


Exploring factors affecting adherence to multiple micronutrient supplementation during pregnancy in Cambodia: A qualitative analysis

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Abstract

For decades, iron-folic acid (IFA) supplements have been provided to pregnant women in Cambodia through antenatal care (ANC) services. However, mounting evidence suggests that multiple micronutrient supplements (MMS) are superior to IFA supplements in achieving positive pregnancy outcomes. The possibility of transitioning from IFA supplements to MMS in government-run health centres is currently being assessed in Cambodia. A crucial component of this assessment involves identifying factors that can influence adherence to MMS, as low adherence can reduce supplement effectiveness. Consequently, this study aimed to explore the potential barriers and enablers to MMS adherence and identify the strengths and challenges of current ANC services. Data were collected through nine focus group discussions with pregnant women ($n = 19$), family members ($n = 18$) and midwives ($n = 18$) and three in-depth interviews with maternal and child health chiefs ($n = 3$) in Cambodia and analysed via content analysis. Factors found to influence MMS adherence included attitudes, perceptions and beliefs about MMS; knowledge related to supplementation; ANC counselling; family influence; physical health; access to ANC; supply of MMS; and supplementation norms. Noted strengths of ANC services were the quality of ANC materials, tailored patient education, midwife-patient relationships and flexibility of provided services. Primary challenges related to poor availability of ANC materials, inadequate midwife training, heavy workload, limited funding and suboptimal physical spaces for delivering ANC services. To effectively promote MMS adherence, strategies must involve pregnant women, family members and community leaders; seek to address knowledge gaps and misconceptions related to MMS; and enhance the availability and accessibility of ANC services.

KEYWORDS

global health, implementation science, maternal-child health services, micronutrient supplementation, pregnant women, prenatal care, treatment adherence and compliance

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1 | INTRODUCTION

Prenatal supplementation with iron-folic acid (IFA) has been a cornerstone of maternal and child health interventions for decades, effectively reducing maternal iron deficiency anaemia and neural tube defects (Peña-Rosas et al., 2015; World Health Organization, 2012). However, there is emerging consensus that maternal and child health guidelines should be revised to outline the evidence that multiple micronutrient supplements (MMS) may confer additional benefits over IFA, including a reduced risk of preterm birth, low birth weight and small for gestational age births (Keats et al., 2019; Sudfeld & Smith, 2019; World Health Organization, 2020). The internationally recognized standard for MMS is the United Nations International Multiple Micronutrient Antenatal Preparation (UNIMMAP), a formulation containing iron, folic acid and 13 other micronutrients, including thiamine, vitamin C, vitamin D, calcium, zinc and iodine (World Health Organization, 2020). The broad range of vitamins and minerals offered in UNIMMAP MMS, referred to hereafter solely as MMS, serves to address the wide spectrum of micronutrient deficiencies commonly faced by women of reproductive age and pregnant women.

National data from Cambodia have revealed evidence of widespread micronutrient deficiencies among women of reproductive age, including vitamin D (Smith et al., 2016), iodine (Laillou et al., 2016) and thiamine (Whitfield et al., 2017). However, iron deficiency anaemia was relatively uncommon, with 3% of women having low ferritin concentrations (<15 mcg/L) (National Institute of Statistics, Directorate General for Health, & ICF International, 2015). In recognition of the potential benefits of MMS for this population, the Cambodian Ministry of Health collaborated with Helen Keller International and Vitamin Angel Alliance from 2021 to 2022 on a landscape analysis to explore the feasibility of transitioning from distributing IFA to MMS in health centres across Cambodia. An important finding from this analysis was that key stakeholders, including government officials and civil society partners, strongly supported the MMS transition.

While the transition to MMS holds promise for improving maternal and child health in Cambodia, it is crucial to explore the challenges that may arise when switching from IFA to MMS to inform strategies for ensuring strong supplementation adherence. Throughout this paper, the term adherence denotes the degree to which an individual follows the indicated supplementation regimen and includes supplement initiation (Vrijens et al., 2012). For decades, IFA supplements have been successfully provided as part of the standard antenatal care (ANC) in Cambodia. The latest Demographic and Health Survey revealed that 98% of women consumed an iron-containing supplement during their most recent pregnancy (National Institute of Statistics Cambodia, Ministry of Health Cambodia, & ICF, 2023), confirming iron supplements (delivered as IFA per the national policy) to be a familiar product

Key messages

- Gaining context-specific knowledge on potential barriers and enablers to MMS adherence in Cambodia is necessary to inform strategies for the effective introduction of MMS in national antenatal care services.
- Factors found to influence MMS adherence included attitudes, perceptions and beliefs about MMS; pregnancy and prenatal supplementation knowledge; ANC counselling; family influence; physical health; access to and availability of ANC; supply of MMS; and community norms.
- Comprehensive strategies incorporating social and behavioural change approaches are essential to promote knowledge about the benefits, effectiveness and safety of MMS among pregnant women, family members, community members and health care workers.

among pregnant women, community members and health care providers. Switching from such a well-known product to one that is unfamiliar to many could raise concerns within the population. Another potential challenge relates to the number of prenatal tablets that will need to be consumed: currently in Cambodia, women are recommended to take one IFA tablet daily for 90 days, whereas they will be recommended to take one MMS tablet daily for 180 days. This longer period of intake has been demonstrated to provide greater benefit for pregnancy and birth outcomes (Bourassa et al., 2019). Understanding the full range of factors that can influence adherence to MMS is essential, as adherence to prenatal supplementation is a key determinant of its effectiveness.

