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The Acceptability and Feasibility of an Innovative Feeding Toolkit to Improve Infant and Young Child Feeding in Mbeya District, Tanzania

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Abstract

The Acceptability and Feasibility of an Innovative Feeding Toolkit to Improve Infant and Young Child Feeding in Mbeya District, Tanzania

By Sarah Grace Sawyer

Introduction: In Tanzania there is a need for tools that allow mothers and caregivers to improve complementary feeding practices for children aged 6-24 months, including improving the quality, quantity, and diversity of food, as well as the frequency of feeding. We used an innovative feeding toolkit, which included a demarcated bowl, slotted spoon, and counseling card, to target the practice of behaviors associated with complementary feeding. **Methodology:** In June–September 2017, we assessed community acceptability of the feeding bowl, spoon, and counseling card and conducted user-testing of the toolkit with caregivers of children 6-18 months of age in Mbeya region, Tanzania. **Results:** Over the course of the trial, the mean number of meals in the previous 24 hours increased from 2.35 to 2.79 meals in 6-8.9 month olds and from 2.58 to 2.78 meals in 9-11.9 month olds, but decreased from 3.35 to 3.28 meals in 12-18 month olds. The mean number of food groups in the previous seven days increased from 5.45 to 6.9 groups in 6-8.9 month olds, from 7.53 to 8.79 groups in 9-11.9 month olds, and from 8.7 to 9.5 groups in 12-18 month olds. The percent of infants consuming age-appropriate volume of food at each meal increased from 20% to 95% in 6-8.9 month olds, from 21% to 50% in 9-11.9 month olds, and from 35% to 39% in 12-18 month olds. The majority of mothers reported changes in their child’s diet since they started using the feeding toolkit, including increases in quantity of the food the child ate and positive changes in the child’s health. Mothers noted increasing feeding frequency and number of food groups fed to their infant. **Conclusion:** The innovative feeding toolkit was generally found to be acceptable and feasible for use in Tanzania to improve infant and young child feeding. Further research needs to be conducted on the feeding toolkit to better determine its effectiveness in improving infant and young child feeding practices.

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Chapter I: Introduction

Context of the Project

Maternal and child undernutrition is a major problem in low and middle income countries including Tanzania. Undernutrition accounts for stunting, wasting, and micronutrient deficiencies, causing serious short-term and long-term consequences. In 2016, the Food and Agriculture Organization of the United Nations (FAO) found that globally, 22.9% of children under five years are stunted, making them more susceptible to disease and poor cognitive development (FAO 2017). The first 1,000 days of a child's life, from pregnancy to age two years is a key period for maternal and child nutrition, and can help produce life-long adult benefits (Black et al 2013). There can be a number of effects, including fetal growth restriction, irreversible stunting, and future non-communicable diseases during adult life without adequate nutrition during this period.

Stunting is prevalent on both mainland Tanzania (35%) and on Zanzibar (24%) in children under the age of five. The highest prevalence of stunting under the age of five in Tanzania exists in the Southern Highlands (45%), and in the neighboring Mbeya Region, the stunting rate is at 38% (Ministry of Health 2015-2016). Incorrect feeding practices are common in Tanzania, and under half of children ages 6-23 months reach minimum dietary diversity, minimum meal frequency, and minimum acceptable diet. (Ministry of Health 2015-2016).

Globally, there are a number of interventions that focus on improving infant and young child feeding including counseling, mass communication, demonstrations, instruction, supplementation, and fortification. To improve infant and young child feeding, the Manoff

Group developed a child feeding bowl which aimed to improve child nutrition by promoting age-appropriate meal volume (Kram et al 2015).

To address gaps in the Manoff child feeding bowl, namely meal frequency, consistency and maternal nutrition, Emory University and Georgia Institute of Technology developed the healthy baby feeding toolkit (Kram et al 2015). It consists of a demarcated bowl, slotted spoon, and a laminated counseling card depicting correct usage of the toolkit with words and pictures for each life stage. The bowl is demarcated to show recommended feeding frequency and food quantity for certain ages, namely 6-9 months, 9-11 months, and 12-24 months. The spoon in the toolkit is slotted to help mothers determine adequate food consistency for infants, and the counseling card incorporates instructions and visual demonstrations of feeding behaviors for infants. The feeding toolkit was developed using the Health Belief Model, drawing mostly from the areas of self-efficacy and cues to action in practicing recommended diet during the first thousand days of life, from pregnancy to two years of age (Champion VL & Sugg Skinner C, 2008; Orji et al, 2012).

Problem Statement

Improving the quality, quantity, frequency, and diversity of food in child feeding is critical for preventing long-term consequences of malnutrition in children (Black et al 2013). In low and middle income countries, such as Tanzania, there is an essential need for effective tools to allow mothers and caregivers to improve feeding practices for children aged 6-18 months, including improving the quality, quantity, and diversity of food, as well as the frequency of feeding.

Purpose of the Project

The purpose of this project was to test the acceptability and feasibility of the healthy baby feeding toolkit in Mbeya Region Tanzania, where stunting rates in children are some of the highest in the entire country (Ministry of Health 2015-2016). Mothers used the feeding toolkits and received counseling during the trial; families kept the toolkit for future use.

Chapter II: Literature Review

Global Problem of Maternal and Child Malnutrition

Maternal and child undernutrition is a major problem in low and middle income countries. Maternal and child undernutrition results in premature deaths and disease burden, with child undernutrition causing 45% of all child deaths globally (Black et al 2013). Maternal and child undernutrition accounts for stunting, wasting, and micronutrient deficiencies, causing serious short-term and long-term consequences. In 2016, the Food and Agriculture Association (FAO) found that globally, 22.9% of children under five years are stunted. In Eastern, Western, and Central Africa, as well as Southern Asia and Oceania (not including Australia and New Zealand), the stunting rate for children under five years was found to be as high as 30% (FAO 2017). Stunting makes children more susceptible to disease, and less likely to have normal cognitive development, which can affect potential in adult life (FAO 2017). The FAO also found the global wasting rate among children under five years to be 7.7%, with the highest rates in Southern Asia (FAO 2017). Like stunting, wasting among children under five years is associated with increased risk of disease and mortality (FAO 2017).

The first 1,000 days of a child's life, which is defined from the start of pregnancy to two years of age, has been identified as a critical period for maternal and child nutrition, and can help produce life-long benefits (Black et al 2013). Without proper nutrition in the first 1,000 days, there can be a number of effects, including fetal growth restriction, irreversible stunting, and future non-communicable diseases during adult life (Black et al 2013). These life-long

effects of maternal and child malnutrition are the reason why correct maternal and infant and young child feeding are crucial to the child's development and future.

Maternal Nutrition

Good maternal nutrition, exclusive breastfeeding for the first six months, and appropriate complementary feeding up until 24 months is critical to infant health. Both maternal overweight and obesity, as well as undernutrition can lead to adverse fetal affects, including birth trauma and infant death (Black et al 2013). Undernutrition, including vitamin deficiencies during pregnancy can lead to increased risk of maternal mortality, low infant birthweight, and infant mortality (Black et al 2013). In low and middle income countries, iron-deficiency anemia, vitamin A deficiency, zinc deficiency, iodine deficiency, and folate deficiency are top causes for concern. Iron deficiency anemia increases a pregnant woman's chance of dying during pregnancy or birth, and limits fetal development (Black et al 2013). Vitamin A deficiency during pregnancy can lead to vision problems in infants, and zinc deficiency causes severe issues with fetal development, including poor protein synthesis and cell division in the fetus' growth (Black et al 2013). Iodine deficiency in pregnancy can lead to poor brain development, and studies have shown that children born to iodine-deficient mothers had large deficits in intelligence quotient points compared to children born to mothers that were not iodine-deficient (Black et al 2013). Folate deficiency during pregnancy can lead to neural tube defects in infants. Calcium deficiency during pregnancy is associated with increased maternal mortality, poor fetal development, and increased risk of premature birth, and vitamin D deficiency during pregnancy is associated with poor fetal bone development and premature

birth (Black et al 2013). Proper maternal nutrition is essential for fetus and infant health which is why pregnancy is included in the critical first 1,000 days of a child's life.

Exclusive Breastfeeding

There is strong evidence that exclusive breastfeeding reduces infant mortality. Globally, not practicing exclusive breastfeeding causes approximately 11.6% of mortality cases in children under five years (Black et al 2013). The current recommendations are that infants should be breastfed within one hour of birth, and exclusively breastfed up until six months. Breastfeeding should continue up to 24 months or longer, with the addition of complementary foods (Black et al 2013). Less than 50% of children under one month old worldwide have been found to be exclusively breastfed, and only about 30% of children aged one to five months are exclusively breastfed (Black et al 2013). Worldwide, it has been found that roughly 36% of infants under six months are exclusively breastfed (Lutter et al 2011).

Complementary Feeding

Appropriate complementary feeding is essential for infant nutrition, starting at age six months while continuing to breastfeed until 24 months of age. Adequate complementary feeding includes guidelines surrounding appropriate number of meals per day, and meal density, quantity, and quality (Dewey 2001). Like exclusive breastfeeding, complementary feeding is also a critical part of the first 1,000 days of an infant's life. To prevent stunting, infants should be fed complementary foods with appropriate quality, density, quantity, and frequency (FAO 2017). Worldwide, it has been estimated that less than 33% of children aged 6-24 months receive adequate dietary variety, and roughly 50% receive appropriate number of meals (Lutter et al 2011).

Consequences of Maternal and Child Undernutrition

Maternal and child undernutrition in the first 1,000 days of an infant's life is associated with long-term permanent effects, including irreversible stunting, less schooling, and fewer earnings during adulthood (Victora et al 2008). Not only does maternal and child undernutrition have serious effects on an individual level, but it has effects at the national level, demonstrating lower academic achievement and economic output for countries with high rates of maternal and child undernutrition (Victora et al 2008).

Review of Theoretical Frameworks

This literature review will assess theoretical frameworks as mechanisms to develop and evaluate maternal and child nutrition interventions. There will be an overview of the Health Belief Model, followed by overviews of the Social Cognitive Theory and the Social Ecological Model. Last, there will be a review of Michie's Model of Behavior Change, which will be applied when assessing several recent maternal and child nutrition interventions.

