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National Vitamin A Supplementation Program in primary care: what is the reality in Minas Gerais, Brazil?

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Abstract *The present study aimed to evaluate the National Vitamin A Supplementation Program in Minas Gerais, adopting the mixed sequential explanatory method. The quantitative approach adopted the multidimensional instrument per the components of vitamin A supplementation and food and nutrition education. We employed an analysis matrix with parameters to define the implementation as adequate, partially adequate, inadequate, and critical. We used semi -structured interviews in the qualitative approach. The "process" dimension was better evaluated than the "structure", with an implementation level (IL) of 84.6% and 78.5%, respectively. The Program's strengths include supplementation planning, achieving goals, recording information, supporting breastfeeding, and the performance of Community Health Workers. Weaknesses are fragmented work, analysis of information limits, access to the Program's actions, implementation of educational actions, and lack of or insufficient availability of nutritionists and training. The Program's reality only partially considered health promotion actions and focused on vitamin A supplementation. Implementing food and nutritional education actions is imperative to face vitamin A deficiency.*

Key words *Vitamin A deficiency, Food and nutrition education, Program evaluation, Health policy*

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Introduction

The United Nations Children's Fund estimates that one in three children under the age of five do not access the nutrition they need to grow well and that despite the decline in malnutrition, 149 million still suffer from stunted growth and 340 million from hidden hunger – vitamin and mineral deficiencies[1].

Overcoming nutritional problems among children is even more challenging given the unprecedented synergic crises – health, humanitarian and economic – resulting from the COVID-19 pandemic. The disrupted health services and reduced access to food caused by the pandemic could lead to a considerable elevation in child and maternal deaths in 118 low- and middle-income countries[2].

Vitamin A deficiency (VAD), a public health problem affecting around 190 million preschoolers, is among the nutritional deficiencies with the most significant magnitude globally. It is the most important cause of blindness among children, contributing significantly to morbimortality from common childhood infections[3].

Studies point to a (rather slow) decline of VAD worldwide from 1990 onwards. It is estimated that the prevalence of disability curbed at an average of 0.3 percentage points annually from 1990 to 2010[4]. Stevens[5] states that 39% of children aged 6 to 59 months in low- and middle-income countries were vitamin A-deficient in 1991, and the deficiency prevalence was 29% in 2013.

VAD reduction in some regions is often justified by government actions, especially the mass administration of high doses of the vitamin[4]. VA supplementation for children under five in developing countries was recommended by the World Organization (WHO) as a public health strategy to achieve the Millennium Development Goals, updated in 2015 by the Sustainable Development Goals[6]. Faced with the challenging setting imposed by the pandemic, vitamin supplementation actions should once again hold a crucial place in the health agendas of developing countries.

Although the worldwide trend is a VAD downward path, studies conducted in different Brazilian regions have identified prevalence levels that characterize the deficiency as a moderate to severe public health problem[7-9]. In Minas Gerais (MG), studies performed since 1986 point to the prevalence of VAD ranging from 8.2 to 39.6%, indicating that this is an important issue, especially among preschoolers and schoolchildren[10,11].

In Brazil, VAD control and prevention actions in children aged 6-59 months have been regulated by the National Vitamin A Supplementation Program (PNSVA) since 2005. Despite the relevance of this program for child health promotion, studies that focused on assessing the implementation of VA supplementation or food and nutrition education actions aimed at this deficiency have yet to be reported in the literature[12].

Which factors facilitate or compromise the organization and functioning of the PNSVA? To answer this question, the present study aims to evaluate the implementation of the PNSVA in primary health care in municipalities in Minas Gerais, Brazil.

Materials and methods

A cross-sectional, explanatory, and sequential mixed method research[13,14] was initially implemented for the quantitative approach, followed by a qualitative study[15]. Quantitative and qualitative data were collected and analyzed separately and integrated at the level of interpretation to identify convergences, differences, or combinations, allowing the triangulation of methods and techniques as shown in Figure 1.

One hundred seventy-seven municipalities targeted by VAD prevention and control actions were eligible for the cross-sectional study. These municipalities were selected due to the interest of state management in exploring the Program in cities with vitamin deficiency prevention actions in place for a long time since the 1980s. The selected municipalities represent 49% of 360 municipalities with a PNSVA implemented in the state.

This study included the municipalities that met the following criteria: PNSVA implemented and in operation and having PHC and technical reference (TR) professionals working in the Program. These cities are located in the regions of Minas Gerais comprising the Jequitinhonha and Mucuri valleys and the North region, areas with more significant socioeconomic weaknesses and worse performance of the state's health indicators. They are distributed in eight Regional Health Management Offices (GRS).