In Cambodia, prenatal supplementation is primarily provided by midwives through ANC services offered at local health centres. Most women (86%) in the country attend at least four ANC visits (National Institute of Statistics Cambodia, Ministry of Health Cambodia, & ICF, 2023). During these visits, midwives distribute IFA and engage in counselling on various pregnancy topics, including prenatal supplementation. Transitioning to MMS will require changes in various components of ANC services, including supplement provision, education and counselling. As such, it is essential to understand the current strengths and challenges of ANC services to gain insights into areas that require improvement during the MMS transition. Optimizing ANC services has been demonstrated to help support prenatal supplementation adherence (Sanghvi et al., 2023).

The social ecological model (1977) provides a valuable lens for examining factors that can affect adherence to prenatal supplementation, as it guides researchers to consider the multiple levels of influence involved in health behaviour. The model proposes that a person's behaviour is shaped by a dynamic system of individual characteristics, interpersonal relationships, organizational

elements, community factors and other environmental factors (Bronfenbrenner, 1977; Salihu et al., 2015). Formative research on prenatal supplementation in seven countries in Asia and Africa found that pregnant women, family members, health care providers, health systems and local communities can all influence supplement adherence (Siekman et al., 2018). To date, no published study has explored factors within the Cambodian context that could support or hinder MMS adherence. This information is crucial for ensuring a successful transition to MMS in Cambodia and for maximizing the benefits of MMS for maternal and child health. Consequently, this study aims to identify the barriers and enablers to adherence to MMS among pregnant women in Cambodia. It also seeks to identify the strengths and challenges of the ANC services currently provided in the country to inform the integration of MMS into the ANC platform.

2 | METHODS

This paper presents the qualitative component of a mixed-methods research study aiming to evaluate the adherence and acceptability of MMS in Cambodia. The quantitative component of the study was a cluster-randomized trial seeking to determine whether adherence rates to MMS were noninferior to IFA supplementation and to evaluate the acceptability of MMS among pregnant women (clinicaltrials.gov identifier: NCT05867836). The study took place in the semi-rural province of Kampong Thom, covering three operational districts (ODs): Kampong Thom, Staung and Baray Santuk. The protocol for the cluster-randomized trial has been published (Hoang et al., 2024) and the trial findings will be available in an upcoming publication by Sauer et al. (2024).

The qualitative study involved nine focus group discussions (FGDs) with pregnant women (not enrolled in the trial), influential family members and midwives, as well as three in-depth interviews (IDIs) with maternal and child health (MCH) chiefs (one from

each district). These groups were selected to capture the influence of factors at the individual, interpersonal and organizational levels of the social ecological model. The FGDs were conducted to understand the range of perspectives in the target populations and to gain insights from participant interactions, whereas the IDIs were conducted to gain a deeper understanding of the perceptions and experiences of the limited number of MCH chiefs in the selected region. See Table 1 for an overview of data collected.

2.1 | Data collection tools

Semistructured guides were developed for the FGDs and IDIs. The guide for pregnant women and family members focused on perceptions, knowledge and social influences related to prenatal supplementation and pregnancy. The guides for midwives and MCH chiefs were focused on ANC provision and health centre needs. Each guide was created in English and, then translated into Khmer, the local language. The translated guides were pretested with members of the target populations and then refined based on the participant responses and feedback. During the FGDs/IDIs, two Android tablets were used to record the audio, and notepads were used for note-taking.

2.2 | Recruitment and data collection

One health centre in each OD was selected as a recruitment location for pregnant women and family members; health centres with a larger population of pregnant women were intentionally targeted to facilitate recruitment, and convenience sampling was used. Health centre staff, village health support groups and village chiefs from each OD helped identify potentially eligible participants, and then data collectors contacted these individuals to review their eligibility. Pregnant women had to reside in Kampong

TABLE 1 Overview of data collected: number of focus groups discussions and in-depth interviews, and number of participants by location.

Participants	Number of focus group discussions or interviews	Number of participants by location		
		Baray Santuk	Kampong Thom	Staung
Pregnant women	3 ^b	6	6	7
Influential family member ^a	3 ^b	6	6	6
Midwives	3 ^b	6	6	6
Maternal and child health chiefs	3 ^c	1	1	1

^aBy design, the composition of influential family member groups varied by location: Baray Santuk included only husbands, Kampong Thom included mothers and mothers-in-law and Staung included husbands ($n = 4$), a mother ($n = 1$) and a sister ($n = 1$).

^bFocus group discussions.

