

QUALITATIVE AND QUANTITATIVE BASELINE REPORT
EVALUATION OF NEXT GENERATION NUTRITION PROGRAMME IN TANZANIA

IFAKARA HEALTH INSTITUTE IN COLLABORATION WITH

CUAMM AND CIFF EME



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Executive summary

Introduction: Although the world has witnessed encouraging progress in improvement of child and maternal health and nutrition indicators, levels of malnutrition, particularly stunting remain high, globally affecting approximately 165 million children aged less than five years in 2011, while wasting alone affects approximately 52 million. Integrated interventions during the first 1000 days of life are thought to be effective in reducing stunting while improving maternal and child health and other nutrition indicators.

Methodology: A mixed method study (KAP and Community norms) was done to establish baseline social-demographic information of mothers and children, nutrition indicators and community norms influencing maternal and child health and nutrition status. The KAP study was implemented in four intervention districts (Mbinga, Namtumbo, Nyasa, Songea Urban) of Ruvuma region located in southern part of Tanzania and three districts (Bariadi, Itilima and Maswa) of Simiyu region located in the Northern part of Tanzania. Four comparison districts (Nzega, Uyui, Ruangwa and Rufiji) were selected as they matched with intervention districts based on poverty and literacy rates, the rate of institutional deliveries, infant mortality, population per health facility, population proportion of children under-five years of age, regional stunting and wasting prevalence and on proximity to the intervention districts. A total of 2,532 households were visited. 3681 under-five children and 2531 mothers' nutritional status was assessed.

For qualitative data, 18 Focus Group Discussions (FDGs) were conducted with pregnant and lactating mothers, 13 FGDs with husbands, 8 FGDs with older women and 13 In-depth Interviews (IDIs) with health workers. Participants for the FGDs were identified through key informants, who were provided with the characteristics of the respondents by the research team. In-depth interviews were conducted with facility workers to gather their experiences in providing maternal and child health services including provision of health education specifically on nutrition to pregnant women and young children. Focus group discussions (FGDs) were conducted with pregnant and lactating mothers, husbands and grandmothers from purposively selected families with a child less than two years old. Data were collected in four districts of intervention sites; Simiyu region (Bariadi and Itilima districts), Ruvuma (Mbinga and Nyasa districts) and four districts of control sites Tabora region (Nzega and Uyui districts) Lindi region (Ruangwa district) and Coast region (Rufiji district).

Data analysis: Quantitative data was analysed using STATA version 13 software. Descriptive statistics explore the distribution of baseline characteristics and nutrition indicators. Chi-square test and logistic regression models were used to identify factors associated with stunting. For qualitative information, all interviews, audio recordings and transcripts were listened or read and re-read to identify themes and emerging themes. Coding and checking for coding consistency was done and the data was managed into units of information that covered broad categories. Analysis was undertaken using a framework grouping of relevant themes that answered key issues as per study objectives.

Key quantitative results and program recommendations:

- There were no differences between intervention and comparison sites in maternal social-demographic information (age, marital status, education, parity, BMI, pregnancy status, child sex, birth weight and age distribution in the intervention and control sites). However, intervention sites had more Christian mothers (69.3%) than control sites (26.7%) while control sites had higher proportions of households with poor social-economic status (27.2%) than intervention sites (19.9%). In addition, intervention sites had more household with better social-economic status (28.1%) than control sites (22.6%).
- Simiyu region had lower rates of antenatal attendance (40.3%) and delivery at the health facility (51.7%) as compared to Ruvuma where antenatal attendance was 56.1% and delivery at health facility was 88.7%. However, the lower rates in Simiyu were comparable to the matched district in Tabora region. Antenatal attendance in Tabora was 41.8% and delivery at health facility was 67.0%. More advocacies on increased antenatal attendance is needed in both intervention sites but a much more focused strategy to mobilize women to deliver at the health facility is needed in Simiyu.
- Over eighty five percent of the mothers in the intervention and control sites used Iron and Folic acid. However, a large proportion used Iron and Folic acid for less than sixty days. The use of antimalarial drugs during pregnancy was above 70% in the intervention and control sites; however use of deworming tablets was low. Health workers need to be reminded to provide deworming tablets and to educate community health workers and pregnant mothers on the importance of using Iron and folic acid in early pregnancy for up to 90+ days.
- Health education provided at the health facility during antenatal visits focused more on sleeping under treated bed net, place of delivery, HIV testing and danger signs during pregnancy. Nutrition and related components received less consideration. Emphasis on inclusion of nutrition education during pregnancy, lactation and child health monitoring clinic is needed.
- More than 70% of mothers in the intervention and control sites gave birth at the health facility and majority delivered full-term babies. The higher rate of delivery at the health facility offers a unique avenue to provide postnatal nutrition education at the health facility.
- 30% and 34% of children 0-5 months were not exclusively breastfed in the intervention and control sites respectively. The presented values are cumulative percentages over a range of child ages which might overestimate the true prevalence. We need to advocate for increased exclusive breastfeeding from 0-6 months

- The main reasons that triggered early complementary feeding before the age of six months in the intervention and control sites were “*baby crying too much*” and “*inadequate milk supply*”. This indicates that an effective breastfeeding promotion program must contemplate infant behaviours such as “*baby crying too much*” as not suggesting a lack of food.
- The majority of children aged 6-23 months in both interventions (82.9%) and control sites (93.3%) did not meet the recommended dietary diversity. In addition, the proportion of children aged 6-23 months who met minimum acceptable diet was very low in both intervention (13.1%) and control sites (4.5%). For successful reduction of stunting, training and sensitization on increased dietary diversity and meal frequency among children 6-23 months is paramount.
- Vaccinations are said to be completed at the age of one year. The information was mainly captured using RCH cards and whenever the card was unavailable, mothers were interviewed. The coverage in Simiyu was 63.2% which was much lower than Ruvuma region (82.1%). More sensitization on immunization is needed particularly in Simiyu.
- There was high prevalence of overall stunting in the intervention sites 46.4 (43.0-49.3) as compared to control sites 39.4 (37.6-41.4). Stunting was much higher in the three districts of Ruvuma region Nyasa (57.4%), Songea urban (51.3%) and Mbinga (56.8) than in Namtumbo district (37.5%) probably due to small sample of children obtained from Namtumbo. Prevalence of stunting within Simiyu region was comparable in all districts (Bariadi 37.2%, Itilima 43.3% and Maswa 45.5%). Other nutrition indicators were similar between intervention and control sites. There is a possibility that Ruvuma region will gain more with the interventions and might observe a larger reduction of stunting than Simiyu since studies suggest a large reduction whenever the prevalence is very high.
- Multivariable regression analysis indicated several maternal and child factors to be associated with stunting:
 - ✚ Households with better social economic status had 26% less chance of having a stunted child as compared to the poor family.
 - ✚ There were strong evidence of association between maternal age and the prevalence of child stunting ($p < 0.001$). When compared to mothers aged 15-19 years, women aged 20-29 years had 26% lower chance of having a stunted child and those aged 30-39 years had 36% lower chance of having stunted child. However, there was no evidence of the difference on the child stunting between mothers aged ≥ 40 years and 15-19 years.
 - ✚ Non married women had higher odds (OR 1.26 (95% CI 1.01-1.57)) of having a stunted child as compared to married women.
 - ✚ Overweight mothers (BMI > 25) had 36% lower chance of having a stunted child as compared to women with normal BMI (> 18.5 to < 25).
 - ✚ Mothers with height below 145cm had **five times** higher chance of having a stunted child when compared to mothers with height above 145cm

- ✚ HIV positive mothers were over two times more likely (OR =2.33 (95% CI 1.39-3.88)) to have a stunted child as compared to non-HIV positive mothers.
- ✚ Women who delivered below 37 weeks of gestation had higher odds (OR=1.31 (95% CI 1.01-1.69)) of having a stunted child compared to those who delivered above 37 weeks.
- ✚ Female children had two times higher chance of being stunted as compared to male children 0-23 months.
- ✚ Risk of stunting increased with increase in child age. Children aged 12-23 months had nearly three times chance of being stunted as compared to children 0-5 months.

Key qualitative findings:

- Delaying to visit antenatal clinic until three or more months was said to be normal. Mothers in FGD reported that *“...you don’t rush to the antenatal clinic because sometimes you may not be pregnant, so you wait be sure of it”* [FGD with pregnant and lactating mothers, Rufiji and Maswa]. The statement indicates the need to advocate for early antenatal attendance for mothers to receive folic acid which is crucial for reducing neural tube defects in the 1st three months of life.
- Most mothers reported that they were happy with the services provided to them especially during pregnancy. One mother in the FGD said; *“when we start attending the clinic the nurse check our pregnancies and then educate us about HIV/AIDS and how to protect ourselves, then they give us different medicines including the one to increase blood, Sulfadoxine Pyrimethamine (SP) and the medicine to treat worms”* [FGD with pregnant and lactating mother, Bariadi]. This information indicates the value placed on the health workers in providing services and education to mothers and therefore implementation should not use health workers for management of Severe Acute Malnutrition (SAM) alone but should consider other aspects.
- Majority of mothers were not taking Iron and Folic acid (drugs to increase blood) as they said that they don’t taste good: *“the tablets do not taste good, that’s why many mothers don’t like it, you know when women are pregnant they also tend to choose certain things they like in regard to their condition”* [FGD with pregnant and lactating mothers, Nyasa] and another reason was that, they may harm the baby in the stomach because of its “minerals”; *“the redness of the drug could be a problem to some mothers, because they fear that the medicine might have ‘minerals’ that could affect the baby in the stomach, and people these communities like to have many children”* [FGD with pregnancy and lactating mothers, Itilima]. These two statements indicate the gap in knowledge about the use of Iron and Folic acid and it suggests the need to adapt supplements to the preferences of targeted women.
- Study participants seemed to have great awareness about the use of antimalarial drugs (SP) during pregnancy. However, motivation for mothers to adhere to SP was low as stated; *“some mothers never wanted to take the drug saying that they don’t have malaria, then the nurses started the system that you have to take the drug at the facility in front of her... but they tell you to eat first before you come to the facility”* [FGD with

pregnant and lactating mothers, Mbinga]. The statement indicates the need to educate mothers about the treatment of placental malaria infection which affects the unborn baby rather than maternal malaria infection.

- Findings also showed that, people who are normally involved in decision making on when and where to go for ANC services are husbands, the wife, and mother in-laws. New mothers were reported to be supported by their own mothers, mother in-law, husbands, and sometimes other female relatives like, sister and aunties. Therefore, health and nutrition education should target a broader range of household members.
- Most mothers and other family members were able to identify children with severe acute malnutrition. A child who is thin and with skin wrinkles, and a big stomach was considered to be malnourished. Mothers reported that health workers provided nutrition education when they attended antenatal care as well as at the time when they took their children for vaccinations at the health facility. However, poverty was reported to be the main setback to many families. In the interviews with health workers, one health worker said *“there was a time a mother came here, her child had malnutrition, I advised the mother to give a child milk, beans, fish and beef, then she said to me thank you, and asked me where would she get the money to buy those things?”* [IDI with Health Workers, Itilima]. This information indicates that although poverty is a problem, there is a gap of knowledge on what is considered to be healthy foods for children among health workers. Mothers should make use of locally available foods to make healthy meals for their children.
- Most respondents in the FGDs reported that children with malnutrition are taken to the health facility to get advice about what to do. Also most mothers seemed to know that if the child has malnutrition the only treatment is to give the child nutritious food; *“...we are told by the nurse that there is no other medicine you can give to the child who is malnourished apart from nutritious food”* [FGDs with pregnant and lactating mothers, Nyasa]. This statement ignores the fact that malnutrition can be related to illnesses rather than food alone and may need treatment with RUFT and therapeutic milks (F100, F75).
- Similar findings were reported in Ruangwa from an FGDs with older women, they added that in the past if the child was malnourished they were taken to the health facility and given food supplements which were rich in vitamins and other essential minerals; *“..when we were young you would hardly see a malnourished child, because we were given something like food to give our children, when you go to the clinic a nurse check your baby and say your baby is not doing well, then she gives you some packets of food to give to your child”* [FGD with older women, Ruangwa]. When managing children with Severe or Moderate malnutrition, other sustainable approaches need to be introduced to mothers such as home gardening, animals keeping and appropriate management of fruits and vegetables off-season.

ABBREVIATIONS

BMI: Body mass index
BF: Breastfeeding
CI: Confidence interval
DHS: Demographic and Health Survey
DQA: Data Quality Assessment
EBF: Exclusive breastfeeding
FANTA: Food and Nutrition Technical Assistance
FGD: Focus group discussion
HAZ: Height for age Z-score
HDSS: Health and Demographic Surveillance System
HIV: Human immunodeficiency virus
IDIs: In-depth interviews
IEC: Information education and communication
IYCF: Infant and Young Child Feeding
KAP: Knowledge attitude and practice
LAZ: Length for age Z-score
LBW: Low birth weight
MDG: Millennium development goal
MTCT: Mother-to-child transmission of HIV
NBS: National Bureau of Statistics
OR: Odds ratio
PANITA: Partners with Nutrition in Tanzania
RUTF: Ready to Use Therapeutic Foods
SES: Social economic status
TDHS: Tanzania Demographic and Health Survey
TMHIS: Tanzania Malaria and HIV/AIDS Indicator Surveys
UNICEF: United Nations Children Fund
WAZ: Weight for age Z-score
WHO: World Health Organisation
WLZ: Weight for length Z score

DEFINITIONS

Any breastfeeding: Requires that the baby obtain some breastmilk and any food or liquid with other non-human milk (World Health Organisation, 2008).

Breastfeeding: “Is an unequalled way of providing ideal food for the healthy growth and development of infants; it is also an integral part of the reproductive process with important implications for the health of mothers” (World Health Organisation, 2003, p. 7).