Health Belief Model

The Health Belief Model has been used to predict health behavior based on six constructs including risk susceptibility, risk severity, benefits to action, self-efficacy, and cues to action (Jones et al 2015). Perceived risk susceptibility relates to an individual's assessed likelihood of a disease or other negative health outcome, and perceived risk severity relates to an individual's perception of a health outcome. Benefits to action refers to an individual's perceived belief about the benefit of doing or not doing a certain behavior, and self-efficacy relates to an individual's perceived capability of practicing a certain behavior. Last, cues to

action refers to encouragement for practicing behaviors, such as reminders from family members (Dutta-Bergman 2005).

The Health Belief Model has been applied to many interventions. In one example, the model was applied to folate intake of low-income pregnant women in the United States. In this example, the Health Belief Model was used to understand pregnant women's attitudes toward high folate diets to prevent neural tube defects (Kloeblen & Batish 1999). In a study published in 1999, researchers found that perceived benefits was the most important component of the Health Belief Model in predicting intention to follow a high folate diet in pregnant women (Kloeblen & Batish 1999). Other important constructs that were predictive of intention to follow a high folate diet included perceived susceptibility, perceived severity, and self-efficacy. This study highlighted the applicability of models in designing interventions that will be most effective.

Social Cognitive Theory

The Social Cognitive Theory is a behavior change theory that focuses on three influences of behavior change, including self-efficacy, goals, and expected outcomes. Stemming from the Social Learning Theory, the Social Cognitive Theory added a self-efficacy component which addresses the need for personal agency to change behavior (USHHS 2005). Through the different concepts in the Social Cognitive Theory, approaches for behavior change can be identified. Concepts within the Social Cognitive Theory include "reciprocal determinism, behavioral capability, expectations, self-efficacy, observational learning, and reinforcements" (USHHS 2005). Reciprocal determinism refers to the intersection of the person, their behavior, and their environment in which they practice the behavior. In terms of behavior change in the

context of this theory, reciprocal determinism refers to promoting behavior change in multiple ways through the person's intentions and their physical environment. Other concepts, including behavioral capability, expectations, and self-efficacy refer to a person's psychological and physical capability to practice a behavior, their beliefs about the outcomes of the behavior, and their belief in their ability to change their behavior. Strategies for change include demonstrating positive outcomes of the desired behavior, developing a person's confidence to practice the behavior, and developing a person's knowledge and skills to practice the behavior.

Observational learning refers to a person learning through seeing others perform the behavior, and reinforcements refer to the provision of incentives to perform the behavior (USHHS 2005).

The Social Cognitive Theory has been applied to nutrition interventions, including those targeting dietary change. In one example, researchers used the concept of reciprocal determinism to identify ways to increase fruit and vegetable consumption in schoolchildren (Baranowski et al 1993). Reciprocal determinism focuses on the interaction between the person, the behavior, and their environment in which the behavior is practiced. Designing focus group discussions using this concept allowed the researchers to identify ways to promote increased fruit and vegetable intake in schoolchildren, including increasing availability of fruits and vegetables in homes, increasing children's desire for vegetables, and building the skills to acquire fruits and vegetables and prepare them (Baranowski et al 1993). The Social Cognitive Theory was useful in this study, and has been used in other nutrition related intervention studies.

Social Ecological Model

While the Social Cognitive Theory focuses on the individual, the Social Ecological Model emphasizes the different layers of influence that affect a person's behavior change, including society, community, relationships, and individual factors. The Social Ecological Model shows that each level is interrelated and they all affect health outcomes (ODPHP 2015). In regard to nutrition, the Social Ecological Model emphasizes the role of traditions, social norms and values, and priorities at the society level, while the community level includes the roles of systems, organizations, and industries in behavior change. The relationship level incorporates the role of personal relationships, which may affect behavior change, including family, work, and school relationships. Last, the individual level focuses on the individual factors that affect behavior change such as psychosocial factors, knowledge, physical and psychological skills, and personal demographics (ODPHP 2015).

The Social Ecological Model has been commonly used in designing nutrition interventions, including those targeting food and physical activity decisions. In one example, researchers applied the Social Ecological Model to the promotion of healthy eating choices in schools to understand the different factors at play in student's eating choices (Townsend & Foster 2011). The researchers analyzed the individual, interpersonal, community, and society level influences on student's dietary choices, and found that a person's interpersonal relationships had a larger influence on eating choices at school than did a person's individual characteristics. Individual characteristics were more of an influence on eating choices made outside of the school environment (Townsend & Foster 2011). The Social Ecological Model is an

effective theory in nutrition because it incorporates the different levels of outside and personal influence that affect behavior change.

Michie's Model of Behavior Change

Dr. Susan Michie created the Behavior Change Wheel to develop an integrative approach for synthesizing existing theories, including those previously discussed, into one framework. The Behavior Change Wheel offers an integrative approach by modeling behavior on three components: capability, opportunity, and motivation (Michie et al 2014). In synthesizing existing theories, Michie's model is relevant for myriad behaviors. At the center of the Behavior Change Wheel are sources of behavior, including psychological, physical, social, physical, reflective, and automatic which tie in with the three main components of the model: capability, opportunity, and motivation. Michie's model argues that changing behavior requires addressing more than one of the components. The Behavior Change Wheel highlights that sources of behavior can be psychological or physical capability, social or physical opportunity, or automatic or reflective motivation. These sources of behavior are intended to show different targets for various interventions (Michie et al 2014).

The second outer portion of the Behavior Change Wheel shows intervention types, dependent on which source(s) of behavior a program is targeting. Intervention functions include education, persuasion, incentivization, coercion, training, restriction, environmental restructuring, modelling, and enablement. The intervention function "education," for example, refers to "increasing knowledge" on a subject or idea. Similarly, the intervention function "training" refers to building skills, and the intervention function "modelling" refers to providing appropriate models for people to copy (Michie et al 2011). The outer most part of the Behavior

Change Wheel highlights policy, including environmental/social planning, communication/marketing, legislation, service provision, regulation, fiscal measures, and guidelines. (Michie et al 2014). Communication/marketing, for instance, refers to using media to convey a message, and fiscal measures refer to using taxes to affect the financial cost of a behavior (Michie et al 2011).

Compared to the Health Belief Model, the Behavior Change Wheel incorporates the “roles of impulsivity, habit, self-control, associative learning, and emotional processing,” allowing it to be more applicable to a variety of target behaviors and interventions (Michie et al 2011). In Dr. Susan Michie’s book about the Behavior Change Wheel, she and other researchers apply the framework to a variety of behaviors in designing interventions, showing the applicability and versatility of the model. The Behavior Change Wheel’s applicability is one of the reasons why it is the most effective framework for assessing recent maternal and child nutrition interventions.

In developing the Behavior Change Wheel framework, Michie and colleagues tested its reliability by coding interventions in the areas of tobacco control and obesity (Michie et al 2011). The researchers found high reliability when applying Behavior Change Wheel framework to these areas of public health, and they identified many strengths and some weaknesses to the framework. The Behavior Change Wheel is effective in that it includes automatic and reflective behaviors, of which the Health Belief Model and others do not (Michie et al 2011). Further, the Behavior Change Wheel allows behaviors to be put into context during intervention design. Specifically, the “social” and “physical” opportunity allows for context to be integrated into the framework from the very beginning (Michie et al 2011). This allows for the natural context to be

easily taken into account during the design of an intervention to change health behavior. In terms of weaknesses of the Behavior Change Wheel, Michie and colleagues identified that other frameworks may be more beneficial in certain cases, meaning that the Behavior Change Wheel is not the most useful in every context (Michie et al 2011).

Evaluation of Recent Maternal and Child Nutrition Interventions *Shortcomings of Infant and Young Child Feeding Programs*

In looking at global child nutrition feeding programs that employ the use of social and behavior change communication techniques, we have seen that interventions to improve infant and young child feeding have not been as successful as other programs that focus on fortification and supplementation for improved child nutrition (Piwoz et al 2013). Researchers have identified that the progress in complementary feeding programs is lacking, when compared to other child nutrition programs, such as supplementation, due to lack of understanding of the barriers to best feeding practices, and lack of resources to support the programs. Further, researchers identified that there needs to be better behavior change communication strategies in order to effectively improve child feeding (Piwoz et al 2013). More approaches need to be field-tested and documented to improve behavior change programs. The following section outlines different infant and young child interventions, including the feeding toolkit, which this study assessed. These programs are reviewed using the Behavior Change Wheel framework to provide further examples of intervention activities that utilize different or similar methods.

The Feeding Toolkit

The original concept of a child feeding bowl was developed by the Manoff Group, in a response to the problem of feeding quantity with infants, and tested in Latin America (The Manoff Group, “A Simple Tool to Improve Child Nutrition”). Later, researchers from Emory University and Georgia Institute of Technology built upon this idea to develop a feeding toolkit, consisting of a demarcated bowl, slotted spoon, and a laminated counseling card depicting correct usage of the toolkit with words and pictures for each life stage. The feeding toolkit was developed using the Health Belief Model, drawing mostly from the areas of self-efficacy and cues to action in practicing recommended diet during the first thousand days of life, from pregnancy to two years of age (Champion VL & Sugg Skinner C 2008; Orji et al 2012). The feeding toolkit cues mothers and caregivers to practice feeding their child the appropriate meal frequency, diet diversity, food volume, and meal consistency through bowl demarcations and symbols, as well as images on the counseling card (Kram et al 2015). The slotted spoon was developed to promote feeding of more energy-dense foods, allowing caretakers to measure the thickness of the food through the slots. For example, in Kenya, researchers found that a slot size of 0.3 centimeters was most appropriate for determining the best thickness of locally produced complementary foods, including porridge (Kram et al 2015).

