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Strengthening and Evaluating the Preventing Malnutrition in Children under 2 Years of Age Approach

Burundi Follow-Up Report: Children 0–23 Months

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Contents

LIST OF TABLES

Abbreviations and Acronyms

A4NH	Research Program on Agriculture for Nutrition and Health
BCC	behavior change communication
BCG	Bacille Calmette-Guérin (tuberculosis vaccine)
BIF	Burundian Franc(s)
BMI	body mass index
CARITAS	CARITAS Burundi
CGIAR	Consultative Group on International Agricultural Research
cm	centimeter(s)
CRS	Catholic Relief Services
CSB	corn-soy blend
DHS	Demographic and Health Survey
dL	deciliter(s)
DPT	diphtheria, pertussis, tetanus (vaccine)
DRC	Democratic Republic of the Congo
EICV	Enquête Intégrale sur les Conditions de Vie des Ménages
FANTA	Food and Nutrition Technical Assistance Project
FH	Food for the Hungry
FFP	Office of Food for Peace
g	gram(s)
HAZ	height-for-age z-score
Hb	hemoglobin
HDDS	Household Dietary Diversity Scale
HFIAS	Household Food Insecurity Access Scale
HepB	hepatitis B virus (vaccine)
HH	household
HHS	Household Hunger Scale
HiB	*haemophilus* influenza B (vaccine)
HIV	human immunodeficiency virus
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMC	International Medical Corps
IMCI	integrated management of childhood illness
INSP	Institut National de Santé Publique
ISTEEBU	Institut de Statistiques et d'Etudes Economiques du Burundi
IU	international unit(s)
IYCF	infant and young child feeding
kg	kilogram(s)
km	kilometer(s)
m	meter(s)

μg	microgram(s)
mg	milligram(s)
mm	millimeter(s)
MUAC	mid-upper arm circumference
NGO	nongovernmental organization
ORS	oral rehydration salts
PCV	Pneumococcal Conjugate Vaccine
PM2A	Preventing Malnutrition in Children under 2 Approach
SD	standard deviation(s)
SE	standard error(s)
SRQ-20	Self-Report Questionnaire
T18	*Tubaramure* 18
T24	*Tubaramure* 24
THP	*Tubaramure* health promoter
TNFP	*Tubaramure* no food during pregnancy
U.S.	United States
UNDP	United Nations Development Programme
USAID	U.S. Agency for International Development
WHO	World Health Organization

Executive Summary

Tubaramure is a "Preventing Malnutrition in Children under 2 Approach" (PM2A) program implemented in eastern Burundi. The program's aim is to improve the health and nutritional status of pregnant and lactating women and children under 2 years of age through three core components: distribution of food rations, participation in behavior change communication (BCC) sessions delivered via care groups, and attendance at preventive health services.

The impact of *Tubaramure* is being evaluated via a community randomized control trial with three different treatment arms. Beneficiaries in the three treatment arms receive food rations for varying durations: from 4 months gestational age until the child is 24 months old, from 4 months gestational age until the child is 18 months old, and from birth until the child is 24 months old. The objective of varying the duration of implementation is to test optimal program duration.

The program's impact is being assessed using three cross-sectional surveys (conducted in 2010, 2012, and 2014). The first cross-sectional study provided a baseline reference. This report presents the findings from the 2012 follow-up survey. This report assesses the impact of *Tubaramure* following about 2 years of program implementation on children between 0 and 23 months of age. The focus of the report is on outcomes, such as maternal knowledge regarding health and nutrition-related practices, including infant and young child feeding (IYCF) practices. The impact on child linear growth (the main measure of nutritional status) will be assessed in children who have been exposed to *Tubaramure* consistently from early pregnancy to 24 months of age. The first group of children to meet this condition will be between 24 and 42 months of age in the October–December 2014 time period.

The three *Tubaramure* components discussed below (food, BCC, and health) were expected to have an impact on maternal nutrition and on child nutrition and development.

The food component of the *Tubaramure* consisted of corn-soy blend (CSB) and cooking oil rations and was expected to increase household availability of micronutrient-rich food and, in turn, consumption of such foods and improved diet diversity. Participation in food distribution was high among those eligible. *Tubaramure* had a large positive effect on household access to food and reduced the percentage of severely food insecure households substantially. *Tubaramure* had a minimal impact on the low level of household and mothers' dietary diversity. The program improved complementary feeding practices. The largest impact was seen in the proportion of children consuming iron-rich foods, which appeared to be directly related to the increased intake of CSB. A more modest positive impact was found for the proportion of children receiving the minimum recommended number of meals, the proportion of children receiving the minimum dietary diversity, and the percentage of children consuming a minimally acceptable diet.