Colostrum: Is the thick yellow milk secreted by the breasts during the first few days after delivery, which gradually evolves into mature milk at 3–14 days postpartum. It contains more antibodies and white blood cells than mature breast milk.

Complementary feeding: Means giving an infant breastmilk and solid or semi-solid foods. It comprises any food or liquids including non-human milk (World Health Organisation, 2008).

Complementary foods: Refers to any solid or liquid foods, whether factory-made or locally prepared, provided to a child in addition to the breastmilk (Barros, Halpern, Victora, Teixeira, & Beria, 1994).

Confidence Interval: Is a range of values well-defined that there is a known chance (mostly 95%) showing that the value of a population parameter lies within it (Ramoo, Trinh, Hirst, & Jeffery, 2014).

Early initiation of breastfeeding: Placing new born to the breast within one hour after delivery.

Exclusive breastfeeding: Refers to when an infant receives only breastmilk; it excludes other liquid and solids except oral rehydration solution, drop and syrup (vitamins, mineral and medicines) (World Health Organisation, 2008).

Infant: Refers to all children aged below twelve months.

Minimum meal frequency: Proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more (World Health Organisation, 2008).

Minimum is defined as:

- 2 times for breastfed infants 6–8 months
- 3 times for breastfed children 9–23 months
- 4 times for non-breastfed children 6–23 months
- “Meals” include both meals and snacks (other than trivial amounts¹), and frequency is based on caregiver report.

Minimum dietary diversity: Proportion of children 6–23 months of age who receive foods from 4 or more food groups (World Health Organisation, 2008).

The 7 foods groups used for tabulation of this indicator are:

- grains, roots and tubers
- Legumes and nuts
- Dairy products (milk, yogurt, cheese)
- flesh foods (meat, fish, poultry and liver/organ meats)
- eggs
- Vitamin-A rich fruits and vegetables
- Other fruits and vegetables

Minimum acceptable diet: Proportion of children 6–23 months of age who receive a minimum acceptable diet (apart from breast milk). This composite indicator is calculated from the following two fractions:

- Breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day over the number of Breastfed children 6–23 months of age
- And**
- Non-breastfed children 6–23 months of age who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day over the number of Non-breastfed children 6–23 months of age (World Health Organisation, 2008)

Mixed feeding: Providing breastmilk to an infant or a child together with other foods or liquids including non-human milk.

Malnutrition: Refers to different forms of poor nutrition as a result of low or excessive intake of specific foods.

Non-breastfeeding: Refers to when the infant did not receive breastmilk (Mihirshahi, Oddy, Peat, & Kabir, 2008).

Odds ratio (OR): An odds ratio is a measure of the strength of association between exposure and the disease (or problem). When the Odds ratio is one means no association between exposure and outcome, above one indicates a positive association between exposure and outcome and below one indicates that exposure is protective or inhibiting factor to the outcome (Ramoo et al., 2014).

Pre-lacteal feeds: Refers to any feeds provided to a newborn before the start of lactogenesis II, which implies the beginning of copious breastmilk ejection that happens within four days after birth (Mihirshahi et al., 2008; Njai & Dixey, 2013)

Stunting: Known as chronic malnutrition which indicates a failure to attain biological potential in growth among children as a result of under-nutrition. Normally it is calculated as Height-for-age < -2 standard deviations (SD) of the WHO child growth standards median (National Bureau of Statistics & ICF Macro, 2011b)

Underweight: Signifies stunting and or wasting which suggests short-term and long-term under-feeding normally calculated as Weight-for-age < -2 standard deviations (SD) of the WHO child growth standards median (National Bureau of Statistics & ICF Macro, 2011b).

Wasting: Reflects present nutritional status which implies seasonal food insecurity, severe infections and natural calamities such as war. Usually it is calculated as Weight-for-height < -2 standard deviations (SD) of the WHO child growth standards median (National Bureau of Statistics & ICF Macro, 2011b).

Z-score: Implies the deviance of an individual's value from the median value of a reference population divided by the standard deviation of the reference population (or transformed to normal distribution) (World Health Organisation, 2006).

SECTION ONE: BACKGROUND INFORMATION

1.1 Background

Although the world has witnessed encouraging progress in improvement of child and maternal health and nutrition indicators, levels of malnutrition, particularly stunting, remain high, globally affecting approximately 165 million children aged less than five years in 2011, while wasting alone affects approximately 52 million (Black et al., 2013). Nearly 45% of all under-five deaths were attributed to malnutrition which contributes up to 3.1 million deaths per year. Sub-optimal infant feeding alone contributes to 800,000 deaths per year and the prevalence of deaths is much higher in south Asia and sub-Saharan Africa than other places (Black et al., 2013).

Tanzania has made progress in reducing under-five chronic malnutrition. The proportion of stunted children has dropped from 43% in 1991 to 34% in 2015 (DHS, 2015), but is still unacceptably high by WHO standards (high prevalence: 30-39%) (World Health Organisation, 2010). More children in rural areas (38%) were affected than in urban areas (25%) and stunting is more pronounced among non-educated mothers (39%) than among educated mothers (23%). Fourteen percent of children were wasted and five percent were stunted. Although there was improvement in nutritional status of children, there have been disparities in the data reported across surveys collected within the same region. For example in Ruvuma, SMART nutrition survey conducted by Tanzania Food and Nutrition Centre in 2014 indicated stunting rates to be 48.4% while the 2015 Demographic and Health Survey indicated rates to be 44.4%. Similar variation was observed in Simiyu where stunting was 26.1% according to SMART survey while Demographic Health Survey indicated 33.3%. Disparities in the proportions obtained may be attributed to seasonal variations and methodological differences particularly sample size and sampling techniques used. Despite the high prevalence of stunting, proportion of children aged less than six months who were exclusively breastfed remains low (50%) in Tanzania (DHS, 2015).

The 2010 Demographic and Health Survey and 2014 SMART nutrition survey conducted by Tanzania Food and Nutrition Centre assessed the nutritional status of women aged 15-49 years. Assessment of nutritional status of women at reproductive age is vital as it is indicative of child health (National Bureau of Statistics and ICF Macro, 2011). The 2010 Demographic and Health Survey indicated that 11% of women who gave birth in the two months preceding the survey were undernourished (BMI less than 18 kg/m²) and 22% were either overweight or obese (National Bureau of Statistics & ICF Macro, 2011b). The SMART survey indicated that 30% of women did not take Iron and Folic Acid supplements during pregnancy (Tanzania Food and Nutrition Centre, 2014) and 41% of pregnant women had anaemia (National Bureau of Statistics & ICF Macro, 2011a). Despite the high level of anaemia, only 8% of pregnant women used Iron and Folic acid as recommended (90+ days during pregnancy), 27% took two dose of antimalarial drugs and 60% slept under the mosquito net (National Bureau of Statistics & ICF Macro, 2011a). Despite an established association between maternal and child health indicators, there has been limited integrated interventions to address both (Baqui et al., 2008; Kumar et al., 2008; Mcpherson, Baqui,

Winch, & Ahmed, 2007) and most of these interventions are not well evaluated which makes them hard to integrate into the health system.

1.2 Rationale of the study

This evaluation study intends to generate new evidence on how the delivery a package of integrated interventions (promotion of increased uptake of Iron and Folic acid, use of recommended dose of antimalarial drugs use of treated bed net and deworming tablet, nutrition education during pregnant and lactation, education on exclusive breastfeeding, appropriate complementary feeding and management of children with Moderate and Severe acute malnutrition) during 1000 days window from conception to two years of age will reduces stunting to children under-fives in Simiyu and Ruvuma. The information will be used to influence the Government of Tanzania's to scale up plans on reduction of stunting and will facilitate the review of National Multi-Sectoral Action Plan on Nutrition (NMAPN) and National Management of Severe Acute Malnutrition protocols. Results of this investment will also be very relevant outside of Tanzania for other countries that have a high burden of stunting and will demonstrate the new approach of tackling stunting in a more cost effective way.

1.3 The Evaluation Objectives

1. To assess the impact of the programme on nutrition outcomes (stunting in children under two and wasting in children under five)
2. To assess the effectiveness of the community-based model in driving uptake of high-impact nutrition interventions and behaviours across the lifecycle
3. To determine the cost-effectiveness of the delivery of an integrated package and whether it is scalable
4. To assess the quality of the routine monitoring data, particularly data collected at the health facilities

1.4 The evaluation's key research questions:

1. What is the impact of the programme on nutrition outcomes (stunting in children under two and wasting in children under five)?
 - a. Does the integrated package across the lifecycle result in improved impact?
 - b. Has total burden of stunting and wasting been reduced?
2. How effective was the community-based model in driving uptake of high-impact nutrition interventions and behaviours across the lifecycle?
 - a. Are community health workers effectively and efficiently reaching key target populations (pregnant women, children under two and children under five)?
 - b. Are children with severe acute malnutrition effectively identified, referred, admitted and treated?
 - c. Are mothers and children receiving effective nutrition promotion services?

- d. Are knowledge, attitudes and practices for key behaviours (complementary feeding, dietary diversity, etc) improving?
 - e. Are mothers accessing key facility-based services such as ante-natal care, IFA supplementation and malaria prevention during pregnancy?
3. Cost-effectiveness and data of the delivery of an integrated package of interventions and whether it is scalable
 - a. What is the cost-effectiveness of the delivery of an integrated package of interventions to address chronic and severe acute malnutrition?
 - b. Is this a scale-able and sustainable model?
 4. What is the quality of the routine monitoring data, particularly data collected at facilities?

1.5 Implementation timeline

The evaluation will have four phases:

Phase	I: Preparation	II: Baseline	III: Midterm	IV: End line
Activities	<ul style="list-style-type: none"> ✓ Preparation evaluation design, tools ✓ IRB approvals 	<ul style="list-style-type: none"> ✓ Baseline survey ✓ Community norms study ✓ Rapid DQA ✓ Present to CUAMM/CIFF ✓ Publish design 	<ul style="list-style-type: none"> ✓ Process quality study ✓ DQA ✓ KAP survey ✓ Present to CUAMM / CIFF 	<ul style="list-style-type: none"> ✓ Process quality study ✓ End-line survey ✓ DQA ✓ Cost evaluation ✓ Dissemination
Outputs	<ul style="list-style-type: none"> ✓ Approved protocol, tools ✓ Project plan 	<ul style="list-style-type: none"> ✓ Survey dataset ✓ Comm.norms data ✓ DQA results ✓ Slide pack ✓ Study design paper 	<ul style="list-style-type: none"> ✓ Process data ✓ DQA report ✓ KAP survey dataset ✓ KAP report ✓ Slide pack 	<ul style="list-style-type: none"> ✓ Process data ✓ Survey dataset ✓ DQA report ✓ Cost estimates ✓ Report ✓ Slide pack ✓ Policy brief ✓ Evaluation paper
Timing	Jan-May 2016	Jun-Dec 2016	Jan-Aug 2017	Nov 2018 – Jun 2020

Figure 1: Implementation timeline

- **Phase I:** preparation of evaluation design, indicators , tools; IRB approvals (Jan-May 2016)
- **Phase II:** quantitative baseline survey for outcome and impact measurement. Rapid DQA. Qualitative exploration (FGDs) of community norms. Data collection (Jun 2016) and preliminary analysis presented in CUAMM program review (Jul/Aug 2016), publication of evaluation design (Sep – Dec 2016)

- **Phase III:** mixed methods midterm for process quality evaluation of service delivery and for Data Quality Assessment and KAP assessment through quantitative method. Tools refinement and pilot testing (Jan-Mar 2017), data collection (July-Aug, 2017), coding and analysis (Sept, 2017), presentation to CUAMM annual program review (Dec, 2017)
- **Phase IV:** Tool refinement (Nov –Dec 2018), data collection for process quality end-line (Jan-Apr 2019), outcome & impact end-line survey (Jul-Dec 2019), DQA (Sep-Oct 2019), cost evaluation (Sep-Dec 2019) and analysis of all four datasets (Jan-Apr 2020), final reporting and dissemination (May-Jun 2020).

SECTION 2: METHODOLOGY

2.1 Evaluation design

A mixed method study design was used to establish household baseline demographic information, maternal and child health and nutrition indicators. A cross-sectional survey was done in the intervention and control sites to measure maternal KAP and nutrition indicators. The KAP survey was followed by community norms qualitative design which was necessary to assist interpretation of the KAP survey results, and to inform design of the CUAMM program's IEC messages. A rapid Data Quality Assessment (DQA) was also done to assess the quality of routinely collected data at health facilities.

2.2 Study sites

Intervention sites: Simiyu region which is found in the northern part of Tanzania and South East of Lake Victoria and Ruvuma region located in Southern part of Tanzania were selected purposively as intervention sites. The selection was based on high prevalence of malnutrition and existence of an Italian Organisation (CUAMM) which will be implementing integrated interventions to reduce stunting and improve other maternal and child health and nutrition indicators.

Control districts: For the control sites, the evaluation team selected four districts. Uyui and Nzega located in Tabora region and Ruangwa districts located in Lindi were selected from the Sentinel Panel of Districts established by Ifakara Health Institute (Kabadi et al., 2015). Rufiji district located in the Coast region was selected from Health and Demographic Surveillance System [HDSS] (Rufiji and Ifakara Urban and Rural) (Geubbels et al., 2015; Mrema, Shamte, Selemani, & Masanja, 2012) operated by Ifakara Health Institute. Uyui and Nzega districts were paired with districts in Simiyu region and Ruangwa and Rufiji districts were paired with districts in Ruvuma region. The selection of control districts was based on the reported similarities from the Demographic and Health Surveys with intervention sites in terms of poverty and literacy rates, the rate of institutional deliveries, infant mortality, and population per health facility, population proportion of children under-five years of age, regional stunting and wasting prevalence and on proximity to the intervention districts.