Data were collected with two semi-structured questionnaires prepared and validated during the evaluability study[12], one intended for the Program's TR and the other for PHC nurses and nutritionists. The selection of these participants is justified by the possibility of obtaining more

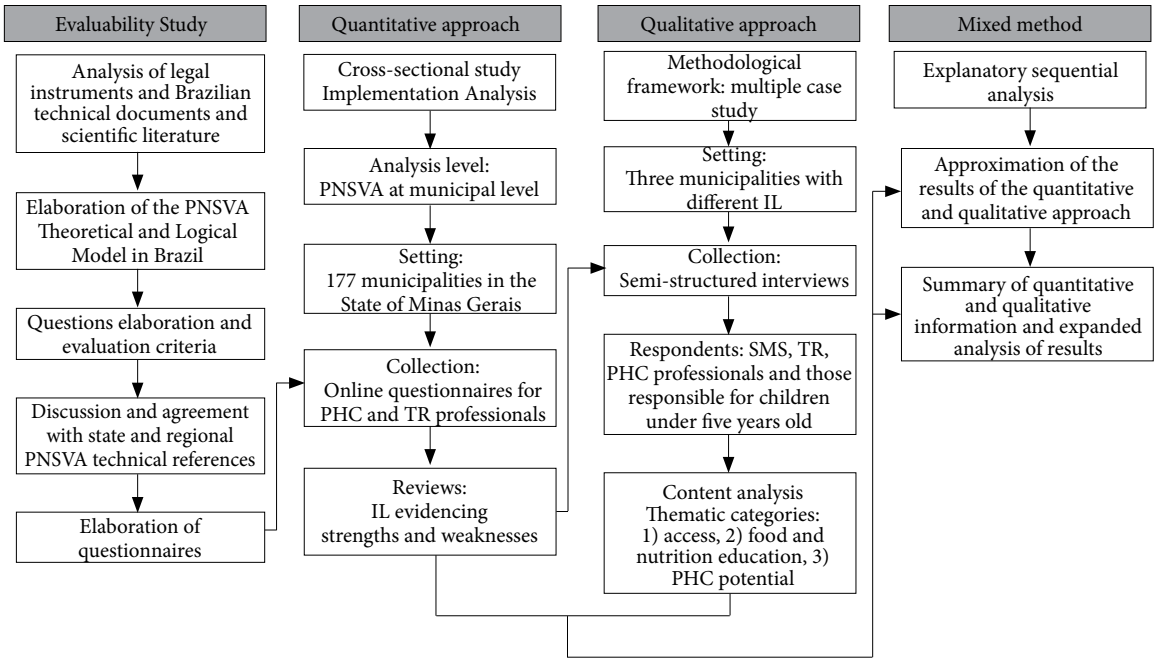

Figure 1. Schematic model of the analysis of the implementation of the National Vitamin A Supplementation Program in municipalities in the State of Minas Gerais, Brazil, 2018.

Source: Authors.

detailed information about the Program's structure and process, as these professionals must be directly involved.

Figure 2 shows the Program's logical model that supported the construction of the questionnaires, showing prophylactic VA medication supplementation and the promotion of healthy eating to prevent VAD as the Program's components. The model described the structure (resources employed and their organization) and process (intended activities) dimensions for each subcomponent, constituting the Program's internal context. In the external context, we highlight the Ministry of Health, the State Health Secretariat of Minas Gerais, the municipality's assigned GRS, the municipality's population size, and the last two variables that were the targets of this investigation.

VA supplementation coverage was also analyzed (children aged 6-11 months; first dose for children aged 12-59 months; second dose for children aged 12-59 months); population size (< 20 thousand inhabitants; 20-50 thousand inhabitants; > 50 thousand inhabitants); GRS (Unaí, Pedra Azul, Diamantina, Pirapora, Teófilo Otoni, Januária, Montes Claros). We aimed to analyze whether these variables influenced the PNSVA's implementation level (IL).

A previous contact was established with the municipal health secretariats to present the relevance and applicability of the research and request their participation in collecting data through access to the link of a form prepared in the Lime Survey software. The researchers contacted the participants by telephone to ensure the success of the research. Four attempts were made to send the questionnaires via e-mail using the Lime Survey software.

An analysis and judgment matrix was used to classify the PNSVA's implementation level, built from the PNSVA's logical model. The criterion, calculation method, parameter, assigned value, and cut-off point were defined for each component's evaluative question to analyze whether the results complied with the established standards. The questions were assessed by adjusting the mean against the maximum score assigned to each criterion.