Tubaramure's BCC strategy was designed specifically to increase knowledge and adoption of best practices in health, hygiene, and nutrition. The BCC component was implemented through participation in care groups that were directed by leader mothers who were also program beneficiaries. Care group participation was low. As a result, impacts on mothers' knowledge was mixed, and mothers' knowledge did not improve in many of the areas where it was expected to improve. However, mothers' knowledge did improve in the area of optimal child feeding practices. *Tubaramure* had only a modest positive impact on a limited number of household hygiene and sanitation practices. The program did not increase reported attendance at growth monitoring services or any of the other types of preventive health care utilization. *Tubaramure* did protect children from the overall increase in child morbidity observed from baseline to

follow-up in the control group. The only effect on curative care-seeking behaviors was found for the proportion of children receiving medication to fight a fever.

The health component was designed to improve the provision of preventive and curative health services by health staff (by providing training for health staff, as well as by providing some key supplies) and to increase utilization of these services by pregnant and lactating women and children under 24 months of age. At follow-up, health centers were better equipped and better staffed to care for expecting mothers and young children. However, shortages of key immunizations and medications were common.[1] The program increased the total number of prenatal visits and the proportion of women delivering in health centers. An alarming finding is the dramatic drop in the proportion of women taking iron supplements during pregnancy. The prevalence of anemia in mothers increased by about 15 percentage points between surveys. The program's protective effect on the prevalence of anemia (4.2–7.5 percentage points) was modest. A similar result was found in children 6–23 months of age, with an overall increase over time in the prevalence of anemia (to around 73%). The intervention had a protective effect on children's hemoglobin (Hb) levels, i.e., the general decline in Hb levels observed in all study groups between surveys was less steep (0.24–0.56 g/dL) in the three *Tubaramure* groups than in the control group. Finally, we observed a general decline between surveys in the highest attained language and motor milestones among children 4–23 months of age. The program was found to have a protective effect on the highest attained motor milestone and on the highest attained language milestone in some of the intervention groups.

[1] Note that *Tubaramure*, under U.S. Agency for International Development (USAID) Office of Food for Peace (FFP) guidelines, was not able to purchase immunizations or medications.

1. Introduction

This report presents the findings from the first follow-up survey for the impact evaluation of the PM2A *Tubaramure* program, which is being implemented in eastern Burundi. Building on the baseline survey, this report assesses the impact of PM2A interventions on children between 0 and 23 months of age following about 2 years of program implementation.

Tubaramure is a USAID multi-year development assistance program (formerly called multi-year assistance program) funded by the Office of Food for Peace (FFP) with Title II resources.[2] The objectives are to improve the health and nutritional status of pregnant and lactating women and children under 2 years of age and to strengthen the quality and delivery of health care services. The program has three core components: distribution of family and individual food rations; required participation of beneficiaries in BCC sessions focused on improving health and nutrition-related behaviors; and required use of preventive health services for pregnant and lactating women and children under 2 years of age. A consortium of nongovernmental organizations (NGOs) implement this program, with Catholic Relief Services (CRS) as the lead and International Medical Corps (IMC), Food for the Hungry (FH), and CARITAS Burundi (CARITAS) as implementing partners.

Integrated into the *Tubaramure* program is a research program being conducted by the International Food Policy Research Institute (IFPRI) in collaboration with the consortium of NGOs and with funding from USAID through the Food and Nutrition Technical Assistance Project (FANTA). The overall objectives of the research are to assess the impact and cost-effectiveness of *Tubaramure* on child nutritional status, as well as to evaluate the differential and absolute impact of varying the duration of receiving food rations. In addition, the study will evaluate the impact of the program on a number of other household, maternal, and child outcomes, such as household hunger, IYCF practices, health-seeking practices, maternal Hb and anemia, children's morbidity symptoms, children's Hb and anemia, and children's language and motor development. In addition to the impact and cost-effectiveness studies, process evaluation research is being conducted to understand program delivery and utilization.

In total, three cross-sectional surveys conducted from October to December in 2010, 2012, and 2014 will assess the program's impact. The first cross-sectional study provided a baseline reference and is summarized in a prior report (Parker et al. 2012). The second cross-sectional study evaluates the programmatic impact on children 0–23 months of age (the current report). The third cross-sectional study will evaluate the impact on children 24–41 months of age.