Several regions or districts were excluded due to already existing program(s) which might jeopardize our results. Morogoro, Dodoma, Manyara and Iringa regions were excluded due to the existence of Mwanzo Bora project funded by USAID which aims to reduce stunting. Njombe and

Mbeya regions were also excluded as they received funds from UNICEF to implement similar activities as Mwanzo bora project. IMA World Health in collaboration with Partners with Nutrition in Tanzania (PANITA) and Development Media International (DMI) are implementing a five year program (from 2015 to 2019/2020) addressing stunting in Kagera, Mwanza, Shinyanga, Geita and Kigoma, hence these regions were excluded. The Catholic Relief Services (CRS) is also implementing a three years project aiming to reduce stunting covering six districts of Mbeya region. Save the Children are implementing nutrition activities in Singida Rural and Ikungi districts and therefore these districts were excluded.



Field supervisor meeting with village leaders to discuss about data collection

2.3 Study participants

2.3.1 Mothers and children

To measure *nutritional indicators* (stunting underweight and wasting) and *KAP*, mothers and their children were recruited, consented, measured (anthropometry) and interviewed (questionnaire) at their home during baseline (Figure 2 below). Home visit was necessary to reduce selection bias as there is a real possibility that malnourished children will not be brought to the health facility due to embarrassment and to capture mother-child dyads that are less likely to attend health services for other reasons (e.g. distrust, use of alternative health care).

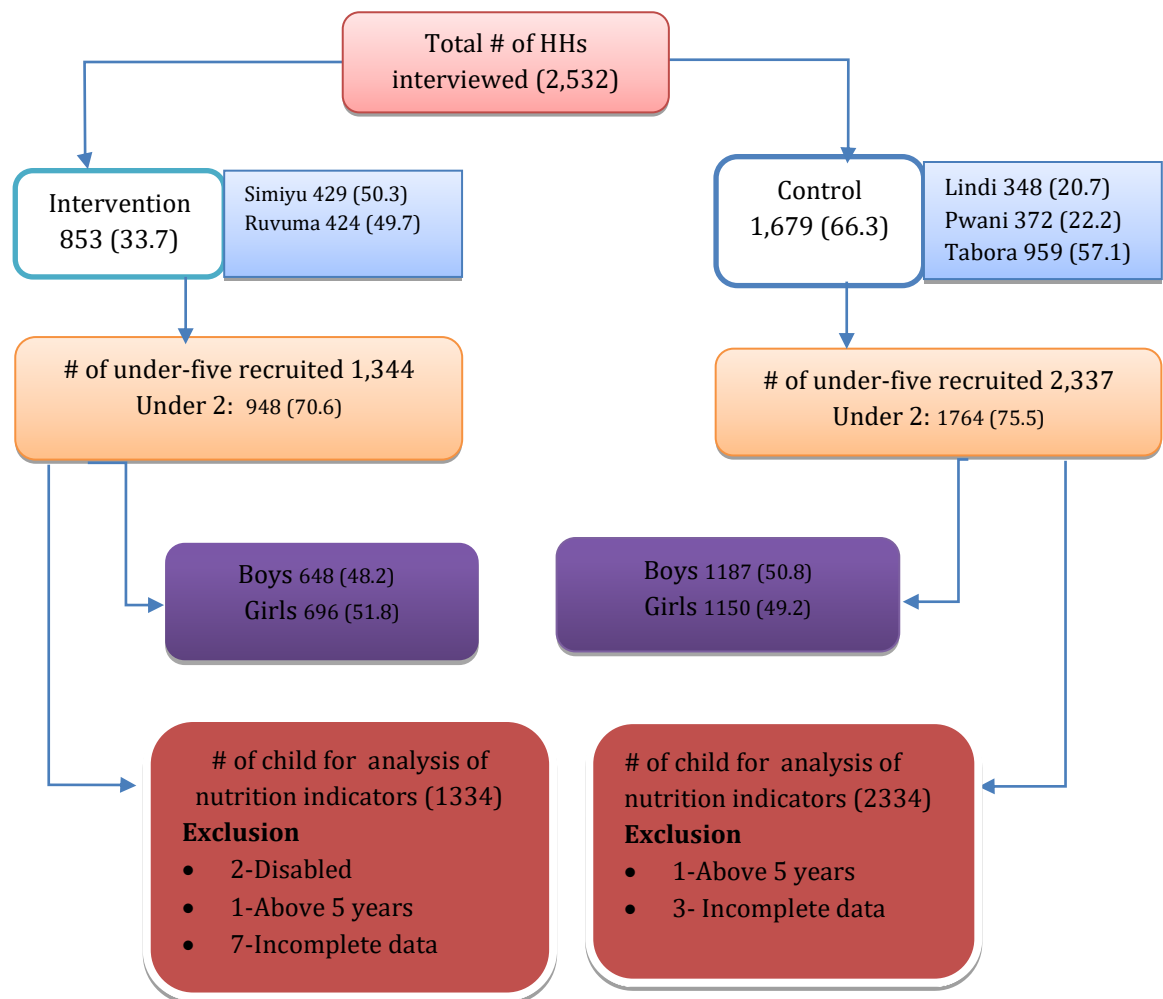


Figure 2: Study Profile

2.4 Eligibility criteria

Mothers who delivered during the 24 months preceding the survey and all children under-five residing in their household were eligible for the baseline survey. The 24 months was selected because child nutrition deteriorates in the period 6-24 months and after this age, stunting is often

permanent hence the intervention will have less impact after 24 months. Infant feeding information was collected for all children under 24 months, longer duration will introduce misclassification of feeding pattern due to recall bias (Li, Scanlon, & Serdula, 2005). Within the same household, anthropometric measurements were obtained from all children aged less than five years who spent the night before the survey in the selected household. Mothers with children under two years were eligible to provide their weight and height measurements. In case the household had more than two women with children less than 24 months of age, the one with the smallest child was interviewed.

2.5 Data collection tool

Characteristics of mothers, service use and infant feeding information were obtained using an adapted version of the validated Demographic and Health Survey (DHS) questionnaire. The questionnaire was modified to accommodate the needs of the evaluation. The mother's responses were validated with her antenatal card, child's ANC and EPI/growth cards. Information asked included i) mother's demographic and reproductive history; ii) alcohol and cigarette smoking (as they may interfere with child health and nutrition indicators); iii) health service utilisation during ANC and postnatal period, including Iron and Folic Acid supplementation use during pregnancy, presumptive treatment for malaria during pregnancy, use of insecticide treated bed nets; iv) main source of breastfeeding information and a series of questions testing maternal knowledge on breastfeeding, complementary feeding and healthy eating during pregnancy and lactation; v) infant feeding practices (including EBF, complementary feeding, frequency). The definition of exclusive breastfeeding and complementary feeding was adopted from WHO guideline (World Health Organization, 2008) and vi) birth preparedness plans was asked from the mother in accordance to the recommendation from the Ministry of health and social welfare.



Field worker interviewing a mother using electronic device

2.5.1 Anthropometry

Anthropometric measurements were obtained for children aged less than five years who spent a night in the same household where the mother of a child under two years was interviewed. Weight was assessed using the calibrated United Nations Children Funds (UNICEF) SECA Digital Scales. Height was measured using a height board. Children less than two years old were lying on the length board and children older than two years and the mothers were standing upright on the board. Weight was recorded to the nearest 0.1kg and height to the nearest 0.1cm.



Field workers measuring height of a child less than two years

2.6 Data Quality Assessment

Data Quality Assessment (DQA) was done to establish quality of routine data (data collection, data flow, reporting systems and verification of reports) collected at the health facilities in both control and intervention sites. A standardized DQA assessment tool adapted from Global Fund to Fight Aids, Tuberculosis and Malaria was used. Monitoring data included: 1) number of health workers trained on SAM, Emergency preparedness plan, Infant and Young Child Feeding (IYCF) and nutrition requirements during pregnant and lactation 2) Number of pregnant women recorded during antenatal care visit 3) Number of women given iron and folic acid supplements 4) Number of women who received antimalarial drug 5) Number of mosquito nets given to mothers during antenatal attendance and for the children 6) Cases of stunted children documented 7) Number of children who were treated for SAM 8) Number of SAM children referred 9) Number of children with SAM who were followed after diagnosis 10) SAM management method and availability of

Ready to Use Therapeutic Foods (RUTF). A total of eight health facilities from control sites and six health facilities from intervention sites were visited.

***The DQA results will be presented in a separate report.

2.7 Sampling

The sample size was calculated to detect a 10% percent absolute baseline-to-end-line change in stunting as a key indicator, using an expected baseline rate of stunting in the intervention and control districts of 40% and 26 % respectively. Assuming a 15% and 5% absolute drop in stunting in intervention and control districts respectively over the 4 year period, with 5% type I error and 80% power, gives a required sample size of 840 in intervention districts and 1680 in control districts accounting for the non-response.

The study employed a two stage stratified sampling process to select community participants in the intervention and control group. The first stage involved a selection of 28 villages in both the intervention and control districts, proportional to district size. Lists of intervention villages were provided by CUAMM and village from control sites were selected from 2012 Tanzania Census. This was followed by a random selection of 30 or 60 households per village for intervention and control sites respectively from the list all women with children under 2 years residing in the selected village. Whenever the number of children needed per village was not attained, particularly in the control sites, all families with children aged less than two years in the village were sampled or an additional reserve village was used. For the exploration of community norms, purposive selection of participants was done in consultation with district health team, village health workers and CUAMM to achieve a wide range of opinions.

2.8 Validity and reliability

All study tools were reviewed by relevant experts prior to data collection. Questionnaires were translated to Kiswahili and back-translated to English to ensure the meaning was maintained. Twelve experienced field workers were hired and trained for six days to reduce the within and between inter and intra-data variability. The training was followed by two days of pre-testing of data tools and necessary changes were made. Weight and height/length measurements were standardized using FANTA guidelines. During the pilot, supervisors and enumerators measured ten children repeatedly as per FANTA guideline to account for the between-measure variability without seeing the results of the enumerator. Supervisors-enumerator difference of measurement taken was established and when the difference in a child's weight was 0.3kg or more, the value was considered large, a difference of 0.2kg was considered medium and a difference of 0.00-0.1kg was considered small. For length measurement, a length difference of 1.0cm or more was considered large, 0.6-0.9cm was medium difference and 0.00-0.5cm was small difference (Cogill, 2003). All enumerators and supervisors who produced a medium or large difference in values obtained were re-trained. Prior to commencement of the field work, an implementation protocol was developed and given to all field workers and supervisors to guide their activities.

During the field work, mothers and children were visited at their home to reduce selection bias. Prior to the interview and taking the measurements, all weighing scales were calibrated using an object with a known weight. Only two field workers per group (two groups) who produced accurate

results during pilot tests were used to assess nutrition status throughout the study to minimize the between enumerator measurement variability. Data collection took place between July and August 2016 using electronic devices (tablets) and data were uploaded to a central data server, allowing instant data quality control and assurance.

2.9 Ethics

Each interviewed participant during qualitative and quantitative study was informed about the purpose of the evaluation and their rights using an information sheet. The sheet was read out to participants to save them from embarrassment if they are not able to read. Participants were asked to confirm their understanding of the activity and their agreement to participate by signing the consent form. The participation was voluntary and participants were offered the right to terminate the interview at any time without any negative consequence. Participants who declined to participate were not discriminated against in any way. All data and records were kept confidential and no identifying information was used or released to anyone. Access to the data and records was limited to the trained researchers. The project will keep electronic copies only after the project ends, i.e. the paper-based informed consent forms will be digitized for safekeeping and paper forms will be destroyed. The quantitative datasets (obtained through tablets) and qualitative audio records and transcript will be archived in Ifakara Health Institute data repository and all data or information collected will be kept for ten years. Regional and district authorities of the area in which the study took place were informed. Ethical approval was sought from IHI's IRB and national ethical committee.



A picture of field worker obtaining consent from the mother who is unable to write

2.10 Analysis

Data analysis was performed using STATA version 13 software. Descriptive statistics for baseline characteristics, health and nutrition indicators (Use of Iron and Folic acid, antimalarial drugs and mosquito net) and feeding pattern (breastfeeding initiation, exclusive, predominant, partial breastfeeding and complementary) was done. Questions on source of drinking water, cooking and lighting energy, sanitation facilities, flooring material, ownership of assets and livestock adapted from the demographic health survey (DHS) questionnaire were used as proxy measures of SES. Descriptive analysis of these variables was conducted to explore their distribution before being used for creation of the wealth index. The first principal components analysis was used to create a SES for each household as proposed by Mckenzie (Mckenzie, 2003). A higher index score indicates greater socio-economic status. For ease of interpretation, the score was divided into five quintiles from poorest (the lower quintiles) to better off (the highest quintile).

Chi-square test and logistic regression model were used to explore maternal and child characteristics associated with stunting among children under 24 months. The child characteristics explored were age, gender, birth weight, minimum acceptable diet, immunization coverage, infections and exclusive breastfeeding. Household and maternal characteristics considered were SES, mother's age, marital status, BMI, HIV status, gestation age, number of children ever born, and number of under-fives residing in the selected household, family size alcohol intake, smoking status and use of folic and iron tablets during pregnancy. Variables generated or collected in a subgroup of the population such as minimum acceptable diet (6-23 month), BMI (for non-pregnancy women on the survey date), birth weight (for children having weight measurement taken after birth), Child complete immunization (12-23 month) were not included in multivariable analysis as these would have reduced the sample size dramatically.

