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Barrier Analysis of Diet Diversity and Milk Consumption of Infants and Young Children in Rural Kenya

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Bachelor of Art
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2012

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
In the Hubert Department of Global Health
2020

Abstract

Barrier Analysis of Diet Diversity and Milk Consumption of
Infants and Young Children in Rural Kenya
By Youngjoo Park

Context: Among rural Kenyan children, only 30% meet global indicators for minimum dietary diversity. For infants and young children 6-24 months old, diet diversity is an indicator of nutritional adequacy and is inversely associated with malnutrition and stunting. The International Livestock Research Institute (ILRI) is a non-profit organization that works in rural communities in Kenya to improve child nutrition through dairy programs. To inform their programming, ILRI conducted formative research among mothers, fathers, and grandmothers of infants and young children to understand the perceived barriers and facilitators of diet diversity and milk feeding practices. This study's objectives are to identify the key determinants of behavior that drive diet diversity and milk consumption behaviors in rural communities in Kenya.

Methods: Data were collected in 2017 in Busia, Kitui, Siaya, Taita Taveta, and Vihiga counties. A barrier analysis survey was conducted among 100 mothers of infants and young children 6-24 months old and 15 focus groups were conducted among mothers, fathers, and grandmothers. Survey participants were categorized as "doers" or "nondoers" of two desired behaviors of diet diversity and milk consumption and analyzed with chi-square tests. Focus group discussion data were used to triangulate findings from the surveys.

Results: 41% of all mothers had fed their child from at least four food groups in the previous day and 66% of mothers of children 12-24 months fed their child at least one serving of milk per day (doer status). Significant differences between doers and nondoers for the diet diversity analysis included action-efficacy and perceived advantages. Milk serving doers tended to have more self-efficacy compared to nondoers and cited livestock ownership more often as a facilitator.

Discussion: To successfully change behavior, ILRI's programming should focus on improving mothers' knowledge of how diet diversity can prevent malnutrition in infants and young children. Milk's acceptability for children in the community was confirmed but there were differences in perceptions of access. Household livestock ownership and milk production may play an important role in improving mothers' opportunity to feed their children more milk. Further analyses should examine doer and nondoer behavior by region.

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Introduction

In Kenya, while 26% of all children under five years old are stunted, the prevalence of stunting is higher in rural children – 29% of rural children in Kenya are stunted compared to 20% of urban children (Kenya National Bureau of Statistics et al., 2015). Largely caused by chronic malnutrition, the high stunting rates in Kenya have severe health implications. Child malnutrition has been linked to decreased immune function and increased infection rates (Bourke et al., 2016) and is a significant risk factor for child mortality (Bhutta et al., 2008; Caulfield et al., 2004). Stunting is largely irreversible and the critical period for child growth has been found to be within the first two years of life (Bhutta et al., 2008; Victora et al., 2010). These increased risks and Kenya's high stunting rates highlight the importance of improving infant and young child feeding practices in Kenya.

Diet diversity is an indicator of nutrient adequacy and has been found to be inversely associated with malnutrition (Arimond & Ruel, 2004; Ruel, 2003). Diet diversity is a challenge in Kenya where diets largely consist of starches and only 29.9% of rural breastfed children met WHO indicators for minimum diet diversity (Kenya National Bureau of Statistics et al., 2015). As an important source of calcium and other vitamins, feeding young children cow's milk has also been found to be associated with linear growth and prevention of stunting (Dror & Allen, 2011a).

There are many different types of interventions for infant and young child feeding practices, with a wide range of efficacy. However, well-designed and context-specific child nutrition interventions have been successful in improving infant and young child feeding practices (Bhutta et al., 2008; Caulfield et al., 1999). To adequately address the

high rates of stunting and malnutrition in rural areas of Kenya through effective nutrition interventions, there is a need to identify the determinants of behaviors that drive diet diversity and milk feeding practices among mothers of infants and young children 6-24 months old in rural Kenya. Therefore this study's objectives include:

1. Understanding the perceived barriers and facilitators of diet diversity and milk feeding practices for infants and young children in rural communities of Kenya.
2. Identifying the key determinants of behavior for diet diversity by examining the differences in perceived barriers and facilitators between mothers who meet diet diversity indicators for their infants and young children and mothers who do not meet diet diversity indicators.
3. Identifying the key determinants of behavior for additional milk consumption by examining the differences in perceived barriers and facilitators for milk consumption between mothers who feed their child at least a serving of milk per day and mothers who do not feed their child a serving of milk per day.

By understanding the behavior of specific communities in rural Kenya, tailored intervention programs can be developed to target the key determinants of behavior. Well-designed interventions informed by community-specific needs can then have the intended impact on infant and young child feeding practices to improve malnutrition in rural communities in Kenya.

Literature Review

Child Undernutrition

The World Health Organization (WHO) estimates that undernutrition is associated with 45% of all child deaths (World Health Organization, 2018). Globally in 2016, among children under five years old, 155 million children were considered to be stunted and 52 million were considered to be wasted (World Health Organization, 2018). Stunting, defined as height-for-age shorter than two standard deviations from the WHO median, is largely irreversible and the critical window for growth promotion occurs in the first two years of life (Victora et al., 2010). This short period highlights the importance of infant and young child feeding practices.

According to the 2014 Kenya Demographic Health Survey (DHS), while Kenya has improved its stunting rates from 38% of children under five years old in 1998, Kenya still experiences high rates of childhood stunting with 26% of children being stunted in 2014 (Kenya National Bureau of Statistics et al., 2015). The Kenya DHS also reported that child stunting rates are even higher in rural areas at 29%, as well as drastic stunting disparities regionally, with the more urban Nairobi county experiencing the lowest rates of stunting at 17.2% compared to the Eastern county of Kitui with a rate of 45.8%.

Infant and Young Child Feeding Practices

For infants and young children under two years old, WHO feeding recommendations include breastfeeding and complementary feeding practices (World Health Organization, 2018). WHO indicators for infant and young child feeding practices include early initiation of breastfeeding, exclusive breastfeeding until six months of age, and introduction of complementary foods at six months (World Health Organization,

2008). In addition to the timing of complementary feeding introduction, WHO indicators include diet diversity and meal frequency as measures of adequate nutritional intake from complementary feeding (World Health Organization, 2008).

While Kenya is largely meeting WHO indicators for continued breastfeeding with 91% of children 6-23 months old being breastfed, only 22% of children meet WHO's standard for a minimally acceptable diet, an indicator that accounts for breastfeeding status, meal frequency, and diet diversity (Kenya National Bureau of Statistics et al., 2015). While 51% of infants and young children meet indicators for meal frequency, the weakest component of minimally acceptable diet was diet diversity, with only 41% of children being fed an adequately diverse diet (Kenya National Bureau of Statistics et al., 2015). Disparities between rural and urban areas also exist with 56.6% of urban children meeting diet diversity indicators compared to 32.1% of rural children.

Diet Diversity

The WHO defines minimum acceptable diet diversity for children 6-23 months old as consuming from at least four of seven food groups: grains, roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin-A rich fruits and vegetables; and other fruits and vegetables (WHO, 2008). Diet diversity is significantly associated with malnutrition and can be used as an indicator of diet quality and nutrient intake, even after controlling for possible economic confounders (Arimond & Ruel, 2004; Ruel, 2003). A cross-sectional study using Demographic and Health Surveys from 39 countries found that children 6-23 months old were less likely to be stunted with each additional food group they consumed food from; children who ate from five food groups still had significantly lower stunting rates than children who ate from four food groups (Krasevec et al., 2017).