Although the feeding toolkit was developed using the Health Belief Model, it can be effectively analyzed with Michie’s framework of Behavior Change. The innovative feeding toolkit intervention draws from the behavior source areas of self-efficacy and cues to action, which are important components of the Behavior Change Wheel’s capability, opportunity, and motivation (COM-B) framework. The feeding toolkit intervention employs particular behavior

change techniques, including: instruction on how to perform a behavior, prompts/cues, monitoring of behavior by others without feedback, information about health consequences, and adding objects to the environment. These behavior change techniques are linked to components of the COM-B framework. Specifically, the feeding toolkit emphasizes reflective motivation in that it improves an individual's perceived capability of practicing a certain behavior, and motivates mothers to improve their child's health by discussing potential negative consequences of not using the feeding toolkit. Further, the feeding toolkit intervention adds the bowl and spoon to the environment and incorporates cues to action, which are both aspects of physical opportunity. Having prompts/cues to practice complementary feeding behaviors increases the opportunity afforded to practice these behaviors, and adding objects to the environment enables caregivers to practice complementary feeding behaviors.

The feeding toolkit intervention also employs interpersonal communication through instruction on how to perform the behaviors and provision of information on consequences. These behavior change techniques fit within the domain of psychological capability because they increase an individual's understanding on how and why to perform complementary feeding behaviors. While the feeding toolkit addresses self-efficacy and cues to action, it does not fully address components of Michie's Framework for Behavior Change, including physical opportunity which also refers to access and availability of foods.

MICAH – World Vision

World Vision's Micronutrient and Health (MICAH) program ran from 1996 to 2005 in five African countries, including Ethiopia, Ghana, Malawi, Senegal, and Tanzania (World Vision

2006). MICAH was funded by the Canadian International Development Agency and implemented by the World Vision country offices in the five program countries.

MICAH aimed to “improve the nutritional and health status of women and children through the most cost-effective and sustainable interventions” (World Vision 2006). It had three main objectives, each of which had specific activities: 1) “increase intake and bioavailability of micronutrients (iron, iodine, and vitamin A), 2) reduce the prevalence of diseases that affect micronutrient status (diarrheal, parasitic and vaccine-preventable), and 3) build local capacity for delivery systems to improve micronutrient status (World Vision 2006). To do this, it incorporated the following activities into its programming: supplementation, fortification, promotion of exclusive breastfeeding and dietary modification, malaria control, treatment for worms and parasites, immunization, latrine construction, safe water point establishment, influencing national policy, training of staff, and equipping of labs (World Vision 2006).

In identifying the activities of the program, it is clear that the program addresses the “opportunity” and “capability” components in the COM-B model. MICAH includes activities that both promote physical opportunity and psychological capability, because its activities aim to increase knowledge by providing education, and increase access to micronutrients, latrines, safe water sources, immunizations, and treatment for worms and parasites. In regard to behavior change techniques, MICAH employs the following: instruction on performing behaviors, restructuring the physical environment, and adding objects to the environment. Instruction on performing behaviors fits within the domain of psychological capability because it aims to increase psychological skills to perform a behavior. Restructuring the physical

environment and adding objects to the environment relates to physical opportunity because it increases the availability of micronutrients, latrines, immunizations within the physical environment etc. Compared to the feeding toolkit intervention, MICAH focuses much more heavily on physical opportunity in regard to its focus on increasing access to micronutrients, latrines, water sources, immunizations, and worm/parasite treatment. Comparatively, the feeding toolkit intervention also employs physical opportunity, but not in the sense of increasing access to services and goods. Rather, it focuses on cues to action, which is an element of physical opportunity because cues increase the opportunity afforded to the caregiver to practice complementary feeding behaviors.

SHOUHARDO II – CARE

SHOUHARDO II began in 2010 and ran until 2015 in 11 districts in Bangladesh. Implemented by CARE, SHOUHARDO aimed to “transform the lives of 370,000 poor and extreme households in 11 of the poorest and marginalized districts in Bangladesh by reducing their vulnerability to food insecurity” (CARE 2015). To reach their goal, CARE aimed to increase availability to and access to nutritious food among 370,000 households, improve health and nutrition status of 176,706 children under two, empower women and adolescent girls, increase accountability of local government, and increase disaster preparedness of communities. SHOUHARDO implemented care occupational groups, growth monitoring and promotion groups, early childhood development groups, and empowerment, knowledge, and transformative action groups with the purpose of monitoring change in communities (CARE 2015).

In regard to improving the health and nutrition status of children under two, SHOUHARDO targeted pregnant and lactating women, as well as children under two. They provided monthly food rations, promoted infant and young child feeding practices, encouraged community based integrated management of childhood illnesses, provided micro-nutrient supplementation with the help of the Ministry of Health and Family Welfare, and worked with partner NGOs to provide water infrastructure. Other objectives of SHOUHARDO were achieved with different program activities, but this review aims to assess infant and young child nutrition aspects of programs.

Within the strategic objective of improving the health and nutrition status of children under two, SHOUHARDO incorporates the “capability” and “opportunity” components of the COM-B model, and specifically, the psychological capability and physical opportunity sources of behavior in the first tenet of the Behavior Change Wheel. SHOUHARDO focuses heavily on physical opportunity in that program activities include provision of food rations, micronutrient supplementation, and provision of water infrastructure in partnership with partner NGOs. In addition, the growth monitoring and promotion groups that monitor progress among children under five increase knowledge among pregnant women and mothers. In regard to behavior change techniques in use, SHOUHARDO included the following: adding objects to the environment, restructuring of the physical environment, instruction on how to perform behaviors, and monitoring of outcomes without feedback. SHOUHARDO is similar to MICAH in that it focuses on “capability” and “opportunity” in the COM-B model.

ENGINE – Save the Children

The Empowering the New Generation to Improve Nutrition and Economic opportunities (ENGINE) was led by Save the Children from 2011 to 2016. The project was part of the Government of Ethiopia's National Nutrition Program and the US Government's Feed the Future initiative which aims to reduce undernutrition in the first 1,000 days of life (Save the Children 2016). ENGINE's strategic objective was to "improve the nutritional status of women and young children through sustainable, comprehensive, coordinated, and evidence-based interventions (Save the Children 2016). To accomplish this, the project aimed to better institutionalize nutrition programs, improve the quality and delivery of nutrition and health care services, and improve the prevention of undernutrition (Save the Children 2016).

Within the objective of improving the prevention of undernutrition, the project aimed to improved infant and young child feeding knowledge and practices. Activities were designed using a behavior change communication approach, based on a behavior-centered model. ENGINE utilized several behavior change techniques, including: restructuring the physical environment, instruction on how to perform behaviors, demonstration on how to perform behaviors, credible source, and social comparison. ENGINE fits within psychological capability in the COM-B model because it aimed to increase the knowledge of mothers and caregivers. The project also incorporated many aspects of physical opportunity in that it aimed to restructure the physical environment by strengthening health centers' nutrition services and their capacity to handle malnutrition cases. This increased the physical opportunity for better child nutrition because of increased resources. In addition, due to the social behavior change communication strategy, the project also was rooted in social opportunity in the COM-B model because it

incorporated the use of religious leaders as credible sources. ENGINE also incorporated the use of social comparison through audio recordings and role plays. Further, the behavior change communication strategy employed the use of cues to promote dietary diversity, which also fits within the domain of social opportunity because these cues aimed to influence the social norms. The project implementers utilized familiar images, such as a *gulicha*, which is a large platter used to cook *injera* bread. Posters showed the three small pillars used to hold a *gulicha* up while cooking, and highlighted these pillars as representing three pillars of excellent dietary diversity: fats/oils, leafy green and vitamin-A rich vegetables, and animal-source foods like meat and eggs (Save the Children 2016). In seeing a familiar image, these posters acted as cues to practice good dietary diversity. They increased the opportunity afforded by social norms which influence the way people think about dietary diversity.

Alive and Thrive – FHI 360

Alive and Thrive, a project implemented by FHI 360 in 10 countries, including Burkina Faso, Ethiopia, India, Bangladesh, Myanmar, Thailand, Laos, Vietnam, Cambodia, and Indonesia (Alive and Thrive 2014). The project first began with formative research in Bangladesh in 2009 (Sanghvi et al 2016). The project utilized advocacy, interpersonal communication and community mobilization, mass communication, and use of data to achieve the goal of “saving lives, preventing illness, and ensuring healthy growth and development through improved breastfeeding and complementary feeding practices” (Alive and Thrive 2014).

To increase exclusive breastfeeding and desired complementary feeding practices, Alive and Thrive used counseling by health workers during home visits, mass media campaigns, community mobilization, and policy advocacy (Alive and Thrive 2014). In regard to behavior

change techniques, Alive and Thrive employed the use of instruction on performing behaviors and the use of credible sources. The project fits within the domains of “capability,” “motivation,” and “opportunity” in the COM-B model. Specifically, because of the utilization of counseling as a behavior change method to promote breastfeeding and complementary feeding, Alive and Thrive employs the psychological capability component of the COM-B model because trained health workers instructed mothers and caregivers on performing behaviors to increase their psychological skills. In addition, because of the emphasis on mass communication as a behavior change strategy, Alive and Thrive also relates to reflective motivation in the COM-B model because it aims to change the community’s intentions and beliefs about breastfeeding and complementary feeding, which focuses on reflective processes in performing a behavior. The community mobilization aspect of Alive and Thrive is rooted in social opportunity because it involves the community in supporting practice of the behavior, including the incorporation of credible sources such as religious leaders and doctors. The interpersonal communication component of Alive and Thrive is also rooted in social opportunity because it focuses on person-to-person communication to provide encouragement and demonstrate skills relating to the priority behaviors (Alive and Thrive 2014). Having social support increases the opportunity afforded by interpersonal influences to perform a behavior, which is why this aspect of Alive and Thrive fits within the domain of social opportunity.

Evaluation of Complementary Feeding Programs

While infant and young child feeding programs have not experienced as much success as other child feeding programs, including supplementation and fortification, the previously described large-scale programs potentially are lessening the gap in success. They were strong in

that they involved interpersonal communication, mass communication, community mobilization, as well as increasing physical opportunity. In an article about evidence-based approaches to design large-scale infant and young child feeding programs, researchers stated that using large communication strategies with multiple facets is important. Behavior change messages should be implemented through multiple methods, and involve family members and community members (Baker et al 2013). In another article, researchers asserted that “interpersonal communication, community mobilization, mass media, and evidence-based policy dialogue and advocacy” were necessary modes for effective infant and young child feeding interventions (Baker, Sanghvi, Hajeebhoy, & Hailu Abrha 2013). The previously described programs are successful in that they employ these methods and are multi-faceted. For example, FHI 360’s Alive and Thrive program utilizes interpersonal communication, community mobilization, and mass communication in their strategy to improve child feeding practices. The feeding toolkit intervention employs interpersonal communication through the counseling portion of the intervention, as well as physical opportunity with its focus on ‘cues to action’ with the feeding bowl, spoon, and counseling card.