^cIn-depth interviews.

Thom province, be 18–45 years of age and not be participating (currently or in the future) in the larger trial. The latter criterion was selected to limit the potential bias that may arise from women having increased knowledge of MMS through exposure to the supplement during the trial. Family members needed to reside in Kampong Thom province and have a pregnant woman in their close family (this woman could be enrolled in the larger trial). Cambodian members of our research team identified husbands, mothers and mothers-in-law of pregnant women as important influencers for pregnancy-related decision-making; therefore, these individuals were prioritized for FGDs: the Baray Santuk FGD was conducted only with husbands, the Kampong Thom FGD included only mothers or mothers-in-law and the Staung FGD was open to any influential family member.

Midwives were recruited through health centres using convenience sampling. To be eligible, they had to reside in Kampong Thom province, work at least part time at a health centre involved in the trial, provide ANC to women in their current position and have at least 1 year of experience.

Six to seven participants were invited to each FGD, with a minimum of four participants required to hold an FGD. Each OD has only one MCH chief; therefore, all three were invited to participate in an IDI. All participants were provided with a towel as a token of appreciation.

Each FGD and IDI was conducted by a pair of data collectors: one individual facilitated the FGD/IDI, while the other took notes. A total of four data collectors, all Cambodian, were involved in this study, and FGDs/IDIs were conducted in Khmer. There were no prior relationships between the data collectors and the study participants. The FGD/IDI facilitators were full-time employees of Helen Keller Intl, while the note-takers were part-time employees of the organization. All were university-trained and had qualitative data collection experience through previous projects. Data collectors also underwent an intensive 2-day training hosted by research team members (MS, MAH, CS & JML). Data collection occurred from April 7 to 22 April 2023.

2.3 | Data processing and analysis

The note-takers developed verbatim transcripts in Khmer of each FGD/IDI. These transcripts were reviewed by the facilitators to ensure their integrity and subsequently translated into English. These transcripts were again reviewed for integrity before data analysis was undertaken by the first author.

Content analysis with inductive and deductive coding was carried out (Elo & Kyngäs, 2008; Lindgren et al., 2020) using NVivo version 14. An initial deductive codebook was developed, based on the research objectives, the findings from a similar study (Siekman et al., 2018) and the social ecological model (Bronfenbrenner, 1977); inductive codes were added as they emerged from the data. Two randomly selected transcripts were recoded by the second author using the same codebook, and a high level of agreement was obtained. Once all transcripts were coded, codes were grouped into larger categories to represent the main factors that may act as

barriers and enablers to MMS adherence, and the strengths and challenges of current ANC services. Members of the research team were consulted throughout the iterative coding, analysis and writing phases to enhance the trustworthiness of our study's findings.

2.4 | Ethics

Ethics approval was obtained from the National Ethics Committee for Health Research in Cambodia (Ethics number 056 NECHR) and The University of British Columbia Clinical Research Ethics Board (Ethics number H23-01316) in Canada. All participants provided written informed consent before participation.

3 | RESULTS

Participants were all of Khmer ethnicity and Buddhist, and most were married with at least one child (see Table 2). No participants dropped out of the study.

The barriers and enablers to MMS adherence are described in Section 3.1. These factors include attitudes, perceptions and beliefs; knowledge and antenatal care counselling; family influence; physical health; access to and availability of antenatal care services; supply of MMS; and prenatal supplementation norms. Next, Section 3.2 details the strengths of current ANC practices, which include quality antenatal care materials; prenatal education and counselling; relationships with pregnant women; and flexibility of ANC services. Finally, Section 3.3 describes the challenges of current ANC practices, which include the availability or adequacy of ANC materials; midwife training; workload and staffing; funding; and physical space for ANC services.

3.1 | Barriers and enablers to multiple micronutrient supplementation adherence

All factors identified in this study, with the exception of 'physical health' and 'prenatal supplementation norms', serve dual roles, functioning both as potential barriers and as enablers to MMS adherence. 'Physical health' was only described as a barrier, while 'prenatal supplementation norms' was only described as an enabler. Figure 1 illustrates how each of these factors relates to the various levels of the social ecological model.

3.1.1 | Attitudes, perceptions and beliefs

Divergent attitudes, perceptions and beliefs about MMS were present among pregnant women and family members. Some expressed a sense of fear or hesitation towards MMS, as they perceived the potential for harm to the mother or the fetus. Wariness about the possible side effects of the supplement or the quality of the supplement was also noted, with one pregnant woman stating that she is

TABLE 2 Participant characteristics.

