

SOCIAL SUPPORT AND ADHERENCE TO
ANTENATAL MICRONUTRIENT SUPPLEMENTS

A Dissertation

Presented to the Faculty of the Graduate School
of Cornell University

In Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy

by

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August 2016

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Cornell University 2016

Antenatal calcium and iron-folic acid (IFA) supplementation can reduce maternal and child mortality, but supplementation programs face multiple implementation challenges. Although strategies to address health system and health facility level challenges have been identified, effective family and individual level strategies to improve adherence to antenatal micronutrient supplements are limited. Social support is associated with maternal and child nutrition behaviors and may influence antenatal micronutrient supplement adherence. We explored the relationship between social support and adherence to antenatal micronutrient supplements and evaluated a behavior-change strategy to increase adherence support.

We conducted cognitive interviews in Oromia Region, Ethiopia and Kakamega County, Kenya to explore the social support women expect during pregnancy and for adherence, and develop contextually-appropriate social support scales that reflect women's values. In both countries, we used trials of improved practices (TIPs) to assess the acceptability of an adherence partner strategy. An adherence partner is someone (e.g. spouse, relative) a pregnant woman asks to provide her with adherence reminders and encouragement. Finally, within the context of a cluster-randomized trial, we integrated an adherence partner strategy into routine antenatal care (ANC) in

Kenya, and assessed whether or not adoption led to greater adherence-specific social support and higher calcium and IFA supplement adherence.

Through cognitive interviews with women in Ethiopia and Kenya, we learned, that not only did social support scales need to be adapted for the socio-cultural context, but also the cognitive interviewing process needed to be adapted. Through an iterative process, we developed contextually appropriate general and adherence-specific social support scales. In TIPs in Ethiopia and Kenya, adherence partners were highly acceptable and women appreciated reminders and encouragement. Within the context of ANC in Kenya, participants with adherence partners reported significantly higher levels of adherence-specific social support, and adherence-specific social support was positively associated with calcium adherence.

We explored social support in several ways, which resulted in a highly acceptable behavior change strategy and contributed to high adherence to a relatively demanding calcium supplement regimen, involving multiple pill-taking events per day. This research demonstrates the importance of adherence-specific social support and the potential of low-cost social support strategies, like adherence partners, to increase adherence and the effectiveness of micronutrient supplementation programs.

BIOGRAPHICAL SKETCH

Stephanie Lee Martin is from Monterey, California. She became interested in addressing social and economic disparities as a teenager participating in volunteer and exchange programs in Mexico, Russia, and the United States. She explored these topics during her undergraduate degree in international development at American University in Washington, DC, and while studying abroad in Chile and Kenya. After graduation, she taught fourth grade at a bilingual elementary school in northern Mexico. She then returned to Washington, DC where she worked at the Academy for Educational Development (AED) on the LINKAGES project, which ignited her commitment to improving maternal and child nutrition. At LINKAGES she provided technical assistance on behavior change and training to nutrition programs in Ghana, India, Nicaragua, and Tanzania. While working at AED, she received her master's degree in adult education from George Mason University in Fairfax, Virginia. Her master's project focused on the potential of peer education to support HIV-positive mothers to exclusively breastfeed.

After more than four years at AED, Stephanie moved to Nairobi, Kenya to work as the materials and curriculum development specialist for PATH's Kenya country program. She worked in Kenya for nearly four years on a variety of public health projects including HIV prevention, adolescent reproductive health, and infant feeding. She, again, returned to Washington, DC and continued to work for PATH on the Infant & Young Child Nutrition project as the behavior change specialist and managed country programs in Ethiopia, Kenya, and Lesotho. In 2012, she began her doctoral studies at Cornell University, to develop research skills to evaluate the impact of nutrition behavior change programs.

For Jon and Mira

ACKNOWLEDGMENTS

I am grateful for the guidance, support, and encouragement I received from the members of my committee. Becky Stoltzfus and Kate Dickin served as my committee co-chairs and in this role they exemplified what it means to be a mentor. Becky's kind and inspirational words led to my decision to pursue doctoral study at Cornell, and continued to motivate me throughout my studies. Having the opportunity to work on trials of improved practices with Kate, who literally wrote the book on this method, was an incredible learning experience and I appreciate all of her support and advice. I feel so fortunate to have learned from and collaborated with Gretel Pelto, whose commitment to sharing women's stories influenced me long before coming to Cornell and will continue to do so. Jeff Sobal gave of his time so generously and I value the conversations we had and his thought-provoking questions, guidance, and feedback. I have been inspired by Kathy Rasmussen's dedication to improving the health and well-being of women and children and am grateful for all of her advice.

The Division of Nutritional Sciences (DNS) offered a collaborative and supportive learning environment. Many DNS faculty members provided guidance on my dissertation research, larger research and implementation questions, and the field of global health and nutrition more broadly; I am especially thankful to Jean-Pierre Habicht, David Pelletier, and Sera Young. The Cornell Statistical Consulting Unit was an invaluable resource. I appreciate Françoise Vermeulen always making time for my questions and teaching me with patience and clarity. I am thankful for the conversations with and instruction from Lynn Johnson, as well as consultations with

Jay Barry, Erika Mudrak, Kevin Packard, and Stephen Parry. DNS staff helped me in so many ways; thank you Al Armstrong, Molly Berwald, Brenda Daniels-Tibke, DoraLee Knuppenburg, Lexi Mast, Jean Miller, Terry Mingle, Donna Whiting, and Cha-Sook You. Faculty members outside of the Division were also incredibly helpful. I am grateful to Felix Thommes for teaching me about propensity score matching during an independent study. Elaine Wethington, Parfait Eloundou-Enyegue, and Suzanne Gervais all helped me think through the development of social support instruments.

I am fortunate to have had such amazing colleagues in the members of the Micronutrient Initiative Cornell University Calcium (MICA) team; thank you Lanre Omotayo, Gina Chapleau, and Stephanie Ortolano for everything. Zewdie Birhanu, Yohannes Kebede, Violet Wawire, Salome Wawire, and Rose Chesoli were wonderful collaborators. Abena Maranga helped me conduct a literature review of social support in Ethiopia and Kenya. I learned so much from my fellow graduate students, especially members of the CENTIR, Maternal and Child Nutrition, and Young research groups, whose insightful questions, comments, and suggestions strengthened my research and expanded my thinking. My friends in DNS were so supportive, I feel lucky to have had so many exercise, writing, and coffee club buddies who made these four years much more enjoyable.

I am grateful for the study participants in Ethiopia and Kenya who gave us their time and shared their experiences with us. This research was supported by funding from DNS, Micronutrient Initiative, and Sackler Institute for Nutrition Science at the New York Academy of Sciences.

I am thankful for my colleagues from the LINKAGES Project, whose mentorship and commitment to infant feeding shaped my career choices and academic pursuits, and my PATH colleagues in Kenya and DC who helped me realize the importance of evaluating behavior change programs. Conversations with Kiersten Israel-Ballard about “feeding buddies” inspired the adherence partner strategy.

I am grateful for the support from my family, especially my grandmother Frances Gooley, and my in-laws Steve and Lynn Kaplan. I am indebted to my mother, Lee Martin, who taught me the importance of goal setting and would have been so proud that I achieved this one. I am most thankful for the support I received from my husband Jon and my daughter Mira. Jon sacrificed so much for me to pursue this degree and then cheered me along at every step. Mira’s curiosity and enthusiasm are contagious and she made sure that I had fun throughout this process. You both made this possible, thank you.

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LIST OF ABBREVIATIONS

ANC	antenatal care
BCI	behavior change intervention
IFA	iron-folic acid
MICA	Micronutrient Initiative-Cornell University Calcium study
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

Maternal and child undernutrition contributes substantially to high rates of morbidity and mortality in low-income countries (Black et al., 2013). Despite well-documented evidence-based interventions to improve the nutritional status of women and children (Bhutta et al., 2013) and consensus that scaling up these evidence-based interventions can markedly reduce malnutrition, effective strategies to implement these interventions are lacking (Menon et al., 2014).

The utilization of an intervention or the adoption of a health behavior is influenced by several factors at multiple levels, including culture, health system, health facility, community, household, and individual (McLeroy et al., 1988, Golden and Earp, 2012). Health promotion strategies need to be designed to address these distinct levels (Golden and Earp, 2012, Waisbord, 2014) through behavior change interventions (BCIs) for program beneficiaries, delivery agents, or policy makers (Waisbord, 2014, Fabrizio et al., 2014). Recent literature reviews have documented that BCIs can improve maternal and child nutrition and health practices and outcomes (Bhutta et al., 2008b, Dewey and Adu-Afarwuah, 2008, Elder et al., 2014), and suggest that BCIs have a key role in improving the adoption of recommended nutrition practices (Waisbord, 2014, Fabrizio et al., 2014, Avula et al., 2013, Fox and Obregón, 2014).

Although there is growing evidence that BCIs have the potential to improve nutritional status, not all BCIs result in positive changes in behavior (Fox and

Obregón, 2014, Avula et al., 2013). These unexpected outcomes could result from how an intervention is implemented, if the intervention is adopted by the target audience, or other factors (Avula et al., 2013). It is often difficult to explain why or how an intervention works or fails because studies typically do not (and cannot) examine all of the factors that influence impact (Avula et al., 2013). There is growing recognition of the need to understand these processes through implementation research (Menon et al., 2014, Tumilowicz et al., 2015).

Antenatal micronutrient supplementation

Antenatal calcium and iron-folic acid (IFA) supplementation are efficacious interventions that can improve maternal and newborn health (Bhutta et al., 2013). Daily iron-folic acid supplementation during pregnancy can reduce the risk of low birth weight, maternal anemia, and iron deficiency (Peña-Rosas et al., 2012), and antenatal calcium supplementation can reduce the risk of preeclampsia (Hofmeyr et al., 2010). It is estimated that universal supplementation with calcium and IFA during pregnancy could prevent 23.6% of all maternal deaths (Bhutta et al., 2008a).

Antenatal calcium supplementation

Epidemiological studies found associations between high calcium intake and low rates of preeclampsia and hypertension (Hofmeyr et al., 2007), which are leading causes of maternal and perinatal morbidity and mortality. These findings informed multiple antenatal calcium supplementation clinical trials testing the hypothesis that

increased calcium intake during pregnancy reduces high blood pressure and preeclampsia (Hofmeyr et al., 2007). Systematic reviews revealed that daily calcium supplementation with at least 1.0 g of elemental calcium during pregnancy significantly reduced the risk of preeclampsia and high blood pressure by half, particularly among women with inadequate calcium intake (World Health Organization, 2013; Hofmeyr et al., 2007; Hofmeyr et al., 2014). The mechanism by which calcium supplementation reduces preeclampsia has not been elucidated, but proposed mechanisms include the inhibition of pathological processes that underlie the development of preeclampsia or the reduction of blood pressure may prevent the manifestation of preeclampsia (Hofmeyr et al., 2007). Findings from systematic reviews led the World Health Organization (WHO) to introduce guidelines to incorporate calcium supplementation into existing antenatal care (ANC) services alongside IFA in countries with low habitual calcium intake (World Health Organization, 2013). WHO (2013) recommends pregnant women, starting at 20 weeks gestation through the end of pregnancy, take 1.5-2.0 g elemental calcium/daily, divided into three doses preferably taken with meals. Women consuming inadequate amounts of calcium (less than 1.0 g/day) are unlikely to exceed the WHO (2013) suggested upper limit of 3.0 g.

In many low-income countries antenatal micronutrient supplementation programs face challenges with delivery, uptake, and adherence (Stoltzfus, 2011). Effective BCIs and health system strengthening are needed to improve supplementation programs (Sanghvi et al., 2010). The addition of calcium supplementation to ANC services could intensify the health system challenges, and

adherence is expected to be especially difficult because WHO recommends taking three calcium pills in addition to IFA (Baxter et al., 2014, Hofmeyr et al., 2014, Omotayo et al., 2016).

Lessons learned from IFA supplementation

Lessons from decades of IFA supplementation programs can be used to identify potential barriers and facilitators to calcium supplementation programs (Martin et al., 2016). Low rates of IFA coverage are the result of health system, health facility, community, household, and individual factors. Antenatal micronutrient supplementation programs require the following components: a primary health care system that can maintain a consistent supply of supplements and provide supplements to all facilities; facility-based staff who provide adequate amounts of supplements to all women, high-quality counseling on health benefits, a clear description of the regimen, and information on the management of side-effects; and women who attend ANC early in pregnancy and are willing and motivated to initiate and adhere to supplements (Yip, 1996, Yip, 2002). It is common for IFA programs to experience challenges with each of these (Sanghvi et al., 2010). A multipronged approach will be required to successfully integrate calcium into antenatal IFA supplementation programs.

Despite the challenges that many IFA supplementation programs have faced, targeted BCIs have been used effectively to create awareness, provide relevant and easy-to-understand information, and motivate behavior change that have improved IFA adherence in low-resource settings (Sanghvi et al., 2010). BCIs that promote

adherence need to be identified and included as part of a comprehensive approach to implement calcium and IFA supplementation at scale.

Social support

Social support is positively associated with medication adherence (DiMatteo, 2004) and influences antenatal micronutrient supplement uptake and adherence (Galloway et al., 2002, Tessema et al., 2009, Nagata et al., 2012).

Definition and categories

Social support is the receipt or perception of the availability of resources from and interactions with others that may influence a person's ability to cope with a problem or practice a behavior (Tay et al., 2013, Wills and Fegan, 2001). Using this definition, social support can include both enacted and perceived support. Enacted support is when one person receives resources or benefits from another person, and perceived support is the perception that these benefits and resources would be available if needed (Tay et al., 2013). This definition also acknowledges that social support is not always perceived as helpful or associated with positive health behaviors or outcomes (Tay et al., 2013), which is a growing concern (Hupcey, 1998, Tay et al., 2013).

Social support actions are often divided into distinct categories (Table 1). Three categories of social support are: emotional support, instrumental support, and informational support (Tay et al., 2013, Uchino, 2004). Emotional support is the

expression of love, understanding, trust, and caring. Instrumental support is the provision of practical or tangible support, aid, and services that can directly help someone in need. Informational support is the provision of information, suggestions, and advice that a person can use to address challenges (Wills and Fegan, 2001, Heaney and Israel, 2008).

Table 1. Social support categories¹

Type of support	Definition	Example
Emotional	Expression of love, understanding, empathy, trust, encouragement, caring, concern, acceptance, comfort, and reassurance	Someone who makes you feel better by listening to your problems
Instrumental	Provision of tangible support (e.g. money or goods) and services (transportation, child care)/material aid that can directly help someone in need	Someone who could give you a personal financial loan
Informational	Provision of information, suggestions, advice, and guidance	Someone who can give you trusted advice or guidance

¹Adapted from Heaney and Israel, 2008; Simoni et al., 2011; Willis and Fegan, 2001; Uchino, 2004

Measures of social support

There are two broad categories of social support measures: structural and functional. Structural measures describe the existence, interconnection, and contacts of social relationships (e.g. marital status) and social networks (Uchino, 2004, Uchino, 2009, Saracino et al., 2015). Functional measures describe the actual function served by social network members, such as the provision of advice, caring, or practical help. Functional measures are then further categorized as measuring perceived support or

received support (Uchino, 2004, Saracino et al., 2015, Barrera, 1986). The perceived adequacy of or satisfaction with support, either available or received, has also been measured (Barrera, 1986). In general, functional measures of perceived social support have been stronger predictors of health behavior and health outcomes than functional measures of support received or structural measures of social support (Uchino, 2004, Saracino et al., 2015, Sarason and Sarason, 2009).

General and adherence-specific social support

Although social support tends to be positively associated with health behaviors and outcomes, this positive association is not consistent across studies (DiMatteo, 2004, Tay et al., 2013). These differences could be the result of how social support is measured. Most studies that have explored social support and health outcomes utilized measures of general social support (Tay et al., 2013). General social support measures are not specific to a health outcome, whereas specific social support measures focus on support that is directly related to a health behavior or outcome (Tay et al., 2013, Lehavot et al., 2011).

Studies that measure behavior-specific social support have found stronger positive associations with health outcomes when compared to general social support measures (Lehavot et al., 2011, Tay et al., 2013, Sallis et al., 1987). This could be because high levels of general social support are not necessarily congruent with a specific health behavior (Tay et al., 2013). For example, if a woman's family provides high levels of social support, but her family believes micronutrient supplements are dangerous during pregnancy, it is unlikely that this support will translate into high

levels of adherence. In contrast, a woman may adhere better if she has a family member encouraging and reminding her to take her supplements. Tay (2013) and Wills and Shinar (2000) recommend measuring social support as it relates to facilitating a specific health behavior.

Social support and adherence

There is increasing recognition that adherence, “the extent to which a person’s behavior corresponds with agreed recommendations from a health care provider” (World Health Organization, 2003), is a dynamic process that is influenced by individuals’ social networks (Simoni et al., 2008). Social support is positively associated with medication adherence. A meta-analysis of social support and medication adherence found a strong positive correlation between practical social support and adherence, as well as emotional social support and adherence (DiMatteo, 2004). Studies that did not differentiate the dimensions of social support found a statistically significant difference in adherence between low and high levels of social support. The relationship between adherence and functional support was stronger than the relationship between adherence and structural social support. (DiMatteo, 2004).

Several mechanisms are proposed for how social support may directly and indirectly improve adherence. Social support may act indirectly by improving self-efficacy, intrinsic motivation, personal control, confidence, self-esteem, mood, or cognitive functioning, as well as by reducing emotional conflict, distress, and depression. In addition, social support can directly influence adherence if the support provided is practical (e.g. reminders) (DiMatteo, 2004).

Social support interventions

Given the evidence of a positive association between social support and adherence, research is warranted to design and evaluate social support interventions to improve adherence (DiMatteo, 2004). Social support interventions that mobilize the strength of social networks have been widely used to improve mental and physical health (Uchino, 2004, Wills and Shinar, 2000). Interventions that build on existing social resources are thought to be more effective than those that rely on short-term, constructed groups (Berkman, 1995, Hogan et al., 2002, Scheurer et al., 2012), because existing networks are better able to support long-term behaviors (Berkman, 1995). Designing interventions that engage family or friends in the practical aspects of pill taking may be an effective approach for improving adherence (Berkman, 1995, Hogan et al., 2002, Scheurer et al., 2012, Willardson et al., 2013).

“Adherence partners” are family members or friends who pregnant women ask to provide pill-taking reminders, help overcome adherence barriers, encourage pill taking and ANC attendance, and offer additional support (Martin et al., 2016).

Adherence partners are a potential strategy to leverage social support that is already available within a social network. Also called treatment partners, supporters, buddies, or keepers, adherence partners formalize and expand existing supportive relationships that can promote adherence success (Andreson et al., 2013, Idoko et al., 2007, Taiwo et al., 2010, Nachege et al., 2006, O’Laughlin et al., 2012, Remien et al., 2005, Unge et al., 2010, Willardson et al., 2013). Unlike other behavior change interventions that require additional human and material resources, adherence partners build on support

that is already available. Adherence partners not only have the potential to improve maternal health and nutrition, but also strengthen family relationships and wellbeing.

The increased complexity associated with the introduction of calcium supplementation to ANC warrants the development, implementation, and evaluation of interventions to improve adherence. Adherence partners are a BCI that has the potential to increase support for supplementation adherence during pregnancy. Implementation research can be used to assess the acceptability, appropriateness, adoption, and feasibility of adherence partners.

Implementation research

Peters et al. (2014) define implementation research as “the scientific inquiry into questions concerning implementation—the act of carrying an intention into effect, which in health research can be policies, programs, or individual practices (collectively called interventions).” Implementation research is conducted in real-world settings and investigates the factors that affect implementation, the implementation processes, and implementation results (Peters et al., 2014).

Implementation outcome variables are used to evaluate implementation success, and are defined as “the effects of deliberate and purposive actions to implement new treatments, practices, and services” (Proctor et al., 2011). These outcomes are acceptability, adoption, appropriateness, feasibility, fidelity, implementation cost, penetration, and sustainability (Proctor et al., 2011). The first

five outcome variables, as defined by Proctor et al. (2011), are most relevant to the early stages of implementation.

- **Acceptability:** The perception that a practice, service, or treatment is agreeable or satisfactory, and considers complexity, content, and comfort.
- **Adoption:** The initial decision to try an intervention; also referred to as uptake.
- **Appropriateness:** The perception that an intervention or practice is relevant or compatible for a given setting, client, or provider; or the perception that an intervention can address an issue.
- **Feasibility:** How well a new intervention can be used or carried out successfully within a given setting.
- **Fidelity:** The degree to which an intervention is implemented as intended by the program developers.

Implementation research outcome variables can be used to examine how well a program or intervention was implemented and to understand how this contributes to health behaviors or outcomes (Peters et al., 2014). In the case of the novel use of adherence partners to support antenatal micronutrient supplements, implementation outcome variables need to be assessed in addition to adherence.

Study context

The Micronutrient Initiative-Cornell University Calcium (MICA) project conducted a program of research in Ethiopia and Kenya titled, “Integrating Strategies

for the Prevention of Preeclampsia and Anemia into Community-based Programs in Kenya and Ethiopia.” This research explored factors that influence the design, implementation, adoption, and effectiveness of calcium supplementation in the context of ANC and IFA supplementation. Ethiopia and Kenya were selected because both have high rates of maternal mortality and low habitual calcium intake, and Micronutrient Initiative had ongoing community-based maternal health programs in both countries. The MICA project took place in Oromia Region, Ethiopia and Kakamega County, Kenya and had three phases:

- In Phase 1, we conducted formative research with pregnant and postpartum women and community- and facility-based health workers to understand knowledge, attitudes, practices, and social support related to ANC services and IFA supplementation. In Kenya, this formative research took place from November to December 2012 (Martin et al., 2016) and in Ethiopia in June 2013 and April 2014.
- In Phase 2, we conducted household trials using trials of improved practices (TIPs) (Dickin et al., 1997) to examine the acceptability of and adherence to different calcium regimens and types of tablets among pregnant women. We collected data in Kenya from February to May 2014 and in Ethiopia from December 2014 to February 2015.
- In Phase 3, a cluster-randomized trial tested the feasibility of integrating calcium supplements into ANC services in western Kenya from October 2014 to June 2015 (Omotayo et al., 2015).

This dissertation explores the influence of general and adherence-specific social support on antenatal micronutrient supplement adherence, and the acceptability, feasibility, and impact of adherence partners through phases 2 and 3 of the MICA project in settings in Ethiopia and Kenya.

In Ethiopia, the study was conducted in rural, isolated areas of Oromia Region, where most people are Oromo, the largest ethnic group in Ethiopia, speak Afan Oromo, a Cushitic language, and practice Christianity, Islam, or Waaqeffannaa, an indigenous Oromo religion (Hussein, 2004). Agricultural farming and livestock production are the main livelihood strategies. Women's experiences in this patrilineal, patrilocal context are characterized by gender inequality and limited decision making power (Central Statistical Agency and ICF International, 2012; Ogota et al., 2009), however, pregnancy and the post-partum periods are times when women are traditionally well-supported (Hussein, 2004). Almost half of women in Oromia Region have no formal education (49%), only 4% completed primary education, and 60% cannot read (Central Statistical Agency and ICF International, 2012).