A forward selection procedure was applied for building the model with the inclusion of variable decided based on smallest p value of the likelihood ratio test comparing the null and the complex model. The procedure involved three main steps: a) descriptive analysis and preliminary investigations of association between variables while paying attention to the size of effects as well as p-values at 95 % significant level. b) Variables selection; from prior knowledge, child age and sex were considered as forced variables in the model. One variable at a time from a list of candidate variables obtained from a univariable analysis was then included in the model with and without adjustment of forced variables to help understanding the effect of forced variables. The choice of the "best" predictor to be included in the model was then decided based on the smallest p values that were less than the p values for inclusion ($P=0.1$). c) Multivariable models were fitted by adding explanatory variables that were removed from the models in step "b" one at a time to help explore their effect when added to the model in presence of other variables in the model.

2.11 Community Norms qualitative study

A qualitative approach was applied rooted in the principles of grounded theory. Focus group discussions (FGDs) and In-depth interviews (IDIs) were conducted with four different sets of respondents: a) pregnant and lactating women; b) Husbands with a recent child aged less than two

years; c) Older women who are no longer in the reproductive age; and d) Health workers who are providing maternal and newborn health services at the facility. At least 18 Focus group discussions (FGDs) were conducted with pregnant and lactating mothers, 13 FGDs with husbands, 8 FGDs with older women and 13 IDIs with health workers (see Table 1).

Table 1: Summary of qualitative research methods conducted

Method	Frequency of interviews
FGDs with pregnant and lactating mothers	18 FGDs (9 FGDs from Intervention and 9 from Control districts)
FGDs with older women	8 FGDs (4 from intervention and 4 from control sites)
FGDs with Husbands	13 FGDs (6 from intervention and 7 from control districts)
IDIs with Health workers	13 IDIs (6 from intervention and 7 from control districts)

2.11.1 Sample selection for community norms

Wards and participants were purposively selected. Participants for the FGDs were identified through key informants, who were provided with the characteristics of the respondents by the research team. In-depth interviews were conducted with facility health care workers to gather their experiences in providing maternal and child health services including provision of health education specifically on nutrition to pregnant women and young children. Focus group discussions (FGDs) were conducted with pregnant and lactating mothers, husbands and grandmothers with a child who is less than two years old to obtain information on several indicators.

2.11.2 Data collection

Qualitative data were collected in four districts of intervention sites; Simiyu region (Bariadi and Itilima districts), Ruvuma (Mbinga and Nyasa districts) and four districts of control sites; Tabora region (Nzega and Uyui districts), Lindi region (Ruangwa district) and Coast region (Rufiji district). Data were collected between July and August by experienced research assistants in qualitative data collection. A semi-structured interview guide was developed and pre-tested for validity before being used in the field. Two experienced data collectors (1 research assistant and 1 note taker) managed the data collection activities. At the end of each field day, the team held a debriefing session and kept a report of each day. All interviews were audio-recorded, transcribed and translated by trained research assistants.

2.11.3 Data management and Analysis for community norms

The research team read and re-read all the transcripts in Kiswahili to identify themes and emerging themes. Coding and checking for coding consistency was done and the data was managed into units of information that cover broad categories. The generated themes were translated from Kiswahili to English. Analysis was undertaken using a framework grouping of relevant themes that answers key issues as per study objectives. Grounded theory approach was used to guide the analysis process which allows deeper exploration of data to provide various explanations with regards to study phenomena. Data analysis was done using NVIVO software. All interviews, audio recordings and transcripts were stored in a laptop computer and a backup to the main server of the Ifakara Health Institute (IHI).

SECTION THREE: RESULTS

3.1 Introduction

This section presents findings of both qualitative and quantitative surveys. Quantitative descriptive, univariable and multivariable results of nutrition evaluation study conducted in Ruvuma (Songea Urban, Mbinga, Nyasa and Nantumbo districts), Simiyu (Bariadi, Maswa and Itilima), Tabora (Nzega and Uyui), Lindi (Ruungwa) and Coast regions (Rungwa) are presented aggregated by region and control/intervention. More detailed tables are attached in the appendix. The section also provides qualitative findings aligned with specific aspect or component of quantitative findings.

3.2 Social-demographic information of study participants

A total of 2,532 mothers were invited to participate in the study. The maternal and child socio-demographic information are presented in Table 2. There were no differences in the distribution of maternal age, marital status, education, parity, number of under-five children, BMI, pregnancy status, child sex, birth weight and age between the intervention and control sites. However, intervention sites had more Christian mothers (69.3%) than control sites (26.7%) while control sites had higher proportions of household with poor social-economic status (27.2%) than intervention sites (19.9%). In addition, intervention sites had more household with better social-economic status (28.1%) than the control sites (22.6%).

Table 2: Social-demographic information of study participants

Table 2: Description of selected baseline household characteristics of intervention and control sites N (%)		
Indicator	Intervention N (%)	Control N (%)
Number of Household	853	1679
Household size		
Median household population size (SD)	6 (2-30)	5 (2-30)
Family size (number of people in the household)		
2-4	277 (32.5)	603 (36.0)
5-7	344 (40.4)	663 (39.5)
8+	231 (27.1)	411 (24.5)
Religion		
Christian	591 (69.3)	449 (26.7)
Muslim	85 (10.0)	971 (57.8)
No religion	177 (20.8)	259 (15.4)
Household wealth		
1 (Poorest)	229 (26.9)	424 (25.3)
2 (Poor)	170 (19.9)	454 (27.2)
3 (Medium)	214 (25.1)	419 (25.0)
4 (Better off)	240 (28.1)	379 (22.6)
Mother's age (years)		
15-19	149 (17.5)	252 (15.0)
20-29	453 (53.1)	911 (54.3)
30-39	208 (24.3)	446 (26.6)
40-49	43 (5.0)	70 (4.2)
Marital status		
Married	724 (84.9)	1327 (79.0)
Single	81 (9.5)	226 (12.1)
Widow	8 (0.9)	12 (0.7)
Divorce	40 (4.7)	114 (6.8)
Mother's education		
No schooling	135 (15.8)	432 (25.7)
Primary	588 (68.9)	1092 (65.0)
Secondary +	130 (15.2)	155 (9.2)
Pregnancy status		
Pregnant	26 (3.0)	57 (3.3)
Not pregnant	827 (97.0)	1622 (96.6)
¹Mother's BMI		
Thinness BMI <18.5	52 (6.3)	103 (6.4)
Normal range 18.5<BMI<25.0	624 (75.5)	1188 (73.3)
Overweight ≥25.0	125 (15.1)	256 (15.8)
Obese ≥ 30.0	26 (3.1)	74 (4.6)
Number of children ever born by interviewed mother		
1	237 (27.8)	467 (27.8)
2-3	321 (37.6)	621 (37.0)
4-5	148 (17.4)	383 (22.8)
6+	147 (17.2)	208 (12.4)
# of <5 children found in interviewed households		
	1344	2337
Sex		
Girls	696 (51.8)	1150 (49.2)
Boys	648 (48.2)	1187 (50.8)
Child age group (month)		
0-5	299 (22.3)	492 (21.1)
6-11	268 (20.0)	505 (21.6)
12-23	381 (28.4)	767 (32.8)
24-35	147 (11.0)	189 (8.1)
36-47	145 (10.8)	246 (10.5)
48-59	103 (7.7)	137 (5.9)
0-23	948 (70.6)	1764 (75.5)
¹ 84 women were pregnant on the day of survey and excluded for BMI calculations. The numbers in brackets are row percent unless stated. SD=Standard deviation		

3.3 Use of antenatal services

The rates of antenatal attendance and delivery at the health facility were low in Simiyu region but were comparable with the matched districts in Tabora region (Figure 3). Majority of the mothers made two to four antenatal visits in both intervention and control sites (Table 3). The gestation age information did not vary between the intervention and control sites. Over 85% of the mothers in the intervention and control sites used Iron and Folic acid. However large proportion used Iron and Folic acid for less than sixty days. Over 70% of mothers in both sites did use antimalarial medication during pregnancy but the use of deworming tablet was low. Health education provided at the health facility during antenatal visits focused more on sleeping under a treated bed net, place of delivery, HIV testing and danger signs during pregnancy. Nutrition and related components received less consideration. More than 70% of mothers in the intervention and control sites gave birth at the health facility and majority delivered at full-term.

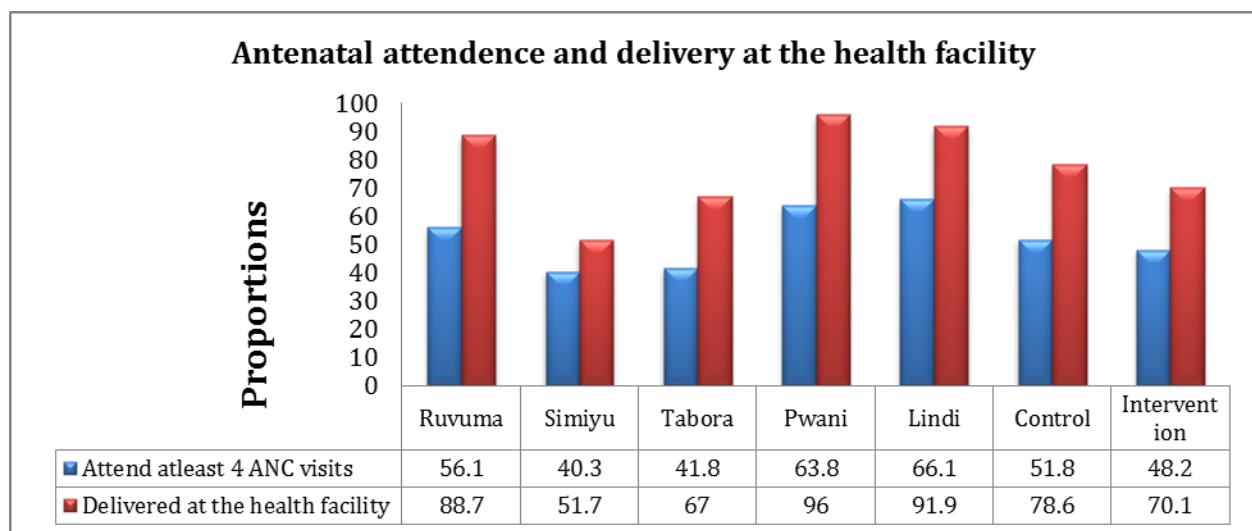


Figure 3: Antenatal attendance and delivery at the health facility in the control and intervention sites.

Table 3 : Pregnancy information and ANC services obtained during the most recent live birth ; Control and intervention regions				
Indicator	Intervention N=853		Control N=1679	
Number of ANC visits attended	N	% (CI)	N	% (CI)
0	7	0.8 (0.4-1.7)	24	1.4 (1.0-2.1)
1	39	4.6 (3.4-6.2)	61	3.6 (2.8-4.6)
2-3	391	45.8 (42.5-49.2)	715	42.6 (40.2-45.0)
4+	411	48.2 (44.8-51.5)	869	51.8 (49.4-54.1)
Don't know	5	0.6 (0.2-1.4)	10	0.6 (0.3-1.1)
Age of pregnancy during the first ANC visit (months)				
0-3	185	21.7 (19.0-24.6)	393	23.4 (21.4-25.5)
4-6	580	68.0 (64.8-71.0)	1,079	64.3 (61.9-66.5)
7-9	82	9.6 (7.8-11.8)	189	11.2 (9.8-12.9)
Never attended	3	0.4 (0.1-1.0)	5	0.3 (0.1-0.7)
Don't know	3	0.4 (0.1-1.1)	13	0.8 (0.4-1.3)
Had mothers anthropometric measurements taken				
Height	509	59.7 (56.3-62.9)	1018	60.6 (58.3-62.9)
Weight	821	96.2 (94.7-97.3)	1633	97.3 (96.4-97.9)
During ANC visits given or prescribed with;				
Iron or folic acid supplements	759	89.0 (86.7-90.9)	1496	89.1 (87.5-90.5)
Drugs to prevent malaria	681	79.8 (77.0-82.4)	1235	73.6 (71.4-75.6)
Drug for treatment for worms	478	56.4 (52.7-59.3)	958	57.1 (54.7-59.4)
Actually took iron tablets/syrup during the recent pregnancy				
Yes	747	87.7 (85.2-89.6)	1,475	87.8 (86.2-89.3)
No	106	12.2 (10.4-14.8)	204	12.2 (10.7-13.8)
# of days iron tablets or syrup was taken during the recent pregnancy				
<60	467	62.5 (59.0-65.9)	726	49.2 (46.7-51.8)
60 – 89	146	19.5 (16.9-22.6)	320	21.7 (19.7-23.9)
90+	134	17.9 (15.3-20.9)	429	29.1 (26.8-31.5)
Took SP/Fansidar used during the recent pregnancy				
Did not use	195	22.9 (20.2-25.8)	484	28.8 (26.7-31.0)
Once	261	30.6 (27.6-33.8)	438	26.1 (24.0-28.2)
twice	243	28.5 (25.6-31.6)	411	24.5 (22.5-26.6)
Three time or more	154	18.1 (15.6-20.8)	346	20.6 (18.7-22.6)
Health education given during ANC visits				
Number of doses of Malaria drugs supposed to be taken	362	42.4 (39.2-45.8)	627	37.3 (35.1-39.7)
Healthy eating during pregnancy	506	59.3 (56.0-62.6)	1010	60.1 (57.8-62.5)
Breastfeeding education	400	46.9 (43.6-50.3)	806	48.0 (45.6-50.4)
Advised to sleep under bed net	716	83.9 (81.3-86.3)	1365	81.3 (79.4-83.1)
Discussed and advised on the place of delivery	734	86.0 (83.6-88.2)	1386	82.5 (80.7-84.3)
Danger sign that can occur during pregnancy	440	51.6 (48.2-54.9)	843	50.2 (47.8-52.6)
Informed where to get support when experiencing danger signs	532	62.4 (59.1-65.6)	1026	61.1 (58.7-63.4)
Counseled about HIV/AIDS	635	74.4 (71.4-77.3)	1248	74.3 (72.2-76.4)
Counseling about prevention of mother to child HIV transmission	425	49.8 (46.5-53.2)	826	49.2 (46.8-51.6)
Slept under mosquito nets the previous night				
Yes	701	92.2 (90.1-93.9)	1412	92.9 (91.5-94.1)
No	59	7.8 (6.1-9.9)	108	7.1 (5.9-8.5)
Place of delivery				
Health facility	598	70.1 (66.9-73.1)	1319	78.6 (76.5-80.5)
Home	255	29.9 (26.9-33.1)	360	21.4 (19.5-23.5)
Mothers gestation age (weeks)				
<37	128	15.0 (12.8-17.6)	191	11.4 (10.0-13.0)
37+	725	85.0 (82.4-87.2)	1487	88.6 (87.0-90.1)

3.4 Mothers accessing ANC services- qualitative findings

The qualitative findings show that most women attended antenatal care at health facilities. Most pregnant women reported to start attending the ANC when their pregnancies are three months old or above. Several reasons were reported as to why most mothers start ANC when they are three months or above. Main reasons include waiting to be sure of the pregnancy. Mothers during FGD reported that *“...you don’t rush to the antenatal clinic because sometimes you may not be pregnant, so you wait be sure of it”* [FGD with pregnant and lactating mothers, Rufiji, Maswa]. Others attended when the pregnancy is 5 months or more with the reason stated; *“People don’t like other people to know that they are pregnant, that’s why other women delay to go to the clinic, if you go to the clinic it’s like you are announcing that you are pregnant, and if there a ‘bad’ people in the community they may destroy your pregnancy”* [FGD with older women, Itilima]

Other potential barrier for antenatal attendance mentioned were

- Taking SP in front of health workers as it might cause bad reaction and majority think they are not feeling sick.
- Going with a partner to test for HIV which might bring relationship problem and majority of mothers are dependent of their husband.
- Lack of knowledge of the importance of ANC care.