Two stages were considered for building IL scores. First, the observed values (Σ of the criteria points) were determined, and the IL was calculated (Σ observed/Σ of the maximum expected

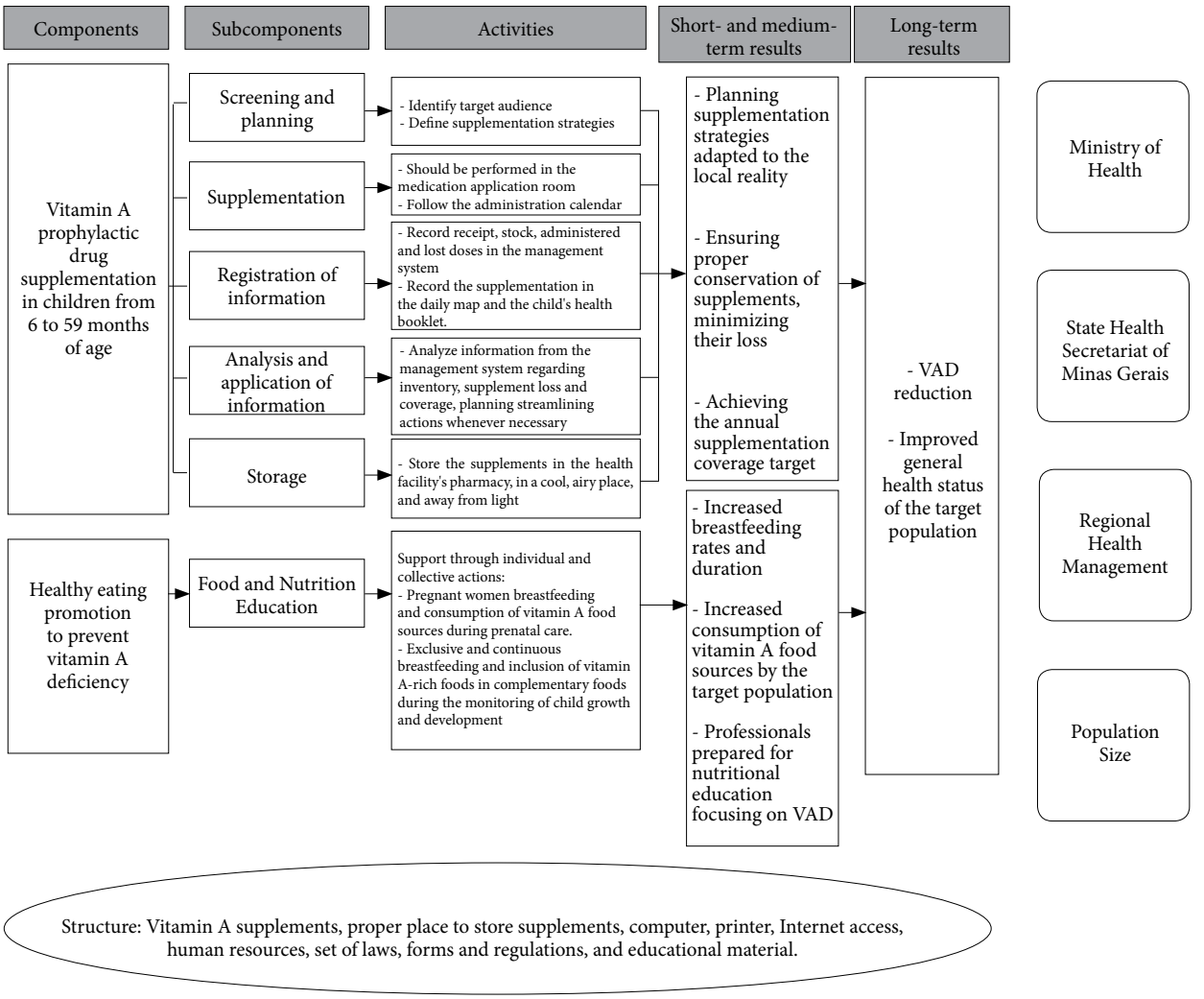

Figure 2. Logical Model of the National Vitamin A Supplementation Program, 2018.

Source: Adapted from Miranda et al., 2018.

points X 100) for each component. Subsequently, the components were added to calculate the total IL. The scores were transformed into percentages concerning the maximum possible score, classified into the following categories: 75% to 100% adequate implementation; 50% to < 75% partially adequate implementation; 25% to < 50% inadequate implementation; 1% to < 25% critical implementation.