Diet diversity and nutrient intake is especially challenging in low and middle-income countries where diets predominantly feature starches (Bwibo & Neumann, 2003; Ruel, 2003). A study on children 9-11 months old in two rural counties in Kenya found that out of over 60 unique food items identified to be fed to children, only 8-13 food items were commonly consumed by more than 20% of their sample (Ferguson et al., 2015). Commonly consumed food items included maize, millet, or sorghum flour, rice, potatoes, cow's milk, beans, chicken or vegetable broth, kale, tomato, avocado, and onions. While researchers determined that most nutrient intake gaps could be reduced by changing food consumption behavior, zinc, iron, and calcium adequacy remained a challenge with locally available foods (Ferguson et al., 2015).

Milk Consumption for Young Children

In sub-Saharan Africa, animal source food (ASF) contributes less than 5% of caloric energy and the lack of ASF in the diet of Kenyan children has been well documented since the 1920s (Bwibo & Neumann, 2003; Dror & Allen, 2011). Although animal husbandry is common among rural households in Kenya, infants and young children do not regularly consume meat, although cow's milk is more often consumed (Bwibo & Neumann, 2003). With its widespread availability, milk can be an important source of vitamin B, vitamin A, riboflavin, folate, and calcium, but due to other limitations, it is not recommended for infants less than 12 months old (Dror & Allen, 2011).

A review of the literature on the benefits of ASF's for children in developing countries found that there was robust observational evidence of milk consumption and linear growth (Dror & Allen, 2011). Dror and Allen's review also found three randomized

controlled trials that examined the effects of a milk feeding intervention for children compared to a nonintervention control group – all three found some evidence that the children in the milk intervention had improved growth rates or reduced stunting (2011). One of the trials took place in Kenya and compared equicaloric milk, meat, and oil supplement interventions for 5-14 years old rural children against a control group (Grillenberger et al., 2003). This study found that the milk intervention had the largest effect on height gain among children with more stunting (height-for-age z scores≤ -1.4).

More recently, a study in Western Kenya examined the consumption of ASF and child growth in infants and young children 6 months-5 years old through a longitudinal cohort study (Mosites et al., 2017). This study conducted 3-day feeding recalls with caregivers for over 800 children and found that over time, each additional feeding of milk was significantly associated with linear growth. Even children who only consumed milk once a day still grew 3% more in height per month compared to children who were not fed milk (Mosites et al., 2017). These findings emphasize that increasing milk consumption in young children over 12 months old can have an impact on linear growth and prevention of stunting.

Need for Context-Specific Interventions

While there are many different types of interventions and programs for infant and young child nutrition, their effectiveness on child outcomes can vary. One review conducted in 2008 examined different types of maternal and child undernutrition interventions globally and estimated their effect on child stunting and mortality (Bhutta et al., 2008). Bhutta's review also examined interventions that impacted child growth and found that certain types of interventions, such as breastfeeding promotion or vitamin A

fortification programs, generally did not improve child growth. However, Bhutta's review did find that complementary feeding support, provision, and education interventions was associated with reduced stunting rates.

Bhutta's review also highlighted the need for interventions to be designed with the local context in mind (Bhutta et al., 2008). His review found that while complementary feeding support and education only programs were effective in reducing child stunting in food-secure households, food-insecure communities needed programs that provided food supplements or conditional cash transfers, with or without an education component, to have an impact on child stunting. Bhutta's review concluded that there was no single best practice for infant and young child feeding interventions due to the varying needs of different communities and the effect of interventions depended heavily on context-specific factors.

Qualitative research methods such as focus group discussions and in-depth-interviews are often used to elicit the context-specific factors such as community needs and cultural practices that affect child nutrition program success. One systematic review examined the findings of 21 qualitative studies looking at infant and young child feeding practices from the perspectives of mothers and family members in lower-income countries such as Kenya (Bazzano et al., 2017). Bazzano's review identified common themes on barriers and facilitators of recommended complementary feeding practices such as food security and social and cultural factors. Identifying the specific social and cultural barriers and facilitators within a community is a key component needed to develop successful interventions to promote behavior change such as improved complementary feeding practices.

Theories of Behavior

In response to the many existing behavioral theories that can be used to understand and change behavior, the Theoretical Domains Framework (TDF) was developed by synthesizing 128 constructs from 33 theories of behavior into a framework for implementation science (Atkins et al., 2017). The most current and revised TDF categorizes behavioral constructs into 14 domains that can be targeted in behavior change strategies (Atkins et al., 2017). The TDF is widely used to identify barriers and facilitators to target health behaviors.

Another commonly used tool for understanding behavior is the COM-B Model of Behavioral Determinants (COM-B). The COM-B Model identifies three components that create or influence behavior: capability, opportunity, and motivation (Michie et al., 2011). The COM-B Model can be used with the TDF by mapping identified barriers and facilitators on the COM-B model. By identifying which barriers and facilitators are the largest influences on behavior with the COM-B Model, behavior change interventions can be created using intervention design methods like the Behavior Change Wheel to target specific determinants of behavior, or mechanisms for actions (Atkins & Michie, 2015; Michie et al., 2011).

ILRI and More Milk

The International Livestock Research Institute (ILRI) is an international not-for-profit research organization that focuses on improving food and nutrition through livestock research and has been based in Kenya since it was established in 1994 (*ILRI*, n.d.). MoreMilk is one of ILRI's research projects to improve child nutrition through dairy production in its program areas in Kenya and Tanzania (Webb Girard et al., 2017). As part

of their objectives to improve child nutrition, MoreMilk's programming includes efforts to improve diet diversity for infants and young children through increased consumption of dairy products.

To create effective social and behavior change specific to the communities in MoreMilk's program areas in Kenya, ILRI partnered with Emory University's Rollins School of Public Health to conduct a formative research project in Western and Southeastern Kenya. Using the TDF and COM-B Model frameworks, the formative research project's goal was to identify the barriers and facilitators to several maternal and child nutrition behaviors, including diet diversity for infants and young children and additional milk servings for young children.

Methods

In 2017, ILRI and Emory University conducted a formative research study to inform the development of a social behavior change communication strategy for ILRI's MoreMilk programs in Kenya. Formative research was conducted in five counties within ILRI's program areas: Vihiga, Busia, Siaya, Taita Taveta, and Kitui. This study uses data from focus group discussions and barrier analysis surveys.

This analysis was determined to be IRB-exempt because it is an analysis of secondary data and all data were de-identified before analysis. Prior to data collection, the study received approval from Emory University's Institutional Review Board through an expedited review (IRB00093939). Research assistants trained by Emory University staff fielded the survey and focus group discussions in March 2017.

Barrier Analysis Surveys

Participants were mothers of infants and young children 6-24 months who resided in the counties and were selected by community health workers. Mothers who were less than 16 years old were ineligible to participate. 10 mothers with infants 6-12 months old and 10 mothers with children 12-24 months old were recruited from each of the five counties, for a total sample of 100 mothers.