	Pregnant women and family members (n = 38)	Midwives and maternal and child health chiefs (n = 21)
Characteristic	n (%)	n (%)
Age		
18–24	3/38 (8%)	0/21 (0%)
25–34	18/38 (47%)	13/21 (62%)
35–44	10/38 (26%)	6/21 (29%)
≥45	7/38 (18%)	2/21 (10%)
Ethnicity		
Khmer	38/38 (100%)	21/21 (100%)
Religion		
Buddhist	38/38 (100%)	21/21 (100%)
Highest level of education		
No education	7/38 (18%)	0/21 (0%)
Primary	18/38 (47%)	0/21 (0%)
Secondary	7/38 (18%)	0/21 (0%)
Higher secondary	2/38 (5%)	5/21 (24%)
University	4/38 (11%)	16/21 (76%)
Marital status		
Married	36/38 (95%)	18/21 (86%)
Widowed/ divorced/ separated	1/38 (3%)	0/21 (0%)
Never married	1/38 (3%)	3/21 (14%)
Number of children		
0	7/38 (18%)	5/21 (24%)
1	11/38 (29%)	4/21 (19%)
2	10/38 (26%)	7/21 (33%)
3	6/38 (16%)	5/21 (24%)
≥4	4/38 (11%)	0/21 (0%)
Primiparous^a		
Prior experience of miscarriage ^a	1/13 (8%)	–
	6/13 (46%)	–

^aData for pregnant women only (n = 13).

Afraid that [by taking MMS] our health will not be good or something not good will happen.

(Pregnant woman)

MCH chiefs noted that some of the unease related to MMS may be caused by people's perception that this novel product is being tested on women in their community.

It is notable, however, that many women indicated a desire to replace IFA, as uncomfortable side effects are commonly experienced

with this supplement, and IFA has an unpleasant smell. One woman explained:

I would be happy and excited [to change from IFA to MMS] because I currently use iron pills and it affects me a lot ... often causing me to vomit.

(Pregnant woman)

Family members also expressed positive perceptions of MMS, stating that they would be happy with any safe prenatal supplement that helps support the health of women and children. Many family members and pregnant women expressed that they would feel comfortable taking MMS if it was endorsed by the Ministry of Health or provided by midwives at health centres.

3.1.2 | Knowledge and antenatal care counselling

Many pregnant women and family members were knowledgeable about the need for prenatal supplementation to maintain the health of women and children, and yet, they lacked specific knowledge on MMS. These participants expressed a desire to learn about the benefits, effectiveness, side effects and physical properties of MMS.

Knowledge needs were also identified among midwives, who reported having little or no training specific to MMS. Enhancing midwife knowledge of MMS is essential to enable them to educate pregnant women during their ANC visits; good-quality education and counselling were noted as key contributors to supplementation adherence:

We need to have strong counseling. ... if [women] have incomplete or are lacking knowledge, then, they may give up.

(MCH chief)

Midwives currently use various educational and counselling approaches during their ANC visits to support supplementation adherence. For instance, they work with women to find effective strategies to reduce and manage the side effects from IFA (e.g., changing the time of day the supplement is consumed). Many of the approaches used by midwives can be applied to supporting MMS adherence.

3.1.3 | Family influence

A woman's family plays an important role in supplementation adherence. A midwife explained that for some women, the advice of family members, particularly elder family members, may be followed more than that of midwives, as,

... [women] come to see us [midwives] once in a while, but elder members of their family speak with them every day.

(Midwife)

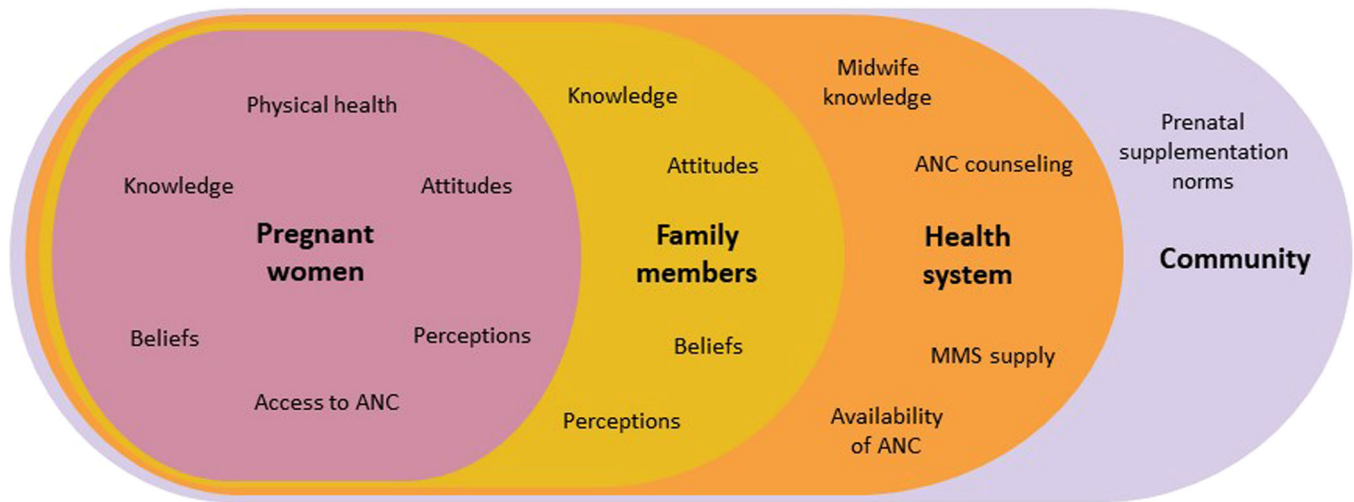


FIGURE 1 Barriers and enablers to MMS adherence among pregnant women in Cambodia. Each circle presents a different level of influence: individual (pregnant women), interpersonal (family members), institutional (health system) and community. The descriptors included in the circles represent the factors functioning as barriers and enablers to MMS adherence. All factors listed, apart from 'physical health' and 'prenatal supplementation norms', were described by participants as being both a potential barrier and an enabler to MMS adherence. 'Physical health' was only described as a barrier, while 'prenatal supplementation norms' was only described as an enabler.