In Kenya, the study took place in Kakamega County in western Kenya where the predominant ethnic group is Luhya (also called Abaluyia or Luyia), which is composed of 17 ethnic communities speaking Bantu dialects; some of which are mutually intelligible. They share similarities with regard to clans and kinship, religious beliefs, patriarchy, patrilocal residence, and gender roles. In rural areas, families typically live together on compounds with parents and their adult sons' families (Cattell, 2004). Although women have limited autonomy (Whyte and Kariuki, 1991; Kenya National Bureau of Statistics and ICF Macro, 2014), they do have a

considerable amount of influence, particularly as they age (Cattell, 2004) and over daily household decision-making (Kenya National Bureau of Statistics and ICF Macro, 2014). Over half of women in Western Province have completed at least primary school or higher and only 4% of women have no formal education (Kenya National Bureau of Statistics and ICF Macro, 2014).

Overall research objectives

Although findings from quantitative and qualitative analyses suggest that family and other members of a woman's social network influence antenatal micronutrient supplement uptake and adherence (Tessema et al., 2009, Ghanekar et al., 2002, Jasti et al., 2005, Lacerte et al., 2011, Nagata et al., 2012, Nisar et al., 2014, Taye et al., 2015 Willardson et al., 2013), a review of the literature did not reveal any studies that explicitly measured general social support or adherence-specific social support and antenatal micronutrient supplement adherence in any settings. In addition, an understanding of the role of social support in antenatal micronutrient supplement adherence is lacking. As a result of challenges at the health system and health facility levels, strategies to improve adherence to antenatal micronutrient supplements typically focus on addressing these issues. However, household-level strategies to support adherence are also needed. This research sought to address these gaps as described in the following chapters:

Chapter 2: Specific research objectives

- To examine the appropriateness of general and adherence-specific social support assessment scales and explore the nutrition- and health-related support women expect during pregnancy through cognitive interviews with pregnant women and mothers in Oromia Region, Ethiopia and Kakamega County, Kenya

Chapter 3: Specific research objectives

- To assess the acceptability of adherence partners to support adherence to calcium and IFA supplements among pregnant women during household trials in both settings in Ethiopia and Kenya

Chapter 4: Specific research objectives

- To examine associations between having an adherence partner and higher adherence-specific social support and adherence to calcium and IFA supplements among pregnant women who participated in the MICA trial in western Kenya
- To elucidate the construct of adherence-specific social support and determine if it acts differently than general social support

Together these chapters describe the relationships between general and adherence-specific social support and adherence to prenatal calcium and IFA supplements and the acceptability, feasibility, and impact of adherence partners to improve adherence to prenatal micronutrient supplements.

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CHAPTER 2

“I CAN’T ANSWER WHAT YOU’RE ASKING ME. LET ME GO, PLEASE.” LESSONS LEARNED FROM COGNITIVE INTERVIEWS TO ASSESS SOCIAL SUPPORT MEASURES IN ETHIOPIA AND KENYA¹

Abstract

Cognitive interviewing is a method to develop culturally appropriate survey questions and scale items. We conducted two rounds of cognitive interviews with 24 pregnant women in Ethiopia and Kenya to assess the appropriateness, acceptability, and comprehension of general and micronutrient supplement adherence specific social support scales. We stopped the first round of cognitive interviews after receiving negative feedback from interviewers and participants about their distressing and uncomfortable experiences with cognitive probes and challenges related to cultural perspectives on social support. Through an iterative process, we made substantial changes to the cognitive interview guides and items from both social support scales. In the second round, the revised cognitive interviewing process substantially improved interviewer and participant experiences and increased comprehension and appropriateness of both social support scales. This study confirms the importance of cultural adaptation of the cognitive interviewing process, as well as social support scales.

¹ This chapter was submitted to *Field Methods*, underwent peer review, and was revised and re-submitted.

Introduction

Pretesting survey instruments prior to administration can reduce measurement error. For a study of prenatal micronutrient supplementation adherence in Ethiopia and Kenya, we prepared two social support scales to assess the relationship between social support and adherence, and selected cognitive interviewing as the pretesting method.

Cognitive interviewing examines the cultural appropriateness, relevance, and acceptability of survey questions, scale items, and response options (Willis and Miller, 2011), enhancing content validity (Brod, Tesler and Christensen, 2009). Using verbal probes and think-aloud techniques, this approach studies participants' cognitive processes when answering questions by exploring comprehension, recall, and decisions, to identify problems with questions (Willis, 2005). Probes can be pre-scripted or emergent, concurrent (asked immediately after each item) or retrospective (asked after administering all items) (Willis, 2005, Willis, 2015). Cognitive interviewing explores how social, cultural, demographic, and psychological factors influence response processes, making it appropriate for cross-cultural research (Willis and Miller, 2011).

Cross-cultural cognitive interviewing (CCCI) is increasingly used to assess survey question appropriateness in multiethnic and multilingual contexts (Willis, 2015), but the process may require adaptation (Willis, 2015, Goerman and Casper, 2010). Participants' responses are influenced by culturally normative communication styles, which may be inconsistent with direct cognitive interviewing probes (Pan et al., 2010). Think-aloud, paraphrasing, hypothetical probes, and over probing can be

problematic in CCCI and in general (Park, Sha and Pan, 2014, Willis, 2015, Prüfer and Rexroth, 2003). Non-English speaking CCCI participants reported multiple challenges with the process (Goerman and Casper, 2010), misunderstood the purpose of CCCI, and appeared angry or humiliated during interviews (Park et al., 2014). Questions remain about the appropriateness of pre-scripted versus emergent codes, and concurrent versus retrospective probes in CCCI (Willis, 2015). Despite challenges, with adaptation CCCI has been used effectively among diverse linguistic and cultural groups (Willis, 2015, Park et al., 2014). However, reports from sub-Saharan Africa are limited.

Measuring social support

Social support is the receipt or availability of resources from others that may influence a person's ability to manage problems or practice behaviors (Tay et al., 2013). Social support influences prenatal micronutrient supplement adherence (Nagata, Gatti and Barg, 2012), a life-saving intervention for mothers and children in low-income countries (Bhutta et al., 2013). Social support measures are diverse and findings are inconsistent (Tay et al., 2013), possibly due to methodological issues: social support scales may not measure the intended construct, not be contextually adapted, or not assess support specific to health outcomes (Wills and Shinar, 2000).

Social support scales developed for one cultural context require adaptation and assessment prior to use in another (Johnson, 2006). Moreover, calls have been increasing to measure social support *specific* to health behaviors (Tay et al., 2013). Most studies measure general social support (e.g., companionship, advice, or

assistance). Studies measuring behavior-specific social support report stronger positive associations with health outcomes compared to general social support, suggesting high levels of general social support are not necessarily supportive of specific health behaviors (Tay et al., 2013). For example, if a woman has a supportive family, but her family believes prenatal micronutrient supplements are harmful, this support is unlikely to improve adherence.

Our objective was to assess the appropriateness of general and adherence-specific social support scales among women in two cultural settings in Ethiopia and Kenya. Here, we present our findings, compared with hypothesized effective CCCI practices (Willis, 2015), and describe how initial participant responses led to adaptations to the interviewing process and scale items, improving content validity.

Study settings

In Oromia Region, Ethiopia, we conducted the study in two predominantly rural zones where nearly all residents are Oromo. We held initial cognitive interviews in Meta Robi and Ada'a Berga districts in West Shewa Zone, and revised cognitive interviews in Kersa district, Jimma Zone. The Oromo, the largest ethnic group in Ethiopia, practice Christianity, Islam, or Waaqeffannaa, an indigenous religion (Hussein, 2004). Women's experiences within this patrilineal, patrilocal context are often characterized by inequitable gender norms and limited decision-making power (Central Statistical Agency and ICF International, 2012; Ogato et al., 2009); however, women are traditionally well supported during the perinatal period (Hussein, 2004). Almost half of women in Oromia Region have no formal education (49%), only 4%

complete primary education, and 60% cannot read (Central Statistical Agency and ICF International, 2012).

In Kenya, the study took place in Kakamega County, where the Luhya, composed of 17 ethnic communities, are the predominant ethnic group. They share similarities with regard to patriarchy, patrilocal residence, religious beliefs, and gender roles (Cattell, 2004). Although women have limited autonomy, they have considerable influence over daily household decision-making (Kenya National Bureau of Statistics and ICF International, 2015, Whyte and Kariuki, 1991). More than half of women in Kakamega County complete primary school or higher and only 3% have no formal education (Kenya National Bureau of Statistics and ICF Macro, 2014).

Methods

Cognitive interview guides

Initially, we created a structured interview guide for each social support scale (Appendices 1 and 2). Study team members translated interview guides and scales from English into their native language, Afan Oromo (Ethiopia) or Kiswahili (Kenya), finalized translations collaboratively, and back-translated them into English. The guides included think-aloud and pre-scripted, concurrent probes. For each item, interviewers were instructed to read the item aloud, ask participants to think-aloud as they answer, and ask a series of probes.

Social support scales

General social support scale

We selected the “Functional Social Support Scale” (Antelman et al., 2001) as our measure of general social support. This ten-item scale measures emotional and instrumental social support, and has been used in sub-Saharan Africa (Antelman et al., 2001; Antelman et al., 2007; Tsai et al., 2012). Prior to administration, we adapted item phrasing to use the second person since questions were interviewer administered, similar to another social support scale used in sub-Saharan Africa (Stewart et al., 2014). Based on a general social support scale used with pregnant women in Zimbabwe (Matare et al., 2015), we added an item asking if family members appreciate the tasks participants do for their family. We deleted an item about talking with someone about work problems, which we thought was captured by an item about talking with a trusted person about personal problems, and deleted an item about help with transportation that seemed redundant.

Adherence-specific social support scale

We created an adherence-specific social support scale to capture functional social support specific to pregnancy and micronutrient supplement adherence. We prepared an item pool (Clark and Watson, 1995) based on social support and behavior change theory (Amico et al., 2005), existing behavior-specific social support scales (Lehavot et al., 2011; Sallis et al., 1987; Warner et al., 2013), and findings from formative research in Ethiopia, where women reported high levels of support from husbands and family members, and Kenya, where husbands were perceived as

generally unsupportive (Martin et al., 2016). Study team members reviewed the items and decided which to include.

Items in both scales used phrases starting with “How often do you...” and provided response options from the Functional Social Support Scale: “As much as I would like,” “Less than I would like,” and “Much less than I would like.” We omitted “Never” as a response option since it cannot measure satisfaction with the amount of support received.

Study sample

In both settings, we recruited women 15 years or older from government health facilities; and in Ethiopia, health extension workers also recruited a few pregnant women from their homes. We used purposive sampling to capture diverse participant circumstances, including age, education level, parity, and in Kenya, marital status. For the general social support scale, inclusion criteria included women who were pregnant or had children younger than 2 years. For the adherence-specific social support scale, inclusion criteria also included pregnant women who received micronutrient supplements during their current pregnancy.

Participants’ socio-demographic characteristics are summarized in Table 1. We intended to recruit 20 participants, ten in each country, five for each scale. Based on interviewers and participants’ negative experiences we stopped recruitment after two initial interviews with each scale in each country (Figure 1). We substantially revised the interview guides and social support scales, and then resumed cognitive interviewing.

Table 1. Initial and revised cognitive interview participants' socio-demographic characteristics

	Initial cognitive interviews			Revised cognitive interviews			
	Ethiopia		Kenya	Ethiopia		Kenya	
	General	Specific	Both	General	Specific	General	Specific
Social support scale	(n=2)	(n=2)	(n=2)	(n=5)	(n=5)	(n=4)	(n=4)
Age (yrs), mean (range)	31.5 (28-35)	24.5 (21-28)	24.5 (23-26)	28.4 (19-35)	25 (20-35)	21 (17-26)	22.3 (18-26)
Married	2	2	2	5	5	3	3
Primigravida	0	0	0	1	2	2	1
Ever attended school	missing	1	2	1	4	4	4

Data collection and analysis

In Ethiopia and Kenya, bilingual, university-educated (or higher), experienced interviewers conducted the interviews. Interviewers participated in a cognitive interviewing orientation including practice during interview guide pretesting. Interviews lasted 30-75 minutes. All interviews were recorded, transcribed verbatim, and translated into English. The study team discussed scale items and cognitive interviewing during peer debriefings.

Data included interview transcripts and field notes. We created matrices to summarize participant's responses, item comprehension across participants, and interviewers' perceptions of each item (Willis 2005, Willis 2015). For the narrative data, we used Atlas.ti software (Scientific Software Development GmbH, Berlin, Germany) to code difficult items, participants' perceptions of social support, and challenges with cognitive interviewing. Using the constant comparative method, we

identified patterns in comprehension and responses (Ridolfo and Schoua-Glusberg 2011), and held frequent peer debriefings.

The Cornell University Institutional Review Board, Jimma University's Ethics Review Committee, Oromia Regional Health Bureau, and Kenyatta National Hospital/University of Nairobi Ethics and Research Review Committee approved this study. Interviewers obtained written informed consent before each interview.

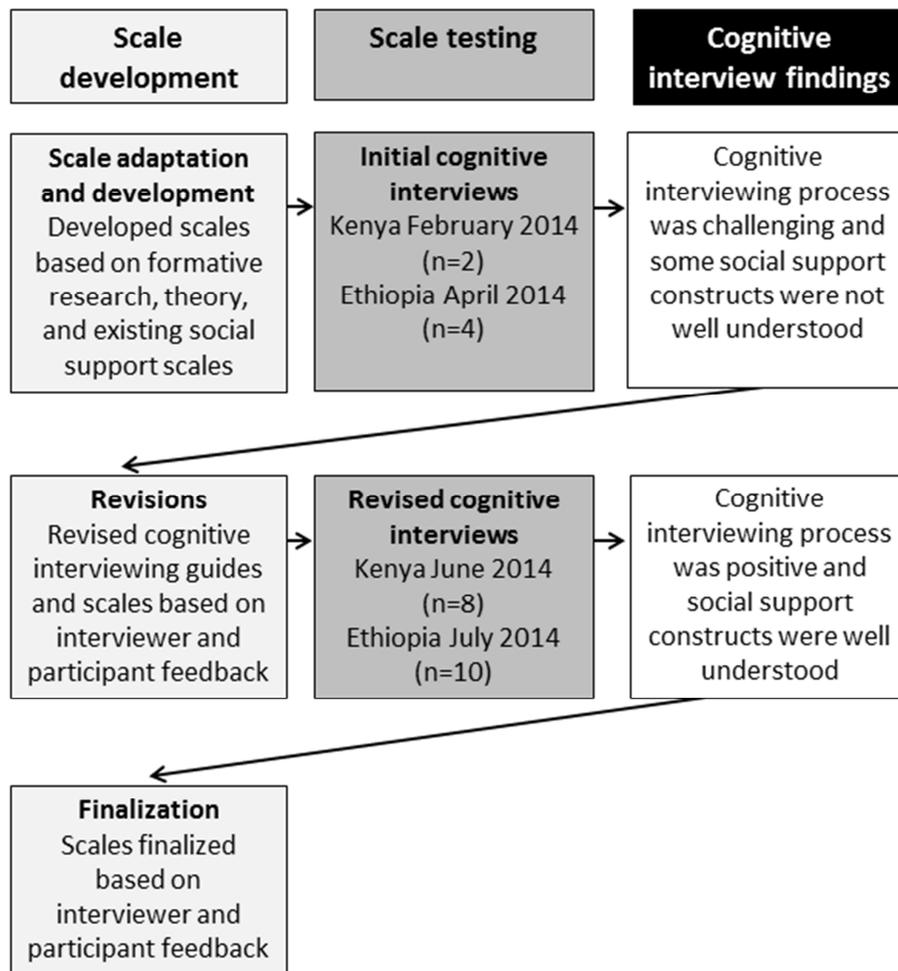


Figure. 1. Timeline for social support scale development, cognitive interviewing, and revisions

Results

Initial cognitive interviews

Cognitive interviewing challenges

Interviewers reported challenges with the initial cognitive interviewing process, social support scale items, and response options. Interviewers asked to discontinue the interviews, which were uncomfortable to administer and distressing for participants. Participants were unaccustomed to answering cognitive interviewing probes. Although participants could respond to social support scale items, they could not explain their responses. When asked to think-aloud, participants typically said, “I wasn’t thinking anything” or “I don’t know.” To assess appropriateness, we used hypothetical probes to ask how items could be clearer for other women. In Ethiopia, participants said they did not know what other women think, and in Kenya, participants typically did not answer. When asked to paraphrase, participants often remained silent. For a few items, participants tried to paraphrase, but for most they did not; a few appeared confused and resistant. Despite initial willingness to participate, most participants appeared frustrated and wanted to stop.

My worry is the reason you asked me such question. Nobody has asked me such a question before...I do not have time to think about these questions.

– 35-year-old multigravida, Ethiopia

Participants in both countries often did not answer probes. As women in Ethiopia struggled to answer, their responses suggested the process was making them feel disempowered. They blamed themselves for not being able to answer, referring to lack of education and low literacy, rather than saying the probes were unclear or uncomfortable.

I don't understand...I don't know how to answer...I am illiterate... I can't answer what you're asking me. Let me go, please.

– 28-year-old multigravida, Ethiopia

Scale and response option challenges

Participants answered most general social support scale items without clarification (Appendix 5). However, women with lower social support appeared to have more difficulty. Many items from both scales used “people” or “someone” to refer to sources of social support and often required clarification. One participant interpreted this to mean people other than her husband, contrary to our expectation that participants would consider husbands, family members, or wider networks.

Why do I need to talk about my personal problems? I should think it over myself. I will share the problem with my husband. Talking with others does not benefit me.

– 35-year-old multigravida, Ethiopia

General social support scale items requiring clarification included items about people showing concern, and receiving money in an emergency, help when sick, and love and affection.

Love can only be expressed by words, it cannot be measured. When you asked me this question I was confused... I don't have a machine to measure love... Your questions are very difficult.

– 35-year-old multigravida, Ethiopia

Adherence-specific social support scale items were difficult for participant to answer and interviewers reported several items were redundant (Appendix 6). For an item about someone listening to their feelings about supplements, participants with less support found the question difficult, whereas well-supported participants answered immediately.

When my friends come to visit and I tell them the tablets are not good, they always tell me I have to persevere because they help.

– 26-year-old multigravida, Kenya

Some participants did not expect adherence support.

I was taking the pill because I believed that I can take them as prescribed and in their benefits. What is the need for others to help me?!

– 21-year-old multigravida, Ethiopia

Most participants struggled to differentiate between the responses “Less than I would like” or “Much less than I would like”.

There isn't a big difference between less and much less...The difference is small. There is no difference.

– 26-year-old primigravida, Kenya

Although not offered as options, women often responded with “Never” and “More than I would like.” Through probing, interviewers determined participants used “More than I would like” to mean considerable support, perhaps exceeding expectations, not that it was excessive.

Revisions after initial interviews

We clarified interview guide instructions to explain that questions may be unclear because researchers in the United States wrote them. Although similar instructions were used initially, this was more explicit. To avoid over probing, concurrent probes asked after each item were changed to retrospective probes after the complete scales (Appendices 3 and 4). For the general social support scale, the complete revised scale was administered, followed by questions about scale items and

response options. For the adherence-specific social support scale, we first asked open-ended questions about adherence-specific support participants received and expected to avoid priming responses. We then administered the complete revised scale, followed by retrospective probes. We deleted all requests to paraphrase, made think-aloud prompts more specific, and revised hypothetical probes to ask if scales could be answered by others. These revisions resulted in considerably shorter interview guides.

For both scales, we changed the item structure from “How often...” to “Do you...” This replaced ordinally-rated response options with dichotomous (i.e., yes/no). With this structure, a “Never” response was classified as “No.” We added a follow-up dichotomous question to assess satisfaction with the amount of support received, which identified women who did not expect support. We included a probe about “More than I would like” to confirm participants meant considerable support. Additional minor changes to the general social support scale included: adding the previously-omitted transportation item because participants mentioned transportation; revising items about love and affection and receiving help when sick; and adding a probe about participants’ expectations of family appreciation. We deleted several repetitive questions from the adherence-specific social support scale (Supplementary Materials). We included probes to (1) assess comprehension and appropriateness of previously problematic scale items, and (2) determine if scales reflected the support women expected.

Revised cognitive interviews

Interviewers found revised cognitive interview guides easier to administer, retrospective probes less burdensome, and dichotomous response options acceptable. All participants understood and responded to all general social support items and reported all questions were appropriate for women in their community. All participants expected appreciation from their families.

Unless we are thankful to each other how can we live together?...We have to understand the work that each of us performs is invaluable. The work I do at home deserves praise.

– 35-year-old multigravida, Ethiopia

When asked what behaviors supported adherence, most women spontaneously mentioned reminders, advice, and encouragement.

When I get advice from people, I feel supported. When my husband tells me to go to the health center and when he encourages me to keep taking the pills, I feel cared about.

– 20-year-old primigravida, Ethiopia

Participants also listed having someone bring pills or assist with household chores, and confirmed expecting others to bring, buy, or make food. All participants were able

to answer all items on the adherence-specific social support scale and all reported that questions were easy and other women could answer them.

Discussion

This study confirms the importance of using an iterative process to culturally adapt cognitive interviewing and social support scales. Women in Ethiopia and Kenya struggled with traditional cognitive probes in the initial interviews, particularly paraphrasing, thinking-aloud, and hypothetical probes. This is similar to other CCCI studies reporting challenges with these types of probes (Willis, 2015) and specifically with think-aloud probes in Kenya (Edwards, Thomsen and Toroitich-Ruto 2005, Vreeman et al. 2014). Initial cognitive probes inadvertently created distress among participants and interviewers. Others have reported negative emotional reactions to CCCI (Park et al, 2014). Participants' limited education and teaching methods commonly used in public primary schools in Ethiopia and Kenya, which emphasize rote memorization and recitation (Karanja, 2010; Metto and Makewa, 2014; Pontefract and Hardman, 2005; Serbessa, 2006), help explain these challenges. Pasick et al. (2001) and Zeldenryk et al. (2013) reported participants with limited education did not understand cognitive probes and felt embarrassed. Education level and survey literacy are important considerations across cultural groups (Willis, 2015). Consistent with Willis (2005), participants could respond to survey items, but not the probes to evaluate them. Although some cognitive probes were ineffective initially, participants in both rounds could answer comprehension and evaluative probes.

Interviewers reported feeling extremely uncomfortable during initial interviews, describing the probing process as unpleasant and inappropriate. We improved the cognitive interviewing experience for interviewers and participants by abandoning highly structured interview guides for semi-structured guides, giving interviewers more flexibility to explore emerging issues (similar to Miller et al. 2011). Replacing concurrent probes after each scale item with retrospective probes at the end of the scale facilitated comprehension and streamlined interviews. These changes are consistent with recommended CCCI practices (Willis, 2015) and cognitive interviewing generally (Willis, 2005).