After receiving consent from participants, surveys were conducted in the participants' homes by trained research assistants in the local language. Each survey took 20-50 minutes to complete, and participants were compensated for their time. Survey responses were de-identified, translated into English, and entered into Microsoft Excel.

The demographic section of the survey included questions ascertaining participants' age, number of children, education level, primary source of income, and marital status. Participants were also asked who was the head of household (e.g. husband, father, father-in-law) and the head of households' occupation. Participants who lived in Siaya, Busia, or Vihiga counties were coded as living in west Kenya while participants who lived in Taita Taveta and Kitui counties were coded as living in east Kenya.

Household hunger was also assessed using the Household Hunger Scale (HHS), a modified version of the Household Food Insecurity Access Scale validated for cross cultural use (Ballard et al., 2011). Three yes or no questions were asked to determine experiences of food insecurity: In the past 30 days, was there ever no food to eat of any kind in your household because of lack of resources to get food; In the past 30 days, did you or any household member go to sleep at night hungry because there was not enough food; In the past 30 days did you or any household member go a whole day and night

without eating anything at all because there was not enough food. According to the HHS, these questions reflect the occurrences of the most severe food-insecure households, and if a participant responded yes to any of the three questions, they were coded as having severe hunger in the household (Ballard et al., 2011).

The barrier analysis methodology is based on the Designing for Behavior Change (DBC) approach and defines a desired behavior in a priority group (Kittle, 2017). While multiple barrier analysis surveys were administered to each participant, this analysis looks at two desired behaviors: mothers of infants and children 6-24 months old feeding their child from four or more food groups in the previous day and mothers of infants and young children 12-24 months feeding their child at least one serving of milk a day. Mothers who already are doing the desired behavior are called "doers" while those who are not are called "nondoers".

For the diet diversity survey, to assess whether participants were doers or nondoers, participants were first shown a photo guide of food categories and asked which foods their child had consumed in the last 24 hours. WHO indicators for dietary diversity were used to calculate doer and nondoer status for mothers of infants 6-12 months old, (World Health Organization, 2008). Participants whose child consumed food from four or more groups were coded as a "doer", and those whose children consumed from three or fewer groups were coded as a "nondoer", under the assumption that mothers were still breastfeeding. For mothers of children 12-24 months old, breastfeeding status was determined through self-report. Using the WHO recommendations for minimum acceptable diet (World Health Organization, 2008), mothers who were still breastfeeding were coded as "doers" if their child consumed food from four or more groups, while

mothers who were not breastfeeding were coded as “doers” if their child consumed from dairy and an additional four or more food groups in the previous day. All other mothers were coded as nondoers.

For the additional milk serving survey, participants reported how often their child is given animal milk (fresh, fermented, or in porridge/food) from a set of Likert-type scale responses: Less than once a month/never; A few times a month; A few times a week; Once a day; More than once a day. Participants who reported giving their child a cup of milk once a day or more than once a day were coded as doers while all other participants were nondoers.

The barrier analysis survey then assesses the determinants that either facilitate or hinder the desired behavior for the priority group. The barrier analysis measures the following determinants based on the Health Belief Model and Social Cognitive Theory: self-efficacy, perceived advantages, perceived disadvantages, perceived facilitators, perceived barriers, perceived social support, perceived social disapproval, access to resources, cues to action, perceived susceptibility, perceived severity, and action efficacy (Kittle, 2017). Some behavioral determinants were asked as open-ended questions while others used Likert-type scale responses (Appendix - Table 1).

The responses from doers and nondoers were compared to determine the differences in determinants between the two groups. For comparison of open-ended survey questions, responses were grouped into categories based on similar meanings. For example, the responses “The child will be healthy” and “The child shall have good health” were grouped together as “Improves Health”. For the question on perceived facilitators, an additional continuous variable was created to represent the number of advantages that the

mother listed. Doer and nondoer groups were then compared for each type of response using chi-squared tests of proportions for categorical responses and two-sample t-tests for continuous variables in SAS9.4. Responses that were uncommonly mentioned in the open-ended questions (less than 10 participants for diet diversity surveys or less than 5 participants for milk serving surveys) were not analyzed statistically.

Focus Group Discussions

The DBC approach also identifies influencing groups that affect the priority group's behavior (Kittle, 2017). Grandmothers and fathers were identified as influencing groups that affect mothers' complementary feeding practices and were included as populations of interest for the focus group discussions. Thus three separate focus group discussions were held in each county for each population of interest: pregnant and lactating women, grandmothers, and fathers.

Community health and agriculture extension agents recruited participants and each focus group had between 7-10 participants. To be eligible for the pregnant and lactating women focus group, participants had to be currently pregnant or breastfeeding a child under the age of two. For the grandmothers' focus group, participants had to be at least 50 years old and with at least one grandchild. For the fathers' focus group, participants were men with children under the age of two years.

Focus group discussions were facilitated by a trained research assistant and conducted in the local languages. A trained note-taker was also present for each discussion. At each focus group, participants gave their consent to voluntarily participate and have their discussion recorded.

Focus group discussion guides were created for the facilitator. Each focus group began with a card sorting activity. Participants were given a set of cards with pictures of different food items and were asked to sort the cards into categories. After discussing their created categories, participants were asked about the foods that were important for pregnant women, breastfeeding women, and children under two years old to consume, along with the accessibility and prioritization of these foods in their community. Other topics discussed included community meal, breastfeeding, and complementary feeding norms.

Recordings and discussion notes were used to create structured detailed summaries of each focus group in English. Pictures of the group activities were also included in the detailed summaries. The detailed summaries were reviewed, memoed, and a codebook was developed. Each detailed summary was then coded and analyzed to identify key themes regarding community diet diversity and milk feeding practices. Key themes from the focus group discussions were then used to triangulate the findings from the doer/non-doer surveys.

Results

Characteristics of survey participants

Mothers of children 6-12 months old and mothers of children 12-24 months old were analyzed together for the diet diversity barrier analysis (n=100). Mothers of children 12-24 months old were analyzed separately for the additional milk serving barrier analysis (n=50). Mothers were on average 27 years old and had an average of 3 children (Table 2). 68% of all mothers had completed at least primary school education. While about half of the mothers did not work, 23% of mothers received their primary source of income from

agriculture and livestock, followed by informal business and trading (15%), casual labor (11%), and formal employment (2%). 77% of mothers were married, and husbands were usually the head of the household (61%). 26% of head of households worked in informal business/trading, 22% worked in agriculture/livestock, 21% provided casual labor, and 18% conducted formal or salaried work. 39% of households experienced severe hunger in the household.

41% of all mothers were classified as feeding their child an adequately diverse diet in the past day (doers) and 66% of mothers 12-24 months fed their child at least one serving of milk a day (doers). There were no significant demographic differences between doers and nondoers with the exception of diet diversity by east or west location. 75.6% of households in the west were diet diversity doers compared to 24.4% of households in the east (p-value = 0.008).