Currently, with IFA supplementation, members of a woman's family tend to positively influence adherence by advising women to initiate supplementation and encouraging and reminding women to consume their supplement daily.

For some pregnant women, permission from family members, such as mothers or husbands, is required to take prenatal supplements. MMS initiation may, therefore, be impeded if a family member is not comfortable with this new supplement. One pregnant woman's mother explained:

I would not allow my daughter to take that medicine [MMS] as it is different from iron folic acid supplements and I don't know what the medicine is or about its quality.

(Family member)

Many family members, however, indicated an openness to MMS, stating that they would allow a pregnant woman to consume MMS if they knew it was an effective product, it came from a reputable source or was registered by the Ministry of Health.

3.1.4 | Physical health

Participants spoke of how the side effects from prenatal supplements, or pregnancy symptoms such as morning sickness, could delay the initiation of prenatal supplementation or hinder regular consumption. In sharing the experience of one of her patients, a midwife stated:

It is difficult for her to take iron pills. ... She tends to have side effects, feels a need to vomit. [IFA has] a bad smell, smells of rust. She didn't want to take it.

(Midwife)

Midwives reported that some pregnant women incorrectly associate the physiological changes of pregnancy, such as increased urination or body temperature, with the side effects of prenatal supplements, leading to delayed initiation or reduced supplement intake. Midwives attempted to remove this barrier by informing women about the typical changes that occur in pregnancy.

3.1.5 | Access to and availability of antenatal care services

ANC services can be challenging to access for women who have inadequate resources for transportation, live far from health centres or have inflexible work obligations. One midwife spoke of a woman who delayed ANC initiation until midway through her pregnancy, as,

... the health center was far away, and she was busy working. She did not dare to ask permission to leave work.

(Midwife)

Access to and availability of ANC services are also influenced by the volume of patients at health centres. When faced with long wait times, some women leave the health centre without being seen by their care team. Other women will wait to be seen but may experience a shorter ANC visit or a reduction in services.

Various strategies at the institutional and community level reported by midwives and MCH chiefs may counterbalance some of the barriers to accessing ANC services. For instance, women can contact midwives by phone with their questions or concerns, enabling them to access advice without travelling to health centres. Women are also permitted to come to the health centre between their scheduled appointments if they have questions or are experiencing issues:

When there is a problem, she can come anytime, even before her next appointment date.

(Midwife)

Finally, midwives and MCH chiefs described how actors outside of the health centre—including village health support groups, village chiefs and nongovernment organizations—are engaged in communities to help women attend ANC visits and to support them in taking prenatal supplements.

3.1.6 | Supply of multiple micronutrient supplements

Midwives and MCH chiefs described how supplies of IFA supplements can at times be inadequate, causing midwives to distribute fewer supplements to women than what is indicated in the MoH policy (60 tablets should be distributed during a woman's first ANC visit and 30 tablets at the subsequent visit). One MCH chief noted that in those situations, health centres will

... give 30 pills for the first time, and when [women] come again, they will give another 30 pills.

(MCH chief)

While midwives and MCH chiefs noted that this approach helps avoid complete stock-outs of supplements, it has the possibility of creating access-related barriers to prenatal supplementation, as women need to return to the health centres more frequently to acquire their supplements. Midwives described how some women—particularly those living in more remote locations or who are constrained by their work—have challenges in regularly accessing the health centre:

Some people are busy working on the farm, most of them do not come [to the health center] very often. Some of them go out to sell things far away!

(Midwife)

Potential enablers for MMS adherence are the current approaches that allow for flexible management of the individual-level supply of prenatal supplements. Midwives and MCH chiefs reported that in instances where supplements provided to a woman become damaged (e.g., if the packaging was not adequately sealed and the product becomes affected by moisture), replacement tablets are provided:

... some [women] have told me they forgot to close their [IFA] bag and ask for more supplements. I say yes. I give them more.

(Midwife)

3.1.7 | Prenatal supplementation norms

Pregnant women, family members and midwives described how prenatal supplementation is the norm in Cambodia, noting that consumption of prenatal supplements is an expected behaviour to support the health of women and their offspring. Some participants framed the consumption of prenatal supplements as a woman's role or responsibility. For instance, the mother of a pregnant woman stated:

... my child has the responsibility to take all supplements from the health center.