To contextually adapt social support scales, scale items should reflect the support participants expect (Williams, Barclay, and Schmied 2004). Others have reported challenges measuring social support and networks in Ethiopia (Butterfield, Kebede and Gessesse 2009, Olsen et al. 2013). In the revised cognitive interviews, we assessed the relevance of social support actions and documented the support participants expected. Women's aptitude to answer questions about social support appeared to be related to their perceived social support. Women with less support struggled to respond more than women with more support. This tentative finding suggests social support may be more difficult to measure (i.e. scales may be less valid) in groups with low social support. This could lead to biased estimates of social support and misleading conclusions about the relationship between social support and health.

Ordinally-rated response options were difficult for these participants to use, even when interviewers displayed stones or other objects to visually represent more and less. Adapting response options across cultural and linguistic groups can be

difficult (Harkness, Villar, and Edwards, 2010), including in East Africa (Ice et al. 2012, Nakigudde et al. 2009, Vreeman et al. 2014). Dichotomous response options in the revised scales were easier for participants.

This qualitative research with a relatively small sample may not be widely generalizable, particularly given calls for increased sample sizes in CCCI (Willis, 2015). Interviewers' limited cognitive interviewing experience may partially explain initial challenges and subsequent improvements during revised interviews (Willis, 2015). As findings are dependent on the ability of participants to articulate their thoughts, improvements could be due to the ability of different participants and not procedural changes. However, the problems we experienced are unlikely to be unique given the similarities among participants in two countries, and similarities with other CCCI research. Between the initial and revised interviews, multiple features of the cognitive interview guides were changed simultaneously (i.e., degree of scripting, probe placement, type of probe used), making it difficult to ascertain which specific changes were effective.

Conclusion

Survey questions, as well as the cognitive interviewing process, need to be adapted for cultural settings and participants' education levels and experience with the topic. Our findings confirmed challenges with initial CCCI in two cultural contexts in East Africa, which caused participants discomfort, lessening the usefulness of the data, and violating the ethical principle to "do no harm." Frequent team debriefings and

encouraging interviewers to share their experiences, in addition to those of participants, allowed these challenges to be identified and remedied. An iterative cognitive interviewing process resulted in appropriate items, reflecting participants' social support expectations, which enhanced scale comprehension and content validity. Although not frequently published, public health practitioners and evaluators report that cognitive interviewing and pretesting are frequently used for program evaluations in low-income countries (Pelto et al., 2015). Cognitive interviewing can assess participant burden, but the burden of cognitive interviewing also needs to be assessed and the process adapted accordingly. To examine the relationship between social support and health, social support scales must be culturally appropriate and reflect the support participants want. This can be achieved through a contextually-adapted approach to cognitive interviewing.

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co-authors participated in data interpretation and critically revised the manuscript.

CHAPTER 3
ADHERENCE PARTNERS ARE AN ACCEPTABLE BEHAVIOR CHANGE
STRATEGY TO SUPPORT CALCIUM AND IRON-FOLIC ACID
SUPPLEMENTATION AMONG PREGNANT WOMEN
IN ETHIOPIA AND KENYA¹

Abstract

Antenatal calcium and iron-folic acid (IFA) supplementation can reduce maternal mortality and morbidity. Yet, even when pregnant women have a stable supply of supplements, forgetting to take them is often a barrier to adherence. We assessed the acceptability of adherence partners to support calcium and IFA supplementation among pregnant women in Kenya and Ethiopia. Adherence partners are a behavior-change strategy to improve adherence, by encouraging pregnant women to select a partner (e.g. spouse, relative) to remind them to take their supplements. We conducted trials of improved practices, a mixed-methods formative research method that follows participants over time as they try a new behavior. We provided pregnant women in Ethiopia (n=50) and Kenya (n=35) with calcium and IFA supplements and counseling, and suggested selecting an adherence partner. For each participant, we conducted semi-structured interviews about acceptability and adherence during four interviews over six weeks. We analyzed interview transcripts thematically and tallied numerical data. In Kenya, 28 of 35 women agreed to try an adherence partner; almost

¹ This chapter has been accepted for publication in *Maternal & Child Nutrition* and is currently in press.

all selected their husbands. In Ethiopia, 42 of 50 women agreed to try an adherence partner; half asked their husbands, others asked children or relatives. Most women who did not select adherence partners reported not needing help or not having anyone to ask. Participants reported adherence partners reminded and encouraged them, brought supplements, provided food, and helped address side-effects. Almost all women with adherence partners would recommend this strategy to others. Adherence partners are an acceptable, low-cost strategy with the potential to support antenatal micronutrient supplementation adherence.

Introduction

Maternal and child mortality remain unacceptably high in many countries. Antenatal iron-folic acid (IFA) and calcium supplementation are two interventions that could substantially reduce the risk of iron-deficiency anemia and preeclampsia, resulting in lower maternal and child morbidity and mortality (Imdad et al., 2011, Bhutta et al., 2013, Hofmeyr et al., 2010, Peña-Rosas et al., 2012). However, there are many challenges to successfully implementing antenatal micronutrient supplementation programs at the policy, health facility, community, and individual levels (Yip, 2002, Stoltzfus, 2011, Galloway et al., 2002), which require health system strengthening and effective social and behavior change interventions (Sanghvi et al., 2010). In countries with low habitual calcium intake, the recommended daily regimen is three calcium supplements and one IFA supplement throughout pregnancy (World Health Organization, 2013), which could exacerbate existing supply, distribution, and delivery challenges (Omotayo et al., 2016) and make adherence especially difficult (Hofmeyr et al., 2014). This complex regimen warrants the development and evaluation of interventions to support adherence (Hofmeyr et al., 2014, Baxter et al., 2014).

Lessons learned from IFA supplementation programs can provide valuable insight into the design and delivery of calcium supplementation interventions (Martin et al., 2016). Supplement supply and distribution challenges substantially contribute to low levels of IFA uptake and adherence in many low-resource settings (Sanghvi et al., 2010, Galloway et al., 2002). Yet, even when women have access to supplements, they

often experience inadequate counseling (Galloway et al., 2002) and more proximal barriers to adherence such as family disapproval (Aguayo et al., 2005, Taye et al., 2015) and forgetting (Gebremedhin et al., 2014, Kulkarni et al., 2010, Zavaleta et al., 2014, Seck and Jackson, 2008). Alternative strategies are needed to ensure that women and their families understand the importance of supplements and remembering to take them (Kulkarni et al., 2010).

In this chapter, we examine the role of adherence partners as a strategy to improve adherence to antenatal micronutrient supplementation. The objective of our research was to assess the acceptability of adherence partners to support adherence to calcium and IFA supplements among pregnant women in Kenya and Ethiopia. Antenatal micronutrient supplementation occurs within the context of care-seeking in pregnancy, which is often influenced by cultural and social constraints. An adherence partner is someone who is already part of a pregnant woman's social network who can address these constraints through support tailored to her context and individual needs. Social support influences micronutrient supplementation uptake and adherence (Taye et al., 2015, Seck and Jackson, 2008, Aguayo et al., 2005, Kulkarni et al., 2010, Nagata et al., 2012). In formative research in Kenya and Ethiopia, some pregnant women reported being reminded and encouraged by husbands and family members to take IFA supplements, while others wished for additional support (Martin et al., 2016). Adherence partners are a low-cost strategy that could leverage this support to increase adherence to antenatal micronutrient supplements. Partners, also called supporters or buddies, have been used to improve health behaviors such as medication adherence (Idoko et al., 2007, Remien et al., 2005, Taiwo et al., 2010, Unge et al., 2010) and

infant feeding (Andreson et al., 2013); peer “keepers” have also been suggested for antenatal micronutrient supplements (Willardson et al., 2013).

Methods

The larger research project

This study is part of a larger research project in Kenya and Ethiopia, which investigated the acceptability and feasibility of integrating calcium supplements into antenatal IFA supplementation programs (Omotayo et al., 2015). In both countries, we used trials of improved practices (TIPs) (Dickin et al., 1997) to compare the acceptability and feasibility of three different calcium and IFA supplement regimens, investigate the acceptability of two different types of calcium tablets (chewable vs. hard), and identify barriers and facilitators to calcium and IFA supplement uptake and adherence. Within the context of this TIPs research project on calcium and IFA supplementation in Kenya and Ethiopia, we explored the acceptability of adherence partners.

TIPs is a mixed-methods formative research method to assess the acceptability, appropriateness, and feasibility of new, recommended health behaviors by conducting a series of visits during which participants are counseled on and can choose to try a behavior (Dickin et al., 1997, The Manoff Group, 2005). Multiple visits allow researchers to explore participants’ previous related experience, and assess their willingness to try the new behavior, whether they actually tried the behavior, and if they continued to practice the behavior (Dickin et al., 1997).

Study setting

The Kenyan site was in Malava subcounty, Kakamega County, in rural western Kenya, where most residents are Luhya. In the 2014 Demographic and Health Survey, 96% of women in Kakamega County received ANC from a trained provider at least once during pregnancy and 47% delivered in a health facility. Although 61% of women in Western Kenya took any iron supplements during pregnancy, only 7% took them for the recommended 90 or more days (Kenya National Bureau of Statistics and ICF International, 2015). IFA supply and distribution barriers are common in Kenya (Maina-Gathigi et al., 2013). Formative research confirmed frequent IFA shortages and stockouts in Malava subcounty. In addition, many women and health workers reported women generally receive little support from their husbands during pregnancy, but some women reported husbands or female relatives reminded and encouraged them to take IFA (Martin et al., 2016).

The Ethiopian site included 10 communities in Ada'a Berga and Meta Robi districts, West Shewa zone, Oromia region, where most residents are Oromo. We selected small towns and rural communities with varying levels of accessibility by road. In the 2011 Demographic and Health Survey, 31% of women in Oromia received ANC from a skilled provider and 8% gave birth at a health facility. Only 12% of pregnant women took any iron supplements during pregnancy (Central Statistical Agency and ICF International, 2012). These communities were part of a recently completed antenatal IFA supplementation program that trained health workers to counsel women and provide supplements, and promoted adherence through community mobilization (Micronutrient Initiative, 2015). Our formative research

revealed that IFA was available at most health facilities, and women in these districts had high levels of social support during pregnancy, with several reporting that husbands and family members reminded them to take their IFA supplements.

Measures and data collection

We conducted TIPs in Kenya from February to May 2014 and in Ethiopia from December 2014 to February 2015. In both countries, the TIPs research comprised four visits to pregnant women's homes; approximately one visit every two weeks for six weeks. After interviewers provided participants with calcium and IFA supplements, counseling, and regimen calendars, they counseled participants on the potential benefits of asking someone they know (e.g. a spouse, other relative, friend) to support them to take calcium and IFA supplements throughout pregnancy. Although adherence partners is the term we use to describe this relationship, it was described to women as someone who can remind and encourage them to take their supplements. During the four interviews, participants were asked about previous social support received for IFA, if they were willing to try an adherence partner, if they actually tried an adherence partner, and if they continued to have an adherence partner (Figure 1). Because participants made different choices about adherence partners at each visit and followed different trajectories related to the use of adherence partners, the timing of these questions varied by participant.

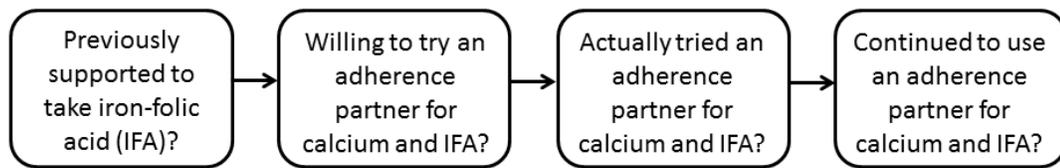


Figure 1. Key questions guiding adherence partner acceptability data collection and analysis

The study team developed structured interview guides for each TIPs visit, based on formative research (Martin et al., 2016), theoretical constructs (e.g. social support, self-efficacy, motivation), and the adherence and antenatal micronutrient supplementation literature. The interview guides included open-ended questions about adherence partners and social support, as well as closed-ended questions about their choices and perceived social support that could be tallied. To measure participants' perceived general social support, we administered a general social support scale at the first interview. We adapted the Functional Social Support Scale, which has been used in Eastern and Southern Africa (Antelman et al., 2001, Tsai et al., 2012), using cognitive interviews in Kenya and Ethiopia. We categorized participants' social support as low if their mean social support score reflected receiving less support than they would like. We translated, back-translated, pretested, and revised the interview guides in both countries before administration.

Participants

Women in both sites were purposively sampled to represent diversity in age, parity, ANC use, and educational level. Inclusion criteria were 15 years of age and older, inadequate calcium intake, and planning to remain in the study area for the next

six weeks. All women invited to participate in the study agreed. In Kenya, we recruited pregnant women (16-30 weeks gestation) from their homes within the catchment areas of six health facilities. In total, 38 pregnant women agreed to participate in the study and completed interview one; 35 participants completed interview two; 29 completed interview three; and 24 completed all four study visits. This attrition is due to 6 women giving birth during the study period, 4 moving out of the study area, and 4 withdrawing from the study. In Ethiopia, we recruited pregnant women (16-28 weeks gestation) from ANC clinics and health extension workers recruited women in their homes who were not attending ANC. Exclusion criteria in Ethiopia included women who were HIV-positive or had developmental disabilities. In total, 50 pregnant women participated in the first two interviews; 49 completed all four visits and one participant withdrew.

Data analysis

We tallied participants' adherence partner choices at each study visit (Dickin and Seim, 2013), and qualitatively analyzed translated interview transcripts. We created a matrix noting participant adherence partner choices and experiences as well as participants' perceived general social support levels based on their general social support scale score. We assessed adherence partner acceptability by documenting pregnant women's direct experience with the intervention over time (Proctor et al., 2011).

We analyzed interview transcripts thematically, using an inductive approach based on the principles of grounded theory and the constant comparative method

(Strauss and Corbin, 1990) using Atlas.ti qualitative analysis software (Scientific Software Development GmbH, Berlin, Germany, version 7). Starting with the Kenya data, study team members developed an initial code list after the independent reading and coding of one participant's complete set of transcripts from all four visits. A draft codebook was created to facilitate coding consistency (DeCuir-Gunby et al., 2011, MacQueen et al., 1998), which included the code name, definition, and inclusion and exclusion criteria (MacQueen et al., 1998). Two researchers (SLM, SEO) independently read and coded three participants' transcripts from all four TIPs visits. The two researchers merged the coded transcripts using Atlas.ti, which allowed codes and coded text from each interview transcript to be compared across researchers. The researchers then discussed emergent codes and any discrepancies, iteratively revising the codebook throughout the coding process. This approach continued with both researchers coding and comparing all transcripts, and meeting to discuss and revise the findings. Throughout coding, the two researchers noted common themes and key quotes and engaged in constant comparative analysis by examining similarities and differences across participants and between themes.

For the Ethiopia qualitative analysis, we followed a similar approach. A third researcher (GMC) joined the original two researchers to independently code interview transcripts for four participants using the existing codebook from Kenya and adding and revising codes as needed. The three interviewers merged and compared the coded transcripts in Atlas.ti. Once the three researchers agreed upon codes, two researchers (SEO, GMC) continued coding the remaining transcripts following the same process.

With the data from both countries, we used an inductive approach to identify emergent themes, summarizing across participants and comparing responses from different types of respondents (e.g. social support levels, adherence partner choices) and between countries. We met frequently for peer debriefings and shared findings across the study team. We deliberated about discrepancies until reaching consensus.

The Cornell University Institutional Review Board, Ethiopian Public Health Institute, and Kenyatta National Hospital/University of Nairobi Ethics and Research Review Committee provided ethical approval of this study. In both countries, interviewers obtained written informed consent from all participants.

Results

Participant characteristics are summarized in Table 1.

Previous experience with social support for IFA supplementation

In Kenya, most participants (28/35) had not taken IFA prior to study enrollment. Among those who had taken IFA before, about half reported being supported or reminded by husbands or female relatives. In contrast, most participants in Ethiopia had taken IFA prior to study enrollment (38/50). Among those who had taken IFA before, almost all reported being encouraged to take IFA and about half reported being reminded by husbands, children, other family members, or friends.

Table 1. Participant characteristics at the first adherence partner interview

Background characteristics	Kenya (n=35)	Ethiopia (n=50)
Age (years), mean (range)	24.0 (16-37)	26.2 (18-38)
Ethnicity, n (%)		
Luhya	33 (94)	-
Luo	2 (6)	-
Oromo	-	50 (100)
Primigravid, n (%)	5 (14)	15 (30)
Gravidity, mean (range)	2.6 (1-8)	3.0 (1-11)
Education level, n (%)		
None	0	22 (44)
Did not complete primary	12 (34)	21 (42)
Completed primary	15 (43)	3 (6)
Completed secondary or higher	8 (23)	4 (8)
ANC use (at least 1 visit), n (%)	18 (51)	41 (82)
Marital status, n (%)		
Married/living together	29 (83)	47 (94)
Separated/divorced/widowed	0	3 (6)
Never married	6 (17)	0
Low perceived social support, n (%)	15 (43)	13 (26)

My husband usually reminded me every time. He said, “Take that medicine [IFA], it will help you.”

– 24-year-old primigravida, Kenya

A few women recognized the importance of having support based on their previous IFA experience, while a few others reported their previous IFA experience increased their confidence in their ability to adhere to the calcium and IFA regimen.

I can remember by myself. I now have a lot of experience taking iron. That is why I say I don't need help from others.

– 22-year-old multigravida, Ethiopia

Willingness to try an adherence partner

Most women in Kenya (28/35) and in Ethiopia (42/50) were willing to try an adherence partner.

I will ask my husband because this is our common concern; my health problem will have an effect on him. This baby belongs to both of us; I think he will remind me for the sake of the baby in the womb.

– 26-year-old primigravida, Ethiopia

However, in both countries, several participants declined to select an adherence partner. In Kenya, almost all who declined (7/35) stated they did not need help with their supplements; one reported not having anyone to ask. In Ethiopia, among the women who declined an adherence partner (8/50), half felt they did not need help or that others might discourage them and the other half reported they had no one to ask.

It is just me... My husband never bothers with these tablets. He just knows that I take medicine. Who will come to ask that you are taking which tablets? It's just me.

– 25-year-old multigravida, Kenya

Actually trying an adherence partner

Most women in Kenya (20/29) and Ethiopia (42/50) followed through and asked someone to be their adherence partner. In Kenya, most women asked their husbands, and the remaining few asked female relatives or children. In Ethiopia, half asked their husbands, one quarter asked their children, and most others asked female or male relatives. Several women in both countries asked multiple people to support them.

Many helped me, many encouraged me...I was happy that many were on my side. They were also happy to encourage me to continue.

– 21-year-old primigravida, Kenya

Some women only shared information about their supplements with their husbands.

I told my husband about the importance of the pills; how they are useful to my health and to my fetus...he reminds me to take them...My in-laws don't know anything about the pills I am taking.

– 28-year-old multigravida, Ethiopia

In both Kenya and Ethiopia, the majority of participants reported that their adherence partners reminded and encouraged them to adhere to their supplements. Participants spontaneously reported that adherence partners provided a variety of types of support, which we classified as instrumental, emotional, and informational (Heaney

and Israel, 2008), and we compared support received across countries (Table 2). The most frequently mentioned examples were of instrumental support, but women also received some informational and emotional support.

Most women with adherence partners reported being satisfied with the support their adherence partners provided and wanting them to continue.

I liked having my husband help me. I could have forgotten had he not been helping me.

– 22-year-old multigravida, Ethiopia

Table 2. Types of social support received by women with adherence partners

Support received	Ethiopia (n=42)	Kenya (n=29)	Illustrative quotes
Social support category: Instrumental (e.g. practical support, help, services)			
Remind	42	29	<i>It was easy to take them because when I was forgetting I was being reminded, so it was a must. My husband was reminding me when I forgot...he was the one asking me have you taken the medicine or not...It was helping me to remember to take the medicine.</i> -21-year-old multigravida, Kenya
Bring or make food	31	6	<i>My mother always tells me to take my pills until I give birth... Sometime there could be no food for lunch but she goes to look for food so that I can take the tablets.</i> -18-year-old multigravida, Kenya
Bring supplement (within or outside home)	23	4	<i>One day I left the bottle at home as I hurriedly went to field...my husband brought me the bottle to the field. He is the one who also reminds me.</i> -27-year-old multigravida, Ethiopia

Support received	Ethiopia (n=42)	Kenya (n=29)	Illustrative quotes
Fetch water or firewood	23	0	<i>When I want to prepare food my husband cuts wood into usable pieces. He also fetches water for me, which helps me...I like and feel happy that he helped me this much while I get tired.</i> -30-year-old multigravida, Ethiopia
Help with household chores	18	1	<i>Even if I say that I remember for myself, there might be a time that I forget, and [my children] help me to take the pills regularly...They also help me with housework...taking crops for grinding, cleaning house, any other chores...I feel very happy in having them around.</i> -37-year-old multigravida, Ethiopia
Social support category: Emotional (e.g. love, caring)			
Encourage pill taking	33	18	<i>Had they disliked that I take these pills and said "stop taking" I could be discouraged and stop taking it. But they encouraged me to take.</i> -28-year-old multigravida, Ethiopia
Motivate in spite of side-effects	8	4	<i>My husband continued helping and encouraging me. I was feeling like this medicine was making me constipated and I should stop taking it, but he encourages me and reminds me of the positive side of it.</i> -26-year-old multigravida, Kenya
Encourage her to stop due to side-effects	6	1	<i>This time round, I reached a point and started having a stomach ache. You know when you feel pain, you partner feels for you. When I was feeling pain he said that when you [the interviewer] come, I should tell you to stop the medicine.</i> -19-year-old multigravida, Kenya
Social support category: Informational (e.g. advice, information)			
Offer advice or tell benefits	10	6	<i>He wants me to take because he has not seen me being sickly like before, so he tells me to take them. He has seen these tablets have benefits; they have helped me. He wants me to be fine and the baby to be fine and healthy.</i> -25-year-old multigravida, Kenya

Support received	Ethiopia (n=42)	Kenya (n=29)	Illustrative quotes
Encourage seeking health care	9	0	<i>[My husband] is helping me...He gave me advice to go to the clinic for antenatal care.</i> -25-year-old primigravida, Ethiopia

^a. (Heaney and Israel, 2008)

100-81%	80-61%	60-41%	40-21%	20-5%	<5%
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Self-reliance and adherence partner uptake

One theme that emerged among several women in Kenya and Ethiopia was their feeling that they did not need support to take supplements; we used the term self-reliant to describe these women. For some women, this self-reliance resulted in not choosing an adherence partner. For some others, despite feeling self-reliant, they still reported receiving and appreciating support. To understand the relationship between participants' feelings of self-reliance and perceived social support, we used participants' general social support scale scores from the first interview to categorize participants' perceived social support (i.e. high or low) and their expressed feelings of self-reliance (i.e. more or less) at any of the visits, which was coded in the qualitative analysis. We then used these categories to examine participants' adherence partner decisions (Figure 2). Participants who appeared more self-reliant had adherence partners less often than participants who appeared less self-reliant; this was especially the case for women in Ethiopia with low perceived social support.