The remainder of the current report is structured as follows. Section 2 presents the study methods. Health center and *colline*[3] characteristics are presented in Section 3. The household, maternal, and child

[2] A study conducted in Haiti and funded by USAID through the Food and Nutrition Technical Assistance Project (FANTA) was the first rigorous evaluation conducted under real programmatic conditions that showed that the blanket targeting of a food-assisted maternal and child health and nutrition program to all children 6–24 months of age (preventive approach) was more effective at reducing the community prevalence of stunting, wasting, and underweight than the traditional approach based on targeting underweight children (weight-for-age z-score < −2) (recuperative approach). Based on the evidence from Haiti, FFP invited proposals to replicate the preventive approach (PM2A) in two other countries: Guatemala and Burundi. The two countries were selected because of their excessively high levels of child stunting. FANTA considered that it would be important to incorporate a strong action-oriented research and development program linked to the implementation of PM2A in the two countries, to allow learning and refinement of the approach and to generate lessons learned for future PM2A programming.

[3] *Colline* is the smallest administrative subdivision in Burundi.

characteristics are presented in Sections 4, 5, and 6, respectively. Section 7 presents information on *Tubaramure* participation. Sections 8, 9, and 10 follow with results on programmatic impact at the household, mother, and child levels, respectively. Section 11 concludes with a discussion of the results.

2. Methods

2.1 Study Setting

Burundi is one of the 10 poorest countries in the world (United Nations Development Programme [UNDP] 2013). The country is located in the Great Lakes region of East Africa, bordered by the Democratic Republic of Congo (DRC), Rwanda, and Tanzania. With approximately 9.85 million people living on 25,680 km^2 of land, Burundi is one of the most densely populated African countries (Food Security and Nutrition Working Group 2010; International Fund for Agricultural Development [IFAD] 2012; World Bank 2012).

Ninety percent of the population lives in rural areas and depends on agriculture for a living, most of which is small-scale subsistence farming. A typical family farm is 0.8 hectares and grows maize, beans, sorghum, cassava, and millet (IFAD 2012; UN Stats 2009). Since 1993, agricultural production has declined by 24%. Approximately 81% of the population lives below the international poverty line of US$1.25 per day (World Bank 2011).

The *Tubaramure* program is being implemented in the eastern provinces of Cankuzo and Ruyigi, located along the border with Tanzania. These provinces are among the poorest of Burundi's 17 provinces and are predominantly rural. According to the 2010 Demographic and Health Survey (DHS), the central-eastern provinces have the greatest prevalence of stunting (62%) and underweight (33%) (ISTEEBU and l'Institut National de Santé Publique [INSP] 2011). Micronutrient deficiencies are common: Anemia prevalence in these provinces is approximately 44% among children 6–59 months of age and 18% among pregnant women; vitamin A deficiency has remained widespread despite large-scale distributions of vitamin A supplements by the Expanded Program of Vaccination (ISTEEBU and INSP 2011). The NGO consortium implementing the *Tubaramure* program chose to work in Cankuzo and Ruyigi after evaluating several health and nutrition indicators (e.g., malnutrition, access to prenatal and postnatal services, IMC growth monitoring results, and food insecurity), which indicated that these two provinces were among those most in need of this type of program.

2.2 The *Tubaramure* Program

The core package of the PM2A includes three components[4]: distribution of food rations, attendance at preventive health services, and participation in a BCC strategy. Women are invited to enroll in the *Tubaramure* program when they are pregnant (at or after the fourth month of gestation).

Food component.[5] The food component of the *Tubaramure* program is expected to increase household availability of micronutrient-rich food and, in turn, consumption of such foods and improved diet diversity. To achieve these goals, all *Tubaramure* beneficiaries enrolled in the *Tubaramure* program receive a monthly household food ration composed of 12 kg of CSB and 1,200 g of oil (see **Appendix 1**). This ration is distributed to the beneficiary, but intended for household consumption. In addition to the household ration, an individual ration is distributed for the beneficiary: a pregnant or lactating woman (0–5 months postpartum) receives 6 kg of CSB and 600 g of oil, while a child 6–23 months receives 3 kg of CSB and 300 g of oil. From the time of enrollment, a beneficiary mother will continue to receive the monthly individual ration until her child is 6 months of age. At 6 months, it is recommended that

[4] FFP limited the focus of the project to the three main areas and did not fund inclusion of such interventions as home gardens or savings/lending groups.