(Family member)

Furthermore, a midwife described that to help women remember to take their prenatal supplements, she tells them:

... your role as a pregnant woman is to take prenatal supplements, you must remember that.

(Midwife)

3.2 | Strengths of antenatal care services

3.2.1 | Quality antenatal care materials

The strength of various materials used for ANC counselling and education were described by midwives and MCH chiefs. Noted as particularly useful was a two-sided flipchart, providing a description of the counselling topic for the midwives—helping them remember all the relevant details—and visuals for pregnant women to help support their learning and information retention. One midwife describes her use of the flipchart:

... we need to tell them what points are listed in the text on the back [of the flip-chart], we look at it, and we let women see the pictures on the front of the page... sometimes when women cannot remember [the information], they can imagine the pictures.

(Midwife)

Posters hung in the waiting rooms and throughout the health centres were also described as useful to inform women on pregnancy-related topics, including prenatal supplementation. An MCH chief noted:

... we provide counseling by showing posters to those who are illiterate, so when they see posters, they understand more clearly what we want to tell them.

(MCH chief)

3.2.2 | Prenatal education and counselling

During ANC visits, midwives provide education and counselling tailored to the interests and needs of pregnant women. For instance, midwives described various approaches to helping women work through the side effects experienced when taking IFA supplements:

... I tell her to take the supplement, and if she has constipation, to try drinking lots of water and taking the pills in the evening when she goes to bed.

(Midwife)

When she ate, she vomited. I advised her that when she eats in the evening, after eating half of her meal, she should take the supplement and then continue her meal.

(Midwife)

Midwives also engage with women to ensure that the information that is being taught is well understood. One midwife described how she checks in with women during the ANC visits,

... to know whether she understands what we said to her or not. I want to get feedback from her (...) I ask her if she wants us to repeat it again.

(Midwife)

Midwives also encourage questions from pregnant women both during and after ANC visits:

I always tell them [pregnant women] that if they have any questions, to ask us.

(Midwife)

The importance of including a woman's family members in prenatal education was discussed by MCH chiefs, who described a desire to have ANC materials, such as take-home leaflets, to enhance the sharing of prenatal education. One MCH chief explained:

If [the leaflet] is at our place, only pregnant women can see it, or their family that come to the health center. Sometimes when they arrive home, they do not say anything. If they had a leaflet, they could share [the information] with others.

(MCH chief)

3.2.3 | Relationships with pregnant women

Another strength of the current ANC services is the ability of midwives to establish strong, meaningful relationships with pregnant women. One MCH chief stated:

They [midwives] have a close relationship with customers [pregnant women] who come to receive their services.

(MCH chief)

Some midwives share their personal pregnancy and supplementation experiences with women, helping build rapport and enhancing the exchange of information.

High levels of confidence in midwives and health centres were expressed by participants, with many family members feeling reassured when pregnant women visit health centres and trusting the recommendations, products and care provided by midwives:

When we go to the health center, what the staff gives, we take it all.

(Family member)

3.2.4 | Flexibility of antenatal care services

Finally, the flexible nature of ANC services is another important strength. Midwives described how they schedule ANC visits at the frequency recommended by the Ministry of Health, but encourage women to come to the health centre sooner if they have any questions or issues. One midwife mentioned that she provided her personal cell phone number to women to allow them to reach her with questions at any time:

Most of the time, I'll give my phone number to her. Because she lives far away and can't come back right away, if she has a problem, she can call and ask me [her questions].

(Midwife)

3.3 | Challenges for antenatal care services

3.3.1 | Availability and adequacy of antenatal care materials

Despite the high quality of some educational ANC materials described by midwives and MCH chiefs, they also noted that not all materials are up to date or in good condition, and some are not appropriate for women who are illiterate. Having regular access to these materials is another challenge described by these participants, as is the lack of take-home materials for women and families:

I have tried to look for posters to place on the wall of each health center. Before, they were available, but now we do not have any.

(MCH chief)

Finally, midwives and MCH chiefs stated that basic equipment for ANC services and labour and delivery, such as instruments and materials for checking haemoglobin levels and foetal heartbeat, are also commonly lacking at health centres. For instance, one MCH chief noted:

... it seems there are less materials, there is a lack of kits for delivery...

(MCH chief)

3.3.2 | Midwife training

Midwives and MCH chiefs noted that there are too few opportunities for midwives to formally refresh their midwifery knowledge and skills. One MCH chief explained her unsuccessful attempts to secure additional training for her staff:

We always make the request at the provincial level, if there is training, invite midwives from each health center to participate in the training.

(MCH chief)

The consequences of delaying refresher trainings for midwives were described by one participant:

Sometimes it is too late to provide refresher training. So, they [midwives] forget!

(MCH chief)

When refresher courses are available, MCH chiefs stated that they are often too short or condensed, limiting the usefulness of these courses.

3.3.3 | Workload and staffing

Midwives and MCH chiefs described how staffing levels for midwives are inadequate at many health centres, leading to excessive workloads for midwives and long wait times for pregnant women. An MCH chief illustrated the impact of this situation on pregnant women:

In some health centers there are 3 or 4 midwives, but if they have a case of childbirth, they also need to help each other. So, they will leave the pregnant women who come for an antenatal checkup in the waiting room.