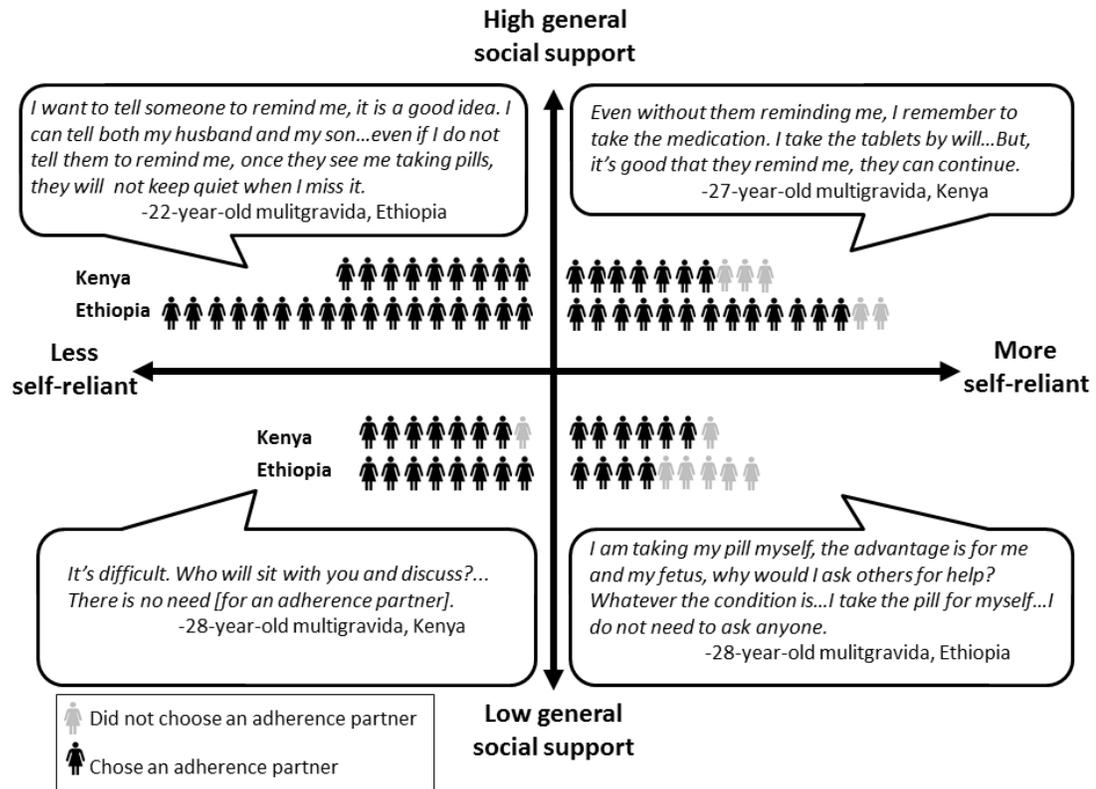


Figure 2. Adherence partner decision by levels of perceived social support and expressed feelings of self-reliance

Sustaining the use of an adherence partner

At the final interview, most participants reported they continued to have an adherence partner (Kenya 20/24 and Ethiopia 41/49) and most participants with adherence partners appreciated the support they received.

I want my husband to continue...He reminds me if I have forgotten, brings them to me, gives me heart, and when he sees I have given up, gives me morale to continue...You know if someone loves and cares, he will help remind you about something concerning your life.

– 26-year-old multigravida, Kenya

However, for some participants, the support received and its value changed over time. In Ethiopia, a few women reported no longer needing support as they had become accustomed to the supplements. In both countries, a few reported their adherence partners stopped reminding them as time passed, either because they were no longer living together or the partner discontinued support.

I am already adapted with pill taking. I don't want support. Previously, during the first two weeks, my husband was reminding me...but he has already forgotten and has not said anything to me.

– 20-year-old multigravida, Ethiopia

One woman in Ethiopia reported the support she received increased over time.

Initially I took it independently without others help. I remembered to take them myself. My family encouraged me after they saw my health improve.

– 27-year-old multigravida, Ethiopia

Several participants highlighted the importance of having adherence partners nearby and available at key times.

If my family was far, I could have forgotten to take the tablets. It helped that they were always by my side. They give me a lot of support to take the tablets.

– 27-year-old multigravida, Kenya

However, others had problems with partners' schedules.

I asked my husband. Mostly he reminded me to take my pills...especially in the evening. But the problem was he works early in the morning and comes home in the evening...So, it is difficult to always get him due to the nature of his job.

– 27-year-old multigravida, Ethiopia

Some women relied on their adherence partners at times when they needed the most support (e.g. when they were busy, tired, or away from home), which varied by participant.

I told both my children to remind me to take the evening pills. I can remember the other. [The evening is] difficult because I could forget as we sit together and talk during the night.

– 38-year-old multigravida, Ethiopia

One participant reported that her husband focused his support based on side-effects she attributed to IFA.

I am comfortable taking the white pill [calcium]. I do not need encouragement and reinforcement. I do not forget and never miss the time. But, I hate the red pill [IFA]. That is why he is checking the red pill only; he knows I do not miss the white pill.

– 19-year-old primigravida, Ethiopia

Recommending adherence partners to others

Almost all participants said they would recommend an adherence partner to other pregnant women.

I can tell my close friends... “Have someone remind you to take the pills on time” ...Yes, it is good to have this kind of person because it is common to forget pill-taking time.

– 19-year-old primigravida, Ethiopia

Some participants suggested they could serve in this role. A few participants in Ethiopia said they would not recommend adherence partners to other pregnant women; their rationale was not wanting to talk with others because pill taking was associated with HIV, and they did not want to be stigmatized.

I would not recommend others have someone remind them because people say different things about it...I personally do not share anything with anyone about the pill I am taking.

– 28-year-old multigravida, Ethiopia

Adherence partners and reported influence on adherence

Most participants reported that having an adherence partner helped them adhere to their calcium and IFA regimen. In Ethiopia, participants identified being reminded as the most important adherence facilitator, and in Kenya, it was one of the most important.

They all encouraged me to take [the supplements] and that is why it was hard for me to forget. Because they reminded me every time, I never missed taking them.

– 34-year-old multigravida, Kenya

Discussion

This study examined the acceptability of adherence partners by examining pregnant women's decisions to try an adherence partner in the context of receiving and trying calcium and IFA supplements, and describing their experiences over time. Our results suggest a high level of acceptance for adherence partners.

Adherence partner acceptability

In Kenya and Ethiopia, most participants agreed to try, actually tried, and continued to have an adherence partner throughout the study. In addition, participants reported appreciating the support they received and wanting it to continue. Participants usually chose their husbands, but children and adult female family members also served as adherence partners. Other studies examining the use of partners found participants often selected family members (Andreson et al., 2013, Nachega et al., 2006). Family members influence antenatal IFA adherence (Aguayo et al., 2005, Nagata et al., 2012) and the importance of engaging them for improved maternal and child health and nutrition practices is well documented (Aubel, 2012, Affleck and Pelto, 2012, Birmeta et al., 2013, Mukuria et al., 2016, Pelto and Armar-Klemesu, 2015). Adherence partners are a potential strategy to engage family members to support antenatal micronutrient supplementation.

Participants received a range of instrumental, emotional, and informational support from their adherence partners; reminders and encouragement were the most common. This is similar to other studies in sub-Saharan Africa that report “treatment partners,” “treatment supporters,” or “buddies” provide reminders (O’Laughlin et al., 2012, Nachega et al., 2006) and encouragement (Nachega et al., 2006, Andreson et al., 2013). Participants noted that it was important for adherence partners to be available and nearby, which is consistent with results from similar studies (Andreson et al., 2013, Nachega et al., 2006, Idoko et al., 2007). Women also reported their adherence partner’s support helped them adhere to the calcium and IFA regimen and overcome perceived side-effects.

Although adherence partners were acceptable to most participants, this research identified potential issues that should be considered before implementation. Some participants did not select an adherence partner; several of these women cited not needing adherence support and a few others reported not having anyone to ask. When counseling women about the adherence partner strategy, it will be important to consider their levels of self-reliance and access to social support. Women lacking social support will need targeted, comprehensive strategies since they are likely to be more vulnerable and socially isolated (Peterson et al., 2002). Self-reliance, even more than available social support, appeared to influence the decision to have an adherence partner. The relationship between self-reliance and adherence to antenatal micronutrient supplements requires further examination. One study of medication adherence found self-reliance predicted lower adherence (Insel et al., 2006). Understanding how self-reliance influences antenatal micronutrient adherence could help inform tailored adherence strategies.

When initially offered an adherence partner, a few women declined because they understood the concept to suggest asking someone outside of their immediate family. In the future, giving pregnant women printed materials that describe and illustrate this role or identifying an appropriate term could increase understanding. We endeavored to identify an idiomatic, emic term for adherence partners during interviews in both study sites; however no terms in Afan Oromo or Kiswahili were discovered. Even though referring to this strategy as “someone who could remind and encourage” was clear for most participants, it may be important to find an emic term in other contexts.

Some of our results suggest it could be beneficial to directly engage adherence partners. While the social support provided by adherence partners generally promoted adherence and helped women continue despite perceived side-effects, for a few women in both settings who perceived severe side-effects, their adherence partners' support resulted in discouraging supplement use. In addition, a few participants reported support from their adherence partner waned over time, similar to a trial in Nigeria that reported "treatment partner fatigue" (Taiwo et al., 2010). Both of these issues could potentially be addressed by engaging adherence partners directly to familiarize them with ways to support pregnant women to overcome perceived side-effects and the importance of continued support throughout pregnancy. Other partner interventions have included training or orientation for partners (Idoko et al., 2007, Andreson et al., 2013, Nachega et al., 2010). Although this could make adherence partners more successful, the additional resources required would limit the potential for scaling up adherence partner programs and complicate implementation. Adherence partners offer a low-resource strategy that leverages existing social support to overcome challenges to adherence. Our results suggest that allowing women to select partners from their social networks who are nearby and available increases the acceptability and sustainability of this strategy. Adherence partners are a promising intervention found to be acceptable to and valued by most women in these two different contexts.

Differences between Kenya and Ethiopia

Adherence partners were acceptable for most participants in Kenya and Ethiopia, but there were differences between participants' experiences in these two sites. The cultural context influenced the types and amounts of support that pregnant women received, independent of the adherence partner intervention. While all participants with adherence partners reported being reminded and most reported being encouraged, pregnant women in Ethiopia received a wider variety of social support than pregnant women in Kenya. Women in Ethiopia reported high levels of instrumental support (e.g. help with chores, receiving food) from their adherence partners that extended beyond support for adherence. Traditionally, Oromo women are well supported during the perinatal period (Hussein, 2004), which was confirmed in our formative research. Although women in Kenya reported being encouraged and reminded to take their supplements, they did not report receiving similar levels of additional support. Some women in Kenya reported receiving food, but only one received help with chores. In our formative research in Kenya, health workers and women reported low levels of support for pregnant women (Martin et al., 2016). In Tanzania, one study of a treatment partner intervention to increase adherence to antiretroviral therapy reported partners provided additional support beyond adherence (O'Laughlin et al., 2012). Ideally, adherence partners would provide increased support for women in several aspects of their pregnancy; however, we only found this in Ethiopia, a context where pregnant women tend to be better supported. Expectations of social support in pregnancy may affect the types of support adherence partners provide.

Another difference between the two sites was the selection of children as adherence partners. In Ethiopia it was much more common for participants to ask their school-aged children; children offered reminders, brought supplements, and helped with chores, whereas nearly all women in Kenya chose their husbands. Children appeared to be acceptable adherence partners for women in Ethiopia. There are examples of programs successfully engaging school-aged children to share health messages and promote health practices within families (Onyango-Ouma et al., 2005, Christensen, 2004).

This study was designed to explore emergent themes related to the acceptability of adherence partners to support antenatal micronutrient supplementation. We documented women's social support and experiences with adherence partners for six weeks, comparing across two contexts and using quantitative data for triangulation; however, it is possible this did not capture related changes that occurred during the remaining weeks of pregnancy. While some participants in Kenya were lost to follow-up, primarily due to giving birth before completing final interviews, the majority of participants completed two follow-up visits and almost all completed at least one. The remaining participants in Kenya reflected the characteristics of our purposive sampling scheme and provided diverse responses. There was almost no loss to follow-up in Ethiopia. Delivering calcium and IFA supplements and counseling through multiple home visits facilitated collection of in-depth data on women's experiences and perceptions; a next step will be assessing the acceptability, feasibility, and effectiveness of delivering this strategy through facility-based ANC throughout pregnancy.

Conclusion

Acceptable, low-cost, scalable social and behavior change strategies to support adherence to antenatal micronutrient supplements are needed to reduce maternal and child morbidity and mortality. Adherence partners are one potential strategy to increase adherence to antenatal calcium and IFA supplements. Adherence partners were acceptable for most women in these two settings, even in the context of limited family support in Kenya and low ANC attendance in Ethiopia. Given the high levels of acceptability among pregnant women in Kenya and Ethiopia, the effectiveness of adherence partners to improve adherence to antenatal micronutrient supplements should be explored further in future research embedded in routine health services. Adherence partners would be most effective as part of a comprehensive program that addresses the multilevel and multifaceted barriers to antenatal micronutrient supplementation, offering a low-cost strategy with the potential to support a variety of maternal and child nutrition interventions.

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CHAPTER 4
ADHERENCE-SPECIFIC SOCIAL SUPPORT ENHANCES ADHERENCE TO
CALCIUM SUPPLEMENTS AMONG PREGNANT WOMEN
IN WESTERN KENYA

Abstract

World Health Organization guidelines recommend integrating calcium supplementation into antenatal care (ANC) along with iron-folic acid (IFA) to reduce maternal mortality. However, antenatal micronutrient supplementation programs face multiple barriers. Approaches to address health system and health facility barriers are well documented, but household- and individual-level adherence strategies are needed. Adherence partners are a behavior-change strategy that leverages existing social support to improve adherence. Pregnant women choose adherence partners from their social network (e.g., spouse, relative) and ask them to provide reminders. The objective of this analysis was to examine if having an adherence partner and higher adherence-specific social support were associated with improved calcium and IFA supplement adherence.

Data are from an implementation trial on integrating calcium supplementation into antenatal care in western Kenya. The study team trained ANC providers about calcium and IFA supplementation and counseling, provided counseling materials and adherence partner posters for women to take home, and ensured sufficient supplement supplies at health facilities. Pregnant women from 16 government health facilities

were recruited and socio-demographic and adherence data were collected during exit interviews and 4-6 week follow-up visits. Adherence was measured with pill counts and self-reports. Culturally-adapted scales measured general and adherence-specific social support. Relationships between participant characteristics and adherence partner status were tested using chi-square and t-tests. Factors associated with adherence partners, adherence-specific social support, and adherence to calcium and IFA supplements were examined using multilevel logistic regression models.

Almost all participants (89%) had adherence partners at follow-up; most (52%) asked their husbands. A significantly greater proportion of participants with adherence partners reported high levels of adherence-specific social support ($p=0.04$).

Adherence-specific social support was positively associated with high calcium adherence at 4-6 week follow-up visits ($p=0.004$), but not IFA adherence.

Adherence partners were highly acceptable in this population and adherence-specific social support was associated with improved adherence to calcium supplementation, a complex regimen. This research demonstrates the importance of adherence-specific social support and the potential of low-cost social support strategies, such as adherence partners, to increase adherence and the effectiveness of micronutrient supplementation programs.

Introduction

Antenatal iron-folic acid (IFA) and calcium supplementation could substantially reduce the risk of iron-deficiency anemia and preeclampsia in pregnancy, resulting in lower maternal and child morbidity and mortality (Bhutta et al., 2013). Yet, antenatal micronutrient supplementation programs face multiple challenges with supply, distribution, and adherence (Yip, 2002, Sanghvi et al., 2010). The World Health Organization (WHO) recommends a daily regimen of three calcium pills and one IFA pill, each taken at separate times. This complex regimen could negatively affect women's adherence to calcium and IFA supplements, as well as program coverage (Omotayo et al., 2016, Baxter et al., 2014). Challenges to adherence occur at several levels; the health system, health facilities, and individual women (Sanghvi et al., 2010). Addressing these issues is a high priority for improving the effectiveness of these valuable public health interventions.

Having someone remind and encourage pregnant women to adhere to antenatal micronutrient supplements, referred to as “adherence partners” (Martin et al in press) and “keepers” (Willardson et al., 2013), has been proposed as a potential behavior change strategy. Although “treatment partners” and “buddies” have been used to promote medication adherence (Nachega et al., 2010, Idoko et al., 2007, Taiwo et al., 2010, Remien et al., 2005) and infant feeding (Andreson et al., 2013), to date their effectiveness have not been evaluated as a strategy for antenatal micronutrient supplements. Our definition of an “adherence partner” is someone a pregnant woman identifies from her social network (e.g. family members, friends, neighbors) and asks

to provide her with reminders and encouragement. Adherence partners can be characterized as a formal expansion of existing supportive relationships and can be used to increase adherence-specific social support.

“Specific social support” is help and support related to a specific health behavior or outcome, whereas general social support is concerned with support that affects general wellbeing (Tay et al., 2013). Measuring adherence-specific social support in the context of antenatal micronutrient supplementation can examine how the support women receive influences adherence.

This chapter presents the results of a study directed to improving adherence at the individual level, more specifically of pregnant women who are in contact with health services in rural Kenya. The objective of this analysis was to assess was to examine if having an adherence partner and higher adherence-specific social support were associated with improved calcium and IFA supplement adherence.. Specifically, we sought to answer the following questions: (1) Did participants with adherence partners report higher adherence-specific social support? (2) Was higher adherence specific social support positively associated with adherence? (3) Was adherence-specific social support more closely associated with higher adherence than general social support?

Methods

Within a cluster randomized trial, we followed a prospective cohort of pregnant women.

Study population

Data are from Micronutrient Initiative-Cornell University Calcium (MICA) study, whose design has been described previously (Omotayo et al., 2015). Briefly, MICA was a parallel, non-inferiority, cluster-randomized trial comparing the effect of higher (3 calcium pills/day) and lower (2 calcium pills/day) dose antenatal calcium supplement regimens on supplement consumption. Pregnant women (n=1,036; 16-30 weeks gestation) were recruited from 16 primary care health facilities in Malava subcounty, Kakamega County in western Kenya. Facilities were randomized to either a higher- or lower- calcium regimen; once-daily IFA supplementation was the same for all facilities. Participants were excluded if they were <15 years old, consumed adequate dietary or medicinal calcium, which was assessed with a screening tool developed for the study, or planned to leave the study area before 8 weeks from the date of recruitment.

Study participants provided written informed consent before enrollment. The Institutional Review Board at Cornell University and Kenyatta National Hospital and University of Nairobi Ethics and Research Review Committee approved this study.

Study interventions

The intervention involved the study team providing participating health facilities the following assistance specific to their assigned regimen: (1) ensuring adequate supplies of calcium and IFA supplements, (2) training antenatal care (ANC) providers on calcium and IFA supplements and counseling skills, (3) counseling cards to counsel women about calcium and IFA benefits and regimen, and (4) take-home

reminder calendars for women. In addition, the adherence partner component of the intervention involved: (1) training for ANC providers to counsel women about the benefits of adherence partners, (2) a counseling card about the benefits of adherence partners, (3) a page in the calendar encouraging adherence partners, and (4) take-home posters for women to share with their adherence partner (Appendix 7).

Data collection

We recruited participants from participating ANC clinics. Study staff conducted all interviews in Kiswahili at the health facilities. At enrollment to MICA, trained study staff collected demographic, psychosocial, and general social support data. Immediately following participants' ANC consultation, study staff collected information about the counseling they received, their perceptions about the calcium and IFA regimen and supplements, and whether they planned to have an adherence partner. These data comprise the baseline data. For the follow-up visit, participants were asked to bring their pill containers. Study staff counted the remaining calcium and IFA pills and collected data about participants' experiences with their supplements, related psychosocial factors, and adherence-specific social support.

Measures

Socio-demographic characteristics. Age was measured as a continuous variable and also categorized as adolescent (15-19 years) and non-adolescent (>19 years). Ethnicity was categorized as Luhya or non-Luhya; <5% of the study sample was not Luhya. Marital status was categorized as married and non-married, which

included women who were single, widowed, separated, or divorced. Participant education level was categorized as did not complete primary, completed primary, and completed secondary or higher. Participants were categorized as primigravid if this was their first pregnancy and multigravid if they had been pregnant before. Gestational age was based on self-report and measured in months as a continuous variable.

Household hunger. The Household Hunger Scale (Ballard et al., 2011), which includes three cross-culturally validated questions on extreme food insufficiency from the parent Household Food Insecurity and Access Scale (Coates et al., 2007), was used to assess household hunger. Participants were categorized as “little to no,” “moderate,” or “severe” hunger.

Household structure. Participants’ household and family context were documented through questions about who was in her household and if she lived on a compound with other members of her family. We asked married participants if their husband traveled frequently, if their mother-in-law lived nearby, and if they were in a polygamous union.

General social support. To assess participants’ perceived general social support at baseline, we adapted the “Functional Social Support Scale” (Antelman et al., 2001). We used cognitive interviewing procedures (Willis, 2005) to adapt the scale to local cultural conditions. The ten-item scale included questions about emotional, instrumental, and informational social support and used dichotomous (yes/no) response options. Each item was scored 0 or 1 and item scores were totaled to create a general social support score. After each item, a follow-up question asked if they were satisfied with the support they received using dichotomous response options (yes/no)

scored 0 to 1. The satisfaction scores were then also totaled. We created a composite score based on the total of the perceived available support and satisfaction scores (range 0-20) and divided the sample into categories based on theoretically-based cutoffs: high (20), moderate (16-19), and low (0-15). We conducted exploratory factor analysis using tetrachoric correlation in R and determined the scale measured a single latent variable (Cronbach alpha=0.87)

Adherence-specific social support. We created a 10-item adherence-specific social support scale to examine participants' perceived support for adherence to antenatal micronutrient supplements. Items were based on existing specific social support scales (Lehavot et al., 2011, Sallis et al., 1987, Warner et al., 2013), behavior change and social support theory (Amico et al., 2005), formative research (Martin et al., 2016), and cognitive interviews. As with the general social support scale, each item was scored 0 or 1 for both perceived availability of support and satisfaction, and a composite score was created (range 0-20). Scores were similarly categorized as high (20), moderate (16-19), and low (0-15). Most participants (60%) had not received IFA supplements prior to study enrollment, so adherence specific social support was only assessed at the follow-up visit. We conducted exploratory factor analysis using tetrachoric correlation in R and determined the scale measured a single latent variable (Cronbach alpha=0.87)

Adherence partner strategy. At the exit interview immediately following the baseline ANC visit, participants were asked if they had been encouraged to ask someone to be their adherence partner and if they had received the adherence partner poster. Participants were also asked if they intended to ask someone to be their

adherence partner. Those who did not intend to ask someone were asked why. At the follow-up visit, participants were asked if they had asked anyone to be their adherence partner, and if so, who they asked, what support they received, and their satisfaction with their adherence partner.