[5] Using private funds, CRS later added a home gardening and animal raising component. Since these activities were not part of the *Tubaramure* program at the time of the baseline, data on these outcomes were not collected.

complementary foods be introduced to the infant. At this time, the mother's individual ration is discontinued and the child begins receiving a monthly individual ration until she or he graduates from the program (at 24 months of age).

Health component. The health component is designed to improve the provision of preventive health services by health staff and to increase utilization of these services by pregnant and lactating women and children from 0 to 23 months of age. The improved provision and increased utilization of these services are expected to contribute to improvements in maternal and child health outcomes. The *Tubaramure* program designed this component to strengthen existing health services through the provision of training for health staff, as well as by providing some key supplies for implementing health services. Health supplies include equipment for prenatal care (e.g., vaginal speculum, *Pinard* obstetric stethoscope), labor and delivery (e.g., delivery table), growth monitoring (e.g., salter scale, infant scale), and curative care (e.g., thermometer, sterile equipment). In addition, utilization of preventive health services by pregnant and lactating women (pre- and postnatal services, respectively) and children 0–23 months (growth monitoring and promotion) is strongly encouraged by the *Tubaramure* program through the BCC strategy. Beneficiary mothers and children are expected to attend and use recommended preventive health services at the local health center, including pre- and postnatal check-ups for women and growth monitoring and vaccinations for children.

BCC component. *Tubaramure*'s BCC strategy was designed specifically to address many of the underlying causes of undernutrition in Burundi and to encourage the adoption of best practices in health, hygiene, and nutrition. The BCC strategy was designed to be implemented by CRS and FH staff members, locally hired *Tubaramure* health promoters (THPs), and leader mothers who are program beneficiaries selected by their fellow beneficiary mothers to teach them. Groups of leader mothers are first trained by the THP during leader mother care groups in health, hygiene, and nutrition topics. The curriculum contains five BCC modules, each with between 6 and 12 lessons.

- The first module, "Care Group Orientation," contains six lessons on the program's objectives, teaching techniques, leader mother responsibilities, watching for change and monitoring groups, the value of children, and the ability to change.
- The second module, "Essential Nutrition, Hygiene, and Care Practices during Pregnancy," has nine lessons on antenatal care services and developing a birthing plan, maternal nutrition, micronutrients (iron and iodine), handwashing with soap (or ash), creation of household handwashing stations, malaria prevention, preparing for delivery and birth, immediate breastfeeding and the use of colostrum, and newborn care practices.
- The third module, "Essential Nutrition, Hygiene, and Care Practices during Infancy," contains 12 lessons on the importance of postpartum care, various aspects of exclusive breastfeeding, childhood illness danger signs, overcoming breastfeeding problems, growth monitoring and promotion, men's involvement in breastfeeding and child care, child spacing, point-of-use water treatment and safe water sources, proper disposal of feces, malaria transmission and prevention, malarial danger signs and treatment, and home care.
- The fourth module, also titled "Essential Nutrition, Hygiene, and Care Practices during Infancy," has seven lessons largely focused on nutrition, including complementary feeding for children between 6 and 8 months of age, 9 and 11 months of age, and 12 and 23 months age; preparing CSB with local foods; the importance of vitamin A and good food sources of vitamin A; worms and deworming medication; and preparing, cooking, and storing foods.
- The fifth and final module, "Management of Childhood Infections," contains six lessons related to the signs and dangers of child dehydration, dehydration prevention using oral rehydration salts (ORS), proper feeding of sick children, dysentery and persistent diarrhea, pneumonia prevention, and developing a kitchen garden.

The leader mother care groups should be held every 2 weeks. These leader mothers in turn train the beneficiary mothers in beneficiary mother care groups (which also meet every 2 weeks) on the topics that they have most recently learned from the THP. All beneficiaries (including leader mothers) are encouraged to adopt optimal health, hygiene, and nutrition practices as part of their participation in the *Tubaramure* program.

In addition to the *collines* participating in the evaluation study (see next section), the *Tubaramure* program is implemented across all *collines* in Cankuzo and Ruyigi.