(MCH chief)

Midwives also noted that at times, pregnant women are asked if they can return the following day to be seen by a midwife. Additionally, when workloads are too high, the level of care becomes affected, with services either being rushed or fewer services being provided to women:

Sometimes the [counseling] time is cut because we are busy.

(Midwife)

One MCH chief noted that she observed a reduction in midwives' level of attention or willingness to provide services when they have too many women to serve.

3.3.4 | Funding

Challenges with acquiring adequate funding from the government to hire midwives, provide staff training and purchase ANC materials and equipment were noted by midwives and MCH chiefs. For instance, two participants stated:

... there are not many [training sessions] because the provincial or national level does not have money. Unless there is support from an organization, otherwise they don't have money for capacity building.

(MCH chief)

[there is a] shortage of money to spend in the health center to buy materials.

(MCH chief)

3.3.5 | Physical space for antenatal care services

Finally, the physical space for providing ANC services was suboptimal at some health centres, with participants describing health centres as too hot, crowded and uncomfortable, and,

cramped, hard to sit and wait.

(Midwife)

In certain cases, there were too few chairs for pregnant women and their family members to use while waiting for services, and in others, there were too few rooms for providing ANC services. An MCH chief provided an example of the limited physical space in one health centre:

... our health center does not have enough room, it does not have a separate room for blood tests.

(MCH chief)

4 | DISCUSSION

A broad range of factors was found to influence women's adherence to MMS in Cambodia, with pregnant women, family members, the health system and communities all having the possibility of promoting or hindering this behaviour. Attitudes, perceptions and beliefs about MMS varied among pregnant women and their family members, and knowledge gaps related to MMS were common among participants, highlighting the need for education and counselling to build a common understanding of the benefits of MMS and support its adherence. Additionally, logistical factors such as access to ANC services or the quantity of MMS tablets provided at once can contribute to MMS adherence, as can community norms related to prenatal supplementation. Many pregnant women expressed a desire to replace IFA with another prenatal supplement due to the adverse side effects and unfavourable organoleptic properties associated with IFA, demonstrating an opportunity for strong MMS uptake among this population.

The barriers and enablers to prenatal supplementation that we have identified in Cambodia align with several findings reported by Siekmans et al. (2018). For instance, both studies found that inadequate access to ANC services and an insufficient supply of prenatal supplement tablets could hinder adherence to prenatal supplementation, while positive interpersonal relationships with family members and support from midwives could facilitate adherence. However, a notable divergence in our findings concerns the willingness of health care providers to prescribe prenatal supplements. Siekmans et al. highlighted reluctance among health care providers in various contexts to prescribe IFA supplements during the first trimester of pregnancy, whereas our study found no such hesitation among midwives and MCH chiefs, suggesting a greater acceptance of prenatal supplementation in this context.

Our study also identified the strengths and challenges of current ANC services. Key strengths included high-quality educational materials and patient education, strong midwife–patient relationships and flexibility of the provided services. Key challenges included poor availability of educational materials, limited opportunities for updating midwife training, midwife shortages, insufficient funding and suboptimal physical spaces for providing ANC services at some health centres. ANC strengths can be leveraged to support MMS adherence, while the challenges should be addressed to the extent possible to ensure an effective transition to MMS and improve the overall quality of ANC.

There is limited research on the experiences of other countries in their transition from IFA to MMS. Several countries, including Haiti, India, Indonesia, Mali, Pakistan, Tanzania, Uganda and Vietnam, are exploring a transition using a phased approach, which generally involves an exploration phase (e.g., landscape analysis or consensus building around the need for MMS) and an implementation phase (e.g., pilot testing) before a national scale-up phase (Mwangi, 2023). Cambodia is currently in the implementation phase, with this paper presenting one aspect of the implementation research being conducted in the country. Findings from our study can provide important considerations for stakeholders in Cambodia and other countries

during their transition to MMS. Outlined below are four recommendations to address potential barriers to MMS adherence.

First, including family and community members in MMS promotion initiatives is crucial. We found that these individuals can be important supports for supplement adherence when they are aware of the benefits of the supplement, but can also impede supplement intake if they do not feel that it is safe or needed. Recent studies in Bangladesh also found that family dynamics and support can play a role in the uptake of MMS (Kraemer et al., 2023) and that decision-making related to health behaviours is influenced by interpersonal relationships, particularly those between pregnant women and their in-laws or grandmothers (Sight & Life & UNICEF, 2021). The influence of family members, peers and community engagement on MMS adherence was similarly observed in South Africa (Silubonde et al., 2022). To promote MMS adherence in Cambodia and garner wider support for the supplement, messaging on the importance, benefits and safety of MMS should be targeted towards pregnant women and the broader community. To enable a wider reach and higher acceptance of these messages, community leaders could also be engaged, as they are generally trusted by the population and have frequent contact with them.