Adherence. Pill counts and self-reports were used to measure adherence. ANC providers were trained to provide sufficient calcium and IFA supplements to pregnant women during ANC consultations, based on the regimen assigned to their facility. During the exit interview, study staff recorded the number of pills participants received. At the follow-up visit study staff recorded the remaining number of calcium and IFA supplements. Pill counts, determined by the difference between the number of pills received at the exit interview and the number of pills returned at the follow-up visit, represented the number of pills consumed. We defined adherence as the percentage of supplements taken as prescribed (Figure 1) (Omotayo et al., 2015, Jasti et al., 2005). Adherence was capped at 100%, as there is no benefit to taking extra supplements and none of the included daily average pill counts were above the upper tolerable limit (3.0g/day) (WHO 2013).

$$\% \text{ IFA adherence} = \frac{\# \text{ pills dispensed} - \# \text{ pills returned}}{\# \text{ days between baseline and follow up visits}} \times 100$$

$$\% \text{ calcium adherence} = \frac{\# \text{ pills dispensed} - \# \text{ pills returned}}{\# \text{ days between baseline \& follow up visits} \times \# \text{ calcium supplements}} \times 100$$

Figure 1. Formulas for calculating IFA and calcium percent adherence

Initially, we intended to use percent adherence as a continuous variable and conduct multilevel linear regression to identify factors associated with adherence, but in these models the residuals were not normally distributed nor did transformation result in normal distribution. This led to the decision to use multilevel logistic regression to identify variables associated with adherence. Participants were categorized as high adherers if their adherence was $>85\%$ and low adherers if it was $\leq 85\%$. The high-adherer category is equivalent to taking IFA at least 6/7 days and calcium at least 12/14 and 18/21 times a week depending on regimen. Adherence was also measured at follow-up by using self-reports. Participants were asked, “Over the last month, how often did you take your [calcium or IFA] pills as you were told: almost never, sometimes, often, or almost always.” Participants who responded with “almost always” were classified as high adherers.

Adherence barriers and facilitators. At the follow-up visit, participants were asked what made it difficult and what made it easier to take calcium and IFA supplements. These data were coded for barriers and facilitators to calcium and IFA adherence. Participants were also asked separate questions about how they felt after taking calcium and IFA, and were provided the following response options: worse, the same, or better. Two separate dichotomous variables were created for participants who reported feeling worse; one for women who attributed feeling worse to calcium and one for women who attributed feeling worse to IFA. In as much as these were separate questions, it was possible for women to report feeling worse for both pills.

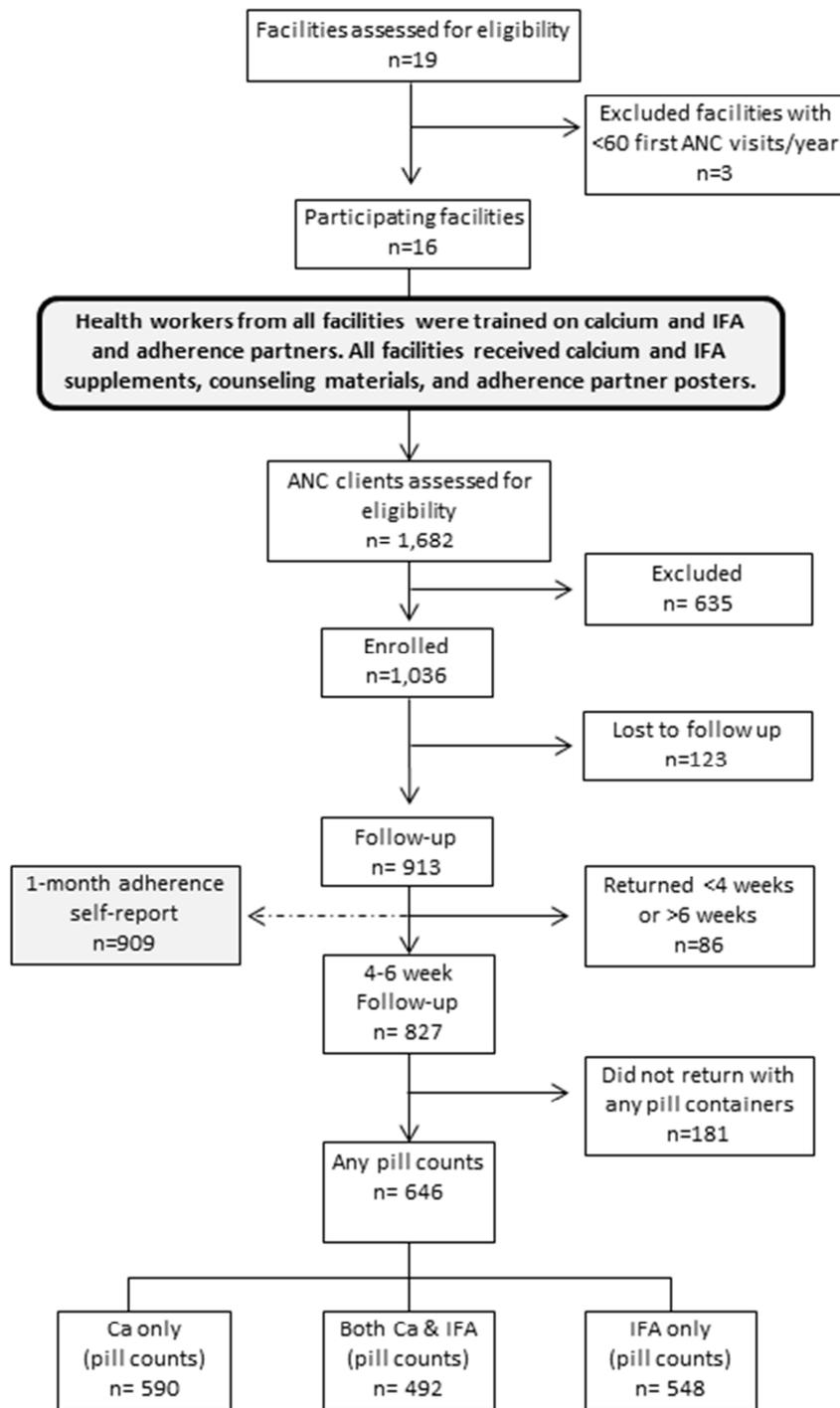


Figure 2. Participant flow diagram for inclusion in this analysis; dashed line represents sample with self-reported adherence data

Analysis

Data from participants who returned for a follow-up visit 4-6 weeks after baseline with pill containers (n=646) were used to conduct the initial analyses (Figure 2). Additional analyses were conducted using self-report adherence measures with a larger sample (n=909). All models accounted for facility-level clustering as a random effect. We used STATA (version 14) to perform all analyses.

Adherence partner strategy

Descriptive statistics were used to examine whether participants had been encouraged by ANC providers to select an adherence partner and to calculate the proportion of participants who had adherence partners at the follow-up visit. Bivariate analyses examined differences in baseline socio-demographic characteristics and exit interview reports among participants, comparing those who had or did not have an adherence partner. Two sample t-tests examined differences in means and Pearson χ^2 tests for differences in proportions, or Fisher's exact tests in cases with low counts. Multilevel logistic regression was used to test associations between baseline characteristics and the odds of having an adherence partner.

Adherence partners and adherence-specific social support

Differences in adherence-specific social support among participants who had and did not have adherence partners were tested using Pearson χ^2 . The differences in adherence-specific social support category (i.e. low, moderate, high) by adherence-partner choice were further examined in unadjusted and adjusted multi-level ordered

logistic regression models. Adjusted models included age, schooling completed, household hunger, general social support, and assigned regimen.

Associations with adherence

Differences in mean percent adherence to calcium and IFA supplements and category of adherence specific social support were examined using ANOVA. Separate multi-level logistic regression models examined variables associated with high adherence to calcium and IFA. Models included age, education, household hunger, having an adherence partner, general social support, adherence-specific social support, assigned regimen, and feeling worse after taking the corresponding supplement.

Propensity score matching was performed to examine the association between having an adherence partner and supplement adherence. Propensity score matching can be used to estimate the treatment effect for measured potential confounders in non-randomized studies (Stuart, 2010, Thoemmes, 2010). The propensity score was the probability of having an adherence partner based on measured covariates and was used to match participants who had an adherence partner to those who did not.

Baseline covariates that were potential confounders included: adolescence, education, marital status, gravidity, household hunger, assigned regimen, general social support, ethnicity, and social resources. The propensity score was estimated, using logistic regression with having an adherence partner as the outcome and the selected covariates as predictors (Thoemmes 2010). Participants were matched using one-to-many (1:10) nearest neighbor matching, such that a single participant without an adherence partner was matched to more than one participant with an adherence

partner. The effect of having an adherence partner on adherence was estimated as the average treatment effect, which is the average difference in adherence between those who had or did not have an adherence partner. This analysis confirmed the results of the logistic regression analysis (data not reported).

Results

Participant characteristics are summarized in Table 1.

Adherence partner strategy

At the exit interview, most participants reported: (1) they were encouraged to ask someone to be their adherence partner, (2) they received the adherence partner poster, (3) they thought an adherence partner would be helpful, and (4) they intended to ask someone to be their partner (Table 1). Among participants who did not intend to have an adherence partner (n=100), most reported that they did not need help from others (86%), and only 14% reported not having anyone to ask.

At the follow-up visit, 89% of participants reported having an adherence partner. There were no significant differences in baseline socio-demographic characteristics between participants who had and did not have adherence partners at follow up. There were significant differences in assigned calcium regimen and intention to have an adherence partner between groups (Table 1). In a multilevel logistic regression analysis (Table 2), characteristics associated with significantly higher odds of having an adherence partner at follow-up were moderate general social

support, being assigned to the 3-pill calcium regimen, and intention to have an adherence partner at the exit interview.

Table 1. Baseline participant characteristics by having an adherence partner or not

Variable	Analytic sample (n=646)	No AP (n=65)	Had AP (n=536)	p
Age (years) mean (SD)	25.2 (5.94)	26.4	25.0	0.08
Adolescent , %	17.8	17.2	18.6	0.78
Education , (%)				
Primary not completed	23.3	20.3	23.4	0.75
Primary completed	55.0	59.4	54.4	
Secondary or higher completed	21.7	20.3	22.2	
Luhya ethnicity , %	95.8	96.9	95.9	0.71
Primigravid , %	24.3	21.5	24.9	0.56
Duration of gestation (months) mean (SD)	5.2 (3.83)	5.3 (1.05)	6.2 (4.17)	0.87
Married , %	88.4	90.5	87.7	0.79
Household structure				
Other family live very nearby	78.3	71.9	79.1	0.13
Spouse lives with her	84.3	79.0	86.4	0.16
Spouse away during past week	15.2	11.1	16.1	0.26
Spouse travels often	21.7	21.1	21.0	0.55
Spouse has other wives	10.0	12.3	9.5	0.32
Mother-in-law lives close	80.7	73.7	81.5	0.11
Spouse education , %				
Primary not completed	20.0	24.6	18.9	0.29
Primary completed	49.0	52.6	48.7	
Secondary or higher completed	31.0	22.8	32.4	
Household Hunger , %				
Little to no hunger	73.8	67.7	74.6	0.19
Moderate hunger	19.7	27.7	18.5	
Severe hunger	6.5	4.6	6.9	
General social support , %				
Low	25.6	35.5	23.7	0.08
Moderate	28.0	19.3	29.1	
High	46.4	45.2	47.2	
Assigned regimen , %				
2-pill calcium	46.1	64.1	45.0	0.004**
3-pill calcium	53.9	35.9	55.0	
Adherence partner				
Received counseling on AP*, %	79.5	83.1	89.7	0.11
Received AP poster, %	90.9	95.4	94.2	0.70
Thinks AP would be helpful, %	89.3	92.3	94.4	0.50
Intends to ask an AP, %	84.5	67.2	87.5	0.000***

*AP, adherence partner

Table 2. Multilevel logistic regression analysis of having an adherence partner

	Odds Ratio (95% CI) (n=574)	p
Participant age	0.95 (0.92, 1.00)	0.065
General social support		
Moderate	2.43 (1.11, 5.34)	0.027*
High	1.50 (0.80, 2.80)	0.206
3-pill calcium regimen	2.29 (1.29, 4.05)	0.004**
Intends to have an adherence partner	3.54 (1.93, 6.49)	<0.001***

Additional variables included in model but not significant: education, household hunger, and health facility, as a random effect

Almost all women chose family members as their adherence partners, with the majority asking their husbands (52%). Among other family members, elder women (23%), children (14%), sisters or female cousins (8%), and male relatives (<1%) were selected. Friends or neighbors were selected by 2%. Participants reported their adherence partner supported them through one or more of the following actions: (1) reminding them to take supplements (89%), (2) helping with food (24%), or (3) bringing pills when it was time to take them (21%). Thirty one percent reported receiving two or more types of support, and 7% reported their adherence partner did not help them.

When asked what makes it easier to take their supplements, participants with an adherence partner listed being reminded by someone significantly more often than participants without an adherence partner (Table 3).

Most participants were very satisfied (79%) with the support they received from their adherence partners; 16% were somewhat satisfied, and 5% were not satisfied. Similarly, most participants wanted their adherence partners to continue in their role (92%); 3% were unsure and 5% did not want them to continue. Few

participants (7%) reported being discouraged from taking their supplements; 4% reported their friends and 3% reported elder women discouraged them.

Table 3. Participants' perceptions of what helps them remember to take supplements

Variable, %	Total Sample (n=594)	Do not have AP (n=63)	Have AP (n=531)	p
Calendar	38.9	41.3	38.6	<0.001
Being reminded	32.6	4.8	36.3	
Poster	18.0	31.8	15.2	
Time of day	3.9	6.4	3.6	
Pill location	2.8	6.4	2.3	
Nothing	4.2	9.5	3.6	

Adherence-specific social support by adherence partner choice

A significantly greater proportion of participants with adherence partners reported high levels of adherence-specific social support ($p=0.042$) (Figure 3). This finding was confirmed using an adjusted ordered logistic regression model (Table 4). Participants who had an adherence partner at follow up had significantly higher odds of having high adherence-specific social support compared to participants who did not have an adherence partner. In addition, participants who reported high general social support at baseline had significantly higher odds of high adherence specific social support at follow up.

Associations with adherence

Adherence was high for calcium and IFA using both pill counts and self-report data (Table 5), and women reported few barriers to calcium and IFA adherence

(Appendix 8). There was a significant positive association between adherence-specific social support and adherence to calcium supplements (Table 6 and Figure 3).

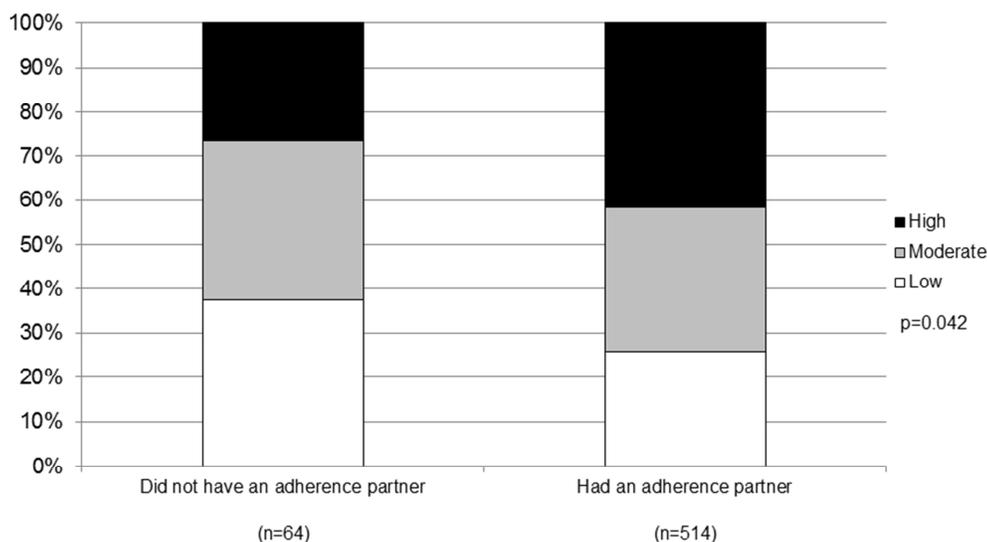


Figure 3. Adherence-specific social support category by adherence partner choice

Table 4. Multilevel ordered logistic regression model for factors associated with adherence specific social support

Variable ^a	Odds Ratio (95% CI) (n=553)	p
Having an adherence partner	2.80 (1.66, 4.76)	<0.001
Married	1.05 (0.52, 1.54)	0.69
Age	1.01 (0.98, 1.04)	0.60
School completed		
Primary	1.23 (0.82, 1.84)	0.31
Secondary or higher	1.32 (0.81, 2.16)	0.26
Household hunger		
Moderate	1.35 (0.74, 1.73)	0.57
Severe	0.95 (0.50, 1.84)	0.89
3-pill calcium regimen	0.97 (0.62, 1.50)	0.88
General social support category		
Moderate	1.38 (0.88, 2.15)	0.15
High	2.19 (1.47, 3.27)	<0.001

^aHealth facility included as a random effect

However, there were no significant associations between having an adherence partner and adherence to calcium or IFA, general social support and adherence to calcium or IFA, or adherence-specific social support and IFA (Table 6 and Figure 4).

Table 5. Adherence to calcium and IFA using pill count and self-report measures

	n	Calcium adherence	IFA adherence
% adherence (pill count), mean(SD)	590	85.7 (21.1)	88.2 (19.9)
% high adherers (pill count)	590	71.5	78.6
% high adherers (self-report)	909	77.7	83.7

Table 6. ANOVA showing participants calcium and IFA adherence (measured by pill counts) by levels of social support and adherence partner variables

	Calcium adherence (%)		IFA adherence (%)	
	Mean(SD) (n=590)	p	Mean(SD) (n=548)	p
General social support				
Low	85.2 (20.6)	0.85	87.7 (19.2)	0.76
Moderate	84.8 (22.1)		87.5 (20.3)	
High	86.0 (21.1)		88.9 (20.1)	
Adherence partner				
No	82.61 (23.0)	0.23	87.19	0.71
Yes	86.16 (20.8)		(21.3) 88.21 (19.8)	
Adherence-specific support				
Low	82.1 (23.8)	0.01	88.0 (21.8)	0.95
Moderate	85.7 (20.2)		88.7 (17.8)	
High	88.5 (19.5)		88.2 (20.0)	

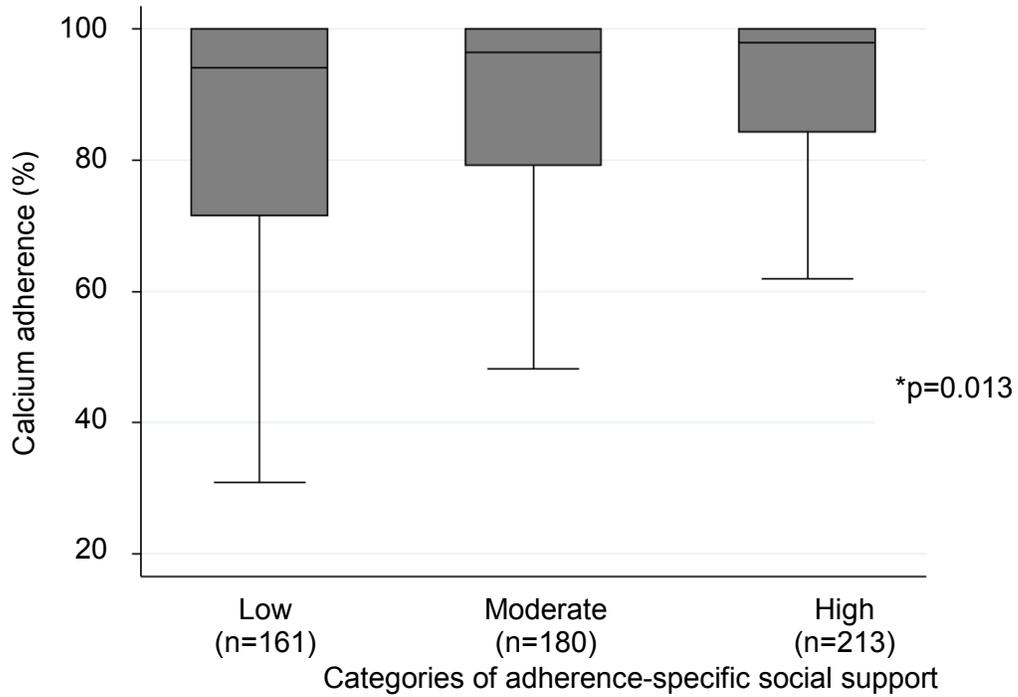


Figure 3. Mean calcium adherence (measured by pill counts) was significantly different by adherence-specific social support category

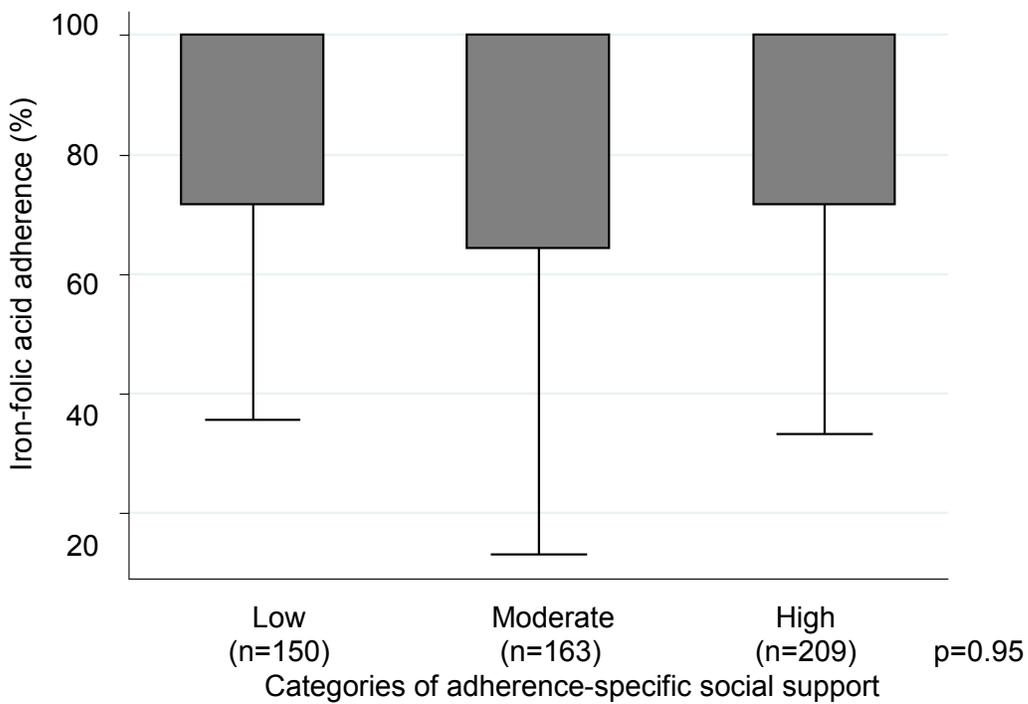


Figure 4. Mean iron-folic acid adherence (measured by pill counts) did not differ by adherence-specific social support category

There was a significant association between high adherence-specific social support and high adherence to calcium supplements using both pill count (Table 7) and self-report data (Table 8). The results were similar for both adherence measures, except for differences in significance for feeling worse with IFA, household hunger, and assigned regimen.