2.3 *Tubaramure* Evaluation Design

For the purposes of the IFPRI-led research on *Tubaramure*, and more specifically to answer questions related to the optimal timing and duration of exposure to PM2A programs, this study compares households located in the *collines* that have been randomly assigned to one of four study groups:

- *Tubaramure* 24 (T24): the full *Tubaramure* program, including BCC, preventive health services, and food rations (individual and family) during pregnancy and lactation for the mother and up to the age of 24 months for the child
- *Tubaramure* 18 (T18): the full *Tubaramure* program, including BCC, preventive health services, and food rations (individual and family) during pregnancy and lactation for the mother and up to the age of 18 months for the child
- *Tubaramure* NFP (TNFP): the full *Tubaramure* program, including BCC, preventive health services, and food rations (individual and family) starting after birth of the child for the mother and up to the age of 24 months for the child; and the BCC and preventive health services, but no food rations, during pregnancy
- Control: the *Tubaramure* program not provided to these households, but they may still access general health services

The *Tubaramure* health strengthening activities (training for health staff and the provision of key supplies for preventive health services) were implemented in all health centers throughout Cankuzo and Ruyigi, regardless of whether they were located in one of the treatment or control *collines*.[6] These activities may thus have had a positive impact on health-related outcomes in all study arms, including the control group.

All research procedures involving human subjects were approved by IFPRI's Institutional Review Board, and the study was approved by Ministry of Health in Burundi. Verbal informed consent was obtained from the primary household respondent before the start of each interview.

2.4 Study Methods

The main outcome of the study is child nutritional status. The largest program impact on child linear growth (the main measure of nutritional status) is expected to be observed in children who have been exposed to *Tubaramure* consistently from early pregnancy to 24 months of age. The first group of

[6] Not every *colline* has a health center (of the 60 *collines* in the study sample, only 13 have a health center). As a consequence, the health strengthening activities could not be randomized.

children to meet this condition will be between 24 and 42 months of age in October to December 2014 (i.e., 4 years after the baseline survey).

The impacts on other outcomes, such as maternal knowledge regarding health and nutrition-related practices, including IYCF,[7] are preferentially measured among mothers of children 0–23 months of age[8] to reduce recall bias. The follow-up cross-sectional survey presented in this report was conducted from October to December 2012 and measures the program's impact on these outcomes among children 0–23 months of age and their mothers.

2.4.1 Sample Size

Sample size calculations were based on the estimated program impact using the differences expected to be found at follow-up among study groups. One-sided test assumptions were used when clear a priori assumptions about the direction of the effect were justified. The required sample size in each study arm is shown below (**Table 1**). The sample size was calculated with the following parameters: 0.05 probability of a type I error, power of 0.90, and an intra-cluster correlation of 0.006 for stunting and 0.009 for height-for-age z-score (HAZ).

Table 1. Required sample size to measure impact on child and household outcomes

	Study group							
	T24		T18		TNFP		Control	
Age (months)	0–23	24–41	0–23	24–41	0–23	24–41	0–23	24–41
Minimum sample size required (by age)	431	1,000	869	1,000	431	1,000	869	584
Minimum sample size required (per arm)	1,431		1,869		1,431		1,453	

2.4.2 Sampling

To systematically select the research *collines*, the 210 *collines* meeting certain population and primary health care provision criteria were ranked according to population size and divided into 5 strata (based on population size) in Cankuzo (13 or 14 *collines* per stratum) and 10 strata in Ruyigi (14 or 15 *collines* per stratum). The number of strata per province was based on the relative population size. Within each stratum, four *collines* were selected using random numbers with a fixed random number seed in Stata version 11 (StataCorp 2009). The four *collines* in each stratum were then each assigned randomly to one of the four study arms in a public event organized in the administrative center of Ruyigi on January 25, 2010. The list of selected *collines* and the assigned study arms is shown in **Appendix 2**.

At the start of both the baseline and follow-up surveys (October of 2010 and 2012, respectively), a household census was conducted in the 60 research *collines* to generate a complete list of households with

[7] Note that specific IYCF guidelines are available only for children under 2 years of age.

[8] For ease of reference, we use "0–23 months" for children 0–23.9 months of age and "24–41 months" for children 24–41.9 months of age in the remainder of the text.

children under 5 five years of age at baseline and under 3 years of age at follow-up.[9] An enumerator visited each household in the 60 research *collines* to inquire if there was a child meeting the age requirements in the household. If the household met the requirement, the following information was recorded on a pre-numbered census sheet: the *sous-colline*[10] where the household lived, the first and last names of the head of household, and the household size. The head of the household was given a pre-printed slip with a unique number corresponding to the number on the census sheet. After all households were identified and recorded, the data were entered and transferred to IFPRI.