Fisher's exact test analyzed the association between IL and outcome (supplementation coverage) and context (population size and GRS) variables, adopting a significance level of 0.05. Information on supplementation coverage and population size was obtained through the public report available on the website of the PHC Secretariat[16] and the website of the Brazilian Institute of Geography and Statistics[17], respectively. Data were processed and analyzed using the Statistical Package for Social Sciences Software (SPSS) version 21.0.

Other questions on the implementation context arose from the findings in the cross-sectional study, such as: What makes the PNSVA better implemented in some municipalities than in others? What factors facilitate and hinder the implementation of the PNSVA?

A case study was developed (YIN, 2015) that allows the empirical, in-depth investigation of events in their contexts to answer these ques-

tions. Implementing the PNSVA and the units of analysis were defined as a case. To this end, we selected municipalities with results at the extremes of classification, the one with the highest implementation value (Municipality A) and the one with the lowest value (Municipality C), besides the municipality with the median value of the implementation level (Municipality B).

The municipal health secretary, the Program's TR, PHC nurses and nutritionists, and those responsible for children under five covered by the Program were purposedly invited to participate in the research. Face-to-face interviews were held in each municipality using a script that addressed the respondents' understanding of VA and its deficiency and the Program. For the professionals, the script also addressed organizational/operational aspects of the municipal PNSVA. The saturation criterion[18] was used to define the appropriate number of interviews. All interviews were transcribed and processed by content analysis in the thematic-categorical modality[15].

The Research Ethics Committee of the René Rachou Institute, Fiocruz Minas, approved the PNSVA evaluation project in the State of Minas Gerais under Opinion CAAE: 57957316.6.0000.5091. Participants received the informed consent form.

Results

The research included one hundred twenty-two (68.9%) of 177 eligible municipalities. Sixty-two (51%) answered two questionnaires, 14% answered only the questionnaire directed to TR, and 35% only answered the one directed to professionals. Ninety-six participating municipalities (78.7%) had a population of fewer than 20,000 inhabitants, 23 (18.9%) had a population of 20,000-50,000, and three (2.5%) had more than 50,000 inhabitants.

The IL was calculated for those municipalities in which the PNSVA was evaluated by the Program's TR and the PHC professionals, totaling 62 municipalities. The PNSVA was adequately implemented in 13 (21%) municipalities and partially implemented in 49 (79%). The structure component had an IL of 78.5%, while the IL of the process component was 84.6%.

Regarding structure, the human resources subcomponent (86%) was better evaluated than the equipment subcomponent (71%). We observed that the most significant weaknesses were the availability of specific forms for the Program to operate, Internet problems, and printer availability. The best-assessed component in evaluating the "process" dimension was VA supplementation (IL = 87%). The supplementation strategies planned by the municipalities, observation regarding the correct dosage for the age group, observation of the supplements' validity period, identification of children under five, and frequency of analysis on supplementation coverage stood out as strengths. On the other hand, the food and nutrition education (EAN) component was classified as partially adequate (IL = 74%). The results regarding the evaluation criteria of the structure and process dimensions are described in Figure 3.

The PNSVA's IL was not associated with population size (p-value 0.541), the GRS to which the municipality belonged (p-value 0.120), or with supplementation coverage for its different doses: children aged 6-11 months (p-value 0.508), first dose for children aged 12-59 months (p-value 1.00), and second dose for children aged 12-59 months (p-value 0.531).

Figure 4 shows an adequate mean of the subcomponents evaluated in the Program's structure and process for the municipalities that responded only to the questionnaire intended for TR or PHC professionals. The subcomponents were stratified into three tiers: the innermost tier contains the criteria with mean adequacy above ≥ 90%, the middle tier includes those with mean adequacy of 80-89%, and the outermost tier includes the criteria with mean adequacy ≤ 79%.

In the qualitative stage, we visited ten PHC Units and interviewed 42 people, 9 (21%) males and 33 (79%) females, 11 in Municipality A, 14 in Municipality B, and 17 in Municipality C. Regarding involvement with the PNSVA, 13 (31%) were nurses, 2 (5%) nutritionists, 3 (7%) from the Program's TR, 3 (7%) from SMS, and 21 (50%) responsible for children benefited by the Program.

We identified three categories common to the three municipalities with different IL from the content analysis: access, EAN, and PHC Potential. In the access category, we found that large geographical extensions of the municipalities, especially in the rural area, and the lack of public transport, associated with structural weaknesses (lack of supplements, support materials, and physical structure to conduct educational actions) and lack of access to information for professionals and women responsible for the children, were substantial obstacles to implementing the Program.