Second, misconceptions about the adverse effects of prenatal supplementation must be addressed. Some pregnant women and family members in our study believed that prenatal supplements could cause harm to the mother or fetus, while others believed that normal changes during pregnancy were side effects of supplements. Erroneous beliefs about prenatal supplementation have been reported in other countries. For instance, many pregnant women in South Africa associated any negative change during pregnancy with MMS intake (Silubonde et al., 2022). The study also reported that poor experience with supplements or medications in the past can hinder future MMS adherence (Silubonde et al., 2022). To address misconceptions and build trust in MMS use, a comprehensive educational strategy should be used, where the effectiveness of MMS is emphasized, the possible adverse side effects and management strategies are described and normal physiological changes during pregnancy are explained. These teachings can be delivered through the ANC platform during antenatal counselling and via take-home educational materials. To ensure that the messaging can be understood by all recipients, the materials should contain textual and visual information. Additionally, a broader social and behavioural change campaign, which incorporates a strong educational strategy, should be considered to further promote MMS among women and community members.

Third, enhancing the knowledge of MMS among midwives through tailored education and counselling materials may aid the transition from IFA to MMS. Addressing insufficient provider knowledge and strengthening counselling of pregnant women during ANC have been found to be key components for enhancing MMS adherence in various other settings (Sight & Life & UNICEF, 2021; Sight & Life, 2023). In a case study on the transition to MMS in Pakistan, the creation of a standard communication package—which included training for health care providers on MMS and new standard

operating procedures—was seen as a promising step towards integrating behaviour change and strengthening implementation (Busch-Hallen et al., 2023). Such an approach could be considered in Cambodia to support midwives in transferring the practices they currently use for prenatal supplement education and counselling from IFA to MMS. Additionally, the heavy workload of midwives in the country should be addressed to ensure that the knowledge acquired through such training can be optimally integrated into daily practices.

Finally, logistical barriers for accessing MMS should not be overlooked. With prenatal supplementation in Cambodia being delivered through health centres during ANC services, any factor that limits the access or availability of these services can hinder MMS access and adherence. The flexibility of ANC services in Cambodia is an important strength that can help promote MMS adherence in the country. However, excessive workloads at health centres are common, leading to long wait times for pregnant women and, at times, a reduced quality of ANC services. Community-level studies in Haiti (Dacius et al., 2023) and Bangladesh (Sight & Life & UNICEF, 2021) found that limited access to ANC due to distance or cost, poor-quality ANC services, ANC staffing shortages, crowding at health centres and stockouts of supplements can become constraints for prenatal supplementation. To support MMS adherence in Cambodia, barriers to ANC access and availability must be addressed, and a secure and reliable supply chain for MMS must be established.

This study's key strength lies in its diversity of included study participants, incorporating views from pregnant women, family members, midwives and MCH chiefs. These varied perspectives offer a comprehensive understanding of factors impacting a woman's MMS adherence and a nuanced description of ANC strengths and challenges. The use of the social ecological model was another strength, as it enabled an exploration of a broad range of factors influencing MMS adherence. Although one limitation of this study is its exclusive geographical coverage of only one province (Kampong Thom) in Cambodia, it did include representation from three ODs and multiple health centres. Factors affecting MMS adherence are not speculated to differ greatly across provinces, however, as most Cambodians share the same ethnicity and cultural practices, and current IFA adherence rates have been shown to be similar across the country (National Institute of Statistics Cambodia, Ministry of Health Cambodia, & ICF, 2023).

5 | CONCLUSION

The findings of this qualitative study underscore the significance of understanding the perspectives and experiences of pregnant women, their families and midwives in promoting MMS adherence in Cambodia. The recommendations presented in this paper offer guidance for addressing barriers to MMS adherence and ensuring a successful transition from IFA to MMS.

Collaborative efforts among health care providers, government agencies, nongovernmental organizations and community groups are essential to ensure a coordinated and well-resourced plan to transition from IFA to MMS. Moreover, a comprehensive sustainability

plan outlining strategies for maintaining MMS availability, funding, training and continued advocacy beyond the initial transition phase is necessary to ensure the long-term success of this supplementation programme. By implementing such approaches, we can effectively promote MMS adherence and ultimately support optimal maternal and child health outcomes in Cambodia.

AUTHOR CONTRIBUTIONS

Jocelyne M. Labonté, Mai-Anh Hoang, Hou Kroeun, Meng Sokchea, Vin Sokhal, Cassandra Sauer, Mary Chea and Crystal D. Karakochuk contributed to study conception and design. Jocelyne M. Labonté, Mai-Anh Hoang, Meng Sokchea, Sreang Sambo and Cassandra Sauer contributed to data collection. Jocelyne M. Labonté and Mai-Anh Hoang analysed the data and Meng Sokchea, Sreang Sambo and Mary Chea supported data interpretation. Jocelyne M. Labonté, Mai-Anh Hoang and Aishwarya Panicker wrote the manuscript, and all authors read and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data detailed in the manuscript will be made available upon reasonable request pending application and approval by the principal investigator.

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