It is important to note that the specific context for infant and young child feeding interventions must be understood when implementing and evaluating the program. Gathering the emic perspective through ethnography allows these programs to be designed for specific environmental and cultural contexts (Tumilowicz 2015). The context of the intervention can affect the effectiveness of the program and make it less or more successful. In this paper, it is important to understand the Tanzanian context, where the healthy baby feeding toolkit trial was implemented.

Tanzania Context

Tanzania Snapshot

Tanzania is a country located in East Africa, bordering Kenya, Uganda, Rwanda, the Democratic Republic of the Congo, Malawi, Mozambique, Zambia, and Burundi. While the country has many natural resources, it is largely underdeveloped. Tanzania ranks 27th globally for maternal mortality ratio, with 398 deaths per 100,000 live births (CIA World Factbook). Further, there are 39.9 infant deaths per every 1,000 live births, making Tanzania rank 46th when compared to other countries worldwide (CIA World Factbook). Only 31.3% of urban populations and 8.3% percent of rural populations have access to an improved sanitation facility. Overall, 13.7% of children under five years are considered underweight (CIA World Factbook).

Maternal and Child Nutrition in Tanzania

In Tanzania, it has been found that only 59% of infants under six months are exclusively breastfed (Ministry of Health 2015-2016). The percentage of infants exclusively breastfed decreases with age. At under four weeks of age, 84% of infants are exclusively breastfed, while only 27% of infants four to five months are exclusively breastfed (Ministry of Health 2015-2016).

Through the Demographic and Health Survey, the Tanzanian Ministry of Health also found that complementary foods were sometimes given to children at too young of an age. Nationally, 52% of children in Tanzania aged between four to five months were being fed a solid or semi-solid food (Ministry of Health 2015-2016). Additionally, the survey found that 6% of Tanzanian children receive some solid or semi-solid food at age 2 months and below while they

are still breastfeeding (Ministry of Health 2015-2016). Stunting is prevalent on both the mainland (35%) and on Zanzibar (24%) in children under the age of five. The highest prevalence of stunting under the age of five in Tanzania is in the Southern Highlands (45%), and in neighboring Mbeya Region, the stunting rate is at 38% (Ministry of Health 2015-2016).

The Accelerated Stunting Reduction Project

The Accelerated Stunting Reduction Project (ASRP), run by Catholic Relief Services (CRS) and the Center for Counseling Nutrition and Health Care (COUSENUTH) in Mbeya, Tanzania, is a four-year project that is funded by UNICEF. The project targets pregnant women and mothers of children under two years, and focuses on: 1) building capacity of community health workers (CHWs) to educate mothers on key feeding practices for children under two years; 2) establishing counseling groups; 3) engaging community leaders and religious leaders; and 4) engaging fathers and grandmothers as key influencers of infant feeding at the family level. To address food security constraints in the region and create a more enabling environment for nutrition, the ASRP has also established farmer groups, to which it provides training and basic equipment. Farmer groups focus on increasing crop production and the availability of nutrient dense foods.

Research suggests that complementary feeding programs need to be expanded in order to better address the high levels of undernutrition globally (Lutter et al 2011). Data suggests that lack of access to quality and quantity of foods, and poor support in infant feeding contributes to inadequate complementary feeding practices. In addition, data suggests that poor communication strategies for conveying recommendations about infant feeding practices may contribute to inadequate complementary feeding (Lutter et al 2011). The child feeding

toolkit, originally developed by The Manoff Group, aims to address the gaps in infant and young child feeding programs, including the ASRP in Tanzania.

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Chapter III: Manuscript

The Acceptability and Feasibility of an Innovative Feeding Toolkit to Improve Infant and Young Child Feeding in Mbeya District, Tanzania

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Abstract

Introduction: In Tanzania there is a need for tools that allow mothers and caregivers to improve complementary feeding practices for children aged 6-24 months, including improving the quality, quantity, and diversity of food, as well as the frequency of feeding. We used an innovative feeding toolkit, which included a demarcated bowl, slotted spoon, and counseling card, to target the practice of behaviors associated with complementary feeding. **Methodology:** In June–September 2017, we assessed community acceptability of the feeding bowl, spoon, and counseling card and conducted user-testing of the toolkit with caregivers of children 6-18 months of age in Mbeya region, Tanzania. **Results:** Over the course of the trial, the mean number of meals in the previous 24 hours increased from 2.35 to 2.79 meals in 6-8.9 month olds and from 2.58 to 2.78 meals in 9-11.9 month olds, but decreased from 3.35 to 3.28 meals in 12-18 month olds. The mean number of food groups in the previous seven days increased from 5.45 to 6.9 groups in 6-8.9 month olds, from 7.53 to 8.79 groups in 9-11.9 month olds, and from 8.7 to 9.5 groups in 12-18 month olds. The percent of infants consuming age-appropriate volume of food at each meal increased from 20% to 95% in 6-8.9 month olds, from 21% to 50% in 9-11.9 month olds, and from 35% to 39% in 12-18 month olds. The majority of mothers reported changes in their child’s diet since they started using the feeding toolkit, including increases in quantity of the food the child ate and positive changes in the child’s health. Mothers noted increasing feeding frequency and number of food groups fed to their infant. **Conclusion:** The innovative feeding toolkit was generally found to be acceptable and feasible for use in Tanzania to improve infant and young child feeding. Further research needs to be conducted on the feeding toolkit to better determine its effectiveness in improving infant and young child feeding practices.

Introduction

In 2016, 22.9% of children under five years globally were stunted. Stunting increases a child's susceptibility to disease and puts them at a heightened risk for poor cognitive development (FAO 2017). The first 1,000 days of a child's life, from pregnancy to age two years is a key period for maternal and child nutrition. Preventing stunting has life-long benefits including greater schooling, work productivity, and reduced risk of chronic disease (Victora et al 2008 & Black et al 2013).

At 35%, stunting in children under five years is a significant public health problem in Tanzania. In Mbeya Region, where this study took place, the stunting rate is 38% (Ministry of Health 2015-2016). Inadequate child feeding practices are common in Tanzania. In 2015, 22% of children were given complementary foods in addition to breastmilk before 6 months of age, and only 10% of infants ages 6-23 months achieved a minimal acceptable diet for their age (Ministry of Health 2015-2016).

The healthy baby feeding toolkit was developed by Emory University and Georgia Institute of Technology, and consists of a demarcated bowl, slotted spoon, and a laminated counseling card depicting correct usage of the toolkit with words and pictures for each life stage, as well as information about diet diversity and hygiene (Collison et al 2015; Kram et al 2015). The feeding toolkit was developed using the Health Belief Model, drawing mostly from the areas of self-efficacy and cues to action in practicing recommended diet during the first 1,000 days of life, from pregnancy to two years of age (Champion VL & Sugg Skinner C, 2008; Orji et al, 2012). Previous studies in Malawi, Kenya, and India found the toolkit to be

acceptable, to promote improved child feeding, and to reduce growth faltering (Collison et al 2015; Faerber et al 2017; Kedera et al 2016; Kram et al 2015).

In an effort to improve its impacts on child feeding, the Accelerated Stunting Reduction Project (ASRP) sought to pilot the acceptability and feasibility of the healthy baby toolkit to improve child feeding practices. Run by Catholic Relief Services (CRS) and the Center for Counseling Nutrition and Health Care (COUSENUTH) in Mbeya, Tanzania, the ARSP is a four-year, UNICEF-funded program that targets pregnant women and mothers of children under two years. The program focuses on: 1) building capacity of community health workers (CHWs) to educate mothers on key feeding practices for children under two years; 2) establishing counseling groups; 3) engaging community leaders and religious leaders; and 4) engaging fathers and grandmothers as key influencers of infant feeding at the family level. To address food security constraints in the region and create a more enabling environment for nutrition, the ASRP has also established farmer groups, to which it provides training and basic equipment. Farmer groups focus on increasing crop production and the availability of nutrient dense foods.

Methods

Study Objectives

In June–September 2017, we assessed community acceptability of the feeding bowl, spoon, and counseling card and conducted user-testing of the toolkit with caregivers of children 6-18 months of age in Mbeya region, Tanzania.

Study Site, Participant Recruitment, and Sampling

The study took place in two districts in Mbeya Region in southwestern Tanzania, the site of ASRP. Formative research occurred in three wards in June and July 2017, while a Trial of

Improved Practices (TIPs) was carried out in two of these wards (four villages total) from July-August 2017. Post-TIPs focus group discussions occurred in early September 2017. ASRP operates overall in six districts (22 wards and 139 villages), and had 16,015 program participants in its first year of implementation. The program began in December 2015 and will run through November 2019. With assistance from CRS, we purposively selected two villages in an urban ward and two villages in a rural ward for TIPs. The criteria for village selection are detailed in Table 1.

Table 1: Study Selection Criteria for Villages in Study in Mbeya Region¹

District	Ward	Health facility	Village	Characteristics
Mbeya District Council	Ward 1	Health facility 1	Village 1	Rural, food diversity, near health facility
			Village 2	Rural, food diversity, further from health facility
Mbeya Municipal Council	Ward 2	Health facility 2	Village 3	Urban, no agriculture
			Village 4	Urban, no agriculture

Participants were recruited with the assistance of CRS and COUSENUTH staff members located in Mbeya Region. These staff members connected the field managers with participant recruiters, who were community health workers or field supervisors at the specific study sites. Participant recruiters were well-connected to families within the community and were able to easily identify eligible study participants, and were compensated for their daily efforts. Eligibility criteria included being over the age of 18 years, intending to stay in the village for the length of the study and either pregnant or with a child <18 months. This manuscript considers only those women with children, the sample for which was 59 women with infants age 6-18

¹ Infant and Young Child Feeding Practices in Mbeya, Tanzania: Formative Field Research. Catholic Relief Services and Emory University. July 2017.

months, including 20 women with 6-8.9 month olds, 19 women with 9-11.9 month olds, and 20 women with 12-18 months olds.