Components	Subcomponents	Activities	Maximum score	Mean (SD)*
Prophylactic drug supplementation of vitamin A in children from 6 to 59 months of age	Screening and planning (99% adequacy)	✓Identification of the number of children under five residing in the municipality	✓2	✓1.94 (0.36)
		✓VA supplementation strategies used in the municipality (routine or occasional)	✓4	✓4.00 (0.0)
	Supplementation (86% adequacy)	✓Achievement of the annual target of 60% for supplementation of children aged 6-11 months	✓4	✓3.23 (1.17)
		✓Achievement of the annual goal of 50% for the first dose of supplementation for children aged 12-59 months	✓4	✓3.13 (1.29)
		✓Achievement of the annual target of 30% for the second supplementation dose of children aged 12-59 months	✓4	✓3.16 (1.28)
		✓In the routine of the service, observation of the date of the last VA supplementation in the children's health booklet	✓3	✓2.87 (0.4)
		✓Observation as to the correct dosage for the age group	✓2	✓1.98 (0.18)
		✓Observation as to the expiry date of supplements	✓2	✓1.98 (0.18)
	Registration of information (85% adequacy)	✓Information on receipt of VA supplements by the municipality registered in the online system	✓2	✓1.68 (0.57)
		✓Registration in the online system when supplements exceed the needs of the municipality	✓2	✓1.57 (0.64)
		✓Registration in the online system when supplements are insufficient to meet the needs of the municipality	✓3	✓2 (1.18)
		✓Monthly record of administered doses of supplements in the management system	✓3	✓2.93 (0.33)
		✓Monthly record of lost supplements in the management system	✓2	✓1.58 (0.69)
		✓Registration of supplementation in the Daily Monitoring Map	✓2	✓1.83 (038)
		✓Registration of supplementation in the Child Booklet	✓3	✓2.92 (038)
	Analysis and application of information (79% adequacy)	✓Analysis of information on the stock of VA supplements, whether they are in excess or short of the municipality's need	✓2	✓1.45 (0.59)
		✓Frequency of analysis on the stock of supplements	✓2	✓1.82 (0.41)
		✓Analysis of information on loss of VA supplements	✓2	✓1. 60 (0.5)
		✓Frequency of analysis of information on supplement losses	✓2	✓1.76 (0.5)
		✓Action planning to minimize losses of vitamin A supplements in the municipality	✓2	✓1.40 (0.66)
		✓Analysis of information on VA supplementation coverage	✓4	✓3.16 (1.12)
		✓Frequency of analysis of information on supplementation coverage	✓2	✓1.94 (0.25)
		✓Action planning to expand VA supplementation coverage	✓4	✓2.61 (1.18)
	Storage (87% adequacy)	✓Adequacy of storage conditions for supplements.	✓4	✓3.48 (1.18)

it continues

Figure 3. Distribution of the mean score in the evaluation of the subcomponents of the process and structure dimensions of the National Vitamin A Supplementation Program in municipalities (n=62) in the State of Minas Gerais, Brazil, 2018.

EAN was considered a significant challenge in PHC due to the lack of or insufficiency of the professional nutritionist, access difficulties, as mentioned above, and the low adherence and socioeconomic status of clients in these municipalities. For the professionals interviewed, working with EAN actions in poverty contexts, which limits access to food, can be challenging, offensive, and embarrassing.

PHC potentialities were highlighted in the respondents' discourse, such as the identification of the community health worker (ACS) as a vital stakeholder for the active search and application of the supplement in the rural area of one of the municipalities in which the geographic dimension resulted in limitation of client access to PHC Units; encouraging breastfeeding, which is part of the service's routine; the follow-up of children based on the children's health booklet and the association of supplementation with routine vaccination actions.

Figure 5 shows the layout of the interaction between the different approaches that identified the results' convergent and divergent aspects and particularities.