Table 7. Multilevel logistic regression models for factors associated with high calcium and IFA adherence based on available pill count data

Variable	High calcium adherence ^a (n=601)	High IFA adherence ^a (n=548)
	OR (95% CI)	OR (95% CI)
Adherence support		
Low	Ref	Ref
Moderate	1.29 (0.82, 2.03)	0.89 (0.54, 1.46)
High	2.20 (1.14, 2.64)**	0.87 (0.54, 1.41)
General social support		
Low	Ref	Ref
Moderate	0.78 (0.47, 1.31)	0.76 (0.43, 1.35)
High	0.73 (0.46, 1.18)	1.10 (0.64, 1.89)
Age (years)	1.00 (0.97, 1.04)	1.02 (0.98, 1.06)
Education completed		
Primary	0.91 (0.58, 1.44)	1.33 (0.80, 2.23)
Secondary	1.62 (0.91, 2.91)	1.25 (0.67, 2.33)
Household hunger		
Little to no	Ref	Ref
Moderate	0.54 (0.34, 0.84)**	0.78 (0.47, 1.32)
Severe	0.84 (0.41, 1.73)	0.88 (0.39, 2.01)
3-pill calcium regimen	0.97 (0.67, 1.42)	2.24 (1.25, 4.02)**
Feeling worse ^b	0.52 (0.31, 0.88)*	0.43 (0.26, 1.02) [†]

^aHealth facility included as a random effect; ^bFeeling worse was attributed to the specific supplement
[†] <0.1; *<0.05; **p<0.01

Table 8. Multilevel logistic regression models for factors associated with high calcium and IFA adherence based on self-report data

Variable	High calcium adherence ^a (n=834)	High IFA adherence ^a (n=830)
	OR (95% CI)	OR (95% CI)
Adherence support		
Low	Ref	Ref
Moderate	1.35 (0.88, 2.06)	1.28 (0.78, 2.11)
High	1.87 (1.22, 2.87)**	1.05 (0.66, 1.66)
General social support		
Low	Ref	Ref
Moderate	1.20 (0.76, 1.91)	1.49 (0.88, 2.52)
High	1.12 (0.74, 1.69)	1.22 (0.53, 2.85)
Age (years)	1.02 (0.99, 1.05)	1.02 (0.98, 1.05)
Education completed		
Primary	1.19 (0.78, 1.82)	1.42 (0.89, 2.26)
Secondary	1.31 (0.78, 2.20)	1.51 (0.86, 2.67)
Household hunger		
Little to no	Ref	Ref
Moderate	0.67 (0.44, 1.02) [†]	0.84 (0.52, 1.34)
Severe	0.84 (0.42, 1.70)	1.23 (0.53, 2.85)
3-pill calcium regimen	0.51 (0.32, 0.82)**	0.51 (0.32, 0.81)**
Feeling worse ^b	0.45 (0.28, 0.72)**	0.38 (0.19, 0.73)**

^aHealth facility included as a random effect; ^b Feeling worse was attributed to the specific supplement
[†] <0.1; *<0.05; **p<0.01

Discussion

In this study, we examined the relationship between social support and adherence to antenatal micronutrient supplements among pregnant women in rural western Kenya. The novel use of adherence partners was highly acceptable among pregnant women and associated with higher adherence-specific social support, a new measure. Adherence-specific social support was positively associated with high adherence to calcium supplementation.

Is it feasible and acceptable to implement an adherence partner strategy?

Our results suggest that it is feasible for ANC providers to encourage women to have an adherence partner and to distribute adherence partner posters through ANC. Although ANC providers have a large number of messages to communicate to women (von Both et al., 2006, Conrad et al., 2012, World Health Organization, 2013a), we found that with training and materials, participating ANC providers shared this simple adherence strategy with women with a high level of fidelity. Additional research is warranted to assess provider burden and whether the inclusion of this recommendation displaces other ANC counseling.

The high levels of intention reflect that the adherence partner strategy was acceptable to most study participants. In addition, most participants had an adherence partner at follow up. Both findings are consistent with our formative research (Martin et al., in press). Intention at baseline and assigned calcium regimen were strong predictors of having an adherence partner at follow-up. Intention is a key construct in several behavior change theories (e.g. Theory of Reasoned Action, Theory of Planned Behavior, and Integrated Behavioral Model) (Glanz et al., 2008), and was important for the adoption of the adherence partner behavior change strategy. Among the minority of women who did not intend to have an adherence partner, most did not think adherence partners would be helpful and a smaller proportion reported not having anyone to ask. These findings are similar to our formative research, which found that feelings of “self-reliance,” even more than lack of general social support influenced women’s decisions to not have an adherence partner (Martin et al., in

press). The association between self-reliance and antenatal micronutrient supplement adherence warrants further study.

Participants assigned to the 3-pill calcium regimen had twice the odds of having an adherence partner at follow-up compared to participants assigned the 2-pill regimen. Regimen complexity, pill burden, and frequent dosing are recognized barriers to medication adherence (Ingersoll and Cohen, 2008, World Health Organization, 2003). Although there was no difference in adherence partner intention after they were assigned their calcium regimen at baseline, participants assigned to the 3-pill calcium regimen may have realized when they got home the importance of additional support to be able to adhere to the complex regimen.

While the adherence partner strategy was highly acceptable, not all participants chose to have an adherence partner. It is important to offer women multiple strategies that can support adherence (Lehavot et al., 2011), such as calendars, visual regimens, storing supplements in a highly visible location, or asking for support. Adherence partners can be part of a comprehensive strategy to support women during pregnancy, and additional targeted strategies should be offered to women who do not want an adherence partner or do not have anyone to provide adherence support.

Is adherence-specific social support associated with adherence?

Participants with adherence partners reported higher levels of adherence-specific social support, and higher adherence specific social support was associated with high calcium adherence. However, the direction of this relationship cannot be determined. When designing antenatal micronutrient supplementation interventions it

is important to include strategies to increase the amount of adherence-specific support women receive. The importance of increasing family and household-level support for maternal and child nutrition is well recognized (Affleck and Pelto, 2012, Pelto and Armar-Klemesu, 2015, Aubel, 2012, Bezner-Kerr et al., 2008), but other than a few exceptions (Aubel et al., 2004, Andreson et al., 2013, Bezner-Kerr et al., 2011, Mukuria et al., 2016), there are a limited number of examples in the literature of effective interventions to successfully engage family members in sub-Saharan Africa. Adherence partners are a low-cost strategy that leverages existing resources and can provide targeted support to pregnant women.

In this analysis, adherence-specific social support was not associated with adherence to IFA. IFA supplementation is an established and familiar intervention in western Kenya and evidence suggests that if women receive adequate IFA supplements and are counseled on the benefits and potential side-effects, adherence can be improved (Sanghvi et al., 2010). In contrast, calcium supplementation is a new and more complex intervention, and ANC providers and women may have focused more on calcium than IFA. It is possible that adherence support is needed for IFA, even though it was not associated with adherence in this analysis. Additional research is warranted to further explore this relationship.

Our findings demonstrate the importance of assessing adherence-specific social support. Had we only measured general social support, our results would have suggested there was not a relationship between social support and calcium adherence. Within this analysis of adherence to micronutrient supplements, general social support was not significantly related to calcium or IFA adherence. Our analysis required the

specificity of adherence-specific social support measure to understand the importance of social support to calcium adherence. Other studies have found measuring social support specific to a health behavior is significantly associated with the related outcome, when general social support is not (Lehavot et al., 2011, Tay et al., 2013). In addition, this information can be used to develop interventions that encourage specific supportive actions family members can perform that are likely to have a positive influence on adherence.

Family members and friends can negatively influence pregnant women's adherence to micronutrient supplements (Tessema et al., 2009, Nagata et al., 2012). However, only a small percentage of participants (7%) were discouraged from taking their supplements, similar to a study in Mali (Aguayo et al., 2005). Notably, no participants reported being discouraged by their husbands. In our formative research using trials of improved practices, we found that a few participants with severe perceived side-effects were encouraged by their adherence partners to discontinue supplements (Martin et al., in press). In this study, we did not collect data to specifically explore this, but very few participants who reported feeling worse were discouraged from taking their supplements.

What other factors may influence supplement adherence?

In the context of a high functioning antenatal micronutrient supplementation trial that ensured health facilities had sufficient supplement supplies and trained ANC providers to address recognized barriers to adherence, participants' adherence to both calcium and IFA were quite high. The high adherence rates are consistent with

reported adherence in an observational study in Kenya (that restricted analysis to women who had received supplements) (Maina-Gathigi et al., 2013) and antenatal micronutrient supplement trials in other low-resource contexts (Aguayo et al., 2005, Kulkarni et al., 2010, Zavaleta et al., 2014). Although substantially lower adherence rates have been reported in Kenya (Kenya National Bureau of Statistics and ICF International, 2015), these included women who did not receive iron supplements.

Calcium adherence and household hunger

Moderate household hunger was negatively associated with calcium adherence, but not associated with IFA adherence. The WHO guideline states that calcium supplements should be taken separately throughout the day, “preferably at mealtimes” (World Health Organization, 2013b). The illustrations used in the visual regimen in the behavior change materials for this trial showed calcium pills being taken with meals (Appendix 7). Although there was a message on the counseling cards stating that calcium pills do not have to be taken with food and this information was included in ANC provider training, it is possible that ANC providers may not have shared this nuanced message during consultations. Participants may have understood that calcium pills had to be taken with food, which could explain why participants who reported moderate household hunger had lower adherence to calcium, but not IFA. In addition, participants frequently mentioned help with food supported them to take their supplements. If antenatal calcium supplementation is implemented at scale, messages and materials will need to be revised to address food insecurity concerns.

Perceived side-effects

Participants who attributed feeling worse to calcium supplements or IFA supplements had significantly lower adherence to their respective supplement. Side-effects are a well-documented barrier to antenatal micronutrient supplements (Maina-Gathigi et al., 2013, Seck and Jackson, 2008), yet studies have reported that side-effects do not affect mean adherence over time (Zavaleta et al., 2014) and the negative influence of side-effects on adherence is overstated (Galloway et al., 2002, Galloway and McGuire, 1994, Nagata et al., 2012). In this study, the trial interventions addressed the other common adherence barriers (i.e. lack of supplies, lack of counseling, forgetting), such that side-effects became the prominent remaining barrier. When participants were asked what made it difficult to take their supplements, 15% mentioned calcium side-effects and 5% mentioned IFA side effects.. More participants attributed feeling worse to calcium supplements rather than IFA, and few participants reported that side-effects from IFA made it difficult to take their pills. Pregnancy causes many physiologic changes, and misattribution of side-effects is possible (Lutsey et al 2007). Perhaps women were more likely to attribute side-effects to calcium than IFA because women perceived the multiple-pill calcium intervention to be more intense; even though data shows that women are not likely to experience side effects from calcium supplements (ref?).

In our formative research, several women reported minor perceived side-effects, which many were able to overcome (often with support from their adherence partners). However, there were some participants who reported particularly severe side-effects that negatively influenced adherence (Martin et al., in press). To address

perceived side-effects, community health workers could be trained to provide support and strategies to help pregnant women manage side-effects at home. Community health workers have been used successfully to promote adherence in other settings (Sanghvi et al., 2010). Adherence partners could participate in an orientation that provided information about how to support women to overcome side-effects And recognize normal changes due to pregnancy. Orientations have been a component of other partner interventions (Andreson et al., 2013, Idoko et al., 2007, Nachega et al., 2010). Both of these strategies would require additional resources and management.

Limitations

This analysis assessed the acceptability and feasibility of delivering the adherence partner strategy during routine ANC. We trained ANC providers from all participating health facilities to encourage pregnant women to have adherence partners. This allowed us to assess acceptability and feasibility across all facilities, but depended upon participant self-selection. To address potential self-selection bias among participants who chose to have an adherence partner, we used multivariate logistic regression models. We first conducted bivariate analyses to identify differences between participants who had or did not have adherence partners and also included key sociodemographic variables in all regression models to account for differences between the two groups. We used propensity score matching to further address self-selection bias and confirm regression results. The propensity score matching results confirmed there was no significant association between adherence partners and adherence, similar to logistic regression. It is possible that participants

would have had adherence partner support without having to ask for it, however, in our formative research very few participants reported family members reminded or encouraged them to take their supplements (Martin et al., 2016). Almost 90% of participants asked someone to be their adherence partner, resulting in disproportionate numbers of women in the group who had an adherence partner and the group who did not have an adherence partner. The small sample of women without adherence partners may also explain why we did not observe a significant direct effect of adherence partners on adherence because of limited statistical power.

Missing pill count data was a major measurement limitation in this data set. Participants were asked to bring their calcium supplement bottles and IFA bags to follow-up visits to record pill counts. Participants often forgot to bring the supplement bottles and bags back with them. As a result, calcium pill counts were missing for 27% of participants and IFA pill counts were missing for 43%. IFA supplements were dispensed in thin, small paper bags and many participants did not realize that they needed to be returned along with the calcium bottles. We identified differences in the assigned regimen and counseling received among participants who had pill counts for calcium and IFA and those who did not in bivariate analyses (Appendix 9). However, the results from the available pill counts were consistent with the results from self-report adherence data, which provided a larger sample size and confirmed the association between adherence-specific social support and calcium adherence. Although pill counts can be considered an objective measure, they do not avoid errors related to dispensing and counting, participants who receive additional pills between visits that are not counted, or pill dumping (Berg and Arnsten, 2006, Williams et al.,

2013). By using multiple methods to measure adherence we were able to triangulate our understanding of adherence to prenatal micronutrient supplements, which can increase the validity and reliability of adherence data (Lehmann et al., 2014).

Conclusions

An adherence partner strategy was a feasible intervention for routine use in ANC in rural Kenya and acceptable to and adopted by a high majority of women. Women with adherence partners reported significantly higher adherence-specific social support and higher adherence-specific social support was positively associated with high calcium supplement adherence using both available pill count and self-report adherence data. This analysis also demonstrates the importance of assessing an intervention outcome with a behavior-specific social support measure rather than a general social support measure. The complex calcium supplement regimen requires targeted behavior change interventions to increase adherence and adherence-specific social support. Adherence partners are a low-cost behavior change strategy for increasing adherence-specific support for antenatal micronutrient supplementation that was acceptable, appropriate, and feasible in the context of routine ANC in rural western Kenya. Additional research is warranted to examine the appropriateness and impact of adherence partners in other contexts.

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CHAPTER 5

CONCLUSION

Antenatal micronutrient supplementation programs face implementation challenges at every level. While actions to resolve health system, health facility, and community challenges have been identified and documented (Sanghvi et al., 2010, Yip, 1996, Yip, 2002), interventions to address household and individual challenges have received less attention. One potential strategy to overcome more proximal barriers to adherence is to increase the adherence-specific social support pregnant women receive from household members, which includes providing reminders and encouragement. We sought to understand the role social support plays in adherence to antenatal micronutrient supplement adherence and to design and assess an adherence partner behavior change strategy to increase adherence-specific social support for women during pregnancy.

Within the context of the Micronutrient Initiative Cornell University Calcium (MICA) study, we first conducted cognitive interviews in Ethiopia and Kenya to explore the support women expect and receive during pregnancy and to develop contextually appropriate general and adherence-specific social support assessment scales. Second, we examined the acceptability of an adherence partner strategy to support adherence to calcium and IFA supplements through household trials with pregnant women in both settings. Third, we assessed the acceptability, feasibility and impact of adherence partners and the influence of adherence-specific social support on

supplement adherence within the context of an implementation trial integrating calcium supplementation into antenatal care (ANC) in western Kenya.

Contributions of these studies

Measuring social support

The relationship between social support and various nutrition and health outcomes have been studied extensively. However, a review of more than 100 studies in Ethiopia and Kenya that measured social support revealed that, although there were some exceptions (Nagata et al., 2015, Puffer et al., 2011, Okawa et al., 2011, Alemu et al., 2012, Araya et al., 2007, Dachew et al., 2015, Deribew et al., 2013, Hamren et al., 2015, Mirkuzie et al., 2011), most social support measures were not adapted to the context, and social support scales used ordinally-rated response options that are difficult for many participants to use. Measuring social support is important, but bypassing the critical process of contextual adaptation could result in measurement error and poor validity of the measure. Cognitive interviewing is a method that can be used to ensure construct validity and cultural appropriateness. Through cognitive interviews, we developed two social support scales that participants in both contexts could understand. We experienced several challenges with cognitive interviewing, which we remedied through an iterative process with extensive peer debriefing and revisions to the cognitive interviewing guides. Our experience confirms how the cognitive interviewing process needs to be adapted for both the cultural setting and participants' education levels.

Adherence partners

We evaluated the acceptability of adherence partners; a behavior change strategy designed to increase adherence-specific social support. Through the household trials, we found that adherence partners were highly acceptable to study participants in Ethiopia and Kenya. Given the cultural differences between these two settings, including higher levels of social support in Ethiopia compared to Kenya, one might expect differences in the acceptability of adherence partners, but this was not the case. Despite high levels of acceptability, there were some participants who chose not to have adherence partners. Self-reliance, even more than low general social support, influenced participants' decisions to not have an adherence partner. Although adherence partners were acceptable to most participants, additional targeted adherence strategies may be needed to support women with low general social support and women who are self-reliant. Our findings suggest that adherence partners were acceptable to most study participants, and are likely to be acceptable to women in multiple contexts.

The adherence partner strategy was delivered with high fidelity through ANC and it was acceptable to a large majority of women. Participants with adherence partners reported significantly higher adherence-specific social support, and high adherence-specific social support was significantly associated with high adherence to calcium supplements. To more thoroughly understand the adherence partner strategy delivered through routine ANC, research is ongoing to explore pregnant women, adherence partners, and health workers experiences with the adherence partner strategy through qualitative analysis of in-depth interviews.

Adherence-specific social support

Social support facilitates a wide range of optimal health and nutrition behaviors, but there is a need to elucidate *how* this occurs (Gallant, 2013). Models that link social support and health outcomes typically suggest social support has either a “buffering” effect, that diminishes the negative impact of stressful events, or a direct effect on health outcomes (Uchino, 2004). Social support can directly influence adherence if the support provided is practical (e.g. reminders) (DiMatteo, 2004). Measuring specific social support is one way to better understand the role of social support in health and nutrition behaviors. General social support reflects actions that contribute to overall wellbeing, such as showing concern, offering assistance in an emergency, or providing financial help when needed. In contrast, specific social support focuses on actions that directly help someone carry out a health behavior. In the case of antenatal micronutrient supplementation, this included reminding and encouraging someone to take supplements. We found that adherence-specific social support was significantly associated with high adherence to calcium supplementation, and general social support was not. This finding adds to the literature on the importance of measuring social support specific to a health behavior or outcome, rather than only general social support. For social support scales to be effective, they need to be adapted to social and cultural contexts and to measure actions that are specific to the health outcome of interest.

Programmatic implications

During pregnancy and lactation women receive dozens of messages about recommended health and nutrition behaviors for themselves and their children. Social support is one of several key factors that influence women's ability to carry out these recommendations (Matara et al., 2015). This dissertation confirms the importance of social support during pregnancy, and highlights the need for strategies to increase social support specific to maternal and child health and nutrition behaviors. When women are well supported they are better able to put nutrition recommendations into practice. To increase social support for women during this critical time, multiple reinforcing strategies at the health system, health facility, community, and household levels are required.

Within households, husbands and elder female relatives (i.e. mothers, mothers-in-law, aunts, grandmothers) are well-recognized for their influence on maternal and child nutrition behaviors (Aubel, 2012, Mitchell-Box and Braun, 2013, Pelto and Armar-Klemesu, 2015, Negin et al., 2016). Interventions are needed to engage family members to support women during pregnancy and lactation. There are few published examples from sub-Saharan Africa of how to effectively engage husbands and elder women, but facilitated peer discussion groups and community mobilization activities have been used (Aubel et al., 2004, Desai et al., 2014, Satzinger et al., 2009, Mukuria et al., 2016). Partners, buddies, or keepers provide another example, which utilizes a different approach focused on support from household members or peers (Andreson et al., 2013, Willardson et al., 2013). Adherence partners are a scalable strategy, which

requires limited external resources and leverages existing social support within a household.

To further improve the effectiveness of antenatal micronutrient supplementation, additional efforts to increase pregnant women's adherence are needed (Abioye et al., 2016). Although we did not find a direct relationship between adherence partners and improved adherence, adherence partners were associated with higher adherence-specific social support, which was positively associated with high calcium adherence. Family and peer support is recognized as an important facilitator of antenatal micronutrient adherence (Ghanekar et al., 2002, Lacerte et al., 2011, Nisar et al., 2014, Willardson et al., 2013), however acceptable and appropriate strategies to increase family support are lacking. In our formative research in Kenya, very few women reported receiving adherence-specific social support from their families, but within the context of the cluster randomized trial, participants with adherence partners reported high levels adherence-specific support. Adherence partners were highly acceptable among pregnant women in two settings and ANC providers delivered the strategy with high fidelity. Adherence partners are one strategy that could be offered as part of a package of behavior-change strategies to increase adherence to antenatal micronutrient supplementation.

Recommendations for future research

Our findings call attention to several methodological and implementation research needs. Measuring supplement adherence in the cluster randomized trial was

challenging, and the present literature does not provide adequate guidance and critical thinking to improve this adherence measurement. We measured adherence using pill counts and self-reports (3-day and 30-day). Self-report measures were quite high and seemed to overestimate adherence, particularly the 3-day estimates (Appendix 10). Although pill counts appeared to be a more concrete measure, this still had several challenges. Pill counts depend on participants returning to the health facility on time and bringing their pill containers with them. In our study, participants were asked to return to the health facility 28 days after enrolling in the trial; 80% of participants returned at this time, but only 78% of those returned with the calcium and/or IFA containers. Using different containers (i.e. bottles for calcium and bags for IFA) to dispense supplements likely contributed to confusion and should be avoided in future studies. Participants who returned to the facility on time and brought their supplements differed in that they had been assigned different regimens and received more counseling compared participants who did not have pill counts at follow up (Appendix 9). Pill counts are often referred to as an objective measure, but they do not consider dispensing errors, counting errors, participants who return between visits and receive additional pills that are not counted, or pill dumping, (Berg and Arnsten, 2006, Williams et al., 2013). Self-report and electronic pill monitoring systems are also fraught with challenges (Lu et al., 2008 , Lehmann et al., 2014). In settings where follow-up ANC visits are inconsistent and infrequent, such as Kenya, relying on ANC visits to collect pill count data is especially difficult (Hemminki et al., 2016), and accurate adherence assessment methods are needed as well as clear instructions to participants about when to return to the facility and what containers to bring.

Adherence-specific social support was associated with high adherence to calcium supplements, using both pill-count and self-report measures. However, we did not observe a significant association between adherence-specific social support and adherence to IFA although the relationship was positive. Further research is warranted to investigate this relationship and whether adherence specific social support is associated with adherence to a single daily pill in other contexts. Future research could also explore the role of specific social support for other maternal and child nutrition behaviors, which would require developing and validating scales based on the specific support women expect. A cognitive interviewing approach that has been adapted to the social and cultural context can be used to verify the acceptability, relevance, and appropriateness of scale items and response options.