Findings also showed that, people who are normally involved in the decision making of when and where to go for ANC are husbands, the wife and mother in-law. Pregnant women were mentioned to be the main decision maker for when to go to the clinic. New mothers were reported to be supported by their own mothers, mother in-law, husbands, and sometimes other female relatives like, sister and aunties. This information suggests that maternal and child health services should be inclusive to cover extended families.

Many families make contact with health facilities through attending antenatal and postnatal care. Majority of the mothers reported being happy with the services provided to them especially during pregnancy. One mother in the FGD said; *“when we start attending the clinic the nurse check our pregnancies and then educates us about HIV/AIDS and how to protect ourselves, then they give us different medicines including the one to increase blood, SP, and the medicine to treat worms”* [FGD with pregnant and lactating mother, Bariadi]. However, mothers were not taking Iron and Folic acid (drugs to increase blood) as they said that they don’t test good: *“the tablets does not test good, that’s why many mothers don’t like it, you know when women are pregnant they also tend to choose certain things they like in regard to their condition”* [FGD with pregnant and lactating mothers, Nyasa]. Others believed that it may harm the baby in the stomach because of its “minerals”; *“the redness of the drug could be a problem to some mothers, because they fear that the medicine might have ‘minerals’ that could affect the baby in the stomach, and people in these communities like to have many children”* [FGD with pregnancy and lactating mothers, Itilima]. These two statements indicate the gap in knowledge about the use of Iron and Folic acid and it suggests the need to adapt supplements to the preferences of targeted women.

Some husbands were reported to advocate the use of iron and folic acid, as they reported encouraging their wives using the tablets and also reminding them at home when to take the tablets; *“We remind our wives when to take the medicine, because if the nurse recommended it, we just have to make sure that our wives use it, since it’s is good for them and for the baby”* [FGD with husbands, Nyasa]. The statement suggests the vital role husbands/partners have in advocating positive behaviours.

Study participants seemed to possess great awareness about the use of antimalarial drugs during pregnancy. However, initiative for mothers to adhere to SP was low as stated; *“some mothers never wanted to take the drug saying that they don’t have malaria, then the nurses started the system that you have to take the drug at the facility is in front of her... but they tell you to eat first before you come to the facility”* [FGD with pregnant and lactating mothers, Mbinga].

3.5 Availability of effective nutrition promotion services- Qualitative findings

In all FGDs with pregnancy and lactating mothers, most of the respondents confirmed the availability of nutrition promotion services at health facilities including dispensaries and health centers; *“...we normally get health education at the dispensary, nurses teach us the importance of nutrition to our health and for the health of our children”* [FGD with pregnant and lactating mothers, Namikulo, Ruangwa].

Different methods have been reported to be used by the health workers in providing nutrition promotion services, these includes using leaflets, flip charts, discussions and lecturing; *“when we go to the clinic to check for our pregnancies, before checking the nurse comes and asks all the pregnant women to enter in the room then she starts teaching us about nutrition, then she distribute the leaflets so that even when we go home we can read them”* [FGD with pregnant and lactating mothers, Mahilo, Mbinga].

Health workers were reported to be the main providers of the nutrition promotion services at the facility. During the interviews with the health workers, they reported that they provide nutrition promotion services as part of the health education but sometimes they are over occupied. They also reported that they organize different sessions in regards to the specific needs of their clients; *“we provide health education to all the mothers during antenatal visits, we educate them on the importance of nutrition so that the mother and the baby get the nutrition they need.....if the child’s development is not good we sit down with the mother and emphasize specific food that will help the baby to improve”* [IDI with health worker, Nyasa].

Taboos and customs were mentioned as the main hindrance for mothers to practice the nutrition education they are provided. Several types of food were reported to be taboo and should not be eaten by the pregnant women for different reasons.

- I. **Goat or Cows meat;** *“a pregnant woman is not supposed to eat the meat of a cow or goat that died from an accident or died due to other reasons, but only if they are slaughtered, because if a pregnant woman eat, she may deliver a baby that is already dead or she may have*

complication during delivery and she may also die” [FGD with pregnant and lactating mothers, Bariadi].

- II. **Catfish:** *“we are not supposed to eat catfish when we are pregnant, because during labour before the baby comes lots of water will come out and also make the baby slippery such that could be slip in the hands of the people helping you and fall down” [FGD with pregnant and lactating mothers, Nyasa].*
- III. **Eggs:** will prevent hair growth of a child.
- IV. **Tomatoes:** They are reddish; they could change the skin colour of the baby in the stomach. And the baby could have the same colour as tomatoes.
- V. **Cashewnuts:** May cause rashes on baby’s skin and may cause the baby to have ‘fatty’ on the skin during delivery. Fatty on the skin was associated with semen as a result of having sex during late stage of pregnancy which normally embarrasses most women when they are giving birth.
- VI. **Groundnuts:** May cause rashes on baby’s skin and may cause the baby to have ‘fatty’ on the skin during deliver

3.6 Health services and education obtained during reproductive and child health clinics

Overall, the intervention and control sites had very low proportions of mothers who were educated on exclusive breastfeeding, complementary feeding and nutrition practices during lactation. In addition, there were few women who were educated on child vaccination, family planning and hand washing (Table 4). Majority of health facilities in both sites did not measure child height. 78.4% and 84.4% of mothers in the intervention and control sites respectively were not informed about nutrition status of their children during child growth monitoring visits. Among few who were informed that their children were malnourished, 5% in the intervention and 4% in the control sites were advised to stop breastfeeding.

Table 4 : Health services and education obtained during reproductive and child health clinics in the Control and intervention sites				
	Intervention N=853		Control N=1679	
Indicator	N	% (CI)	N	% (CI)
Health education given during reproductive and child health clinics after delivery				
Healthy eating during lactation	190	22.3 (19.6-25.2)	344	20.5 (18.6-22.5)
Eating main three meals and one extra meal or snack	25	2.9 (2.0-4.3)	49	2.9 (2.2-3.8)
Breastfeeding for the first six months of life	284	33.2 (30.2-36.5)	574	34.2 (32.0-36.5)
Start complementary feeding after six month	98	11.5 (9.5-13.8)	255	15.2 (13.5-17.0)
Hand washing with water and soap	39	4.5 (3.4-6.2)	98	5.8 (4.8-7.1)
Family planning	44	5.2 (3.9-6.9)	34	2.2 (1.4-2.8)
Child vaccinations	50	5.9 (4.5-7.7)	106	6.3 (5.2-7.6)
Others	24	2.8 (1.8-4.2)	34	2.2 (1.4-2.8)
Not trained	321	37.6 (34.4-40.9)	710	42.3 (40.0-44.7)
Child anthropometric measurements taken during clinic visit				
Weight	763	89.4 (87.2-91.3)	1555	92.6 (91.3-93.8)
Height	32	3.8 (2.7-5.3)	71	4.2 (3.3-5.3)
Informed of the nutrition status of the child				
Yes	184	21.6 (18.9-24.5)	262	15.6 (13.9-17.4)
No	669	78.4 (75.6-81.1)	1417	84.4 (82.6-86.1)
Nutrition status messages conveyed to mothers by health care professions¹				
Child is growing normal	152	82.6 (76.4-87.5)	208	79.4 (74.0-83.9)
Child is underweight	17	9.2 (5.7-14.4)	23	8.8 (5.9-13.0)
Child have mild malnutrition	3	1.6 (0.5-5.0)	1	0.4 (0.0-2.7)
Child is obese	0	-	3	1.1 (0.4-3.5)
Other	12	6.5 (3.7-11.2)	24	9.2 (6.2-13.3)
Advice given to mothers with underweight or malnourished child²				
Increase frequency of breastfeeding	11	55.0 (31.8-76.2)	10	41.7 (22.9-63.1)
Stop breastfeeding	1	5.0 (0.6-32.2)	1	4.1 (0.5-27.4)
Increase feeding frequency	9	45.0 (23.8-68.2)	14	58.3 (36.9-77.1)
Increase variety of foods	8	40.0 (20.0-64.0)	14	58.3 (36.9-77.1)
Increase RCH visit	0	-	1	4.2 (5.0-27.4)
Given Ready to Use Therapeutic (RUTF) foods	0	-	1	4.2 (0.5-27.4)
Other	0	-	3	12.5 (3.7-34.5)
¹ Denominator include only those who were informed about their nutritional status				
² Denominator include only those who were told that their child has underweight or malnourished				

3.7 Mother main source of nutritional education and awareness

The main source of nutrition and health related information for both intervention and control sites are health care providers followed by neighbors or relatives of the women. Over 80% of the mothers were aware that breastfeeding is better than formula feeding. Nearly a half of women in the intervention and control sites knew that feeding more often increases breastmilk supply and that babies need to breastfeed more when they had poor growth. One third of interviewed women knew that feeding formula to a one month old baby reduces the amount of milk produced by the mother (Table 5).

Majority of the women knew that vaginal bleeding is one of the danger signs if it happens before, during or after delivery. The level of awareness varies significantly between the intervention (80.5 %) and control sites (69.3%). Other danger signs (prolonged labour for more than 12 hours, foul smell vaginal discharge, high fever, Dizziness, retained placenta and convulsion) were less-known. Three quarter of women in both intervention and control sites knew that HIV can be transmitted from mother to child during breastfeeding and over 95 % of the mothers were aware that mixed feeding is not recommended for children born with HIV.

Table 5: Mother main source of nutritional education and awareness

Indicator	Intervention N=853		Controls N=1679	
	n	% (CI)	n	% (CI)
Reported main sources of mother and child health education				
Health care providers	719	84.3 (81.7-86.6)	1414	84.2 (82.4-85.9)
Neighbors or relatives	116	13.6 (11.5-16.1)	192	11.4 (10.0-13.0)
Brochures, Posters/ Leaflet	17	2.0 (1.2-3.2)	13	0.8 (0.5-1.3)
Radio	6	0.7 (0.3-1.6)	14	0.8 (0.5-1.4)
Television	1	0.1 (0.0-0.8)	1	0.0 (0.0-0.4)
Others	53	6.2 (4.8-8.0)	147	8.8 (7.5-10.2)
Breastfeeding knowledge				
Formula-feeding is better than breastfeeding	79	9.3 (7.5-11.4)	191	11.4 (9.9-13.0)
Feeding more often increases breastmilk supply	408	47.8 (44.5-51.2)	907	54.0 (51.6-56.4)
Babies need to breastfeed more when they are having a poor growth	418	49.0 (45.7-52.4)	877	52.2 (49.8-54.6)
Feeding formula to a one month old baby will reduce the amount of milk produced by the mother	269	31.5 (28.5-34.7)	584	34.8 (32.5-37.1)
Danger sign that might happen before, during or after delivery				
Vaginal bleeding	190	80.5 (74.9-85.1)	309	69.3 (64.8-73.4)
Prolonged labour (more than 12 hours)	55	23.3 (18.3-29.1)	123	27.6 (23.6-31.9)
Convulsion	32	13.6 (9.7-18.6)	80	17.9 (14.6-21.8)
Retained placenta for more than 30 minutes after birth	18	7.6 (4.8-11.8)	35	7.8 (5.7-10.7)
Foul smell vaginal discharge	39	16.5 (12.3-21.8)	54	12.1 (9.4-15.5)
High fever	34	14.4 (10.5-19.5)	63	14.1 (11.2-17.7)
Dizziness	8	0.9 (0.5-1.9)	11	6.6 (0.4-1.2)
Other	17	7.2 (4.5-11.3)	24	5.3 (3.6-7.9)
Transmission of mother to child HIV infection				
During pregnancy	101	14.8 (12.4-17.7)	198	15.3 (13.4-17.3)
During delivery	154	22.6 (19.6-25.9)	220	17.0 (15.0-19.1)
During breastfeeding	519	76.2 (72.9-79.3)	970	74.8 (72.3-77.1)
I don't know	84	12.3 (10.1-15.1)	210	16.2 (14.3-18.3)
Recommended feeding practice for children born to HIV positive mothers				
Exclusive breastfeeding for six months	327	38.3 (35.1-41.6)	559	33.3 (31.1-35.6)
Avoid mixed feeding	35	95.9 (94.3-97.0)	64	96.2 (95.2-97.0)
Exclusive breastfeeding for six months and continue to breastfeed for 12 month while the child using ARV	17	2.0 (1.2-3.1)	56	3.4 (2.6-4.3)
HIV testing for children aged 4-6 months	12	1.4 (0.8-2.5)	32	1.9 (1.4-2.7)
Breast feeding only even if there is no ARVs	3	0.4 (0.1-1.1)	3	0.2 (0.1-0.6)
Other ¹	41	4.8 (3.5-6.5)	63	3.8 (2.9-4.8)
¹ Others include exclusive breastfeed for first three month and then start complementary feeding and not breastfeeding at all				

3.8 Infant and Young Child Feeding Practices

Adequate nutrition is critical for children's growth and development. Exclusive breastfeeding is the only recommended way by WHO to feed children below six months of age. Despite the recommendation, 30% and 34% of children 0-5 months were not exclusively breastfed in the intervention and control sites respectively (Table 6a and b). Simiyu region had the highest cumulative rates of exclusive breastfeeding (93%) compared with Ruvuma region (70.5%) which had the lowest prevalence (Figure 4). Over 90% of children aged 6-9 months were given complementary feeding in both intervention and control sites.