Table 2: Sociodemographic Characteristics of 100 Rural Kenyan Mothers of Infants and Children 6-24 months

Mothers of infants and young children	**6-24 months (n=100)**	**12-24 months (n=50)**
	Mean (SD)	**Mean (SD)**
Age	27.1 (6.7)	27.9 (6.46)
Number of children	2.9 (1.68)	3 (1.60)
Education level	**Proportion**	**Proportion**
- Did not complete primary	32%	32%
- Completed primary or more	68%	68%
Primary Source of Income		
- Does not work	49%	42%
- Agriculture/livestock	23%	28%
- Informal business/trader	15%	16%
- Casual labor	11%	10%
- Formal/salaried employment	2%	4%
Marital status		
- Married	77%	84%
- Single/Divorced/Separated	23%	16%

Table 2: Sociodemographic Characteristics of 100 Rural Kenyan Mothers of Infants and Children 6-24 months (continued)		
Mothers of infants and young children	**6-24 months (n=100)**	**12-24 months (n=50)**
Head of Household	**Mean (SD)**	**Mean (SD)**
- Husband	61%	66%
- Male relative	28%	20%
- Female relative	7%	6%
- Respondent	4%	8%
Head of Household Occupation		
- Informal business/trader	26%	26%
- Agriculture/livestock	22%	22%
- Casual labor	21%	22%
- Formal/salaried work	18%	18%
- Does not work	10%	10%
- Other	3%	2%
Household Food Hunger		
- Severe Food Hunger	39%	42%
- Not Severe Food Hunger	61%	58%
Doer Status		
- Diet Diversity[1]	41%	42%
- Milk Serving[2]	--	66%
Diet Diversity Doer Status by Location		
- West (n=60)	75.6%	--
- East (n=40)	24.4%	--

[1] For children 6-12 months or breastfed children 12-24 months, fed from four or more food groups in past day. For non-breastfed children 12-24 months, fed from five or more food groups in the past day.
[2] Fed child at least one serving of animal milk per day, either fermented, fresh, or in tea/foods

Child's past day food consumption

When examining past day child diet diversity by doers and nondoers, there were significant differences between doers and nondoers for every food group except for eggs (Table 3). Almost all mothers fed their child grains, roots, or tubers (100% of doers, 86.4% of nondoers) and most also fed their children dairy products (85.4% of doers, 61% of nondoers). While most doers fed their children fruits and vegetables (90% fed children Vitamin A-rich fruits and vegetables, 80.5% fed children other fruits and vegetables), less than half of nondoers did the same (44.1% and 23.7% respectively). Legumes and nuts

and flesh foods were less likely to have been fed (less than half of all mothers), and eggs were the least consumed with only 7.3% of doers and 1.7% of nondoers.

Table 3: Food group consumption in the previous 24 hours among rural Kenyan children 6-24 months

	Doers (n=41)[1]	**Nondoers (n=59)**	**p-value**
Grains, roots, and tubers	100%	86.4%	0.01*
Legumes and nuts	36.6%	18.6%	0.04*
Dairy	85.4%	61.0%	0.01*
Flesh foods	48.8%	13.6%	0.00*
Eggs	7.3%	1.7%	0.16
Vitamin A-rich fruits and vegetables	90.2%	44.1%	0.00*
Other fruits and vegetables	80.5%	23.7%	0.00*

[1] For children 6-12 months or breastfed children 12-24 months, fed from four or more food groups in past day. For non-breastfed children 12-24 months, fed from five or more food groups in the past day.

Diet Diversity Doer/Nondoer Survey

For the behavior domains that were assessed with Likert-type scale items, there were no significant differences between doers and nondoers for self-efficacy, social norms, perceived access to resources, cues to action, perceived susceptibility, and perceived severity (Table 4). Most mothers felt they were able to feed their child from four or more food groups (self-efficacy) and had the approval of most people they know to feed their child from four or more food groups (social norms). About half of mothers felt it was somewhat difficult to get the resources required (perceived access to resources) and most felt it was not difficult at all to remember to feed their child from four or more food groups (cues to action).

Table 4: Proportions of behavior domain responses for feeding their child from four or more food groups per day among rural Kenyan mothers of children 6-24 months			
	Doers (n=41)[1]	**Nondoers (n=59)**	**p-value**
Self efficacy			
- Yes	58.5%	49.2%	
- Possibly	17.1%	20.3%	0.65
- No	24.4%	30.5%	
Social norms			
- Yes	100%	93.2%	
- No	0%	5.1%	0.24
- Don't know	0%	17.9%	
Perceived access to resources			
- Very difficult	26.8%	37.3%	
- Somewhat difficult	48.8%	50.9%	0.22
- Not difficult at all	24.4%	11.9%	
Cues to action			
- Very difficult	4.9%	3.4%	
- Somewhat difficult	17.1%	8.5%	0.38
- Not difficult at all	78.1%	88.1%	
Perceived susceptibility			
- Not at all likely	73.2%	62.7%	
- Somewhat likely	17.1%	13.6%	0.25
- Very likely	4.9%	18.6%	
- Don't know	4.9%	5.1%	
Perceived severity			
- Not at all serious	7.3%	3.4%	
- Somewhat serious	17.1%	17.0%	0.67
- Very serious	75.6%	79.7%	
Action efficacy			
- Not at all likely	9.8%	28.8%	
- Somewhat likely	39.0%	18.6%	0.04*
- Very likely	51.2%	50.9%	
- Don't know	0%	1.7%	
[1] For children 6-12 months or breastfed children 12-24 months, fed from four or more food groups in past day. For non-breastfed children 12-24 months, fed from five or more food groups in the past day.			

While most mothers felt their child was not likely to become malnourished over the next few months (perceived susceptibility), and that it would be very serious if the child did become malnourished (perceived severity), there were significant differences between doers and nondoers for whether they believed their child would become

malnourished if they did not eat from four or more food groups (action efficacy). While about half of all mothers believed it was very likely their child would become malnourished if not fed a diverse diet, a larger proportion of doers believed becoming malnourished was somewhat likely (39% doers vs 18.6% nondoers) compared to not at all likely (9.8% doers vs 28.8% nondoers).

For the open-ended question on perceived advantages of feeding their child from at least four food groups a day, common responses included improving the child's health, preventing disease, increasing strength, improving the child's mood, increasing growth, and increasing weight (Table 5). Uncommonly cited advantages that were mentioned by less than 10 participants included improving the child's brain/intelligence, improving the child's sight, aiding digestion, and improving the child's skin.

Table 5: Proportions of perceived advantages to feeding their child from four or more food groups per day among rural Kenyan mothers of children 6-24 months old

	Doers (n=41)[1]	**Nondoers (n=59)**	**p-value**
Improves health	65.9%	64.4%	0.88
Prevents disease/illness	43.9%	57.6%	0.18
Increases strength	31.7%	33.9%	0.82
Improves mood[2]	12.2%	8.5%	0.54
Increases growth	36.6%	28.8%	0.41
Increases weight	17.1%	22.0%	0.54
Increases energy	43.9%	25.4%	0.05*
Gives nutrients[3]	17.1%	6.8%	0.11
Specified a food group[4]	29.3%	13.6%	0.05*
- Specified fruits and vegetables	26.8%	10.2%	0.03*
- Specified other food group	17.1%	5.1%	0.05*
Number of advantages listed[5]	3.1 (1.5)	2.6 (1.0)	0.05*

[1] For children 6-12 months or breastfed children 12-24 months, fed from four or more food groups in past day. For non-breastfed children 12-24 months, fed from five or more food groups in the past day.
[2] e.g. stops crying, makes child happy
[3] Participant listed nutrients broadly or a specific nutrient (e.g. vitamins, carbohydrates)
[4] Participant listed an advantage of consuming a specific food group
[5] Mean (SD)

When comparing doers and nondoers, doers were on average able to list more advantages than nondoers. Doers were also more likely to cite an increase in energy or activity as an advantage compared to nondoers (42.9% of doers vs. 25.4% of nondoers). A larger proportion of doers were also able to list an advantage of giving a child a specific food group (29.3% vs 13.6%). 26.3% of doers stated an advantage of feeding the child fruits and vegetables, such as feeding fruit helps the child to be strong, and 17.1% of doers specified an advantage of another food group, such as carbohydrates give the child energy, compared to only 10.2% and 5.1% of nondoers respectively.