Within a cluster-randomized trial, we sought to explore the feasibility of integrating calcium supplementation into routine ANC. Yet, training and support from the study team resulted in a markedly improved antenatal micronutrient supplementation program in Malava subcounty. With the MICA study team support, health facilities and health workers addressed several of the key challenges that are common barriers to antenatal micronutrient supplementation programs. Exploring the role of specific social support and adherence partners in a more “real-world setting” (e.g., no training for providers, no behavior change materials) may reveal alternative findings. It is possible that adherence partners would have a direct impact on adherence in a typical setting.

Additional research about adherence partners is needed. To understand the effectiveness of this strategy, in-depth interviews with pregnant women, adherence

partners, and health workers could be used to explore their perceptions and experiences. For example, perceived side effects were a significant barrier to adherence for some women. In the household trials, we found that adherence partners often supported pregnant women to continue to take their supplements despite perceived side effects. For the cluster-randomized trial, we did not collect data to directly explore this, but the importance of helping women manage side effects could be included in an adherence partner orientation or added to an adherence partner poster. Other studies have provided training or an orientation for partners (Andreson et al., 2013, Idoko et al., 2007, Nachega et al., 2010). In the interest of having a low-cost, simple, scalable strategy, we decided not to. However, future research could compare adherence among women who had adherence partners who received an orientation and those who did not, and compare the cost-effectiveness of the two approaches. The role of adherence partners could also be explored to support other health and nutrition interventions during pregnancy and lactation. The relationship between self-reliance and adherence and the implications for designing targeted behavior change strategies also warrant further study.

Conclusion

This research was preceded by formative research that identified a potential behavior change strategy—encouraging women to have someone provide pill-taking reminders—that some women were already using to improve adherence to antenatal micronutrient supplements (Martin et al., 2016). For this dissertation, we conducted

cognitive interviews to ensure that social support measures were appropriate, understandable, and reflected the support that women expect during pregnancy, and also confirmed that women appreciated adherence support. The adherence partner strategy was then assessed through household trials with in-depth interviews to explore women's experiences with adherence partners and the support they received. Through the qualitative analysis we learned that women valued the support, reminders, and encouragement they received from adherence partners, and they believed this support helped them to better adhere to their supplements. Finally, within the context of routine ANC we examined the association between adherence partners and adherence-specific social support and high adherence to antenatal micronutrient supplements. This four-phase process allowed us to explore social support in several ways and resulted in a behavior change strategy that was highly acceptable to pregnant women and contributed to higher adherence to calcium supplements.

Many efficacious interventions to improve maternal and child health and nutrition are well established, but effective implementation approaches to ensure that all women and children benefit from these interventions are lacking. Antenatal micronutrient supplementation programs exemplify this implementation gap. Mixed-methods implementation research helped identify and address barriers and facilitators in two cultural contexts in East Africa, and similar research is needed more generally. Contextually appropriate, acceptable, low-cost, scalable strategies to support adherence to antenatal micronutrient supplements are needed to reduce maternal and child morbidity and mortality. Adherence partners are one potential strategy to increase adherence-specific social support.

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APPENDIX 1.

INITIAL COGNITIVE INTERVIEW GUIDE:
GENERAL SOCIAL SUPPORT SCALE

Interview information

Interviewer's Name:	
Date:	
District	
Ganda/kebele	
Setting (urban/rural)	

Thank you for agreeing to talk with me today. I am happy to be learning about your experiences. I would like to ask you several questions. I would like to know your answers to the questions, as well as what you think about the questions themselves and if they are clear. There are no right or wrong answers— you are the expert on your experiences. If you have any questions or if a question is difficult to understand, please let me know. Your honest responses will help us make questions that are clear and easy to understand.

Demographic information

What is your age?			
How many months pregnant are you?			
Who do you live with?			
Do you have any children?	Y	N	How many?
If yes, what are their ages:			
What is the highest level of education you completed?			
Did you receive iron-folic acid pills during your most recent pregnancy? <i>Note: If no, they should only answer the general social support scale questions</i>			

Start time: _____ : _____

There are times and situations in our lives when we need help, encouragement, and support. This help and encouragement can be given by a spouse or partner, family members, friends, or other members of our community. I would like to ask you questions about the help you receive in different situations from all of these people. I will ask you a question and after you answer it, I will ask you what you understand about the question itself and how you decided on your answer.

A. Ask: How often do you get visits from friends and family?

[If they need additional information] Do you get to see people who care about you who don't live near you or from people who do not live near you that you want to see?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. [If necessary, probe: Who are you thinking about? What circumstances are you thinking about?]
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer? If yes, in what way was it difficult to answer?
5. How would you answer the question if you had to choose one of the following responses:

How often do you get visits from friends and family?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
 - Was it difficult to answer the question using one of these responses?
 - If yes, in what way was it difficult?
 - Would “a little less than I would like” be a better way to describe the amounts of visits you receive from friends and family? Why?
 - Could you imagine that someone would feel that they get more visits from friends and family than they would want? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]
 7. How would you answer a similar question: How often do you meet or talk with your family, relatives, and friends?

8. Please tell me what you are thinking about as you answer this new question. [If necessary, probe: Who are you thinking about? What circumstances are you thinking about?]
- Is this question different from “How often do you get visits from friends and family?” How? [Probe if necessary: Is this different from what you were thinking about during the first question? Is it the same people? The same amount of time?]
 - What is your answer?
9. How would you answer this question if you had to choose one of the following responses:

How often do you meet or talk with your relatives and friends?	Much less than I would like	Less than I would like	As much as I would like
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- Does your answer fit within these response choices? Is there another response that you would prefer was an option?
- Would “a little less than I would like” be a better way to describe how often you meet or talk with relatives and friends? Why?
- Could you imagine that someone would feel that they meet or talk with their relatives and friends more than they would want? If yes, could you imagine feeling that way? Why?

B. Ask: How often do you get useful advice about important things in your life?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[Probe: What did “useful advice” mean to you? What kind of things did you think about when the question asked about “important things in your life”?*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?

If yes, in what way was it difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

How often do you get useful advice about important things in your life?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
 - How difficult was it to answer the question using one of these responses? Is there another response that you would prefer was an option?
 - What does “much less than I would like” mean to you?
 - What does “less than I would like” mean to you?
 - How is “much less than I would like” different from “less than I would like”
 - What does “as much as I would like” mean to you?
 - Would “a little less than I would like” be a better way to describe how often you get useful advice about important things in your life?
 - Could you imagine that someone would answer this question with more than I would like? Why would someone answer that way?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

C. Ask: How often do you get to talk with someone you trust about your personal and family problems?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question.
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?

If yes, why was it difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

How often do you get to talk with someone you trust about your personal and family problems?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
- How difficult was it to answer the question using one of these responses?
- Is there another response that would be easier to use to answer this question?
- Would “a little less than I would like” be a better way to describe how often you get to talk with someone you trust about personal and family problems?] Why?

Could you imagine that someone would answer this question with “more than I would like”? If yes, could you imagine feeling this way? Why?

6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

D. Ask: How often do you feel that there are people who are concerned about what happens to you?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question.
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?
If yes, why was it difficult to answer?
5. How would you answer the question if you had to choose one of the following responses?

How often do you feel that there are people who are concerned about what happens to you?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
- How difficult was it to answer the question using one of these responses?
- Does your answer fit within these response choices? Is there another response that you would prefer was an option?
- Would “a little less than I would like” be a better way to describe how often you feel that there are people who are concerned about what happens to you? Why?

Could you imagine that someone would answer this question with more than I would like? If yes, could you imagine feeling that way? Why?

6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

E. Ask: How often do you get the love and affection you want?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question.
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand? *[Probe: What do you understand by the words love and affection?]*
4. Was this question difficult for you to answer?

If yes, why was it difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

How often do you get the love and affection you want?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often you get the love and affection you want? Why?
 -
6. How could we ask this question that would make it clearer or easier for you to answer? *[If it is clear for her, ask how about for other people]*
 7. How would you answer a similar question: How often do you feel loved by the people you love?
 8. Please tell me what you are thinking about as you answer this new question. *[If necessary, probe: Who are you thinking about? What circumstances are you thinking about?]*
 - Is this question different? How? *[Probe if necessary: Is this different from what you were thinking about during the first question? Is it the same people? The same frequency?]*
 - What is your answer?
 9. How would you answer this question if you had to choose one of the following responses:

How often do you feel loved by the people you love?	Much less than I would like	Less than I would like	As much as I would like
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- Does your answer fit within these response choices? Is there another response that you would prefer was an option?
 - Would “a little less than I would like” be a better way to describe the amounts of visits you receive from friends and family?] Why?
 - Could you imagine that someone would feel that they feel loved by the people they love more than they would want? If yes, could you imagine feeling that way? Why?
10. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

F. Ask: How often do people show you that they are thankful for the things you do for your family?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[Probe if necessary: What is meant by appreciate? How is this demonstrated? By whom?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?

If yes, why was it difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

How often do people show you that they are thankful for the things you do for your family?	Much less than I would like	Less than I would like	As much as I would like
--	-----------------------------	------------------------	-------------------------

Why did you choose this answer?

- Does your answer fit within these response choices? Is there another response that you would prefer was an option?
- Would “a little less than I would like” be a better way to describe how often people show you that they are thankful for the things you do for your family? Why?

Could you imagine someone answering this question with “more than I would like”? If yes, could you imagine feeling that way? Why?

6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

G. Ask: How often do you get help with your household chores?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[Probe (if necessary): Who helps you? What kind of help are you thinking about?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?
If yes, why was it difficult to answer?
5. How would you answer the question if you had to choose one of the following responses:

How often do you get help with your household chores?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
 - How difficult was it to answer the question using one of these responses?
 - Does your answer fit within these response choices? Is there another response that you would prefer was an option?
 - Would “a little less than I would like” be a better way to describe the amounts of visits you receive from friends and family? Why?
 - Could you imagine that someone would answer this question with “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

H. Ask: How often do you get help with money in an emergency?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[Probe (if necessary): What kind of help? What kind of emergency? From whom?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?
If yes, why was it difficult to answer?
5. How would you answer the question if you had to choose from one of the following responses:

How often do you get help with money in an emergency?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
 - How difficult was it to answer the question using one of these responses?
 - Does your answer fit within these response choices? Is there another response that you would prefer was an option?
 - Would “a little less than I would like” be a better way to describe how often you get help with money in an emergency? Why?
6. If I ask, “How often do you get the help you need in an emergency? This could mean money, transport, or other help?” does this change your answer?
 7. If I ask, “How often do you get the help when you need to go somewhere and you do not have money for transportation?” does this change your answer?
 8. Which of these three questions is the easiest for you to answer? Why?
 - How often do you get help with money in an emergency?
 - How often do you get the help you need in an emergency? This could mean money, transport, or other help
 - How often do you get the help when you need to go somewhere and you do not have money for transportation?
 9. Could you imagine that someone could feel that they get more help in an emergency than they would want? If yes, could you imagine feeling that way? Why?
 10. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

I. Ask: How often do you get help when you are sick?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[Probe (if necessary): What kind of help? From whom? What kinds of sickness did you think about? Was there a particular time that you thought of?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?
If yes, why was this question difficult to answer?
5. How would you answer the question if you had to choose from one of the following responses:

How often do you get help when you are sick?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer?
 - How difficult was it to answer the question using one of these responses?
 - Does your answer fit within these response choices? Is there another response that you would prefer was an option?
 - Would “a little less than I would like” be a better way to describe how often you get help when you are sick? Why?
6. How would you answer a similar question, “How often do you get help being cared for when you are sick?”
 7. What are you thinking as you answer this question? Is it different from the question I just asked?
 8. Which of the two questions is easier to answer? Why?
 10. Could you imagine that someone would answer either of these question with “more than I would like”? If yes, could you imagine feeling that way? Why?
 11. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

End time: ____:____

APPENDIX 2.

INITIAL COGNITIVE INTERVIEW GUIDE:
ADHERENCE-SPECIFIC SOCIAL SUPPORT SCALE

Interview information

Interviewer's Name:	
Date:	
District	
Ganda/kebele	
Setting (urban/rural)	

Thank you for agreeing to talk with me today. I am happy to be learning about your experiences. I would like to ask you several questions. I would like to know your answers to the questions, as well as what you think about the questions themselves and if they are clear. There are no right or wrong answers— you are the expert on your experiences. If you have any questions or if a question is difficult to understand, please let me know. Your honest responses will help us make questions that are clear and easy to understand.

Demographic information

What is your age?			
How many months pregnant are you?			
Who do you live with?			
Do you have any children?	Y	N	How many?
If yes, what are their ages:			
What is the highest level of education you completed?			
Did you receive iron-folic acid pills during your most recent pregnancy? <i>Note: If no, they should only answer the general social support scale questions</i>			

Start time: ____ : ____

Most women need help, encouragement, and support at times during their pregnancy. This help can be given by the baby’s father, family members, friends, and health workers, such as nurses or community health workers. I would like to ask you questions about the help you receive from all of these people during your pregnancy. I will ask you a question. After you give your answer, then I will ask you what you understand about the question and how you decided on your answer.

I will also ask some specific questions about any help you received with taking iron-folic acid pills (show pills). Did you receive any pills like these from the health facility during your pregnancy? *[If women did not receive IFA, they should only answer questions on general social support].*

A. Ask: How often do people talk with you about ways to be healthy during pregnancy?

1. [After they answer] Please tell me what you were thinking about as you answered this question. *[(If necessary, probe: Who talks with you? What do they suggest you do?)]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. Was this question difficult for you to answer?

If yes, why was it difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

How often do people talk with you about ways to be healthy during pregnancy?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
- How difficult was it to answer the question using one of these responses?
- What does “much less than I would like” mean to you?
- What does “less than I would like” mean to you?
 - How is “much less than I would like” different from “less than I would like”
 - What does “as much as I would like” mean to you?
- Would “a little less than I would like” be a better way to describe how often people talk with you about ways to be healthy during pregnancy? Why?

- Could you imagine that someone would feel that people talk with them about ways to be healthy during pregnancy more than they would like? If yes, could you imagine feeling that way? Why?
 - Is there another response that would be easier to use to answer this question?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

B. Ask: During your pregnancy, how often do people do or say things to show that they are concerned about your health and the health of your baby?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who shows this concern? What do they say or do?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people do or say things to show that they are concerned about your health and the health of your baby?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people show they are concerned about your health and your baby’s health? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

C. During your pregnancy, how often do people listen to you talk about your feelings about the iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who listens to you? What do you talk about?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people listen to you talk about your feelings about the iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people listen to you talk about your feelings about the iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

D. How often do people encourage you to take your iron-folic acid pills during pregnancy?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who encourages you? How do they encourage you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

How often do people encourage you to take your iron-folic acid pills during pregnancy?	Much less than I would like	Less than I would like	As much as I would like
--	-----------------------------	------------------------	-------------------------

- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that you would prefer was an option?
 - Would “a little less than I would like” be a better way to describe how often people encourage you to take your iron-folic acid pills during pregnancy? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

E. During your pregnancy, how often do people bring you your IFA pills or fetch your iron pills for you?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. (If necessary, probe: Who handles your pills? What do they do?)
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people bring you your IFA pills or fetch your iron pills for you?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question
 - Would “a little less than I would like” be a better way for you to answer this question? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

F. During your pregnancy, how often do people tell you that taking iron-folic acid pills is healthy for you or your baby?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who tells you this? What do they tell you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people tell you that taking iron-folic acid pills is healthy for you or your baby?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people tell you that taking iron-folic acid pills is healthy for you or your baby? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

G. During your pregnancy, how often are there people who help you believe you can take your iron-folic acid pills as instructed?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who helps you believe? How do they help you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often are there people who help you believe you can take your iron-folic acid pills as instructed?	Much less than I would like	Less than I would like	As much as I would like
---	-----------------------------	------------------------	-------------------------

- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often there are people who help you believe you can take your iron-folic acid pills as instructed? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? *[If it is clear for her, ask how about for other people]*

H. During your pregnancy, how often do people ask you how you are doing taking your iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who asks you? What do they ask you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people ask you how you are doing taking your iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
---	-----------------------------	------------------------	-------------------------

- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people ask you how you are doing taking your iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

I. During your pregnancy, how often do people talk with you about taking your iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who talks with you? What do they talk with you about?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people talk with you about taking your iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
---	-----------------------------	------------------------	-------------------------

- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people talk with you about taking your iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? *[If it is clear for her, ask how about for other people]*

J. During your pregnancy, how often do people remind you to take your iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who reminds you? How do they remind you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people remind you to take your iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people remind you to take your iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]
 7. *[For people who are reminded, ask]:* Is it helpful to have them remind you? Why or why not?
 - Do you like when they remind you? Why or why not?

K. During your pregnancy, how often do people help you if you have any side effects from the iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. [If necessary, probe: Who helps you? How do they help you?]
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people help you if you have any side effects from the iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
--	-----------------------------	------------------------	-------------------------

- Why did you choose this answer?(Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people help you if you have any side effects from the iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
 -
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

L. During your pregnancy, how often do people help you understand information about your iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question.*[If necessary, probe: Who helps you? How do they help you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people help you understand information about your iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
--	-----------------------------	------------------------	-------------------------

- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people help you understand information about your iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

M. During your pregnancy, how often do people help you come up with a way to remember to take your iron-folic acid pills?

1. *[After they answer]* Please tell me what you were thinking about as you answered this question. *[If necessary, probe: Who helps you? How do they help come up with ways to remember?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy , how often do people help you come up with a way to remember to take your iron-folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
---	-----------------------------	------------------------	-------------------------

- Why did you choose this answer?(Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people help you come up with a way to remember to take your pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

N. During your pregnancy, how often do people encourage you to talk with a health worker if you have questions or problems with the pills?

1. *[After they answer] Please tell me what you were thinking about as you answered this question. [If necessary, probe: Who encourages you? How do they encourage you? When do they encourage you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do people encourage you to talk with a health worker if you have questions or problems with the pills?	Much less than I would like	Less than I would like	As much as I would like
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- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people encourage you to talk with a health worker if you have questions or problems with the pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

O. During your pregnancy, how often do you feel that people are proud of you for taking your iron and folic acid pills?

1. *[After they answer] Please tell me what you were thinking about as you answered this question. [If necessary, probe: Who encourages you? How do they encourage you? When do they encourage you?]*
2. Please explain what this question is asking using your own words.
3. Are there any words or phrases in the question that are confusing or difficult to understand?
4. How difficult was this question for you to answer?

What about it was difficult to answer?

5. How would you answer the question if you had to choose one of the following responses?

During your pregnancy, how often do you feel that people are proud of you for taking your iron and folic acid pills?	Much less than I would like	Less than I would like	As much as I would like
--	-----------------------------	------------------------	-------------------------

- Why did you choose this answer? (Probe, if necessary: Who and what were you thinking about that made you choose this answer?)
 - How difficult was it to answer the question using one of these responses?
 - Is there another response that would be easier to use to answer this question?
 - Would “a little less than I would like” be a better way to describe how often people are proud of you for taking your iron-folic acid pills? Why?
 - Could you imagine that someone would answer this question “more than I would like”? If yes, could you imagine feeling that way? Why?
6. How could we ask this question that would make it clearer or easier for you to answer? [If it is clear for her, ask how about for other people]

End time: ____ : ____

APPENDIX 3.

REVISED COGNITIVE INTERVIEW GUIDE:

GENERAL SOCIAL SUPPORT SCALE

Instructions for interviewer

The main objective of this round of testing is to see if the questions from the General Social Support Scale in section A are well understood by women. We also want to confirm that the items in the scale reflect the social support that women want and expect. Please ask all of the questions in the scale as they are written. For the questions in section B, there is no need to ask questions if they have been answered before. Please only probe if necessary. Feel free not ask questions or probes in section B if the woman has adequately responded to that information earlier in the interview. Also, feel free to ask other clarifying questions that are not included in section B as appropriate. We are relying on you to decide which questions need more probing and which do not. We do not want to burden people. Thank you!

Interview information

Interviewer's Name:	
Date:	
District	
Ganda/kebele	
Setting (urban/rural)	

Thank you for agreeing to talk with me today. I am happy to be learning about your experiences. I would like to ask you several questions about the help and encouragement you receive. We will use this information to develop questions to ask other pregnant women about their experiences so that we can understand the kind of support pregnant women have and want. There are no right or wrong answers— you are the expert on your experiences. If you have any questions or if a question is not clear, please let me know. This will help us make questions that are clear and easy to understand. Because these questions were written in the United States in English and have been translated into Afan Oromo, we want to make sure the questions are clear for women in this area.

Start time: _____:_____

A. General social support scale

There are times in our lives when we need help, encouragement, and advice from people we know. This help can be given by a spouse, family members, friends, neighbors, or other members of your community. I would like to ask you questions about the different kinds of help you receive.

Note to interviewer: For this set of 10 questions, follow up about any questions that seemed difficult for the woman to answer and ask why it was difficult. For example, if she hesitates, you could say, "It seems like this wasn't a clear a question, what is not clear about this question?" If they do not seem to have any problems, there is no need to ask or probe. Please note if that the question was understood.

	Question			Notes
1	Do you get visits from your friends, neighbors, and relatives (who do not live with you)?	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
2	Do you get useful advice about important things in your life? For example, from your husband, family members, friends, neighbors, or others.	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
3	Do you get to talk with someone you trust about your personal and family problems? For example, from your husband, family members, friends, neighbors, or others.	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	

	Question			Notes
4	Are there people who hope you are doing well?	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
5	Do you feel loved by your family?	<input type="checkbox"/> No	[If no] Would you like that? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
6	Do your husband and family tell or show you that they are thankful for the things you do for your family?	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
7	Do you get help with your household chores?	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
8	Do you get help with money in an emergency? For example, when you or someone in your family is sick, or if you have a problem with your pregnancy.	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	

	Question			Notes
9	Does anyone help you when you need transportation? For example, money for transportation, horseback, help arrange for travel?	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
10	Do you get cared for when you are sick at home?	<input type="checkbox"/> No	[If no] Would you like to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do you get: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	

- How easy was it for you to answer these questions? Tell me about any of the questions that were unclear.
- Do you think women in this area can answer these questions easily?
- For any of these questions, could you imagine answering that you get too much of the help described than you would like? This would mean that you would prefer to receive less help and encouragement than people give you.

B. Open-ended questions on general social support

1. There are many different ways your family members, neighbors, friends, and others can help and encourage you. This can be through talking with you or listening to your feelings or problems, helping you with specific tasks, giving money or items when you need them, encouraging you or praising you, showing you love and concern, or giving information or advice.

- a. Which of these are important to you? [Note: For each response ask:] Who should provide this?
- b. What kind of help and encouragement do you receive that makes you feel cared about and supported?

2. We have talked about several different types of help.

- Are there other types of help that you need or want that I did not ask about?
- Were some of the types of help that I asked about not important to you?

3. Is it important for you to feel like your family is thankful for all of the work you do?

- Is this something you expect? Why?
- Is this something you would like? Why?
- What does (or could) your family do or say to show they are thankful for the work you do?

4. When you are sick, what kind of help would you like, (for example, help with chores, help being cared for, etc.)?

- Do you expect this kind of help when you are sick?

When I asked you question about get cared for when you are sick, what type of care were you thinking?

5. When I asked questions about help with money in an emergency, what kind of an emergency were you thinking of?

6. When I asked, "Do you feel loved by your family?" Who were you thinking about? What kinds of things do they do or say that make you feel loved?