Data Collection

Data were collected at three time points over a 40-day period. At baseline, in-depth structured interviews were conducted with participants and captured sociodemographic information, breastfeeding and complementary feeding practices. Complementary feeding practices were assessed by asking the participant about feeding frequency, food volume and consistency, and diet diversity. Mothers were asked how many meals and snacks their infant usually takes in a day, and were asked to show on the feeding bowl the amount they usually give their child to eat. To assess typical food consistency, mothers were shown images of porridge with different consistencies, and asked to point to whichever image best matched the thickness of porridge they feed their child. Further, to measure diet diversity, mothers were asked to recall the number of days in the previous seven in which the index child had consumed foods from 11 different food groups. Food picture cards were used to assist with recall. Following the interview, research assistants provided the toolkit, in addition to one-on-one counseling about using the toolkit to achieve life-stage appropriate dietary recommendations.

Follow up interviews occurred approximately 10 days and 30 days after baseline. Research assistants conducted in-depth structure interviews on current feeding practices, use of the feeding toolkit, and perceived challenges and benefits. Research assistants continued to counsel participants on the correct use of the feeding bowl and spoon and life-stage relevant feeding recommendations.

Following endline data collection, three focus group discussions were conducted in the study sites with six to eight participants each. The focus group discussions included the participants' experiences using the feeding toolkit, perceived challenges and benefits, opinions about the community acceptability of the toolkit, and recommendations for implementation of the toolkit in the community.

Data Management and Analysis

This study was approved by Emory University's Institutional Review Board, the Mbeya Medical Research and Ethics Committee, and the CUHAS Research and Ethical Committee. Written informed consent was obtained from participants prior to participation in the user testing. Verbal consent was additionally obtained prior to recording interviews and focus group discussions.

Enumerators collected closed-ended and brief open-ended responses on questionnaires and data were entered into Excel. Interviews were recorded with permission and transcribed into detailed summaries, and detailed summaries were used to elaborate on open-ended responses as well as to verify close-ended data. Response frequencies and sociodemographic characteristics are reported as means (SD) or percentages. Change in quantitative indicators from baseline to endline were not assessed for due to small samples, but rather qualitatively evaluated in the context of the thematic analyses.

Key indicators were developed based on questions in the interview guides at baseline and endline to highlight feeding frequency, meal volume, and diet diversity. Feeding frequency was averaged by age group, and percent of participants feeding age-appropriate meal volume was averaged. Diet diversity was shown with several indicators: percent of infants consuming

four or more meals per day, percent of infants consuming a food group in the past seven days, and average number of days which the food group was consumed in the previous seven days.

Results

Acceptability of the feeding toolkit, study participant demographics, baseline feeding practices, and change in feeding practices over the trial period will be reported in the this section. Further, perceived benefits of the toolkit from study participants will be discussed.

Acceptability of the Feeding Toolkit

There was generally a positive reaction to the toolkit, and all mothers stated that they were willing to use the feeding bowl and spoon and did not expect difficulties. Nearly all mothers liked the color of the bowl and spoon. Some mothers said they would prefer other colors, such as blue, red, blue, or black. All mothers liked the material of the bowl and spoon. Nearly all mothers said that the sizes of the bowl and spoon were “good.” All mothers reported that they liked the slots on the spoon, with many saying that they appreciated being able to measure the thickness of the porridge. Mothers liked the symbols on the bowl and spoon and said that they were clear. Some mothers also reported that the bowl should have two handles and a lid for easy storage. All mothers expressed positive perceptions of the bowl demarcations and symbols, and felt they were understandable and clear.

Nearly all mothers said that the symbols and images were clear and easy to understand, and no mothers said they found the counseling card confusing. Most mothers stated that found the images on the counseling card appropriate, and that they were clear and large enough to understand easily. Additionally, most mothers said that the images on the card helped tell the message accurately about the bowl and spoon, however one mother noted that the images

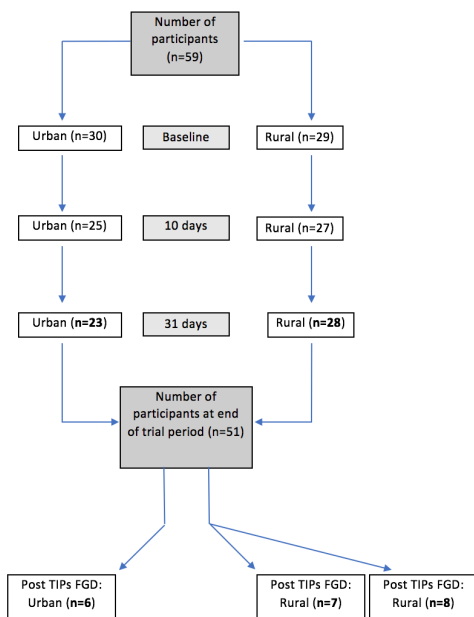
should be larger, and another raised the concern that some women may be illiterate and not understand the card's words.

User Testing Participants

59 women and children ages 6-18 months were included (n=30, urban; n=29, rural) (Figure 1). As the trial progressed 13 participants were lost to follow up, and seven aged out of their baseline age group and into the next age group. Five of those who transitioned into a new group were <6 months at baseline and were in the other part of the trial with pregnant women and women with 0-5.9 month old infants. At the end of the trial there were 51 remaining participants.

In cases where the infant transitioned age groups, the research enumerators interviewed them at the next stage of the trial using the appropriate interview guide and participants were included in the new age group. The figures included in Appendix 1 reflect the changes in numbers in each infant age group throughout the trial period.

Figure 1: Flow Chart of Complementary Feeding Study Participants



Demographics of Study Participants

Table 2 highlights demographics of study participants overall and by urban and rural sites. 73% of caretakers were between the ages of 18-27 years and 47% had just one child at the time of the trial. 59% had completed some primary school, and 34% had completed some secondary school. 52.5% of participants were farmers, and 30.5% were businesswomen or traders. In rural areas, it was more common for participants to be farmers, compared to the urban areas, where it was more common for participants to be businesswomen/traders.

Table 2: Overall Demographics of Complementary Feeding Study Participants at Baseline

Demographic Characteristic	Number of Total Participants (n=59)	Number of Urban Participants (n=30)	Number of Rural Participants (n=29)
Age (in years)			
18-27	43 (73%)	24 (80%)	19 (65%)
28-37	11 (19%)	5 (17%)	6 (21%)
38-41	5 (8%)	1 (3%)	4 (14%)
Mother's Education			
No schooling	3 (5%)	0 (0%)	3 (10%)
Primary	35 (59%)	14 (47%)	21 (72%)
Secondary	20 (34%)	15 (50%)	5 (17%)
Tertiary	1 (2%)	1 (3%)	0 (0%)
Mother's Occupation			
Farmer	31 (52.5%)	3 (10%)	28 (97%)
Businesswoman/trader	18 (30.5%)	17 (57%)	1 (3%)
Housewife	9 (15%)	9 (30%)	0 (0%)
Teacher	1 (2%)	1 (3%)	0 (0%)
Marital Status			
Married	56 (95%)	28 (93%)	28 (97%)
Not married	3 (5%)	2 (7%)	1 (3%)
Religion			
Christian	55 (93%)	28 (97%)	27 (93%)
Muslim	2 (3.5%)	2 (7%)	0 (0%)
No religion	2 (3.5%)	0 (0%)	2 (7%)
Number of Children			
1	28 (47%)	17 (57%)	11 (38%)
2 to 3	17 (29%)	7 (23%)	10 (34%)
4 to 5	10 (17%)	6 (20%)	4 (14%)
6 to 8	4 (7%)	0 (0%)	4 (14%)

Baseline Practices: Complementary Feeding of Infants 6-18 Months
Diet Diversity, Meal Volume, Feeding Frequency, and Food Consistency

Common foods fed to 6-8.9 month old infants included bread (1 slice on average), one- to two handfuls of ugali, porridge (average 100mL-200mL), mashed Irish potatoes with cooked bananas (average 100mL), and orange juice (usually below 20mL). Mothers also reported feeding black tea as a food. Other foods that were less regularly given to children this age included mandazi, ugali and dagaa (small dried fish). Porridge was most typically made from sifted maize flour with four mothers saying they soaked the maize flour before making porridge. Twelve of the 30 mothers of 6-8.9 month old infants reported feeding four or more food groups in the previous seven days at baseline. Common foods fed to 9-11.9 month old infants included porridge (250-275mL on average, and typically a blend of maize, groundnuts, and sesame), mashed ugali with beans (250mL on average), Irish potatoes (200mL on average), and soup (275mL on average). Other common foods included rice, pumpkin leaves, other greens, dagaa, ripe banana, and mandazi. Mothers also reported feeding black tea as a food to infants. Four of the 19 mothers of 9-11.9 month old infants reported their infants consumed the recommended 275mL of food at each meal. Common foods fed to 12-18 month olds included porridge (sifted maize flour, soaked maize flour, or nutritional porridge), ugali, rice, and Irish potatoes. Other commonly reported foods included oranges, beans, mandazi and greens. Less commonly reported foods included beef, boiled eggs, and ripe bananas. Seven of the 20 mothers of 12-18 month old infants said that their infants consumed the recommended 340mL or more of food at each meal. For all ages, the mean number of food groups consumed in the previous seven days and percent consuming specific food groups in the previous seven days are shown in Table 3.

Overall, about half of all mothers stated that they fed their infants the age-appropriate number of meals per day. Over half of all mothers stated that they prefer giving thick porridge for their infants when shown a card with pictures of porridge of varying consistencies.

