.

( ) Based on 25-49 unweighted cases.

Na: Note applicable, as age not recommended at campaign time.

**Univariate non-parametric Chi2 test, p-value <0.05 with VAS status

Looking retrospectively at children's participation in the last two events (campaign in April 2019 and routine in February 2020), 45% of children who received supplementation in April 2019 could receive vitamin A after transitioning to routine mode. Meanwhile, 34.4% (IC95%, 31.7%-37.3%) dropped out, e.g., received VAS in campaign mode and did not receive it in routine mode 6-8 months later. An analysis of the factors associated with this dropout is presented in **Error! Reference source not found.** to understand its associated factors. The number of children who did not receive vitamin A supplementation in both routine and campaign mode is estimated to be 19.6% (CI95%: 17.2%-22.3%)

Table 3. Profile of children aged 6-59 months (VAS, April 2019 campaign, and February 2020 routine)

Profile	*(n=2226) % [IC95%]*
Received neither in campaign nor in routine	19.6% [17.2%-22.3%]
Received in campaign and not in routine	34.4% [31.7% - 37.3%]
Received in campaign and in routine	45.2% [42.1% - 48.2%]
Not received in campaign but received in routine	0.8% [0.4% - 1.4%]

Factors Contributing to the Drop in Coverage During the Transition to Routine

The household's environment explains the decrease in coverage between rural and routine. Indeed, children living in rural areas were 2.86 (AOR: 2.86, CI95%: 1.63 – 5.03) more likely not to receive routine vitamin A than urban households. There was also a gender dimension associated with the decline in coverage during the transition, with girls 31% more likely to receive routine supplementation than boys (AOR: 1.31, CI95%: 1.12 – 1.55). During the transition, community exposure to mass media communication campaigns on vitamin A was a shield against coverage decline. Even if they received VAS earlier in the campaign mode, children exposed to these campaigns were 44% (AOR: 0.56, CI95%: 0.33 – 0.96) less likely to miss routine supplementation. This highlights the power of effective communication in maintaining coverage. Also, children from households with more children under 5 years of age who received VAS in campaign mode were 2.39 times more likely (AOR: 2.39, CI95%: 1.63-5.03) not to receive vitamin A supplementation during routine transition. For each home visit made by the community agent or health worker between these two events, children who received supplementation in campaign mode had a 10% (AOR:1.1, CI95%: 1.0-1.2) chance of not receiving routine supplementation.

Factors Associated with Routine Supplementation Coverage

Analysis of routine supplementation shows that child age is negatively associated with increased coverage. Indeed, for each additional year of age, the odds of children aged 6-59 receiving vitamin A is reduced by 27% (OR 0.73; CI95%: 0.65 – 0.82). The same applies to rural residences, where the likelihood of receiving vitamin A supplementation is reduced by 59%. Factors such as household wealth index, completion of mothers' 4 prenatal visits, and community exposure to awareness campaigns were positively associated with vitamin A coverage, with respectively a 28% increased likelihood (OR:1. 28, CI95%: 1.12 – 1.47) of receiving vitamin A when the wealth index increased by one point; by 85% (OR: 1.85, CI95%: 1.0 – 3.44) for a child living in a household where the mother had completed at least 4 prenatal visits; and by

a 2.7-fold increase (OR: 2.7, CI95% : 1.24 – 5.92) in the likelihood of receiving vitamin A supplementation when the children's home village had been exposed to mass media communication about vitamin A during the routine.

Children in areas where drugs or other supplies were obtained from community nutrition sites were 2.9 times more likely to receive vitamin A (AOR: 2.9, CI95%: 1.36–6.1) than children where supplies were obtained from health centers.

Discussion

Our study of vitamin A coverage and its determinants shows two results: a vitamin A coverage of 79.1% (CI95%: 76.6%-82%) for the last campaign mode in April 2019, and a nationwide coverage of 50.6% (CI95%: 47.7%-53.5%) during the transition to the routine mode in February 2020. This routine coverage is 19 percentage points lower than the 69.5% achieved when the routine mode was piloted in two health districts, Morondava and Andramasina, months earlier. The evolution of vitamin A coverage, assessed through various representative household surveys, notably through a household-based survey (DHS), shows vitamin A coverage fluctuating between 72% (2003/2004) and 79% (2019). This post-transition decline was also observed in Ethiopia in 2012 [12], after this country gradually transitioned to routine mode in 2010 via the Health Extension Program (HEP), from over 80% to 31%. But this rate rose again in routine mode to stabilize between 70-80% from 2013 to 2014, thanks to a series of interventions including strong supervision, follow-up of unreached children via the family record, and support from a panoply of community mobilizers.