Table 6a: Breastfeeding status among children less than 2 years by age; Intervention N(852)							
Age in months	N	Ever breastfeed	Not breastfeed	Exclusively breastfeeding	Breastfeeding And consuming Plain water only	Breastfeeding And consuming Other milk	Breastfeeding And consuming complementary foods
0-1	86	83 (96.5)	0 (0.0)	79 (91.9)	0 (0.0)	1 (1.2)	5 (5.8)
2-3	92	90 (97.8)	0 (0.0)	69 (75.0)	4 (4.4)	2 (2.2)	17 (18.5)
4-5	105	105 (100.0)	0 (0.0)	50 (47.6)	6 (5.7)	4 (3.8)	45 (42.9)
6-8	123	122 (99.2)	0 (0.0)	11 (8.9)	3 (2.4)	0 (0.0)	109 (88.6)
9-11	119	118 (99.2)	1 (0.8)	1 (0.8)	1 (0.8)	0 (0.0)	116 (97.5)
12-17	179	178 (99.4)	6 (3.4)	0 (0.0)	0 (0.0)	2 (1.1)	171 (95.5)
18-23	148	145 (98.0)	56 (37.8)	0 (0.0)	0 (0.0)	0 (0.0)	90 (61.6)
0-3	178	173 (97.2)	0 (0.0)	148 (83.2)	4 (2.3)	3 (1.7)	22 (12.4)
0-5	283	278 (98.2)	0 (0.0)	198 (70.0)	10 (3.5)	7 (2.5)	67 (23.7)
6-9	169	168 (99.4)	1 (0.6)	11 (6.5)	4 (2.4)	0 (0.0)	153 (90.5)
12-15	117	116 (99.2)	2 (1.7)	0 (0.0)	0 (0.0)	2 (1.7)	113 (96.6)
12-23	325	321 (98.8)	61 (18.8)	0 (0.0)	0 (0.0)	2 (0.6)	261 (80.3)
20-23	88	88 (100)	41 (46.6)	0 (0.0)	0 (0.0)	0 (0.0)	46 (52.3)
Presented values in the bracket are cumulative row prevalence							

Table 6b: Breastfeeding status among children less than 2 years by age; Control N=1675							
Age in months	N	Ever breastfeed	Not breastfeed	Exclusively breastfeeding	Breastfeeding and consuming Plain water only	Breastfeeding And consuming Other milk	Breastfeeding And consuming complementary foods
0-1	142	140 (98.6)	0 (0.0)	135 (95.1)	3 (2.1)	0 (0.0)	4 (2.8)
2-3	146	145 (99.3)	0 (0.0)	100 (68.5)	13 (8.9)	4 (2.7)	29 (19.9)
4-5	189	187 (98.9)	0 (0.0)	83 (43.9)	12 (6.4)	3 (1.6)	91 (48.2)
6-8	244	243 (99.6)	0 (0.0)	8 (3.3)	1 (0.4)	1 (0.4)	234 (95.9)
9-11	232	231 (99.6)	4 (1.7)	2 (0.9)	1 (0.4)	0 (0.0)	225 (97.0)
12-17	354	352 (99.6)	14 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)	339 (95.8)
18-23	368	360 (97.8)	161 (43.8)	0 (0.0)	0 (0.0)	2 (0.5)	203 (55.2)
0-3	288	285 (99.0)	0 (0.0)	235 (81.6)	16 (5.6)	4 (1.4)	33 (11.5)
0-5	477	472 (99.0)	0 (0.0)	318 (66.7)	28 (5.9)	7 (1.5)	126 (26.0)
6-9	337	335 (99.4)	1 (0.3)	8 (2.4)	1 (0.3)	1 (0.3)	326 (96.7)
12-15	237	235 (99.2)	4 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	232 (97.9)
12-23	714	704 (98.6)	169 (23.7)	0 (0.0)	0 (0.0)	2 (0.3)	540 (75.6)
20-23	244	238 (97.5)	132 (54.1)	0 (0.0)	0 (0.0)	1 (0.4)	111 (45.5)
Presented values in the bracket are cumulative row prevalence							

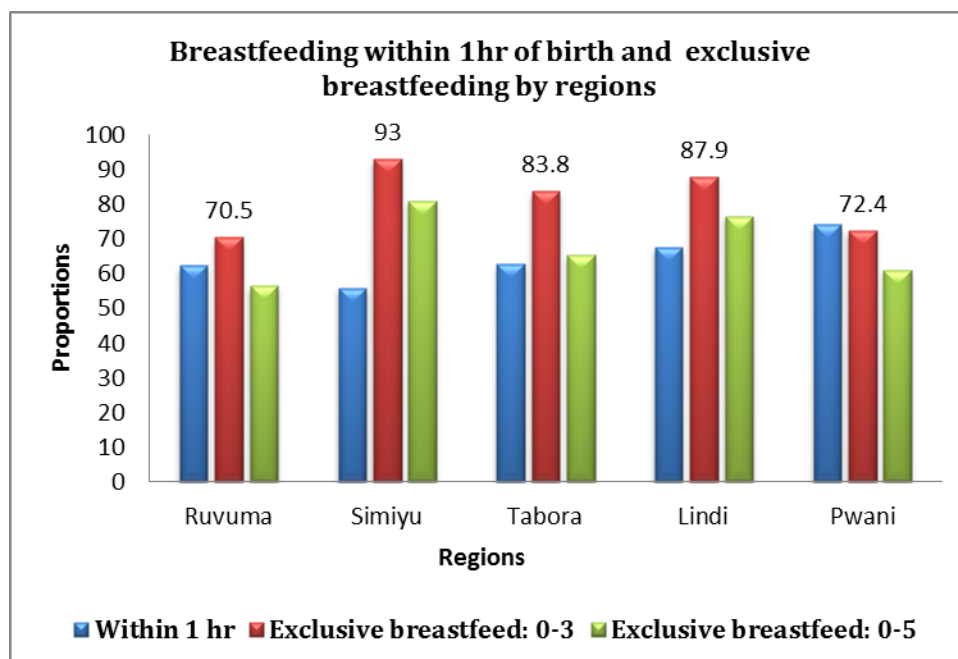


Figure 4: Breastfeeding within 1hr of birth and exclusive breastfeeding by regions

3.9 Infant and Young Child Feeding Practices- Qualitative findings

Breastfeeding was commonly mentioned as the main food for newborn and infants and was encouraged to start within one hour of delivery as reported by most mothers during the FGDs. *“immediately after delivery the nurse covers the baby and gave you to start breastfeeding the baby”* [FGD with pregnant and lactating mothers, Ruangwa].

Knowledge of exclusive BF is there, despite the fact that few mothers practice. Porridge, ugali, soft rice, fruits and juices were frequently mentioned food that mothers reported to give their infants. Other types of foods include cow and goat milk, meat, eggs and vegetables. The type of food that was given to the baby depends on the household income; well-off families were reported to manage purchasing milk, eggs, meat, and any other food of their choice.

Poor families mostly relied on giving their babies porridge and ugali; *“status of families are different: some families are poor and other are well off, poor families depend on giving their babies porridge because they may not have the money to buy other foods, such as milk and eggs”* [FGD with pregnant and lactating mothers, Bariadi].

3.10 Mothers breastfeeding behavior for their children less than six months

In the intervention and matched control sites, *“baby crying too much”* was the main reason mentioned for early complementary feeding (Table 6). Inadequate supply of breastfeeding was mentioned in both sites as a second main reason for early complementary feeding with higher percentage in the control (60.8%) than intervention sites (40.5%). Most mothers having children under 6 months in both sites made their own decision on how to feed their baby and over 20% of mother in both sites mentioned health workers guided them on how to feed their baby (Table 7).

Table 7: Mothers breastfeeding behavior for their children less than six months of age				
	Intervention (283)		Controls (477)	
Indicator	n	%	n	%
Reasons for giving complementary foods to children under 6 months¹				
I don't have enough milk	32	40.5	79	60.8
Formula is better for the baby	0	0.0	1	0.8
Baby is crying too much	49	62.0	80	61.5
Baby was not gaining enough weight	3	3.8	6	4.6
Baby sick	2	2.5	0	0.0
I will go back to work soon after the birth	1	1.3	1	0.8
Mother had health problem	0	0.0	2	1.5
Other reasons	12	15.2	8	6.2
Who helped you decide how to feed the baby				
No one, I decided myself	249	88.0	420	88.1
The baby's father	16	5.7	23	4.8
My mother or mother in law	28	9.9	52	10.9
Health professional	59	20.9	119	25.0
Traditional birth attendant	4	1.4	15	3.1
Other relatives or friends	14	5.0	22	4.6
¹ Denominator includes mother interviewed whose children are less than 6 months and given complementary foods (79 for intervention vs 130 in the control group)				

3.11 Minimum dietary diversity by age group

Minimum dietary diversity which is calculated as proportion of children 6-23 months who received food from ≥ 4 food groups during previous day is presented in Table 8a and b. Overall majority of children in both intervention and control group did not meet the recommended minimum dietary diversity (Table 8a). However the intervention sites had slightly higher proportion of children who met recommended dietary diversity than control regions in all age groups. Table 8b indicates that over 85% of children who were aged 6-23 months did not meet the minimum dietary diversity in all regions.

Table 8a: Proportions of children 6-23 months who received a minimum dietary diversity in the intervention and control sites

Table 8a: Minimum dietary diversity by age group				
	Intervention		Control	
Age group	N	n (%)	N	n (%)
6-11	242	23 (9.5)	476	16 (3.4)
12-17	179	41 (22.9)	354	21 (5.9)
18-23	146	33 (22.6)	360	43 (11.9)
Denominator includes Breastfed and non-Breastfed children aged 6-23 months of age				

Table 8b: Proportions of children 6-23 months who received a minimum dietary diversity by regions

Table 8b: Minimum dietary diversity by age group										
	Ruvuma		Simiyu		Tabora		Lindi		Coast	
Age group	N	n (%)	N	n (%)	N	n (%)	N	n (%)	N	n (%)
6-11	122	8 (6.6)	120	15 (12.5)	285	8 (2.8)	99	5 (5.1)	92	3 (3.3)
12-17	92	21 (22.8)	87	20 (23.0)	189	10 (5.3)	81	5 (6.2)	84	6 (7.1)
18-23	81	18 (22.2)	65	15 (23.1)	209	30 (14.4)	67	4 (6.0)	84	9 (10.7)
Denominator includes Breastfed and non-Breastfed children aged 6-23 months of age										

3.12 Minimum acceptable diet

Minimum acceptable diet is calculated as the proportion of breastfed children 6-23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day. It also includes non-breastfed children 6-23 months of age who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day. Majority of children in both intervention and control sites did not meet minimum acceptable diet (Table 9). There was not much variability in the proportions of children who met minimum acceptable diet between the study regions. However, the situation was worse in the control sites (Figure 5).

Table 9: Minimum acceptable diet

Table 9: Minimum acceptable diet in the intervention and control sites				
	Intervention		Control	
Age group (months)	N	n (%)	N	n (%)
6-11	242	23 (9.5)	476	15 (3.2)
12-17	179	35 (19.6)	354	19 (5.4)
18-23	146	16 (11.0)	360	19 (5.3)
Denominator includes Breastfed and non-Breastfed children aged 6-23 months of age				

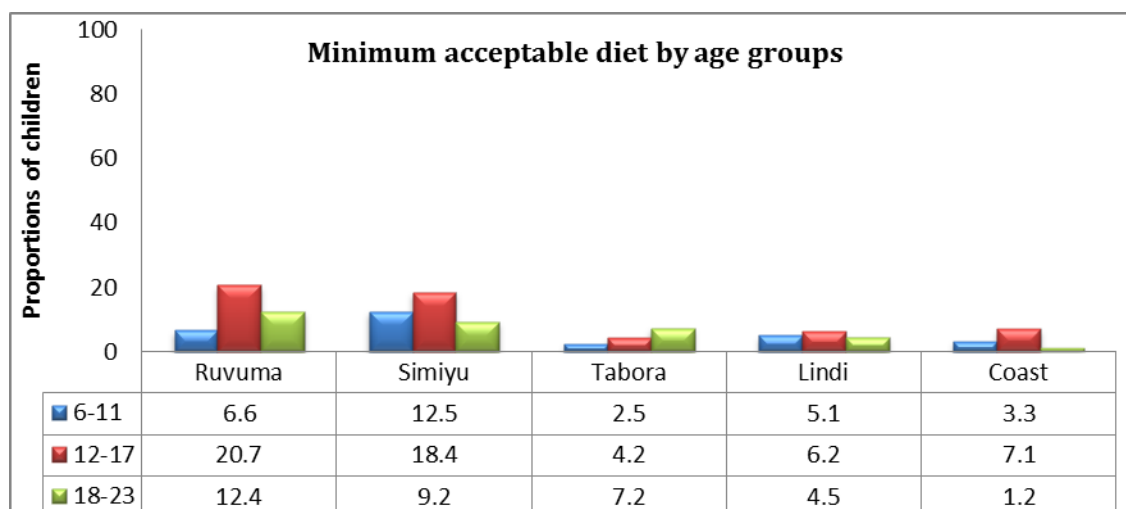


Figure 5: Minimum acceptable diet by age groups in all surveyed regions

3.13 Immunization coverage

A child was considered to have received all basic vaccination if she/he received BCG, three dose of DPT, at least three doses of Polio and one dose of measles vaccine. All these vaccinations are completed at the age of one year. The vaccination information was mainly captured using RCH cards and whenever the card was unavailable, mothers were interviewed. Ruvuma region had the highest proportions of children 12-23 months who received all vaccinations.