Responsive Feeding

If their child refused to eat, mothers across age groups reported stopping, leaving the infant alone, or force feeding (often by holding the infant's hands and legs, and/or pressing their cheeks). Overall, nearly half of mothers across age groups reported force feeding their infant if they refused to eat. Over half of urban mothers reported force feeding their infants, compared to about a quarter of rural mothers. Few mothers across age groups reported encouraging their children to eat with singing, encouraging language, or providing a toy to encourage the infant. Mothers of 6-8.9 month old infants noted starting to breastfeed their infants if they refused to eat, providing water, or providing food at short intervals. Mothers of 9-18 month old infants did not report trying to breastfeed if their infant refused to eat. Mothers across age groups discussed challenges during feeding, including infants crying during feeding, refusing to eat, and vomiting during feeding. Mothers reported that encouraging the infant to eat takes a long time. Some mothers noted that these challenges cause stress, and that feeding takes a lot of time, with one mother stating that she *"feels stress because the baby takes a long time to feed."*

Changes in Infant and Young Child Feeding Practices over the Trial Period

Table 3: Changes in Infant and Young Child Feeding Practices over the Trial Period

Indicator	6-8.9 Months		9-11.9 Months		12-18 Months	
	Baseline (n=20)	Endline (n=19)	Baseline (n=19)	Endline (n=14)	Baseline (n=20)	Endline (n=18)
Mean number of meals (std) consumed in previous 24 hours	2.35 (1.04)	2.74 (0.56)	2.58 (0.96)	2.78 (0.58)	3.35 (1.14)	3.28 (0.67)
Mean number of snacks (std) consumed in previous 24 hours	1.1 (0.85)	0.89 (1.15)	1.42 (1.07)	1.29 (0.83)	2 (1)	1.44 (1.10)
% of 6-18 month olds who consumed age-appropriate number of meals or more per day ²	45% (n=9)	79% (n=15)	58% (n=11)	71% (n=10)	40% (n=8)	39% (n=7)
% of 6-18 month olds who consume age-appropriate volume of food per meal ³	20% (n=4)	95% (n=18)	21% (n=4)	50% (n=7)	35% (n=7)	39% (n=7)
% of 6-18 month olds who consumed 4 or more food groups in previous 7 days	60% (n= 12)	89% (n= 17)	100% (n= 19)	100% (n= 14)	100% (n= 20)	100% (n= 18)
Mean number of food groups (std) consumed in previous 7 days	5.45 (3.19)	6.9 (2.33)	7.53 (1.87)	8.79 (2.15)	8.7 (1.59)	9.5 (1.40)
% consuming any dairy in previous 7 days	20% (n=4)	37% (n=7)	53% (n=10)	64% (n=9)	55% (n=11)	78% (n=14)
Mean number of days (std) consumed dairy in previous 7 days	1.36 (2.16)	1.65 (2.46)	2.11 (2.79)	2.29 (2.76)	1.75 (2.47)	2.78 (2.58)
% consuming eggs in previous 7 days	20% (n=4)	32% (n= 6)	37% (n=7)	64% (n= 9)	35% (n=7)	61% (n= 11)
Mean number of days (std) consumed eggs in previous 7 days	0.35 (0.75)	0.95 (1.84)	0.74 (1.15)	1.14 (1.17)	0.65 (1.04)	1.17 (1.65)
% consuming any meat/fish in previous 7 days	60% (n= 12)	74% (n= 14)	68% (n= 13)	86% (n= 12)	85% (n= 17)	100% (n= 18)
Mean number of days (std) consumed meat/fish in previous 7 days	2.1 (2.49)	2.15 (1.56)	1.53 (1.35)	2.29 (1.68)	2.2 (1.91)	3 (1.97)

² Age-appropriate number of meals per day is defined as three meals/day for infants age 6-8.9 months, three meals/day for infants ages 9-11.9 months, and four meals/days for infants ages 12-18 months. This was measured based on 24-hour meal recall.

³ Age-appropriate food volume per meal is defined as 200 mL for infants age 6-8.9 months, 275 mL for infants ages 9-11.9 months, and 340 mL for infants ages 12-18 months.

% consuming vitamin A rich fruits/vegetables in previous 7 days	20% (n=4)	32% (n=6)	37% (n=7)	50% (n=7)	50% (n=10)	61% (n=11)
Mean number of days (std) consumed vitamin A rich fruits/vegetables in previous 7 days	0.4 (0.88)	1.58 (2.67)	1.53 (2.50)	1.71 (2.55)	2 (2.85)	2.89 (2.93)
% consuming legumes, beans, nuts, and/or seeds in previous 7 days	55% (n=11)	57% (n=11)	95% (n=18)	93% (n=13)	100% (n=20)	100% (n=18)
Mean number of days (std) consumed legumes, beans, nuts, and/or seeds in previous 7 days	1.6 (2.19)	2.39 (2.97)	1.82 (2.19)	1.61 (1.57)	2.9 (2.81)	2.72 (2.43)

As seen in Table 3, over the course of the user testing the mean number of meals in the previous 24 hours increased in 6-8.9 month old and 9-11.9 month old infants, but decreased slightly in 12-18 month old infants. The mean number of food groups in the previous seven days increased across all age groups. The percent of infants consuming age-appropriate volume of food at each meal increased across all age groups.

Perceived Benefits of the Feeding Toolkit

At endline the majority of mothers (n=47) reported that they noticed changes in their child's diet since they started using the feeding bowl and spoon. Overall, 32 of 51 mothers said that they noticed an increase in quantity of food that their infant was consuming. 37 of 51 mothers noticed changes in their infant's health, including weight increases, less illness, and the child appearing to have more energy. Across age groups, mothers noted increasing feeding frequency and the number of food groups they fed to their infant.

When asked about what led to these changes, 12 of 51 mothers reported that the counseling component of the trial had led to improved feeding and positive changes in their

child's health. Only one mother attributed the perceived changes in her child's health to increasing the thickness of her infant's food. Other mothers attributed the changes in their child's health to "improved feeding" in general, or the amount of food, frequency of feeding, and/or diet diversity.

Mothers of 6-8.9 month old infants highlighted health changes, including: perceived increases in weight (n=14), the child being 'happy, energetic, and starting to crawl', the child not crying as much (n=1), and the child not becoming sick (n=15). One mother reported that her infant's *"energy increased and the baby [started] to crawl."* Most mothers noted that these health changes were spurred because of the counseling received during the trial. Two of these mothers reported that increased breastmilk consumption led to changes in their child's health, while this was not reported in the other age groups.

Mothers of 9-11.9 month old infants reported many health changes in their infants, including increases in weight (n=7) and energy level (n=8). One mother noted that her *"child feels energetic and increased weight, child can now walk."* Only three mothers reported less illness in their child. Most mothers noted that "improved feeding," including meal volume and feeding frequency as leading to the perceived changes.

Mothers of 12-18 month old infants reported health changes in their infants including increases in weight (n=11) and energy level (n=14). One mother reported that her infant *"looks energetic and happy."* Thirteen of these mothers reported less illness in their child during the trial period. Four mothers reported the counseling as something that led to the perceived changes in their child while others attributed the perceived changes to appropriate meal volume, feeding frequency, and the increased variety of food given to the child.

Challenges in Using the Feeding Toolkit at Midline and Endline

Over the course of the trial, 18 total mothers stated that they had experienced challenges since starting to use the bowl and spoon, including lack of money to buy food from diverse food groups, foods from many food groups not available, their child not liking eating with the slotted spoon, and the spoon being too small to feed the child. Mothers said they managed some of the mentioned challenges faced by stopping use of the spoon, resorting to breastfeeding the child when he/she refuses to eat, force feeding the child, persuading the child to eat more, or slowly introducing new foods until the child felt comfortable eating a variety of food groups.

During the focus group discussions after endline, mothers reported that obtaining the different types of foods as shown on the counseling card was difficult because many were not available in their communities. Many mothers also reported not having the money to buy food items that were available the market, and not having the time to purchase food items and prepare them. In rural areas, mothers reported spending most of their time on the farm. Some mothers also reported that it was difficult to cool food quickly in the bowl, and that the width should be increased so that food can cool faster.

Discussion

Summary of the Study

This paper presents findings from our 40-day trial of the healthy baby toolkit in Mbeya Region, Tanzania. We assessed community acceptability of the toolkit and conducted user-testing with mothers with infants ages 6-18 months. From the user-testing trial, there were many positive perceived benefits from the feeding toolkit among mothers with infants ages 6-

18 months, demonstrating its ability to support ASRP programming which focuses on improving infant and young child feeding to reduce stunting.

Findings

At the trial's endline, mothers across infant age groups noted positive changes in their child's diets and health, which they attributed to changes in infant feeding practices since receiving the feeding toolkit and the counseling. Similar perceived benefits were reported in other sites testing the acceptability and feasibility studies on the feeding toolkit in Western Kenya, India, and Malawi (Collison et al, Kram et al, & Kedera et al). In Western Kenya, researchers conducted a study on the acceptability of the feeding toolkit to improve maternal and child nutrition. Similarly, many mothers reported increasing the number of meals per day for their infant, and feeding thicker porridge and some semi-solid food during meals (Kram et al 2015). The study in India demonstrated consistency with our results in Tanzania; the researchers found that over the course of the trial, quantity of foods, feeding of animal-source foods, and feeding frequency increased for 6-18 month olds (Collison et al 2015). Another feeding toolkit study conducted in Malawi had consistent findings in regard to improved complementary feeding indicators (Kedera et al 2016). The feeding toolkit studies in Kenya, India, and Malawi demonstrate that the findings from our feeding toolkit study in Tanzania are consistent within the literature on the feeding toolkit. There is the potential for expansion, given the positive results from the trials and the feeding toolkit's inclusion of different behavior change domains.

Mapping the Feeding Toolkit to Michie's Behavior Change Framework

The feeding toolkit draws mostly from areas of self-efficacy and cues to action in applying recommended dietary practices in the first 1,000 days of life, throughout pregnancy and up to 2 years of age (Champion VL & Sugg Skinner C 2008; Orji et al 2012). The feeding toolkit as an intervention can be effectively applied to Susan Michie's Framework for Behavior Change, where self-efficacy and cues to action relate to the domains of opportunity and motivation (Michie et al 2014). Michie's Framework has three core components which affect behavior: capability, opportunity, and motivation (COM-B), shown in Table 4. Capability relates to an individual's psychological or physical ability to perform a behavior, opportunity relates to factors outside of the individual, and motivation relates to individual attitudes, beliefs, and emotions about practicing a behavior. The feeding toolkit emphasizes reflective motivation in that it improves an individual's perceived capability of practicing a certain behavior, and motivates mothers to improve their child's health by discussing potential negative consequences of not using the feeding toolkit (Table 4). Further, it also fits into the component of physical opportunity because it emphasizes cues to action in its model for behavior change in complementary feeding, which distinguishes it from other interventions (Table 4). Like other infant and young child feeding interventions, such as FHI 360's Alive and Thrive, the feeding toolkit employs interpersonal communication through counseling, which is related to the domain of psychological capability (Alive and Thrive 2014).