For the behavior domain of perceived disadvantages, there were no significant differences between doers and nondoers. 80.5% of doers and 86.4% of nondoers said there were no disadvantages to feeding their child from at least four food groups (p-value = 0.42). Those who did list a disadvantage mentioned reactions to eating a specific food (such as beans make the baby itchy, eggs are hard for digestion), or a consequence of eating too much food (such as causes bloating, indigestion). Three respondents mentioned the child gaining too much weight or becoming obese as a possible disadvantage.

For perceived facilitators, mothers listed money, their ability to farm or harvest their own produce, their ability to raise their own livestock and produce milk and eggs, general food availability, their child's health and appetite, social and financial support, and other resources for feeding such as time to prepare food, accessible water sources, and firewood for cooking (Appendix - Table 6). While there were no statistically significant differences between doers and nondoers, the proportion of doers that mentioned child factors, such as a healthy child or child with a healthy appetite, was over twice as high as the proportion of nondoers (22% vs 10.2%, p-value= 0.10).

Among perceived barriers to feeding from four or more food groups, mothers most often cited a lack of money, along with child's illness or lack of appetite, an inability to plant or harvest their own produce, a lack of food availability, barriers to buying food in the markets, or a lack of other personal resources such as time to prepare food, lack of oil or fuel, or a lack of livestock ownership (Appendix - Table 6). Uncommonly cited barriers that were not included in the analysis included a mother's lack of knowledge or issues with the mother's health. One participant said there were no barriers. When comparing doers and nondoers, the only significant barrier was the inability to plant or harvest their own food, with 36.6% of doers mentioning this as a barrier compared to 15.3% of nondoers.

The majority of mothers said their husbands would be supportive of feeding their child from at least four food groups. Other social enablers named by mothers included relatives-in-law, their parents and siblings, and other female figures, such as grandmothers, house-girls, and co-wives (Appendix – Table 7). 11 mothers also mentioned themselves as approving of feeding their child from at least four food groups. Almost all mothers also said that nobody would disapprove of feeding their child from four or more food groups a day (95.1% of doers, 83.1 of nondoers, p-value = 0.07). Only one doer was able to list social blockades (some friends and her mother-in-law). Other responses from nondoers included neighbors (n=3), enemies (n=2), and other family members (n=5).

Additional Milk Serving Doer/Nondoer Surveys

All mothers believed most people would support giving their child an additional serving of milk (social norms), most believed it was not difficult at all to remember to do

feed their child more milk (cues to action); however, over half (51.5% of doers, 58.5% of nondoers) believed it was somewhat difficult to get the necessary resources for feeding milk (Appendix - Table 8). Most mothers also believed their child was not at all likely to become malnourished in the near future (perceived susceptibility), and it would be very serious if their child did become malnourished (perceived severity). Although not statistically significant, a larger proportion of doers (63.6%) believed they had the necessary knowledge, resources, skills, and family support to give their child an extra cup of milk compared to nondoers (37.5%). Doers were also more likely to believe that their children would become malnourished without milk. While 62.5% of nondoers believed it was unlikely their child would become malnourished if not given additional milk, only 37.5% of doers believed this (p-value=0.26)

For perceived advantages of feeding additional milk, mothers cited improving the child's health, preventing disease, increasing strength, child satisfaction, increased growth or weight, and increased energy (Appendix - Table 9). Most mothers said there were no disadvantages, but some disadvantages listed included diarrhea or another adverse health outcome. There were no significant differences between doers and nondoers in perceived advantages and disadvantages.

The accessibility and availability of milk were primary determinants of milk consumption. Money, or lack of it, was the most commonly cited facilitator and barrier to feeding additional servings of milk (Appendix - Table 10). Mothers also cited milk availability and other personal resources such as time and energy to prepare milk as facilitators. Doers were more likely to mention owning livestock and producing their own

milk as a facilitator than nondoers (72.7% vs. 41.2%, p-value=0.03), although about an equal proportion of doers and nondoers mentioned not owning livestock as a barrier.

Mothers listed their husbands, mothers-in-law, sisters-in-law, parents, friends, other children, and female relatives as social enablers (Appendix - Table 11). Other uncommonly cited enablers included fathers-in-law, brothers, househelp, and healthworkers. Almost all mothers also said that nobody would disapprove of feeding this child an additional serving of milk. The three mothers who listed a blockade mentioned their father-in-law, doctors (if the baby had diarrhea), and their "enemy".

Focus Group Discussions - Pregnant and Lactating Women

For the food sorting activity, focus groups of pregnant and lactating women created between 3 and 10 different categories. One focus group categorized food by the timing of consumption (foods/drinks served in the morning or foods/drinks served in the evening) while another group categorized food by availability (very expensive food, foods they have to purchase from the market, seasonal foods, foods that they can produce). The other three groups attempted to categorize foods based on their nutritional value or function, creating categories such as fats, proteins, carbohydrates, or vegetables. Two of these groups also created a separate "snack" category with items such as samosas and potato crisps. Most groups also created a category for foods that were not consumed in this community (e.g. animal blood, cassava ugali)

Focus group discussions with mothers corroborated responses from the doer/nondoer surveys. For the advantages of feeding their infant or young child from four or more food groups a day, the participants discussed improving the health of the child and preventing diseases. Mothers also most commonly discussed money and producing

their own food as perceived facilitators. For barriers, mothers also mentioned a mother's ignorance of proper feeding in addition to having a lazy husband who was unable to properly provide for the family.

When asked about what foods were commonly consumed in their community, mothers talked about what foods were easily accessible, either to produce themselves or affordable to buy. There was some variability in responses regarding milk consumption - in Busia and Vihiga, participants said milk was not often consumed while milk was mentioned as being easy to access in Taita Taveta since most households own dairy cows.

In terms of how they prioritized who received food in the household when there wasn't enough food, there were differences depending on what food was scarce. There were varying answers in terms of meat prioritization – some women said the husbands were given the meat, others said the children, or some said it would be distributed equally in small portions. However, if there wasn't enough milk, the participants discussed that children were given the first priority. One focus group with mothers mentioned that it also depended on the type of milk as fermented milk would be given to the husband but children would be given fresh milk.

Focus Group Discussions – Fathers

For the food sorting activity, fathers created between 5 and 12 different categories. Most focus groups sorted foods based on what was often served together, such as a category for foods that were served for breakfast, foods served with carbohydrates, or foods not consumed in their community (e.g. blood). Thus, some foods were their own standalone categories, such as sugarcane or termites. Each focus group created a separate fruits category. Two focus groups (Busia and Vihiga) created categories based on

nutritional value or function (e.g. foods that give energy, proteins, foods that prevent diseases/give vitamins) but some items would be miscategorized. For example, soda would be found in the "starches" category.