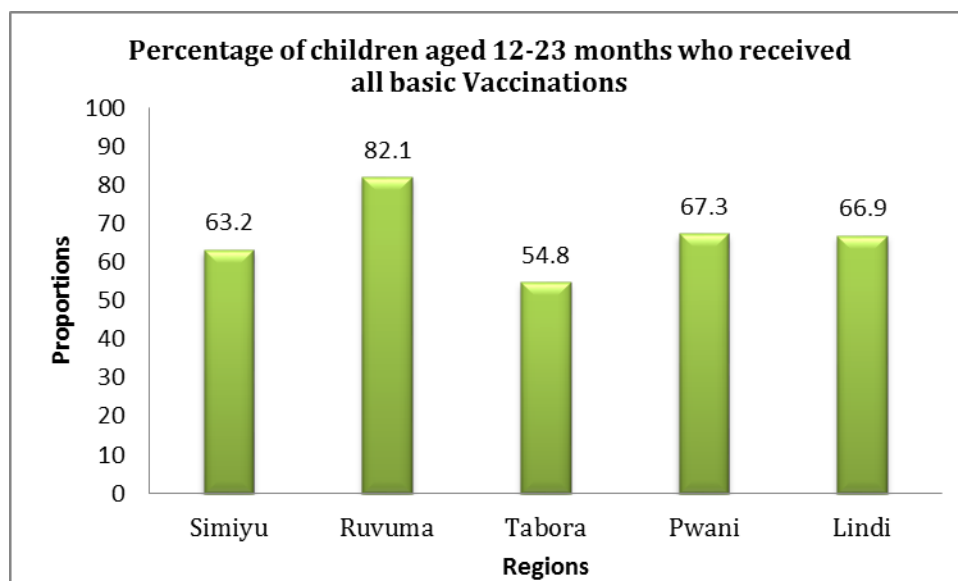


Figure 6: Percentage of children aged 12-23 months who received all basic Vaccinations

3.14 Nutritional indicators in the Intervention versus control sites

Height/length for age Z-score (HAZ), Weight for age Z-score (WAZ) and Weight for length Z-score (WLZ) were computed to establish the prevalence of nutritional status among under-fives. Table 10 indicates prevalence of underweight, stunting and wasting (Z-score < -2) in the intervention and control sites. Fourteen children were excluded due to incomplete data (10 from interventions and 4 from control). There was a higher prevalence of overall stunting in the intervention sites 46.4 (43.0-49.3) as compared to control sites 39.5 (37.6-41.5) and the difference was statistically significant. Other nutritional indicators (underweight and wasting) were comparable between the intervention and control sites.

Table 10: Nutritional indicators in the Intervention versus control sites

Table 10: Nutritional indicators-Control Vs intervention regions				
	Intervention region (Ruvuma & Simiyu) N=1334		Control region (Lindi, Coast and Tabora)N=2333	
	# of cases	Prev (%). (CI)	# of cases	Prev (%). (CI)
Under 5				
<i>Stunting</i>				
Overall	619	46.4 (43.7-49.1)	919	39.4 (37.4-41.4)
Moderate	383	28.7 (26.3-31.20)	602	25.8 (24.1-27.6)
Severe	236	17.7 (15.7-19.8)	317	13.6 (12.3-15.0)
<i>Underweight</i>				
Overall	234	17.5 (15.6-19.7)	352	15.1 (13.7-16.6)
Moderate	180	13.5 (11.8-15.4)	267	11.4 (10.2-12.8)
Severe	54	4.0 (3.1-5.2)	86	3.7 (3.0-4.5)
<i>Wasting</i>				
Overall	41	3.1 (2.3-4.1)	80	3.4 (2.8-4.2)
Moderate	31	2.3 (1.6-3.3)	66	2.8 (2.2-3.6)
Severe	10	0.7 (0.4-1.4)	14	0.6 (0.4-1.0)

3.15 Prevalence of malnutrition in the intervention and control districts

Stunting represents chronic undernutrition among children under-five. Stunting was high in three districts of Ruvuma region (Nyasa, Songea urban and Mbinga) than in Namtumbo district probably due to small number of children sampled from Namtumbo. The control districts matched with Ruvuma had low prevalence of stunting (Figure 7a, b). Prevalence of stunting within Simiyu region was comparable with all matched control districts (Figure 7a, b).

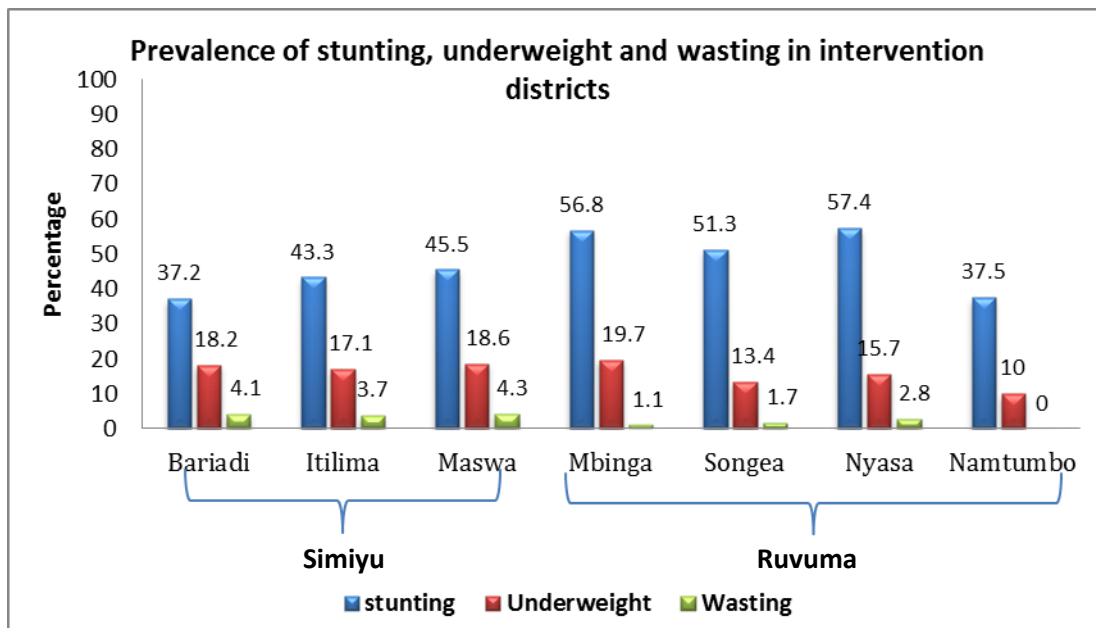


Figure 7a: Prevalence of stunting, underweight and wasting in the intervention sites

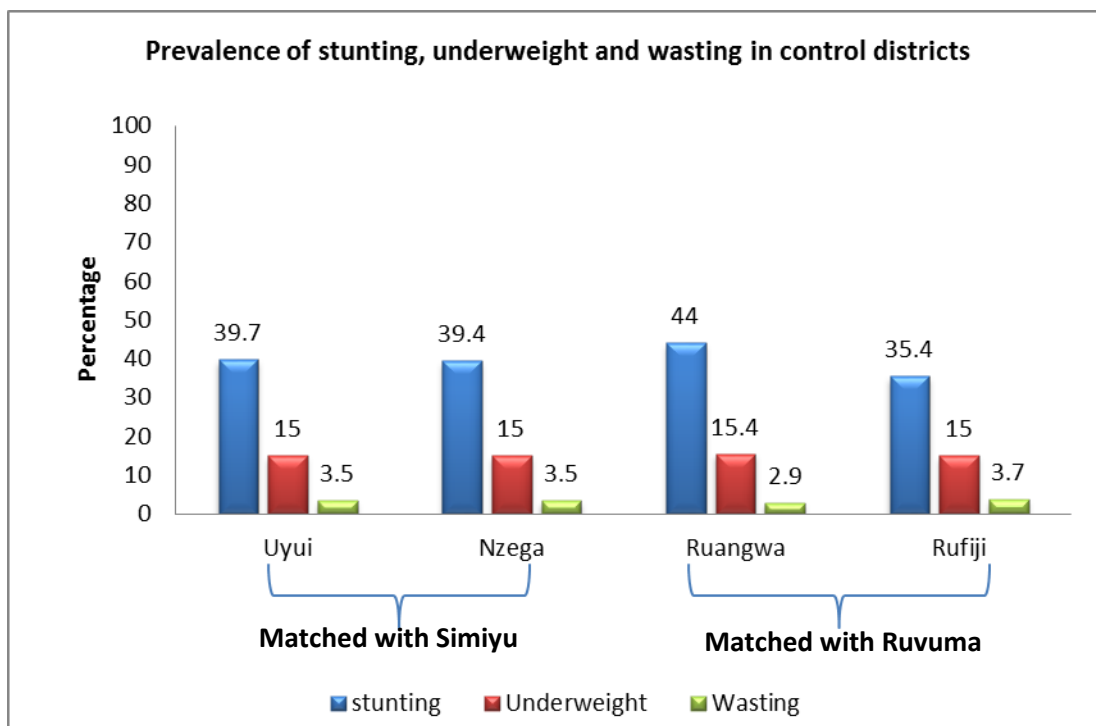


Figure 7b: Prevalence of stunting, underweight and wasting in the control sites

3.16 Qualitative results about knowledge, perception and support for a child with malnutrition

Findings show that most mothers and other family members are able to identify children with severe acute malnutrition. A child who is thin, with skin wrinkles and a big stomach was considered to be malnourished. Most mothers reported that health workers provide nutrition education when they attend antenatal care as well as during children vaccinations clinic visits at the facility. Health workers reported that they normally educate mothers on the signs and symptoms of malnutrition so that when they see specific signs they should go to the facility to get advice from health workers; *“in this dispensary we do our best to make sure that mothers understand the problem of malnutrition and its signs so that they can report to us immediately when they see the changes to their children, we teach and give them leaflets that have pictures of malnourished children”* [IDI with health worker, Itilima].

Poverty was reported to be the main setback to many families, in the interviews with health workers, they reported that sometimes they advise mother on the type of food that would help the child, but the family may not be financially capable to buy the food; *“..there was a time a mother came here, her child had malnutrition, I advised the mother to give a child milk, beans, fish and beef, then she said to me thank you, and asked me where would she get the money to buy those things?”* [IDI with Health Workers, Itilima]. This information indicates the gap in what is considered healthy foods for children among health workers. Mothers should make use of locally available foods to make healthy meals for their children.

Similar findings were reported from the FGDs with husbands, as one husband in the FGDs says; *“...the issue is money, many things here needs money and we don't have the money to buy everything that nurses recommend, you can try to get one or two, we hope that the government will help families with children who are malnourished like in the past”* [FGD with husbands, Bariadi].

3.17 Care for severe acute malnutrition

Most of the respondents in FGDs reported that children with malnutrition are taken to the facility to get advice on what to do. Also most mothers seemed to know that if the child has malnutrition the only treatment is to give them nutritious food; *“...we are told by the nurse that there is no other medicine you can give to the child who is malnourished apart from nutritious food”* [FGDs with pregnant and lactating mothers, Nyasa]. This statement ignores the fact that malnutrition can be related to illnesses rather than food alone.

Similar findings were reported in Ruangwa from FGDs with older women, they added that in the past if the child is malnourished they were taken to the health facility and given food supplements which are rich in vitamins and other essential minerals; *“..when we were young you would hardly see a malnourished child, because we were given something like food to give to our children, when you go to the clinic a nurse check your baby and say your baby is not doing well, then she give you some packets of food to give to your child”* [FGD with older women, Ruangwa].

3.18 Variation of stunting by child age

Figure 8 shows the variation of the prevalence of stunting with child age. The prevalence peak at around 50 percent among children aged 12-23 months in all regions except in Ruvuma. The prevalence of stunting in Ruvuma was much higher than other four regions and peak at 70 percent among children aged 24-35 months. After the age of 24 months, there was a sharp decline in the prevalence of stunting in Ruvuma unlike in the other regions.