Table 4: Mapping the Feeding Toolkit to the COM-B Framework

Capability	Opportunity	Motivation
<p><u>Psychological Capability</u>: By instructing on how to perform the behavior, and providing information about health consequences, the feeding toolkit relates to the domain of psychological capability because the intervention increases understanding the knowledge of complementary feeding behaviors and why they are important.</p>	<p><u>Physical Opportunity</u>: The feeding toolkit emphasizes cues to action in its model for behavior change in complementary feeding.</p> <p>The physical object of the bowl and spoon restructures the environment, and increase physical opportunity to perform the behavior.</p> <p>While the feeding toolkit addresses this aspect of physical opportunity, it does not address the aspect of physical opportunity that is access and availability to foods.</p>	<p><u>Reflective Motivation</u>: The feeding toolkit improves an individual's perceived capability of practicing a certain behavior, and motivates mothers to improve their child's health by discussing potential negative consequences of not using the feeding toolkit.</p>

The feeding toolkit intervention employs particular behavior change techniques, including: instruction on how to perform a behavior, prompts/cues, monitoring of behavior by others without feedback, information about health consequences, and adding objects to the environment. These behavior change techniques are linked to components of the COM-B framework. The feeding toolkit intervention adds the bowl and spoon as objects to the environment, and incorporates cues to action, which are both aspects of physical opportunity (Table 4). Having prompts/cues to practice complementary feeding behaviors increases the opportunity afforded to practice these behaviors, and adding objects to the environment enables caregivers to practice complementary feeding behaviors. The behavior change techniques 'instruction on how to perform a behavior' and 'information on health consequences' fit into the domain of psychological capability because they aim to increase an individual's understanding on how and why to perform complementary feeding behaviors. The feeding toolkit intervention employs interpersonal communication through these behavior change techniques. Reflective motivation, a component of the COM-B model, is an element of

the feeding toolkit intervention design, however there are no associated behavior change techniques in the feeding toolkit intervention. While the feeding toolkit addresses self-efficacy and cues to action, it does not fully address components of Michie's Framework for Behavior Change, including physical opportunity which also refers to access and availability of foods, as shown in Table 4. Increasing access and availability of foods could be addressed by way of structural or policy changes.

Uptake of the Feeding Toolkit

There are several factors that promote and challenge the uptake of the feeding toolkit as a mechanism for behavior change in Tanzania. Mothers in the study noted that health centers and community groups may be effective delivery platforms for the feeding toolkit, with counseling taking place in these settings. Mothers emphasized certain messages about the bowl, that they felt would encourage the uptake of it in their communities, including health messages about the use of the feeding toolkit reducing stunting and reduced illness among children, which motivates mothers to use it. Further, mothers noted that the message of the feeding toolkit helping children be strong, healthy, and happy would increase its uptake in the community. Mothers were highly responsive to these messages about the toolkit. Regarding modes of delivery for the feeding toolkit, mothers suggested community groups, household visits, and health facilities, where mothers could be counseled by health workers. Health facilities, however, are often understaffed, and individualized counseling may not be feasible. Community groups could serve as a group platform for rolling out the feeding toolkit, and would be a good way to spread information about its use. Further, this method could normalize the practice of using the feeding toolkit in the community. However, mothers may not be

adequately instructed on how to use the feeding toolkit effectively in these groups since the counseling would not be individualized, but this could be overcome by adapting the counseling for groups. A few mothers suggested using radio to share the information about the feeding toolkit. Last, mothers also noted that the feeding toolkit could be potentially sold in local markets for 500-1000 Tanzanian Shillings (USD 0.22-0.44), and others would be willing to buy the toolkit at this range in price.

Study Limitations and Challenges

This trial had several limitations and challenges. Participant mobilization was challenging in part due to the distances between people's homes, and there was loss to follow up across age groups. Those who dropped out of the trial at either midline or endline were from both urban and rural sites, however more mothers with 6-11.9 month old infants (n=12) dropped out than mothers with 12-18 month old infants (n=3). Mothers who were lost to follow up were mostly farmers, although some were housewives or businesswomen/ traders. Their ages ranged from 18-40 years, with a mean age of 24.9 years. Among their infants at baseline, the average number of meals per day was 2.6 meals. 47% of infants whose mothers were lost to follow up had received the age-appropriate number of meals in the previous 24 hours at baseline.

Other limitations of the trial include distractions during interviews which could have interfered with the discussion between the mothers and research assistants. Further, some participants who spoke Kinyekusa or other local languages had trouble communicating freely in Swahili. Verifying ages of the children and their participating mothers was difficult because some mothers did not have health cards. As a result, some mothers transitioned to a higher

child age group after baseline and midline data collection. This could have affected the new age group because not all mothers received the same tailored information at the previous data collection period. Last, because of food insecurity, some mothers expressed difficulty in following the recommendations on the counseling card in the toolkit. They were unable to find or afford diverse foods in the area, and adhere to the counseling recommendations during the trial.

Moving Forward

Our study examined the acceptability and feasibility of the feeding toolkit in Mbeya, Tanzania, and found generally positive results. For the feeding toolkit to be used in a large-scale intervention, there needs to be more studies conducted to examine its effectiveness. The individualized counseling is a strength of this trial because mothers understood the counseling material thoroughly, although this was set back by the fact that several participants switched age groups because of aging out. These participants may not have received the same age-appropriate recommendations as others if they switched groups at one of the data collection points. Despite this set back, if there was no individual counseling, this could have been a limitation of the study. Further, in an intervention, individualized counseling may not be able to be sustained, and counseling may need to be adapted for groups. If participants age out of groups, it may be difficult to adequately counsel them with new age-appropriate recommendations in groups. Further, there needs to be improvements on the counseling card, and potentially with the feeding bowl and spoon. Mothers recommended the bowl having two handles and a lid for food storage, and this could be an important improvement before moving forward. In the future after these improvements are made, randomized control trials should be

implemented in contextually relevant settings. Studies with control groups will provide more conclusive results about the feeding toolkit's effect on complementary feeding practices and positive behavior change.

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Chapter IV: Conclusion and Recommendations

Maternal and child undernutrition in the first 1,000 days of an infant's life is critical due to its association with long-term consequences, including irreversible stunting, less schooling, and fewer earnings during adulthood (Victora et al 2008). To prevent stunting, infants must be fed complementary foods with appropriate quality, density, quantity, and frequency (FAO 2017). Worldwide, it has been estimated that less than 33% of children aged 6 to 24 months receive adequate dietary variety, and roughly 50% receive appropriate number of meals (Lutter et al 2011). The feeding toolkit, developed by Emory University and Georgia Institute of Technology aimed to improve infant and young child feeding practices by serving as a cue to action, and educating mothers on adequate nutrition.

Before conducting TIPs, we completed formative research in which we identified barriers and facilitators to appropriate infant and young child feeding practices in Mbeya Region. The formative research allowed us to gather responses to the feeding toolkit prior to implementing the trial in which we focused on assessing its acceptability and feasibility in the communities. The feeding toolkit trial demonstrated improved feeding practices of infants ages 6-18 months over the course of the study period. As part of the trial we obtained recommendations for the ASRP, as well as for future research, including the following:

- The ASRP program should appropriately engage fathers and mothers-in-law in supporting mothers to use the toolkit for themselves and their children and to follow recommendations.

- Program implementers should consider an additional tool for dietary diversity, such as the diet diversity wheel, or changing and expanding the foods on the card so mothers and caregivers do not think they are limited to just the foods listed on the counseling card.
- The images on the counseling card must be culturally appropriate. Specifically, the image on the counseling card of the woman eating while breastfeeding needs modification because mothers did not approve of the image of a woman breastfeeding and feeding herself at the same time. The image must show her breastfeeding separately from eating.
- Mesh covers could be considered as an additional component of the toolkit for the demarcated bowl. Bowl covers would allow mothers and caregivers to safely store food for several hours.

It is important to note that further research needs to be conducted on the feeding toolkit in order to better determine its effectiveness in improving infant and young child feeding practices. More trials should be implemented to determine the toolkit's feasibility in other locations in Tanzania as well as other countries. Further, more research on the barriers and facilitators to adequate infant and young child feeding should be identified in order to potentially improve the nutritional messages and behavior change communication for infant and young child feeding. Last, randomized control trials must be completed with the feeding toolkit as an intervention, in order to obtain quantitative data to compare to control groups. This should be implemented before the toolkit is used in any large-scale interventions.

Chapter V: Appendices

Appendix 1: Flow Charts of Complementary Feeding Study Participants, by Infant Age Group

Figure 1: Flow Chart of Complementary Feeding Study Participants – Ages 6-8.9 months

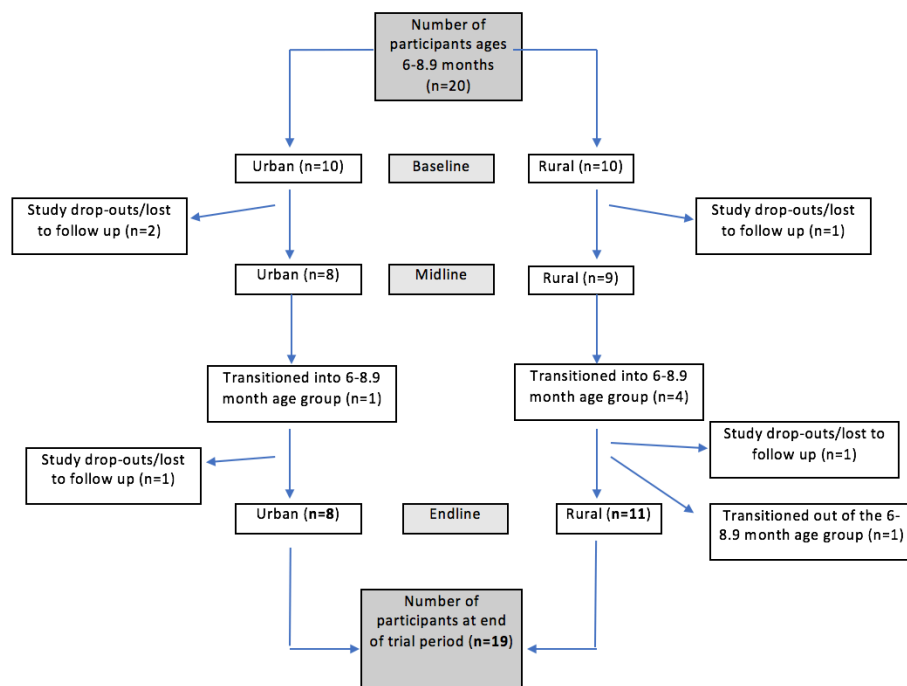


Figure 2: Flow Chart of Complementary Feeding Study Participants – Ages 9-11.9 months