Our results also suggest that this reduction is associated with the frequency of home visits received by mothers from community health workers. Community health workers' sensitization visits to homes had the opposite effect as expected, reducing the likelihood that children from these households would receive vitamin A during routine immunization. One possible explanation could be the quality of the message(s) delivered to the household during these visits. Indeed, the diversity of messages to be delivered on measles, vitamin A, deworming, exclusive breastfeeding, and sensitization of pregnant women to the four minimum antenatal visits required by the MCHW package may have obscured understanding of the key message on vitamin A while the transition of VAS to routine was already underway. In addition, the conduct of home visits to households during this transition to routine MCHW may have led mothers to believe that they should wait to receive routine VAS at home, whereas vitamin A was administered at health centres, most of which were within a 5 km radius of the children's homes.

Looking at socioeconomics and factors associated with routine VAS uptake, age, residence, and now household wealth index, were associated with vitamin A intake. These findings are consistent with several studies conducted in India, Ethiopia, and twenty-three sub-Saharan African countries [13-15], which showed that socioeconomic status (age, residence of children), maternal education and household income were associated with vitamin A intake. However, our study found no significant association between maternal education and VAS, as was also the case in Bangladesh when Manoj Kumar Raut [16] conducted a secondary analysis on 4852 children with DHS 2007 data and found no association, although a significant association was obtained on 7,087 children with DHS 2011 data; more generally, higher maternal education is positively associated with better child health and survival [17-19].

Also, results showed the positive effect of the community nutrition sites (PNNC) on the VAS. Although the PNNC sites did not provide VAS, this positive association suggest that their

following services: growth monitoring and promotion, management of moderate acute malnutrition, nutrition education and awareness, community management of childhood diseases, and support for household food security may indirectly benefit VAS.

Regarding actionable variables, our results suggest the critical role of:

1. the awareness campaigns in explaining the decline in coverage during the transition from the last campaign to routine VAS, as well as the positive impact on the likelihood of children benefiting from routine VAS. These findings are consistent with other studies that have shown that exposure of mothers to media sensitization on VAS, particularly through television, is associated with increased awareness and coverage of vitamin A supplementation campaigns [20-22].
2. Mothers' knowledge of vitamin A is positively associated with the likelihood that their child will benefit from vitamin A supplementation, as in several studies conducted in southern Ethiopia [23], Kenya [24], Nigeria [25], and Libya [26], despite slight differences in the definition of the content of vitamin A knowledge (frequency of administration, age group, lists of foods containing vitamin A, whether or not malnourished children take vitamin A, side effects) across studies.

Transition to Routine Pathways for Madagascar: Lessons Learned from Other Contexts Complementing our Study Results

Based on existing literature, several strategies can be considered to improve Vitamin A Supplementation (VAS) coverage during the transition to routine mode. Miglietta et al. [27] highlighted the limitations affecting the quality of administrative VAS coverage during the transition from event-based VAS distribution to routine health system contacts. Kassa et al. [28] expressed concerns about the potential decline in VAS coverage during the transition from campaign-based to routine service delivery. Additionally, Koroma et al. [29, 30] discussed the integration of VAS with other reproductive and child health services during the transition to routine VAS, emphasizing the need for comprehensive approaches emphasizing the popularity of accessing routine [31], confidential "quality" family planning counselling at the same point of contact, indicating the potential for integrating VAS with other services to improve coverage.

In addition, Horton et al. [32] discussed the use of a hybrid approach, combining routine delivery with outreach ("mini-campaigns") to improve VAS coverage. Dissieka et al. [33] suggested that providing mothers with mobile phone message reminders could effectively improve VAS coverage. Moreover, Abu-Rish et al. (2022) emphasized the importance of monitoring vaccination coverage and developing strategies to improve coverage during pandemics, which could be extended to VAS coverage. Clarke-Deelder et al. [34] discussed the application of the 'periodic intensification of routine immunization' (PIRI) strategy, which adapts techniques from mass immunization campaigns to the delivery of routine vaccines, indicating a potential strategy for improving VAS coverage.

Overall, the strategies to improve VAS coverage during the transition to routine mode include integrating VAS with other health services, employing a hybrid approach combining routine delivery with outreach, utilizing mobile phone message reminders, and adapting techniques from mass immunization campaigns to routine VAS delivery.

Strengths and Limitations of the Study

This study has the advantage of being conducted at a point in Madagascar's transition from campaign to routine administration of the VAS, allowing it to capture both post-campaign

coverage and coverage during the first 6 months of routine mode, as well as to look for an explanation for the decline in coverage among exogenous factors specific to the transition, in addition to those associated with routine administration. It also serves as a basis for programmatic reflection on proven strategies to maintain high VAS coverage during the transition period. However, it is not without its limitations, which we can list: the specificity of coverage measurement between campaign and routine mode.