Thank you for sharing your experiences with us!

APPENDIX 4.

REVISED COGNITIVE INTERVIEW GUIDE:

ADHERENCE-SPECIFIC SOCIAL SUPPORT SCALE

Instructions for interviewer

The main objective of this round of testing is to see if the questions from the Adherence Specific Social Support scale are well understood by women. We also want to confirm that the items in the scale reflect the social support that women want and expect. Please ask all of the questions in the scale (Section B) as they are written. For section C, there is no need to ask questions if they have been answered before. Please only probe if necessary. Feel free not ask questions or probes in sections A and C if the woman has adequately responded to that information earlier in the interview. Also, feel free to ask other clarifying questions that are not included in A and C as appropriate. We are relying on you to decide which questions need more probing and which do not. We do not want to burden people. Thank you!

Interview information

Interviewer's Name:	
Date:	
District	
Ganda/kebele	
Setting (urban/rural)	

Thank you for agreeing to talk with me today. I am happy to be learning about your experiences. I would like to ask you several questions about the help and encouragement you receive. We will use this information to develop questions to ask other pregnant women about their experiences so that we can understand the kind of support pregnant women have and want. There are no right or wrong answers— you are the expert on your experiences. If you have any questions or if a question is difficult to understand, please let me know. This will help us make questions that are clear and easy to understand. Because these questions were written in the United States in English and have been translated into Afan Oromo, we want to make sure the questions are clear for women in this area.

Start time: _____:_____

A. Adherence-specific social support

Many women need help, encouragement, and advice during their pregnancy. This help can be given by a spouse, family members, friends, neighbors, health workers (such as nurses or HEWs) or other members of the community. I would like to ask you questions about the help you receive and the help you would like to receive during your pregnancy.

We are asking these questions because doctors might start to ask pregnant women to take 3-4 pills each day during pregnancy, instead of just the one IFA pill. These new pills could help reduce the risk of high blood pressure during pregnancy and help prevent fits during pregnancy. We are trying to understand what would make it easier for pregnant women to take additional pills each day.

- What kind of help and encouragement would you like to receive to help you take these pills during pregnancy?
 - For each response, probe: Who provides this kind of help?
 - Probe if not mentioned:
 - Information/advice
 - Emotional (talking about concerns)
 - Reminding to take pills
 - Bringing pills
 - Encouraging pill taking
- What kind of help and encouragement do you receive that makes you feel cared about and supported?

B. Adherence-specific social support scale

Now I would like to ask you questions about the different kinds of help and encouragement you receive during pregnancy.

[Note to interviewer*:** For this set of 10 questions, follow up about any questions that seemed difficult for the woman to answer and ask why it was difficult. For example, if she hesitates, you could say, “It seems like this wasn’t a clear a question, what is not clear about this question?” If they do not seem to have any problems, there is no need to ask or probe. Please note if that the question was understood.]

	Question			Notes
1	Does anyone talk with you about ways to be healthy during pregnancy? For example, your husband, family members, or health workers.	<input type="checkbox"/> No	[If no] Would you like someone to talk with you? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Does this happen: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
2	Does anyone do or say things to show they care about your health and the health of your baby? For example, your husband, family members, or neighbors.	<input type="checkbox"/> No	[If no] Would you like someone to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Does this happen: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
3	Does anyone talk with you about your feelings about taking your iron-folic acid pills?	<input type="checkbox"/> No	[If no] Would you like someone to talk with you about them? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Does this happen: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	

	Question			Notes
4	Does anyone encourage you to swallow/ingest/take your iron-folic acid pills?	<input type="checkbox"/> No	<p>[If no] Would you like someone to encourage you?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	<p>[If yes] Do they encourage you:</p> <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
5	Does anyone bring your iron-folic acid pills to you when it is time to swallow them?	<input type="checkbox"/> No	<p>[If no] Would you like someone to bring you your pills?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	<p>[If yes] Do they bring them:</p> <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
6	Does anyone tell you that taking iron-folic acid pills is healthy for you or your baby?	<input type="checkbox"/> No	<p>[If no] Would you like someone to tell you that the pills are healthy?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	<p>[If yes] Do they tell you:</p> <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
7	Does anyone remind you to swallow your iron-folic acid pills?	<input type="checkbox"/> No	<p>[If no] Would you like someone to remind you?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	<p>[If yes] Do they remind you:</p> <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	

	Question			Notes
8	Does anyone encourage you to talk with a health worker if you have problems with the IFA pills?	<input type="checkbox"/> No	[If no] Would you like someone to? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do they encourage you: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
9	Does anyone say it is good that you are taking your iron and folic acid pills?	<input type="checkbox"/> No	[If no] Would you like someone to say it is good? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do they say it is good: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
10	Does anyone bring or prepare food for you to help you take your pills	<input type="checkbox"/> No	[If no] Would you like that: <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Do they bring or make food: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	
11.	Do most people who are important to you and know that you are taking IFA pills support you to take or (swallow) your pills? For example, your spouse, family, friends, or neighbors.	<input type="checkbox"/> No	[If no] Would you like them to support you? <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<input type="checkbox"/> Yes	[If yes] Is the support you receive: <input type="checkbox"/> Less than you would like <input type="checkbox"/> As much as you would like	

- How easy was it for you to answer these questions? Tell me about any of the questions that were unclear.
- Do you think women in this area can answer these questions easily?

C. Open-ended questions on social support for pill taking in pregnancy

[Remember: Do not ask questions or probe if things have already been discussed.]

- I just asked you about several different types of help during pregnancy, such as talking with you about being healthy, encouraging you to talk to a health worker, reminding you to take your pills, telling you taking the pills is good for you.
 - Are there other types of help that you need or want to take IFA during pregnancy that I did not ask about?
 - If yes, what?
 - Who would provide this support?
 - Were some of the types of help that I asked about not important to you? Is it important to you to have someone talk with you about being healthy in pregnancy, encouraging you to talk to a health worker, reminding you to take your pills, telling you taking the pills is good for you.
 - If yes, which ones?
 - For any of these questions, could you imagine answering that you get too much of the help described than you would like? This would mean that you would prefer to receive less help and encouragement than people give you.
- Is having someone help prepare or purchase food for you important for you to take your pills? Is it something you would expect during pregnancy?
- What kind of help is most important for you to be able to swallow/take all of your IFA pills throughout pregnancy?
- Is it helpful to have someone that you can talk with about [your feelings/your experience] taking IFA pills?
 - Who?
 - What would be helpful?
- When asked if anyone encourages you to swallow/ingest/take your iron-folic acid pills? Who encourages you?
- Are there people in your family or among your friends who discourage you from taking your IFA pills?
 - Who?
 - What do they say?
- Do the opinions of others about IFA influence your decision to take the pills?
 - How?
 - Who influences?
 - Who does not influence you?
- When I asked about someone bringing you your IFA pills, what did you think of?
Thank you for sharing your experiences with us!

APPENDIX 5.

REVISIONS TO THE GENERAL SOCIAL SUPPORT SCALE

	Initial general social support scale^a	Revised general social support scale	Final general social support scale	Basis for revisions
1a.	How often do you get visits from friends and family?	Do you get visits from your friends, neighbors, and relatives (who do not live with you)?	Same.	
1b.	How often do you meet or talk with your relatives and friends?	Deleted.		Question 1a was preferable and easier for participants to answer.
2.	How often do you get useful advice about important things in your life?	Do you get useful advice about important things in your life? For example, from your husband, family members, friends, neighbors, or other members of your community.	Same.	Participants thought about people outside of their families; examples were needed.
3.	How often do you get to talk with someone you trust about your personal and family problems?	Do you get to talk with someone you trust about your personal and family problems? For example, your husband, family members, friends, neighbors, or other members of your community.	Same.	Participants thought about people outside of their families; examples were needed.

	Initial general social support scale^a	Revised general social support scale	Final general social support scale	Basis for revisions
4.	How often do you feel that there are people who are concerned about what happens to you?	Are there people who hope you are doing well?	Are there people who are concerned about whether you are doing well?	“What happens to you” was unclear.
5a.	How often do you get the love and affection you want?	Do you feel loved by your family?	Same.	“Affection” was inappropriate and deleted. “Family” added for clarity.
5b.	How often do you feel loved by the people you love?	Deleted.		Question 5a was preferable and easier for participants to answer.
6.	How often do people show you that they are thankful for the things you do for your family? ^b	Do your husband and family tell or show you that they are thankful for the things you do for your family?	Same.	
7.	How often do you get help with your household chores?	Do you get help with your household chores?	Same.	

	Initial general social support scale^a	Revised general social support scale	Final general social support scale	Basis for revisions
8.	How often do you get help with money in an emergency?	Do you get help with money in an emergency? For example, when you or someone in your family is sick, or if you have a problem with your pregnancy.	Do you get help with money in an emergency?	Examples of emergencies were not required.
9.		Does anyone help you when you need transportation? For example, money for transportation, help arranging travel.	Does anyone help you when you need transportation? For example, giving money or helping arrange for travel.	Added because transportation was spontaneously mentioned by participants.
10.	How often do you get help when you are sick?	Do you get cared for when you are sick at home?	Same.	Added “at home” to differentiate from care provided at a facility.

^aAdapted from the Functional Social Support Scale (Antelman et al. 2001). ^bAdapted from the Sanitation, Hygiene, Infant Nutrition Efficacy (SHINE) Trial (Matara et al. 2015).

APPENDIX 6.

REVISIONS TO THE ADHERENCE-SPECIFIC SOCIAL SUPPORT SCALE

	Initial adherence-specific social support scale	Revised adherence-specific social support scale	Final adherence-specific social support scale	Basis for revisions
1.	How often do people talk with you about ways to be healthy during pregnancy?	Does anyone talk with you about ways to be healthy during pregnancy? For example, your husband, family members, or health workers.	Does anyone discuss ways for you to be healthy during pregnancy? For example, your husband, family members, or health workers.	Replaced “talk” with “discuss” because “talk” was understood to mean a formal health talk at a health facility.
2.	During your pregnancy, how often do people do or say things to show that they are concerned about your health and the health of your baby?	Does anyone do or say things to show they care about your health and the health of your baby? For example, your husband, family members, or neighbors.	Same.	
3.	During your pregnancy, how often do people listen to you talk about your feelings about the iron-folic acid pills?	Does anyone talk with you about your feelings about taking your iron-folic acid pills?	Does anyone discuss your feelings about taking calcium and iron-folic acid pills?	Replaced “talk” with “discuss” because “talk” was understood to mean a formal health talk at a health facility.

	Initial adherence-specific social support scale	Revised adherence-specific social support scale	Final adherence-specific social support scale	Basis for revisions
4.	How often do people encourage you to take your iron-folic acid pills during pregnancy?	Does anyone encourage you to take your iron-folic acid pills?	Same.	
5.	During your pregnancy, how often do people bring you your iron-folic acid pills or fetch your iron pills for you?	Does anyone bring your iron-folic acid pills?	Does anyone bring your calcium and iron-folic acid pills to you when it is time to swallow them?	Participants understood this to mean going to the health facility to pick up pills.
6.	During your pregnancy, how often do people tell you that taking iron-folic acid pills is healthy for you or your baby?	Does anyone tell you that taking iron-folic acid pills is healthy for you or your baby?	Deleted.	Participants only thought about health care providers and not others in their social network.
7.	During your pregnancy, how often are there people who help you believe you can take your iron-folic acid pills as instructed?	Deleted.		No one expected this.

	Initial adherence-specific social support scale	Revised adherence-specific social support scale	Final adherence-specific social support scale	Basis for revisions
8.	During your pregnancy, how often do people ask you how you are doing taking your iron-folic acid pills?	Deleted.		Redundant.
9.	During your pregnancy, how often do people talk with you about taking your iron-folic acid pills?	Deleted.		Redundant.
10.	During your pregnancy, how often do people remind you to take your iron-folic acid pills?	Does anyone remind you to swallow your iron-folic acid pills?	Same.	
11.	During your pregnancy, how often do people help you if you have any side effects from the iron-folic acid pills?	Deleted.		Participants only thought about health care providers and not others in their social network.

	Initial adherence-specific social support scale	Revised adherence-specific social support scale	Final adherence-specific social support scale	Basis for revisions
12.	During your pregnancy, how often do people help you understand information about your iron-folic acid pills?	Deleted.		Participants only thought about health care providers and not others in their social network.
13.	During your pregnancy, how often do people help you come up with a way to remember to take your iron-folic acid pills?	Deleted.		Redundant with question 10.
14.	During your pregnancy, how often do people encourage you to talk with a health worker if you have questions or problems with the pills?	Does anyone encourage you to talk with a health worker if you have problems with the iron-folic acid pills?	Same.	
15.	During your pregnancy, how often do you feel that people are proud of you for taking your iron and folic acid pills?	Does anyone say it is good that you are taking your iron and folic acid pills?	Same.	

	Initial adherence-specific social support scale	Revised adherence-specific social support scale	Final adherence-specific social support scale	Basis for revisions
16.			Does anyone bring or prepare food for you to help you take your calcium and iron-folic acid pills?	Participants confirmed this was expected during pregnancy.
17.		Do most people who are important to you and know that you are taking iron-folic acid pills support you to take (or swallow) your pills? For example, your spouse, family, friends, or neighbors.	Do most people who are important to you and know that you are taking iron-folic acid pills agree that you should take (or swallow) your pills? For example, your spouse, family members, or neighbors.	The word “support” was not well understood; “agree” was used to ease comprehension.

APPENDIX 7.

ADHERENCE PARTNER BEHAVIOR CHANGE MATERIALS

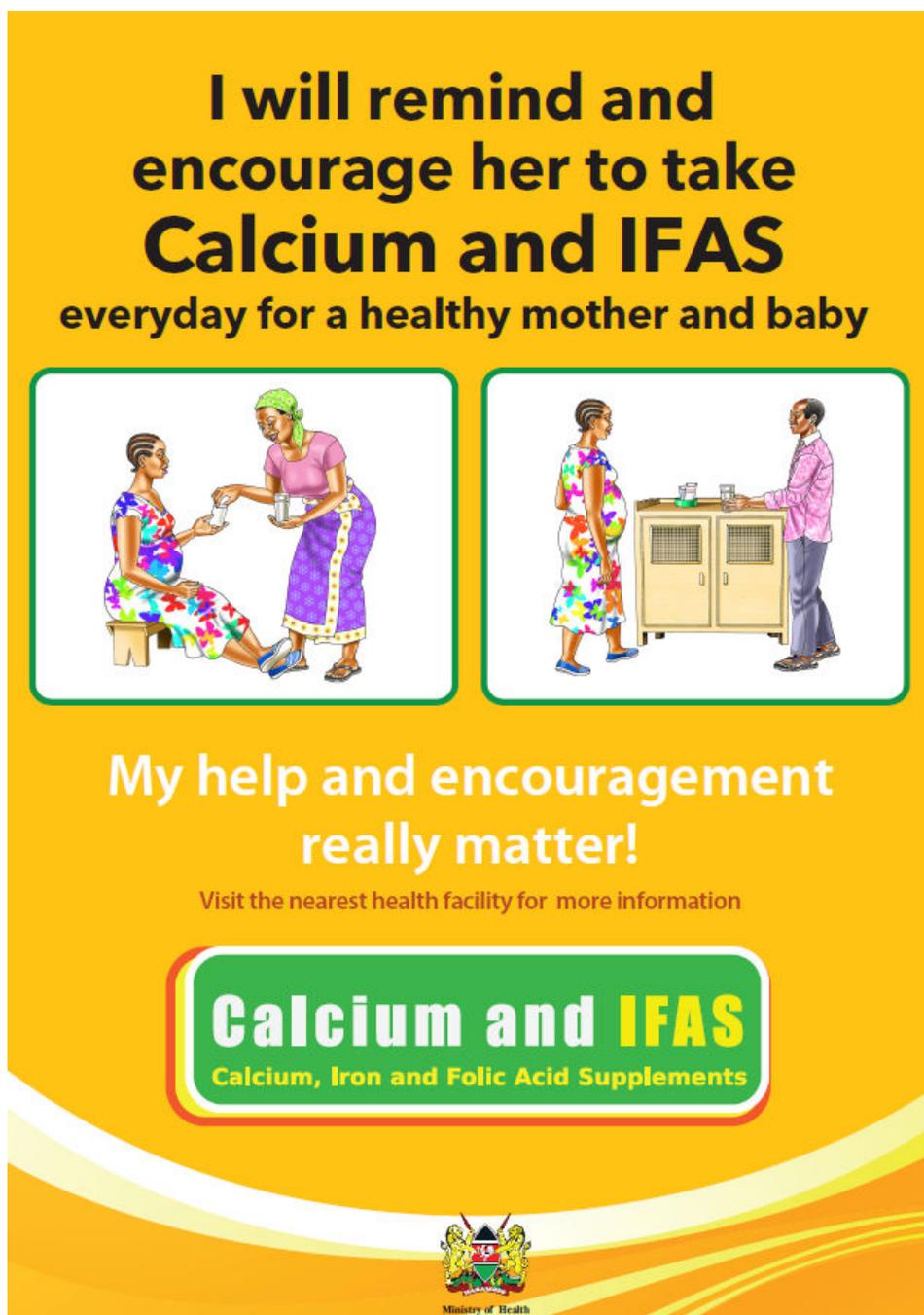


Figure 1. Adherence partner poster (English translation)



Ask someone close to you to help remind you and encourage you to take the tablets every day

1 Probing questions for health worker

- Ask the client to describe what they see in the picture
- If this is her first visit provide all the information in this card
- If this is her return visit, ask her if someone has been encouraging and reminding her to take the calcium and IFAS
- Build on the client response explain that having someone who encourages and reminds her can help her take her tablets every day.

2 Explain to the woman

- For some women, asking someone to help and encourage them can make it easier for them to take their calcium and IFAS tablets.
- Is there someone at home or near your home who you could ask to help and encourage you to take these tablets?
- What kind of help would you like from them?

3 Follow up question for client
Will you ask someone to help and encourage you to take your tablets every day?

13

Figure 2. Adherence partner counseling card (English translation)

Month 1 (One)









	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1							
Week 2							
Week 3							
Week 4							

Tick after taking each tablet



Take calcium and IFAS tablets everyday for a healthy pregnancy and healthy baby

3

Figure 3. Example page from take-home calendar (English translation)

APPENDIX 8.

BARRIERS TO CALCIUM AND IFA ADHERENCE

Table 1. Barriers to calcium adherence in previous month

Reported barriers	n (n=641)	%
None	481	75.04
Side effects	96	14.98
Taking with meals	32	4.99
Forgetting	11	1.72
Not at home	6	0.94
Too many pills	6	0.94
Fear of pills	5	0.78
Organoleptic properties	2	0.31
Other illnesses	1	0.16
Discouraged by others	1	0.16

Table 2. Barriers to IFA adherence in previous month

Reported barriers	n (n=637)	%
None	593	93.09
Side effects	29	4.55
Taking with meals	8	1.26
Forgetting	3	0.47
Not at home	2	0.32
Too many pills	2	0.31

Table 3. Overall difficulty taking any supplements in previous month

How difficult was it?	n (n=638)	%
Not difficult	545	85.02
Somewhat difficult	77	12.43
Very difficult	16	2.55

Table 4. Feelings attributed to calcium and iron-folic acid supplements

	Calcium (n=577)	IFA (n=573)
Worse, %	11.8	4.9
Same, %	22.0	34.0
Better, %	66.2	61.1

APPENDIX 9.

PARTICIPANT CHARACTERISTICS BY INCLUSION CATEGORY

Variable	Included in analysis (n=646)	No pill counts at follow up (n=267)	Did not return for follow up (n=123)	p
Age (years) mean (SD)	25.15 (5.94)	24.67 (5.56)	24.97(6.02)	0.53
Adolescent, %	17.8	17.3	20.0	0.81
Education completed,(%)				
Primary not completed	23.3	21.4	24.8	0.45
Primary completed	55.0	51.3	53.7	
≥Secondary completed	21.7	27.3	21.5	
Luhya ethnicity, %	95.8	94.7	99.2	0.12
Primigravid, %	24.3	25.8	29.3	0.50
Months pregnant, mean (SD)	5.19 (3.83)	5.59 (1.08)	5.80 (0.99)	0.052
Married, %	88.4	88.3	82.0	0.13
Spouse education,%				
Primary not completed	20.0	14.6	18.5	0.46
Primary completed	49.0	50.4	49.5	
≥Secondary completed	31.0	35.0	32.0	
Household Hunger, %				
Little to no hunger	73.8	77.2	75.6	0.87
Moderate hunger	19.7	17.6	18.7	
Severe hunger	6.5	5.24	5.7	
General social support, %				
Low	25.6	32.3	24.0	0.17
Moderate	28.0	28.3	33.0	
High	46.4	39.4	43.0	
Household structure				
Other family lives nearby	76.9	76.7	83.6	0.24
Spouse living with her	84.3	83.4	88.5	0.48
Spouse away in past week	15.2	22.7	16.5	0.07
Spouse travels often	21.7	23.5	20.4	0.78
Spouse has other wives	10.0	11.2	3.9	0.07
Mother-in-law lives close	80.7	82.8	83.8	0.68
Assigned regimen, %				
2-pill calcium	46.1	61.8	52.5	0.000
3-pill calcium	53.9	38.2	47.5	
Counseled on AP,%	79.5	72.8	88.1	<0.001
Received AP poster, %	90.9	85.7	92.4	0.007
Thinks AP would help¹, %	89.3	87.3	93.6	0.006
Intends to ask an AP, %	81.2	83.0	84.5	0.62

AP, adherence partner

¹ Participants were asked: How helpful do you think it would be to have someone encourage you to take your pills, not helpful, somewhat helpful, or very helpful. This percentage reflects responses of “very helpful.”

APPENDIX 10.

SELF-REPORTED ADHERENCE TO CALCIUM AND IFA SUPPLEMENTS

Table 1. Participants' self-reports of how often they took supplements as prescribed

	Calcium (n=642)		IFA (n=639)	
	n	%	n	%
Almost never	6	0.93	4	0.63
Sometimes	31	4.83	17	2.66
Often	99	15.42	72	11.27
Almost always	506	78.82	546	85.45

Table 2. Self-reported 3-day adherence

	Calcium (n=583)	IFA (n=483)
	Mean (SD)	97.80 (8.09)
Median	100	100
Category, n %		
0%-79%	22 (3.77)	0 (0)
80%-99%	38 (6.52)	0 (0)
100%	523 (89.71)	483 (100)

Table 3. Mean pill counts by 1-month self-report categories (ANOVA)

1-month self-report category	Calcium (n=586)		IFA (n=544)	
	n	Mean (SD)	n	Mean (SD)
Almost never	6	68.7 (44.4)	4	0 (0)
Sometimes	32	60.9 (26.4)	11	76.6 (30.8)
Often	95	80.2 (20.6)	73	87.5 (17.3)
Almost always	517	87.7 (20.2)	511	88.0 (20.9)
	650	p<0.001	599	p<0.001

APPENDIX 11.

RELATIONSHIP BETWEEN GENERAL SOCIAL SUPPORT AND ADHERENCE-SPECIFIC SOCIAL SUPPORT