Discussion

Research in which mixed methods are chosen explicitly looks for synergy in integrating both paradigms, aiming at a broader understanding of the event of interest. The integration of quantitative and qualitative data pointed out in the present study into positive characteristics of VA supplementation, such as planning, achieving goals, recording information, and supporting breastfeeding, which the organization of the PHC dynamics

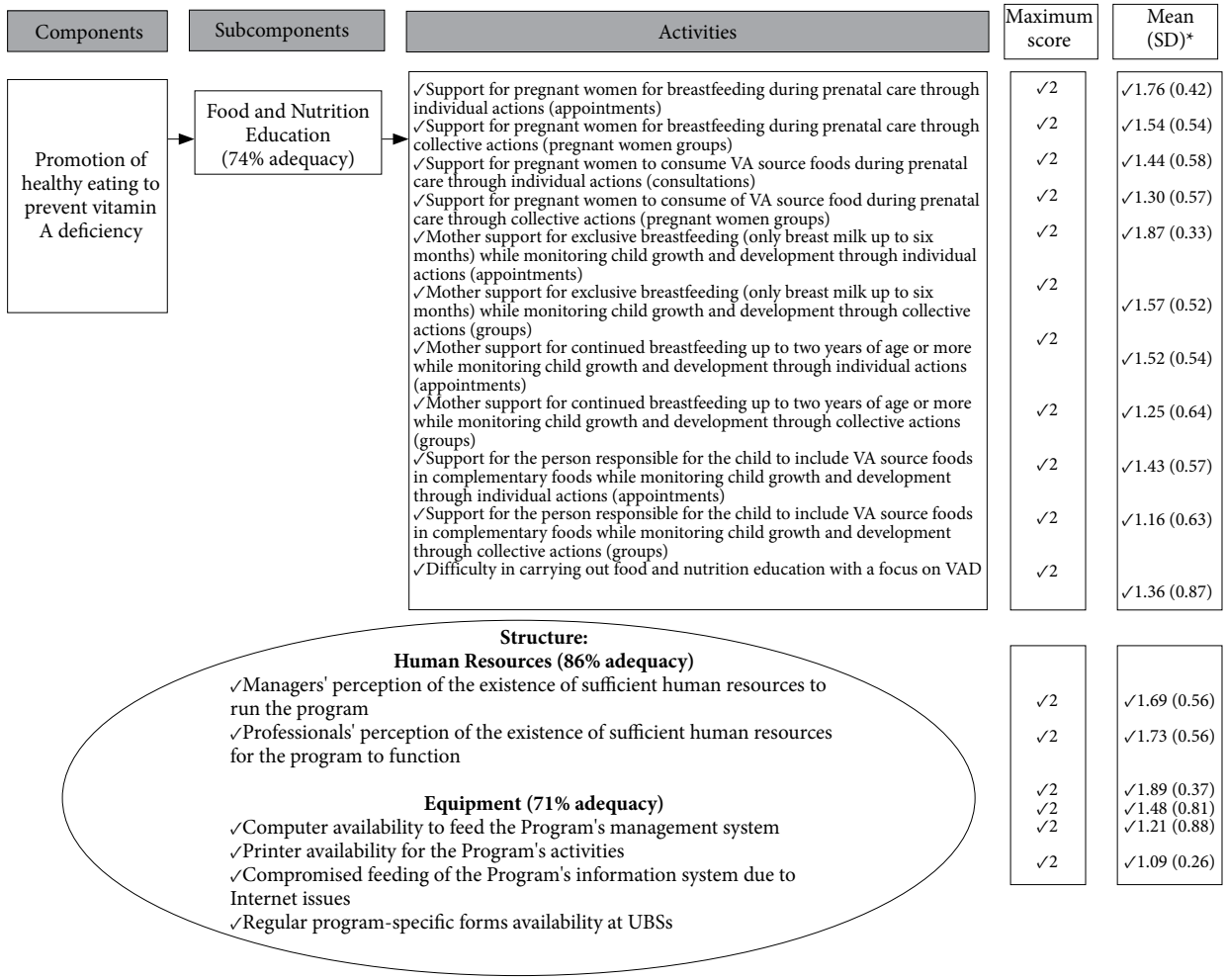

Figure 3. Distribution of the mean score in the evaluation of the subcomponents of the process and structure dimensions of the National Vitamin A Supplementation Program in municipalities (n=62) in the State of Minas Gerais, Brazil, 2018.

*SD: standard deviation.

Source: Authors.

can explain, and way of operating, evidenced in the statements of the stakeholders interviewed during the qualitative stage. Thus, overcoming the gaps found in the context of the PNSVA permeates the PHC potential.

Data integration also showed convergent aspects regarding the difficulties in implementing the Program, which resulted from the fragmented work and lack of training for professionals directly involved with the Program in PHC.

Although recording information is part of the work of professionals in the PNSVA context, it is not commonly analyzed or used by municipalities to support decision-making. This mismatch between advances related to information and the dimension of its product's effectiveness as a power to intervene in the management of services is evidenced by other studies in the country[19,20], which is one of the challenges of the Brazilian public health system.