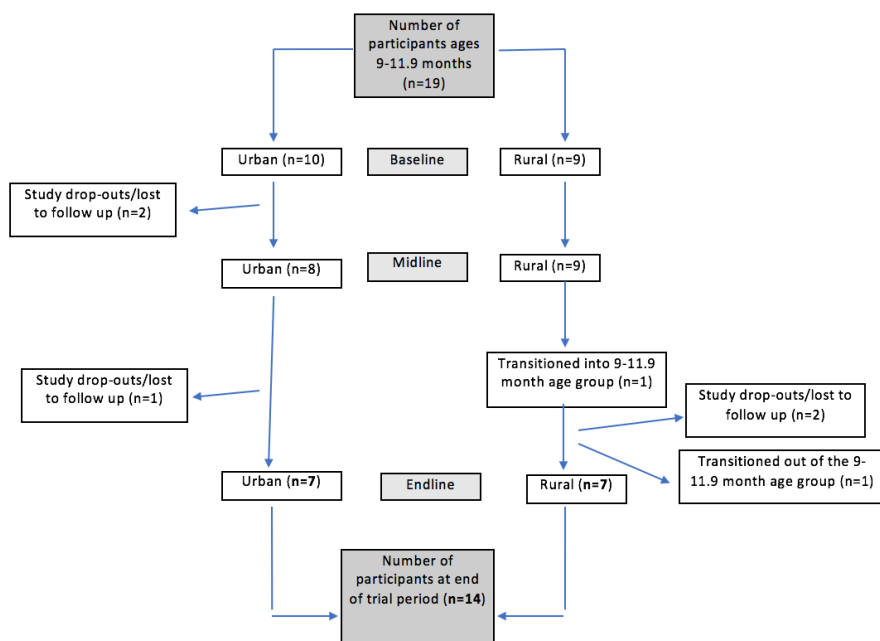
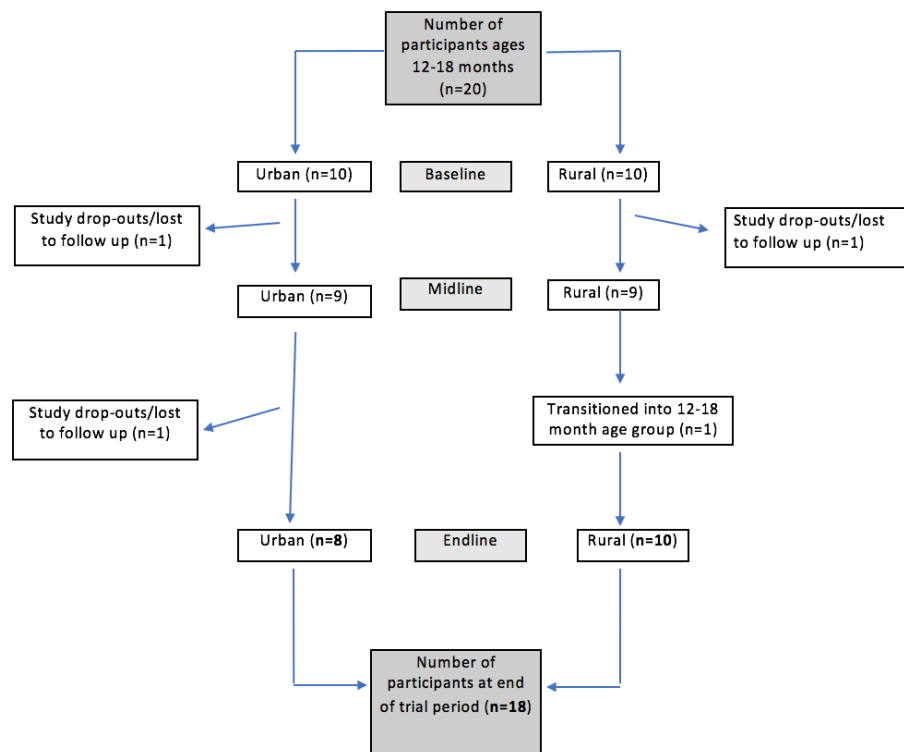


Figure 3: Flow Chart of Complementary Feeding Study Participants – Ages 12-18 months



Appendix 2: Demographic Tables by Specific Infant Age Group

Table 1: Characteristics of Women with Children Ages 6-8.9 Months

Number Included in Study	20 women with children ages 6-8.9 months
Average Age	27.85 years
Marital Status	96.67% participants stated they are married
Median Number of Children	2 children
Religion	90% Christian, 10% Muslim
Mother's Occupation	50% of the participant are farmers, 35% of participants work in business, and 15% of participants are housewives or traders.
Husband's Occupation	45% of the participants stated their husband works as a farmer, 25% participants stated their husband works in business, and the remaining 30% of participants stated their husband is a teacher, driver, electrician, or other.
Education	65% of participants stated they had completed 7 years of education, 15% of participants stated they had completed through Form 6, and 20% of participants stated other schooling.

Table 2: Characteristics of Women with Children Ages 9-11.9 Months

Number Included in Study	19 women with children ages 9-11.9 months
Average Age	24.3 years
Marital Status	94.7% participants stated they are married
Median Number of Children	1 child
Religion	100% Christian
Mother's Occupation	47.4% of the participant are farmers, 31.6% of participants work in business, and 21% of participants are housewives.
Husband's Occupation	52.6% of the participants stated their husband works as a farmer, 15.8% participants stated their husband works in business, and the remaining 31.6% of participants stated their husband is a driver, mechanic, painter, mason, or other.
Education	42.1% of participants stated they had completed 7 years of education, 47.4% of participants stated they had completed through Form 4, and 10.5% of participants stated no schooling.

Table 3: Characteristics of Women with Children Ages 12-18 Months

Number Included in Study	20 women with children ages 12-18 months
Average Age	24.7 years
Marital Status	95% participants stated they are married
Median Number of Children	1.5 children
Religion	100% Christian
Mother's Occupation	60% of the participant are farmers, 15% of participants work in business, and 25% of participants are housewives or teachers.
Husband's Occupation	55% of the participants stated their husband works as a farmer, 10% participants stated their husband works in business, and the remaining 35% of participants stated their husband is a driver, mason, teacher, lawyer, or other.
Education	65% of participants stated they had completed 7 years of education, 20% of participants stated they had completed through Form 4, and 15% of participants stated other schooling.

Appendix 3: Change in Complementary Feeding Practices over the 40-day Trial, among those with data available at both baseline and endline

Table 4: Change in complementary feeding practices among children 6-8.9 months among those with both baseline and endline data

Indicator	Baseline (n=14)	Endline (n=14)
Percent of 6-8.9 month olds who consumed 4 or more food groups in previous 7 days	57% (n= 8)	100% (n= 14)
Mean number of food groups (std) consumed in previous 7 days	5.07 (3.02)	7.86 (1.29)
% consuming any dairy in previous 7 days	21% (n=3)	37% (n=7)
Mean number of days (std) consumed dairy in previous 7 days	0.5 (1.09)	1.37 (2.35)
% consuming eggs in previous 7 days	7.14% (n=1)	36% (n=5)
Mean number of days (std) consumed eggs in previous 7 days	2 (0)	1.21 (2.08)
% consuming any meat / fish in previous 7 days	50% (n=7)	86% (n=12)
Mean number of days (std) consumed meat or fish in previous 7 days	1.93 (2.59)	2.36 (1.50)
Proportion consuming vitamin A rich fruits / vegetables in previous 7 days	14%	43%

Table 5: Change in complementary feeding practices among children 9-11.9 months among those with data available at both baseline and endline

Indicator	Baseline (n=13)	Endline (n=13)
Percent of 9-11.9 month olds who consumed 4 or more food groups in previous 7 days	100% (n= 13)	100% (n= 13)
Mean number of food groups (std) consumed in previous 7 days	7.69 (2.10)	8.62 (2.14)
% consuming any dairy in previous 7 days	69% (n=9)	62% (n=8)
Mean number of days (std) consumed dairy in previous 7 days	3 (2.97)	2.38 (2.84)
% consuming eggs in previous 7 days	46% (n=6)	62% (n= 8)
Mean number of days (std) consumed eggs in previous 7 days	0.92 (1.26)	0.92 (0.86)
% consuming any meat / fish in previous 7 days	54% (n= 7)	85% (n= 11)
Mean number of days (std) consumed meat or fish in previous 7 days	1.23 (1.42)	2.23 (1.74)
Proportion consuming vitamin A rich fruits / vegetables in previous 7 days	38%	46%

Table 6: Change in complementary feeding practices among children 12-18 months using an innovative feeding toolkit

Indicator	Baseline (n=17)	Endline (n=17)
Percent of 12-18 month olds who consumed 4 or more food groups in previous 7 days	100% (n= 17)	100% (n= 17)
Mean number of food groups (std) consumed in previous 7 days	8.65 (1.69)	9.47 (1.42)
% consuming any dairy in previous 7 days	59% (n=10)	76% (n=13)
Mean number of days (std) consumed dairy in previous 7 days	1.94 (2.61)	2.82 (2.65)
% consuming eggs in previous 7 days	35% (n=6)	59% (n= 10)
Mean number of days (std) consumed eggs in previous 7 days	0.65 (1.06)	1.18 (1.70)
% consuming any meat / fish in previous 7 days	82% (n= 14)	100% (n= 17)
Mean number of days (std) consumed meat or fish in previous 7 days	2.41 (2.00)	3.12 (1.96)
Proportion consuming vitamin A rich fruits / vegetables in previous 7 days	47%	59%