Fathers discussed similar advantages, facilitators, and barriers to feeding their infants and young children from four or more food groups per day in the focus group discussions. Fathers also discussed what foods were commonly consumed by infants and young children in their community. In addition to the foods that were not often consumed due to a lack of availability, fathers also believed certain foods were inappropriate to feed their child. Some foods were viewed as being too hard to digest or chew for young children, such as cassava, sweet potatoes, chapatti, and githeri (a local dish of beans and maize mixed together). Pilau was thought to contain too many spices for children and lemons were too bitter. Two focus groups also mentioned that eggs were rarely given as eggs caused speech delays in children or were only given to them raw as cough medicine.

When asked about how food was prioritized and served to members in the household, most focus groups with fathers said that children were prioritized first. Milk was understood to be prioritized to young children and if there was a lack of meat, participants again said children were given priority, or even the mother and children. However, one father brought up that despite this being what is supposed to be done in the community, he rarely sees this practice and that usually it is the husband who consumes food when it is scarce in the home.

Focus Groups Discussions – Grandmothers

When asked to sort foods into categories, focus groups with grandmothers created between 2 and 16 categories. Two focus groups created groups based on foods that were

eaten in this community and foods that weren't commonly eaten or found in their community. The other groups seemed to categorize foods based on function, such as foods taken with tea, different types of ugalis (a porridge staple), or foods served with ugalis. Two of the groups, with 11 and 16 categories, often had categories with only one food item in it and were unable to label or justify the category (e.g. category with only sesame, pumpkin, or mushroom).

When asked about advantages to feeding infants and young children from four or more food groups per day, grandmothers were unable to have as robust discussion compared to mothers and fathers. Some focus groups only touched about disease prevention, while in another focus group, only one participant was able to think of an advantage (helping child's growth and energy). In addition to a lack of money and availability, grandmothers also commonly discussed lazy women who weren't working as a barrier to being able to feed children from four food groups. One focus group with grandmothers also thought that a lack of respect for others made it harder for people to borrow from their neighbors what they were lacking. Participants also brought up that if husbands and wives were fighting, the husband could mistreat his wife or withdraw financial support from the wife making it more difficult for her to buy food.

When asked about what foods were commonly fed to infants and young children, grandmothers in Kitui and Taita Taveta believed milk was easily available since most families owned cows while participants in Vihiga thought that milk was challenging since not all households have milk at home.

Discussion

Diet Diversity Determinants of Behavior

When triangulated, focus group discussions and the barrier analysis surveys revealed complementary themes related to the barriers and facilitators of feeding infants and young children diverse foods, including milk. Finances were brought up almost uniformly by all participants as a barrier to feeding their child a diverse diet. Other commonly cited barriers or facilitators included availability and access of foods, from planting, animal husbandry, or to purchase in markets. These common themes highlight the shared or common experiences of rural communities in Kenya. However, despite these common barriers, a substantial minority of mothers (41%) were able to successfully feed their child an adequately diverse diet.

When comparing doers and nondoers, several statistically significant (p-value<0.05) determinants of behavior were identified. While all mothers acknowledged that malnutrition was a severe problem, there was a noted difference in how doers and nondoers linked the problem of child malnutrition to their complementary feeding behavior (i.e. action-efficacy). Action-efficacy is an indication of whether a person believes that an action will be effective in preventing an adverse outcome and would affect their motivation to change their behavior according to the COM-B Model (Davis Jr., 2004; Michie et al., 2011). Behavior theories suggest that in order for an individual to set an intention or be motivated to change their behavior, an individual needs not only risk perception and self-efficacy, but also the belief that their actions would reduce the health risk (action-efficacy) and a study of 580 adults in Germany confirmed that risk perception, self-efficacy, and action-efficacy were associated with intention to change personal

nutrition habits (Schwarzer & Renner, 2000). In this analysis, since mothers who were doers were more likely to connect malnutrition with a lack of diet diversity and milk, nondoers may not believe that feeding their child a diverse diet or milk can prevent malnutrition. If mothers are unaware of the links between diet and malnutrition, it may be more difficult to motivate them to feed their child an adequately diverse diet, despite their awareness of the risk of malnutrition.

In addition, doers were able to list more advantages of feeding their child from four or more food groups a day and were more likely than nondoers to discuss the benefits that specific food groups offered their child. Focus group discussions also revealed that community members conceptualize food groups differently than the WHO food groups defined by nutritional function. Many of the focus groups sorted foods based on how the food was served or what was commonly consumed and the few focus groups that attempted to sort food by nutritional function commonly incorrectly sorted food items, showing a lack of nutritional knowledge. Another qualitative study utilizing focus group discussions from Kenyan mothers of children 0-23 months old found similar findings that although mothers felt competent with complementary feeding, their knowledge of how to build a balanced diet for their child was not aligned with recommended complementary feeding recommendations (Schneider et al., 2017). An ethnographic study in Kitui and Vihiga counties of caregivers of infants and young children 6-23 months found that while caregivers largely understood the importance of children's diets for their development, there was wide variability in nutritional knowledge (Pelto & Armar-Klemesu, 2015). Applied to the COM-B Model (Michie et al., 2011), these findings suggest that having more knowledge about the function of nutrients in the body may increase mothers'

psychological capability and understanding the nutrients' roles in the prevention of malnutrition may increase their motivation to feed their child an adequately diverse diet.

Differences in perceived barriers were also found between doers and nondoers. Doers were more likely to identify that having the inability to grow their own produce, from factors such as not owning land or from a poor harvest, would make it more difficult to feed their child from four or more food groups per day. A much larger proportion of doers fed their child fruits and vegetables in the previous day compared to nondoers as well. Although household production levels are unknown, mothers who are successful in feeding their child from four or more food groups have identified that growing their own food is an important factor and may have more opportunity to grow their own food compared to nondoers.

Additional Milk Serving Determinants of Behavior

Focus group discussions revealed that milk was viewed by fathers, grandmothers, and mothers as acceptable to give to their young children and that children were often prioritized in receiving milk when available in the households. Pelto and Armar-Klemusu's ethnographic study also found that milk was a part of the core foods that were given to infants and young children in Kitui and Vihiga counties (Pelto & Armar-Klemesu, 2015). However, there were differences by region on the availability of milk as some counties' participants viewed milk as easily available due to widespread cattle ownership while other counties mentioned that cattle ownership was not common and many households did not have access to milk without purchasing. Regional differences in livestock ownerships have been previously reported in Kenya, with rural households in the north tending to own more livestock than others (Mosites et al., 2015).

When comparing doers and nondoers, although not significant, a much larger percentage of doers believed they had the necessary resources and skills to feed their child an extra serving of milk compared to nondoers, indicating that milk access may be an important factor in facilitating feeding children more milk. Cattle ownership may play a role in increasing access as a much larger proportion of doers cited livestock ownership and milk production as a facilitator of feeding their child an additional serving of milk compared to nondoers. One study of the coastal and highland regions of Kenya found that household ownership of dairy cows had a positive association with child growth and reduction in stunting for children under six years old (Nicholson et al., 2003) while a more recent study in Western Kenya also found that household cattle ownership was associated with an increase in the frequency of milk consumption by young children under 5 years old, although this relationship was not statistically significant (Mosites et al., 2017). In accordance to the COM-B Model, owning cattle could facilitate the physical opportunity needed to feed children additional milk (Michie et al., 2011). However, dairy intensification interventions should be considered cautiously as a study on household dairy production in rural Kenya found that household dairy production was negatively associated with exclusive breastfeeding as households who produced their own milk were more likely to give their infants milk and water before six months of age (Wyatt et al., 2015).