Incorporating qualitative data in mixed methods of the explanatory sequential type aims to deepen the quantitative information and, thus, expand the findings on the event, giving more significant evidence to the results. In this study, quantitative research showed evidence of PHC's

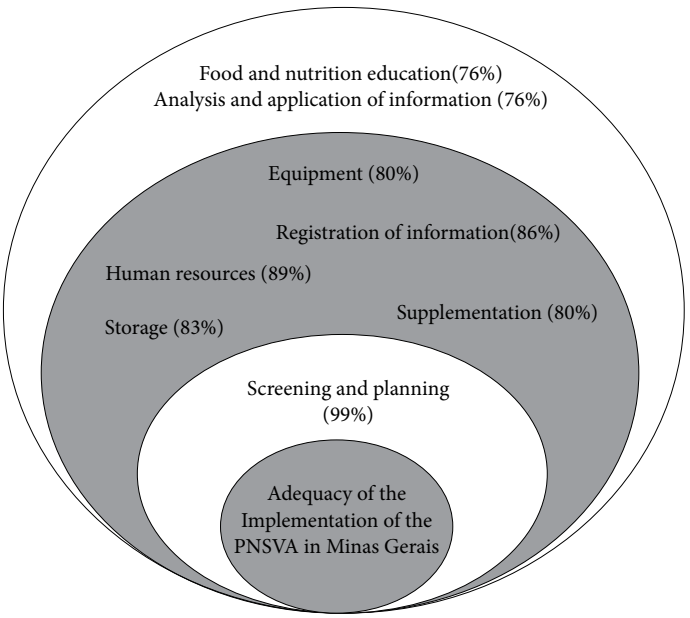

Figure 4. Adequacy of the mean for the process and structure dimensions of the National Vitamin A Supplementation Program, when evaluated by technical references or health professionals, in municipalities (n = 60) in the State of Minas Gerais, Brazil, 2018.

Source: Authors.

fragmented work, which could be better understood through a qualitative approach. The lack of VA supplements, for example, can be explained in some periods, since, in recent years, due to changes in how supplements are acquired by the Ministry of Health, which started to be via a bidding process, some delays we observed in the transfers of vitamins to the States, causing a domino effect, which culminated in the impracticable or restricted supplementation for the target public, compromising PNSVA's effectiveness.

However, irregular access to supplements appeared as commonplace in the reports from that municipality with the lowest IL, which cannot be explained by changes in how the Ministry of Health purchases them but instead by PHC's fragmented work. The fragmented work process in the PNSVA context was also identified by Brito et al.[21], who observed a Taylorist logic of division and organization of the activities developed.

EAN actions were another critical weakness of the PNSVA in PHC. The fact that supplementation has been included for decades in the country and in association with actions aimed at child health, especially vaccination campaigns, allows understanding that this is a consolidated practice in the region, recognized as a daily activity of health services. However, the same happens with EAN actions relegated to the background, and other insufficient educational practices indicated in the literature, left out in the planning and organization of services[22].

Despite being considered by the WHO as an essential strategy for overcoming VAD, supplementation with VA megadoses should be a short-term practice. It is necessary to pursue the right to adequate and healthy food to overcome this problem sustainably, facing food and nutritional insecurity situations that violate the fundamental human right inherent to the dignity of the human person and indispensable to realizing the rights enshrined in the Brazilian Federal Constitution.

Including the EAN in the policies to face the VAD needs to be better explored in the literature. The most definitive study on the subject in the country was conducted by Rodrigues and Roncada[23], who reported that the educational actions were not part of a broader context of health promotion and were temporary and without evaluation during that period when investigating the official programs in the country for VAD prevention and control from 1968 to 2008.