The transition from event-based vitamin A supplement (VAS) distribution to routine distribution through health system contacts may pose monitoring challenges beyond coverage estimation, as Alessandro Miglietta et al. explored in a 20-21 methodological meta-analysis [27]. The extended 6-10 months period between the April 2019 campaign and the February data collection may have affected maternal recall for this coverage. This limitation should be put into perspective given the visual measures taken to show mothers the vitamin A capsules, red and blue according to age, before asking the question, and the studies by Julia Porth and others showing that VAS coverage detection via mother's declaration remains good globally compared to vaccination cards.

Table 4. Result of the Multilevel Mixed-Effects Logistic Regression Analysis of Individual- and Community-Level Factors Associated with VAS During Transition, and Routine Mode

	Receipt of Vitamin A supplementation in the April 2019 campaign (and not in routine Feb-2020). (Yes/no)	*Receipt of Vitamin A supplementation within last 6 months (Yes/no)-in routine Feb-2020*
	AOR [CI95%]**	AOR [CI95%]**
Place of residence		
Urbain	1 (ref)	1 (ref)
Rural	2.86 [1.63 – 5.03]*	0.41 [0.27 – 0.67]*
Children Sex		
Male	1 (ref)	1 (ref)
Femal	1.31 [1.12 – 1.55]*	1.1 [0.89 – 1.34]
Children age	1.11 [0.8 – 1.54]	0.73 [0.65 – 0.82]*
Mother education level		
None	1 (ref)	1 (ref)
Primary	0.45 [0.21 – 1.07]	1.46 [0.91 – 2.34]
College	0.96 [0.32 – 2.9]	0.69 [0.38 – 1.28]
High school and up	0.84 [0.46 – 15.5]	0.73 [0.08 – 7]
Number of children under 5 in household	2.39 [1.38 – 4.13]*	0.42 [0.18 – 1.02]*
Drug and medical supplies sources		
Health Facilities	1 (ref)	1 (ref)
Non-governmental organization NGO	0.67 [0.4–1.15]	0.9 [0.6 – 1.36]
National Community Nutrition Program sites (PNNC/SECALINE)	0.62 [0.27 – 1.45]	2.9 [1,36 – 6,1]*
Others	1.26 [0.25 – 6.5]	0.84 [0.19 – 3.72]
Antenatal care (ANC) visits (4+)		
No	1 (ref)	1 (ref)
Yes	0.66 [0.48 – 0.89]	1.85 [1 – 3.44]*
Household Wealth index	1.06 [0.89 – 1.26]	1.28 [1.12 – 1.47]*
Distance to nearest health facility		

<5 km	1 (ref)	1 (ref)
5-10 km	0.89 [0.49 – 1.62]	1.53 [0.71 – 3.4]
> 10 Km	0.67 [0.21 – 2.12]	1.36 [0.5 – 3.73]
Knowledge of Vitamin A Score	0.68 [0.44 – 1.06]	1.9 [1.15 – 3.05] *
Exposure to mass media communication about vitamin A		
No	1 (ref)	1 (ref)
Yes	0.56 [0.33 – 0.96] *	2.7 [1.24 – 5.92] *
Number of home visits by community health workers	1.1 [1.0 – 1.21] *	0.97 [0.89 – 1.08]

*Results significant at the 0.05 level, OR= Odd ratio

**Confidence intervals were determined by considering the design of the study, including the unequal probabilities of households with survey weights. AOR= Adjusted Odd ratio

Conclusion

This study aimed to estimate VAS coverage and associated factors during the country's transition from campaign to routine VAS. The study found that coverage was 79.1% after the MCHW campaign compared to 50.6% during routine VAS. The socio-economic and demographic factors (number of children under 5 in the household, gender and place of residence) also significantly influenced the decrease in vitamin A intake when switching from campaign to routine mode. In addition to community exposure to mass media campaigns on VAS, the number of home visits by community health workers was positively associated with the decline. In the routine mode, place of residence and mass media campaigns remained significantly associated with VAS, and new factors emerged, such as the age of children, completion of four prenatal visits, and household wealth index.

In conclusion, the transition to routine vitamin A supplementation is a complex process that requires careful planning, monitoring, and evaluation. While the shift from campaign-based to routine delivery has potential advantages in terms of sustainability and integration with existing health services, a comprehensive approach that addresses these factors is essential to improve coverage. This could include strengthening targeted age-specific interventions and combined outreach activities in hard-to-reach areas within the existing immunization program, while ensuring a high level of media campaigning on VAS before activities. Learning from successful transitions in other countries [35] and implementing robust monitoring methods will also be critical to ensuring the success of routine vitamin A supplementation programs.

Conflict of Interest

All authors declare no conflict of interest.

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