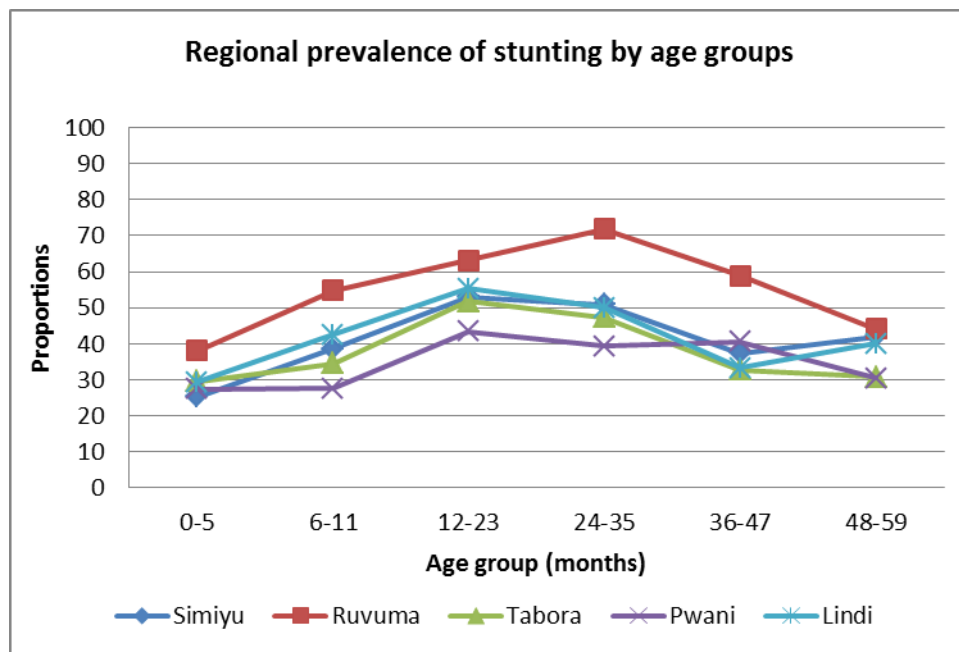


Figure 8 Regional prevalence of stunting by age groups

3.19 Factors associated with stunting among children 0-23 months

The chi-square test was used to test the association between maternal socio-demographic characteristics and stunting in children less than two years. Stunting decreased with increase in maternal SES, age, BMI, height, gestational age, number of children ever born and use of Iron and Folic acid for 90+ days. Stunting was also higher among non-married mothers and HIV positive mothers (Table 11).

Table 4 : Health services and education obtained during reproductive and child health clinics in the Control and intervention sites				
	Intervention N=853		Control N=1679	
Indicator	N	% (CI)	N	% (CI)
Health education given during reproductive and child health clinics after delivery				
Healthy eating during lactation	190	22.3 (19.6-25.2)	344	20.5 (18.6-22.5)
Eating main three meals and one extra meal or snack	25	2.9 (2.0-4.3)	49	2.9 (2.2-3.8)
Breastfeeding for the first six months of life	284	33.2 (30.2-36.5)	574	34.2 (32.0-36.5)
Start complementary feeding after six months	98	11.5 (9.5-13.8)	255	15.2 (13.5-17.0)
Hand washing with water and soap	39	4.5 (3.4-6.2)	98	5.8 (4.8-7.1)
Family planning	44	5.2 (3.9-6.9)	34	2.2 (1.4-2.8)
Child vaccinations	50	5.9 (4.5-7.7)	106	6.3 (5.2-7.6)
Others	24	2.8 (1.8-4.2)	34	2.2 (1.4-2.8)
Not trained	321	37.6 (34.4-40.9)	710	42.3 (40.0-44.7)
Child anthropometric measurements taken during clinic visit				
Weight	763	89.4 (87.2-91.3)	1555	92.6 (91.3-93.8)
Height	32	3.8 (2.7-5.3)	71	4.2 (3.3-5.3)
Informed of the nutrition status of the child				
Yes	184	21.6 (18.9-24.5)	262	15.6 (13.9-17.4)
No	669	78.4 (75.6-81.1)	1417	84.4 (82.6-86.1)
Nutrition status messages conveyed to mothers by health care professions¹				
Child is growing normally	152	82.6 (76.4-87.5)	208	79.4 (74.0-83.9)
Child is underweight	17	9.2 (5.7-14.4)	23	8.8 (5.9-13.0)
Child has mild malnutrition	3	1.6 (0.5-5.0)	1	0.4 (0.0-2.7)
Child is obese	0	-	3	1.1 (0.4-3.5)
Other	12	6.5 (3.7-11.2)	24	9.2 (6.2-13.3)
Advice given to mothers with underweight or malnourished child²				
Increase frequency of breastfeeding	11	55.0 (31.8-76.2)	10	41.7 (22.9-63.1)
Stop breastfeeding	1	5.0 (0.6-32.2)	1	4.1 (0.5-27.4)
Increase feeding frequency	9	45.0 (23.8-68.2)	14	58.3 (36.9-77.1)
Increase variety of foods	8	40.0 (20.0-64.0)	14	58.3 (36.9-77.1)
Increase RCH visit	0	-	1	4.2 (5.0-27.4)
Given Ready to Use Therapeutic (RUTF) foods	0	-	1	4.2 (0.5-27.4)
Other	0	-	3	12.5 (3.7-34.5)
¹ Denominator includes only those who were informed about their nutritional status				
² Denominator includes only those who were told that their child was underweight or malnourished				

3.20 Univariable analysis of risk factors associated with stunting among children 0-23 months

The univariable analysis indicates an association of stunting in children 0-23 months with maternal SES, age, marital status, BMI, height, HIV status, maternal gestation age number of children ever born and use of Iron and folic acid during pregnancy. Child indicators associated with stunting were child sex, birth weight and whether the child was exclusively breastfed (Table 12).

Table 12: Univariable analysis for risk factors associated with stunting among children aged 0 to 23 months N=2510				
			Crude estimates	
Explanatory variables	N	Number of cases (n)	odds ratio (95% CI)	P value
Maternal characteristics				
Household wealth				
1 (Poorest)	646	274	1	0.001
2 (Poor)	623	273	1.06 (0.85-1.32)	
3 (Medium)	627	275	1.06 (0.85-1.32)	
4 (Better off)	614	211	0.71 (0.57-0.89)	
Mother's age (years)				
15-19	397	186	1	0.013
20-29	1352	565	0.81 (0.65-1.12)	
30-39	650	241	0.67 (0.52-0.86)	
40-49	111	41	0.66 (0.43-1.02)	
Marital status				
Married	2035	808	1	0.002
Not married	475	225	1.37 (1.11-1.67)	
Mother's education				
No schooling	562	229	1	0.838
Primary	1664	691	1.03 (0.85-1.25)	
Secondary +	284	113	0.96 (0.72-1.29)	
1Mother's BMI				
Normal range 18.5<BMI<25.0	1799	761	1	<0.001
Thinness BMI <18.5	153	81	1.53 (1.10-2.14)	
Overweight ≥25.0	378	114	0.59 (0.46-0.75)	
Obese ≥ 30.0	98	30	0.60 (0.39-0.93)	
Mothers height				
≥145	2436	978	1	<0.001
<145	73	55	4.56 (2.66-7.80)	
Mother HIV status				
Positive	69	39	1	0.009
Negative/Not known	2441	913	0.53 (0.33-0.87)	
Mother's gestational age				
37+	2193	885	1	0.029
<37(Preterm)	316	148	1.30 (1.02-1.65)	
Number of children ever born by mother				
1	694	323	1	0.001
2-3	934	381	0.79 (0.65-0.96)	
4+	882	329	0.68 (0.55-0.84)	
Number of under 5 Children				
1	1604	676	1	0.398
2	734	288	0.89 (0.74-1.06)	
3+	172	69	0.92 (0.67-1.27)	
Family size				
2-4	873	375	1	0.392
5-7	997	404	0.90 (0.75-1.09)	
8+	637	253	0.87 (0.71-1.08)	
Mother taking alcohol				
Yes	115	48	1	0.897
No	2395	985	0.98 (0.69-1.43)	
# of iron tablets or syrup taken during pregnancy				
0	306	130	1	0.027
<90	1649	702	1.00 (0.78-1.28)	
90+	555	201	0.77 (0.58-1.02)	
Child Sex				
Boys	1274	417	1	<0.001
Girls	1236	616	2.04 (1.73-2.4)	
Child age				
0-5	754	219	1	<0.001
6-11	718	271	1.48 (1.19-1.84)	

12-23	1038	543	2.68 (2.20-3.27)	
Birth weight ²				
Normal (≥2500 g)	1738	691	1	<0.001
Low (<2500 g)	129	91	3.63 (2.46-5.36)	
Breastfeeding				
Exclusive	532	151	1	<0.001
Non exclusive	1978	882	2.03 (1.65-2.50)	
Child diet meet Minimum acceptable diet ³				
No	1629	758	1	0.595
Yes	127	56	0.90 (0.63-1.30)	
Child full immunized ⁴				
No	371	185	1	0.239
Yes	667	358	1.16 (0.90-1.50)	
Child had infection in the past two weeks				
At least one infection	1055	417	1	0.158
No infection	1455	616	1.12(0.96-1.32)	
¹ Include non-pregnant mothers with valid anthropometric measurement				
² Calculated only for children having weight measurement taken at birth				
³ Denominator includes Breastfed and non-Breastfed children aged 6–23 months of age				
⁴ Denominator includes children aged 12-23 months				

3.21 Multivariable analysis for risk factors associated with stunting among children aged 0 to 23 months

Multivariable regression models exclude exclusive breastfeeding as it is targeted for children 0-6 months only and hence its inclusion in the model will exclude a large number of children in the analysis. For similar reason the minimum acceptable diet, birth weight, child immunization and mothers BMI were excluded.

- Household with better social economic status had 26% less chance of having a stunted child as compared poor family.
- There was strong evidence of association between maternal age and the prevalence of child stunting ($p < 0.001$). When compared to mothers aged 15-19 years, women aged 20-29 years had 26% lower chance of having a stunted child and those aged 30-39 years had 36% lower chance of having stunted child. However, there was no evidence of the difference on the child stunting between mothers aged ≥ 40 years and 15-19 years.
- Not married women had higher odds (OR=1.26 (95% CI 1.01-1.57)) chance of having stunted child as compared to married women.
- Overweight mothers (BMI > 25) had 36% lower chance of having stunted child as compared to women with normal BMI (> 18.5 to <25).
- Mothers with height below 145cm had five times higher chance of having a child who is stunted as compared to mothers with height above 145cm
- HIV positive mothers were over two times more likely (OR=2.33 (95% CI 1.39- 3.88)) risk of having stunted child as compared to non-HIV positive mothers.
- Women who delivered below 37 weeks of gestation had OR=1.31 (95% CI 1.01-1.69) risk of having stunted child compared to those who delivered above 37 weeks
- Female children had two times higher chance of stunting as compared to male children 0-23 months.
- Risk of stunting increased with increase in child age. Children aged 12-23 months had nearly three times chance of being stunted as compared to children 0-5 months.

Table 13: Multivariable analysis for risk factors associated with stunting among children aged 0 to 23 months N=2426				
			Adjusted estimates	
Explanatory variables	N	Number of cases (n)	odds ratio (95% CI)	P value
Household wealth				
1 (Poorest)	623	258	1	0.010
2 (Poor)	603	260	1.06 (0.83-1.35)	
3 (Medium)	602	261	1.09 (0.86-1.38)	
4 (Better off)	598	206	0.74 (0.58-0.95)	
Mother's age (years)				
15-19	384	179	1	0.019
20-29	1295	534	0.74 (0.58-0.94)	
30-39	638	232	0.64 (0.48-0.85)	
40-49	109	40	0.68 (0.43-1.08)	
Marital status				
Married	1954	761	1	0.037
Not married	472	224	1.26 (1.01-1.57)	
1Mother's BMI				
Normal range	1798	761	1	<0.001
18.5<BMI<25.0				
Thinness BMI <18.5	153	81	1.38 (0.97-1.96)	
Overweight ≥25.0	377	113	0.64 (0.49-0.83)	
Obese ≥ 30.0	98	30	0.66 (0.41-1.06)	
Mothers height				
≥145	2353	930	1	<0.001
<145	73	55	5.28 (2.99-9.31)	
Mother HIV status				
Negative /unknown	2357	946	1	0.002
Positive	69	39	2.33 (1.39-3.88)	
Mother gestation age				
37+	2127	848	1	0.044
<37	299	137	1.31 (1.01-1.69)	
Child Sex				
Boys	1232	402	1	<0.001
Girls	1194	583	2.06 (1.73-2.44)	
Child age				
0-5	752	218	1	<0.001
6-11	714	270	1.57 (1.25-1.97)	
12-23	960	497	2.92 (2.36-3.62)	

4. Conclusion

In this mixed method study design, maternal knowledge, attitude and perception on the health and nutrition services provided during pre and post-natal period were assessed. The study also measured maternal and child nutrition status, infant and young child feeding practices and community norms surrounding maternal and child health and nutrition.

- Baseline findings from this study indicates unacceptably high prevalence of stunting (high prevalence: 30-39%) according to WHO (World Health Organisation, 2010) in both intervention and control sites. Ruvuma region had relatively much higher proportions of stunted children than its matched districts. This implies that, Ruvuma is likely to observe a large decline in stunting at end-line which might not necessarily reflect the effect of the intervention (Barnnet, van der Pols, & Dobson, 2004). However, having control districts will account for this effect the during data analysis.
- To improve rates of exclusive breastfeeding up to 6 months from birth , infant and young child feeding sessions need to address child behaviours such as ‘baby crying too much’ and the perceived low maternal breastmilk supply which were mentioned as the main reasons for early complementary feeding. This can be done when mothers are in contact with community health workers or during antenatal education sessions.
- For the program to be able to improve child nutritional status, the minimum acceptable dietary intake needs to be attained. The advocacy on appropriate child feeding should account for the differences in environmental and economic activities between Simiyu and Ruvuma. In Simiyu where majority of families are pastoralists, advice should be based to use of animal products to improve child diet while in Ruvuma where majority are farmers, the advice should be based on the use of agricultural products to improve child diet.
- The program may achieve increased proportions of pregnant mothers using Iron and Folic acid for 90+ days, three or more doses of Antimalarial drugs (SP) and deworming tablets when they are well informed about the relevance of the drugs or supplements and when myths are well addressed.

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