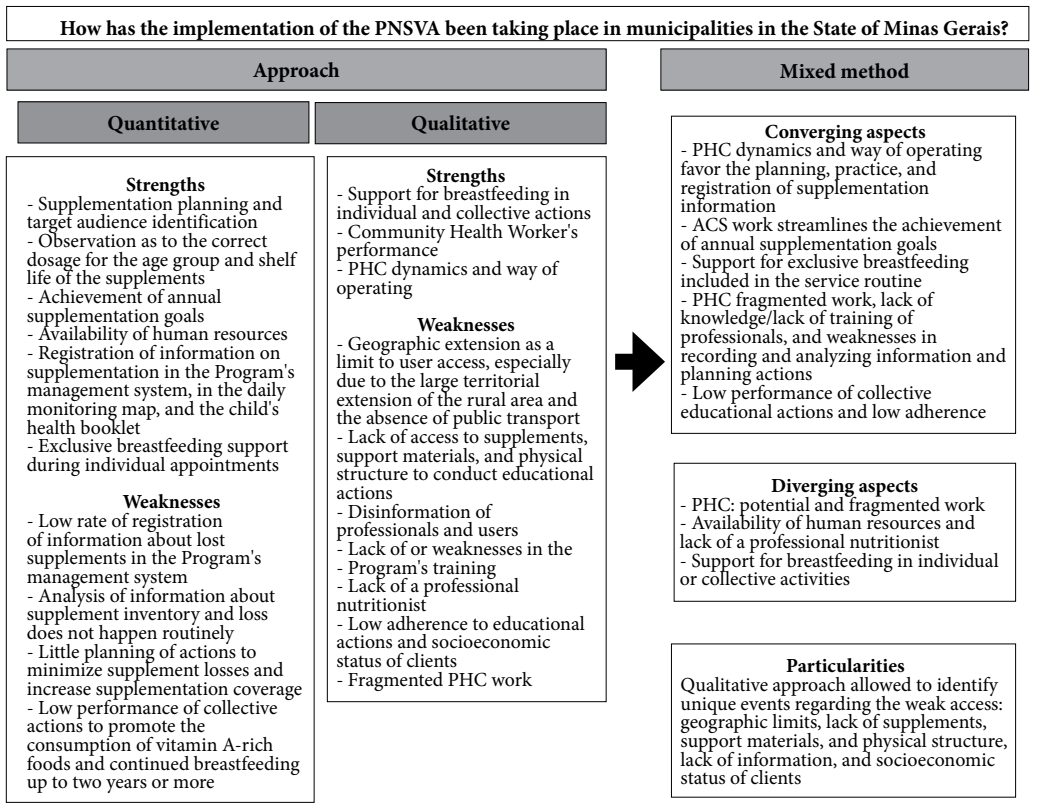

Figure 5. Layout of the explanatory sequential design of the implementation of the National Vitamin A Supplementation Program in municipalities of Minas Gerais, 2018.

Source: Authors.

The only successful EAN action identified by the survey was support for exclusive breastfeeding. The relationship between exclusive breastfeeding and health service support is well explored in the literature. PHC actions, such as puerperal visits, preserve exclusive breastfeeding, while the lacking or weak support, such as the trivialized maternal anguish by health professionals, favor early weaning.[24] On the other hand, continued breastfeeding actions up to two years of age and encouraging the consumption of VA-source food, primarily through collective actions, are significant challenges.

The study identified that although the human resources for the PNSVA operationalization have been sufficient per the quantitative approach, the lack of a professional nutritionist evidenced in the qualitative research is a vital area for improvement of the Program. The lack of or insufficient nutritionists in the PHC in the municipalities of Minas Gerais can help us understand the challenges of implementing EAN actions. When available, these professionals face the challenge of caring for a large population, compromising the effectiveness of food and nutrition actions[25].

The research identified events that prevented or limited clients' access to supplementation or EAN actions, such as geographic limits caused by the extension of some municipalities, in which a considerable part of the population resided in rural areas without access to public transport. Furthermore, an important limitation of implementing EAN from the perspective of health professionals was the low socioeconomic status of the population, which compromised access to food. This concept points to unprepared professionals facing complex situations that require more than prescriptive behaviors. This reality requires contextualized education actions, with appreciation and listening to the population, and the development and strengthening of PNSVA articulation strategies with other food and nutrition security programs, such as the Food Acquisition Program, the National School Food

Program, and the *Bolsa Família* (Family Aid) Program to promote access to and consumption of VA-source foods.[26]

Final considerations

Although the international literature on mixed methods research is extensive, it still needs to be discussed in Brazil, and this method has been explored in more recent research[27]. In this investigation, the methodology proved valuable and timely to evaluate in-depth the implementation of the PNSVA in the municipalities of Minas Gerais, highlighting factors that facilitate and others that compromise the Program's organization and functioning in PHC. We expect that this research's findings will support and guide health management toward valuing the strengths identified and promoting changes that streamline VAD prevention actions, and subsidizing studies using this methodology in other Brazilian regions or other countries where nutritional deficiencies, such as VAD, persist as a public health problem.

Collaborations

WD Miranda contributed to the conception, design, analysis, interpretation of data, drafting of the article and its critical review, and approval of the version to be published. EAA Guimarães contributed to the conception, design, and drafting of the article and its critical review, and approval of the version to be published. DS Campos contributed to the conception, design, and drafting of the article and its critical review, and approval of the version to be published. ZMP Luz contributed to the conception, design, and drafting of the article and its critical review, and approval of the version to be published.

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