Strengths and Weaknesses

The strengths of this study included the utilization of established theories and rapid assessment tools including COM-B and barrier analysis (Davis Jr., 2004; Michie et al., 2011). The barrier analysis methodology has been widely tested and adopted by many

international organizations for child survival and community development programs. Within the barrier analysis sample, besides differences in regional location (east vs west), there were no significant differences between doers and nondoers on demographic variables which reduces the risk of confounding and allows us to draw stronger conclusions on key determinants of behaviors. In addition, this study also utilized a mixed-methods approach by triangulating results with qualitative data from focus group discussions of three separate populations of interest.

However, since there were significant differences in the proportions of doers and nondoers by east and west location, some of the significant determinants of behavior found may be influenced by regional differences. In addition, for the additional milk barrier analysis surveys, the analysis was limited by a small sample size. For some analyses, chi-square tests had expected values less than 5, in which chi-square test results should be interpreted cautiously. In addition, due to resource constraints, focus group discussion data were captured in detailed summaries and not verbatim transcripts, leading to the potential loss of a more nuanced and in-depth analysis of the qualitative data.

Public Health Implications

Implications for ILRI

By identifying the key determinants of behavior for diet diversity and additional milk consumption for children in these specific communities in Kenya, ILRI can inform the development of their MoreMilk program. To effectively change behavior to increase diet diversity and milk consumption in infants and young children 6-24 months old, the MoreMilk program's behavior change techniques should be linked to the identified mechanisms of action (Michie et al., 2018). Following the behavior change wheel

intervention design method, once the determinants of behavior are understood, intervention functions can be identified to design an effective program to change eating behavior (Atkins & Michie, 2015).

For diet diversity in infants and young children 6-24 months old, this analysis suggests that mothers' motivation and psychological capability to feed their child from four or more food groups a day can be increased by improving their knowledge about the function of nutrients from different food groups (increasing perceived advantages) and the role of diet diversity in preventing malnutrition (increasing action-efficacy). According to a review of the effects of child nutrition interventions, complementary feeding support and education interventions have been found to be associated with reduced stunting in food-secure households (Bhutta et al., 2008). However almost 40% of households in this sample experienced food insecurity and education alone may not be effective in changing feeding behavior and reducing stunting (Bhutta et al., 2008). As the inability to grow their own food or grow enough food was also identified as a significant barrier, increasing household crop production could also play a role in increasing mothers' opportunity to feed their children diverse diets. ILRI could decide which mechanisms of action they could target with their program and design their intervention functions accordingly, such as focusing on education or persuasion to increase mothers' knowledge of nutrition while also focusing on environmental restructuring or enablement to improve crop production (Atkins & Michie, 2015).

For additional milk consumption, milk was established in the focus group discussions as an acceptable food to give to young children. In addition, household milk production was found to be a significant facilitator of mothers giving their children

additional milk servings per day. By focusing their programming function on environmental restructuring or enablement, ILRI could increase cattle ownership in these communities and thus improve mothers' physical opportunity to feed their young children milk. While literature supports the positive effects of dairy intensification programs on young children's milk consumption and linear growth, ILRI should also consider potential negative externalities on other infant and young child feeding practices such as exclusive breastfeeding when designing their programs and defining their target populations (Mosites et al., 2017; Nicholson et al., 2003; Wyatt et al., 2015)

Recommendations for future analyses

Due to the differences in east or west location by doer and nondoer status, future research should examine doer and nondoer behavior by region. A barrier analysis by location could potentially find differences in significant determinants of behavior by region, which could inform the appropriateness and effectiveness of future programming. In addition, any programming that results from these formative research results should be evaluated to assess whether programs were effective in changing the targeted behavior of increasing diet diversity and milk consumption in these communities.

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Appendix: Tables

Table 1: Diet Diversity and Additional Milk Serving Barrier Analysis Surveys' Behavioral Domain Items			
Behavioral Domain	**Desired Behavior: Diet diversity**	**Desired Behavior: Additional milk serving**	**Response Type**
Self-efficacy	Considering your knowledge about diet, the resources and skills you have, and your family support, do you think you would be able to feed [child's name] foods from four or more of these groups each day?	Considering your knowledge about diet, the resources and skills you have, and your family support, do you think you would be able to give an extra cup of milk to [child's name] every day? This milk can be in any form – fresh, fermented, or mixed with porridge or other foods.	Yes, Possibly, No, Don't Know
Perceived advantages	What do you think are the advantages of feeding [child's name] foods from four or more of these groups each day?	What do you think are the advantages of giving an extra cup of milk to infants that are 12-24 months of age?	Open-ended
Perceived disadvantages	What do you think are the disadvantages or negative consequences of feeding [child's name] foods from four or more of these groups each day?	What do you think are the disadvantages or negative consequences of giving an extra cup of milk to infants that are 12-24 months of age?	Open-ended
Perceived facilitators	What would make it easier to feed [child's name] foods from four or more of these groups each day?	What would make it easier to give [child's name] an extra cup of milk each day?	Open-ended
Perceived barriers	What would make it difficult to feed [child's name] foods from four or more of these groups each day?	What would make it difficult to give [child's name] an extra cup of milk each day?	Open-ended
Social norms	Would most of the people that you know approve of/support your feeding [child's name] foods from four or more of these groups each day?	Would most of the people that you know approve of support your giving [child's name] an extra cup of milk each day?	Yes, Possibly, No, Don't Know

Table 1: Diet Diversity and Additional Milk Serving Barrier Analysis Surveys' Behavioral Domain Items (continued)			
Behavioral Domain	**Desired Behavior: Diet diversity**	**Desired Behavior: Additional milk serving**	**Response Type**
Social blockades	Who are all the people that would disapprove of/not support your feeding [child's name] foods from four or more of these groups each day?	Who are all the people that would disapprove of/not support your giving [child's name] an extra cup of milk each day?	Open-ended
Perceived access to resources	How difficult is it/ would it be to get the resources needed to feed [child's name] foods from four or more of these groups each day?	How difficult is it/ would it be to get the resources needed to give [child's name] an extra cup of animal milk each day?	Very difficult, Somewhat difficult, Not difficult at all, Don't Know
Cues to action	How difficult do you think it is/would be to remember to feed [child's name] foods from four or more of these groups each day?	How difficult do you think it is/would be to remember to give [child's name] an extra cup of animal milk each day?	Very difficult Somewhat difficult, Not difficult at all, Don't know
Perceived susceptibility	How likely do you think it is that [child's name] would become malnourished over the next few months?	How likely do you think it is that [child's name] would become malnourished over the next few months?	Very likely, somewhat likely, Not at all likely, Don't know
Perceived susceptibility	How serious would it be for [child's name] to become malnourished?	How serious would it be for [child's name] to become malnourished?	Very serious, Somewhat serious, Not at all serious, Don't know
Action-efficacy	How likely is it that [child's name] would become malnourished if s/he did not eat from four or more food groups each day?	How likely is it that [child's name] would become malnourished if s/he did not drink extra animal milk?	Very likely, Somewhat likely, Not at all likely, Don't know

Table 6: Proportions of perceived facilitators and barriers to feeding their child from four or more food groups per day among rural Kenyan mothers of children 6-24 months

Facilitators	**Doers (n=41)[1]**	**Nondoers (n=59)**	**p-value**
Money/income	78.1%	89.8%	0.10
Farm/harvest[2]	41.5%	30.5%	0.26
Livestock[3]	14.6%	10.2%	0.50
Food availability	36.6%	45.8%	0.36
Child's health/appetite[4]	22.0%	10.2%	0.10
Social/financial support[5]	19.5%	15.3%	0.58
Other resources for feeding[6]	9.7%	18.6%	0.22
Barriers			
Lack of money	82.9%	89.8%	0.31
Child's illness/lack of appetite	9.7%	15.3%	0.42
Inability to plant/harvest[2]	36.6%	15.3%	0.01*
Lack of food availability (general)	26.8%	42.4%	0.11
Market availability/accessibility[7]	17.1%	6.8%	0.11
Lack of other personal resource[8]	24.4%	15.3%	0.25

[1] For children 6-12 months or breastfed children 12-24 months, fed from four or more food groups in past day. For non-breastfed children 12-24 months, fed from five or more food groups in the past day.
[2] Participant's ability to grow their own produce or increase their crop production
[3] Participant's ability to raise livestock to consume or produce milk and/or eggs
[4] Child is healthy, has a healthy appetite, and/or eats easily
[5] From family, parents, and/or friends
[6] e.g. time to prepare food, accessible water source, firewood for cooking
[7] Lack of food to buy in markets or distance from market
[8] e.g. Time to prepare food, lack of oil or fuel, lack of livestock ownership or production (eggs, milk)

Table 7: Proportions of social enablers and blockades to feeding their child from four or more food groups per day among rural Kenyan mothers of children 6-24 months

Enablers	**Doers (n=41)[1]**	**Nondoers (n=59)**	**p-value**
Husband	61.0%	76.3%	0.10
Mother-in-law	43.9%	45.8%	0.85
Sibling-in-law	19.5%	18.6%	0.91
Own mother	31.7%	18.6%	0.13
Own father	22.0%	10.2%	0.10
Own sibling	17.1%	10.2%	0.31
Herself	12.2%	10.2%	0.75
Other females[2]	9.7%	10.2%	0.95
Number of enablers listed[3]	2.61 (1.09)	2.46 (1.09)	0.49
Blockades			
Nobody	95.1%	83.1%	0.07

[1] For children 6-12 months or breastfed children 12-24 months, fed from four or more food groups in past day. For non-breastfed children 12-24 months, fed from five or more food groups in the past day.
[2] e.g. Grandmothers, house-girls, co-wives
[3] Mean (SD)

Table 8: Proportions of behavior domain responses to giving their child an additional serving of milk per day among rural Kenyan mothers of children 12-24 months

	Doers (n=33)[1]	**Non Doers (n=17)**	**p-value**
Self efficacy[2]			
- Yes	63.6%	37.5%	
- Possibly	18.2%	18.8%	0.14
- No	18.2%	43.8%	
Social norms			
- Yes	100%	100%	
- No	0%	0%	
Perceived access to resources			
- Very difficult	18.2%	29.4%	
- Somewhat difficult	51.5%	58.8%	0.31
- Not difficult at all	30.3%	16.7%	
Cues to action			
- Very difficult	0%	5.9%	
- Somewhat difficult	12.1%	23.5%	0.20
- Not difficult at all	87.9%	70.6%	
Perceived susceptibility			
- Not at all likely	63.6%	82.4%	
- Somewhat likely	21.2%	0%	0.19
- Very likely	6.1%	11.8%	
- Don't know	10.0%	5.9%	
Perceived severity			
- Not at all serious	6.1%	11.8%	
- Somewhat serious	12.1%	17.7%	0.64
- Very serious	81.8%	70.6%	
Action efficacy			
- Not at all likely	37.5%	62.5%	
- Somewhat likely	28.1%	18.8%	0.26
- Very likely	34.4%	18.8%	

[1] Fed child at least one serving of animal milk per day, either fermented, fresh, or in tea/foods

[2] Missing data = 1, Doers (n=33), Non Doers (n=16)

[3] Missing data = 2, Doers (n=32), Non Doers (n=16)

Table 9: Proportions of perceived advantages and disadvantages to feeding their child an additional serving of milk per day among rural Kenyan mothers of children 12-24 months

Advantages	**Doers (n=33)[1]**	**Non Doers (n=17)**	**p-value**
Improves health	45.5%	58.8%	0.37
Prevents disease/illness	30.3%	29.4%	0.95
Increases strength	33.3%	23.5%	0.47
Satisfies child[2]	21.2%	5.9%	0.16
Increases growth/weight	27.3%	35.3%	0.56
Increases energy	42.4%	29.4%	0.37
Number of advantages listed	2.3 (0.94)	2.1 (0.78)	0.56
Disadvantages			
None	75.7%	94.1%	0.11
Causes diarrhea	15.2%	0%	0.09
Other adverse health outcome[3]	15.2%	5.9%	0.34

[1] Fed child at least one serving of animal milk per day, either fermented, fresh, or in tea/foods
[2] e.g. quenches thirst, makes child full
[3] e.g. worms, get fat, rashes

Table 10: Proportions of perceived facilitators and barriers to feeding their child an additional serving of milk per day among rural Kenyan mothers of children 12-24 months

Facilitators	**Doers (n=33)[1]**	**Non Doers (n=17)**	**p-value**
Money/Income	72.7%	76.5%	0.78
Livestock/production[2]	72.7%	41.2%	0.03*
Milk availability[3]	18.2%	23.5%	0.65
Other personal resource[4]	21.2%	5.9%	0.59
Barriers			
Lack of money	78.8%	94.1%	0.16
Lack of availability[5]	24.2%	23.5%	0.96
Lack of livestock/production[2]	42.4%	41.2%	0.93

[1] Fed child at least one serving of animal milk per day, either fermented, fresh, or in tea/foods
[2] Participant's ability to own cows/goats and/or produce milk
[3] Availability generally or specifically to buy from neighbors or at the market
[4] e.g. time to feed, water or firewood for boiling, energy
[5] Availability generally or specifically to buy from neighbors or at the market

Table 11: Proportions of social enablers and social blockades to feeding their child an additional serving of milk per day among rural Kenyan mothers of children 12-24 months

Enablers	**Doers (n=33)[1]**	**Non Doers (n=17)**	**p-value**
Husband	75.7%	76.5%	0.96
Mother-in-law	54.6%	35.3%	0.20
Sister-in-law	18.2%	5.9%	0.24
Own mother	18.2%	29.4%	0.36
Own father	12.1%	11.7%	0.97
Friends/Neighbors	21.2%	17.7%	0.77
Child's siblings	6.1%	17.7%	0.20
Other female relatives[2]	15.2%	0%	0.09
Number of enablers listed[3]	2.5 (1.00)	2.0 (0.94)	0.10
Blockades			
Nobody	93.9%	94.1%	0.98

[1] Fed child at least one serving of animal milk per day, either fermented, fresh, or in tea/foods

[2] e.g. Own sister, grandmother, brother-in-law's wife

[3] Mean (SD)