Using the household census data, the target sample sizes for children 0–23 (baseline and follow-up) and 24–41 months of age (baseline) were calculated for each *sous-colline*. At baseline, the target sample size for each *sous-colline* was calculated by first dividing the total number of households with a child under 5 years in each *sous-colline* by the total number of households with a child under 5 years in the 15 *collines* of each study arm. The target sample size was then calculated for each age group (0–23 and 24–41 months) in each *sous-colline* by multiplying the *sous-colline*-specific proportion by the arm- and age group-specific sample size needed. The same approach was used at follow-up to calculate the number of children 0–23 months to be sampled.

A list of the potential households to be surveyed was generated for the field team in each of the 265 *sous-collines*. Each *sous-colline*-specific list showed the *sous-colline* identifiers and the total number of households to be visited with a child 0–23 months of age (baseline and follow-up) and 24–41 months of age (baseline). Each list further showed all (randomly ordered) households with a child 0–5 years (baseline) or 0–3 years of age (follow-up) living in the *sous-colline*. The supervisor of each field team was instructed to visit households in the order that they were listed until the required sample size for each age group was reached. Households were revisited when the respondent was not available. Once the quota for one age group was reached, only children from the remaining age group were sampled.

2.4.3 Selection of Index Child

At baseline, if there was only one child under 42 months of age in the household, that child was designated as the "index child." If there was more than one child under 42 months of age, the children's first names were alphabetized from A to Z, and the first child on the list was selected as the index child.[11] The same procedure was followed for children under 24 months of age at follow-up.

2.4.4 Selection of *Colline* Leaders and Health Centers

To better understand the health service and community context, data were collected from a group of leaders in each *colline* and from all public health centers located in a research *colline*. To complete the *colline*-level questionnaire, several community leaders in each *colline* were invited to meet. A trained

[9] No detailed age verification could be conducted at the time of the preliminary census. Therefore, a higher age cutoff for the census was used than in the survey. This strategy ensured that no households with children in the age group of interest would be missed. The exact age of the child was verified during the survey, and households not meeting the age requirement were excluded.

[10] Each *colline* is divided into a number of *sous-collines*. The 60 study *collines* consist of a total of 265 *sous-collines*.

[11] At baseline, it was determined that mothers with two children 0–41 months of age would be interviewed only about one child for two reasons. First, we wanted to reduce the respondent burden to the extent possible. Second, lengthy surveys can lead to poorer data quality (United Nations Department of Economic and Social Affairs Statistics Division 2005).

member of the survey team helped the group collaboratively complete the *colline*-level questionnaire. The *colline*-level interviews were conducted at both baseline and follow-up.

To describe how health care services differed at baseline and follow-up, all public health centers located within one of the 60 research *collines* were invited to be interviewed. At baseline, the study team identified 13 public health centers in the research *collines*. All centers were visited, and a member of the anthropometry team interviewed a member (or multiple members) of the staff capable of completing the survey. It was later determined that one of the putative health centers was actually a hospital, and it was therefore not revisited at follow-up. Additionally, personnel from one center did not agree to an interview at follow-up. Thus, the description of health centers is based on the 11 health centers for which we have both baseline and follow-up data.

The sample sizes for the PM2A evaluation were calculated to detect meaningful changes in child health outcomes measured at the individual level. The study is not powered to detect meaningful changes at the health center or *colline* level. Therefore, these data are mainly intended to be descriptive.

2.4.5 Data Collection

Data were collected at the *colline*, health center, and household levels, using pretested questionnaires. The list of modules included within each of the questionnaires and brief module descriptions are presented in **Tables 2**, **3**, **4**, and **5**.

Colline Questionnaire

The *colline* questionnaire collected information on the local schools and health services, food crops, fruit trees, presence of associations or cooperatives, forms of transportation, infrastructure, recent immigration/emigration patterns, weather conditions, development projects, and positive and negative events that affected the *colline* residents.

Table 2. List of modules included in *colline* questionnaire

Module	Topic	Description	Respondent
1	Schools	Identified schools attended by children living in the *colline*, including location, type, costs, and perceived quality	Group of community members
2	Health services	Identified health services used by families living in the *colline*, including location, travel time, vaccination campaigns, and epidemics	Group of community members
3	Food crops	Identified the main crops in the *colline* and timing of harvest	Group of community members
4	Fruit trees	Identified the main fruit trees in the *colline* and timing of harvest	Group of community members
5	Community organizations	Identified existing organizations, objectives, and membership	Group of community members
6	Transportation	Investigated the distance from and the availability and cost of public transportation to various public services	Group of community members
7	Infrastructure	Investigated the availability of electricity, water, and telephone services	Group of community members
8	History	Investigated migration, climatic conditions, and living conditions over the past 5 years	Group of community members
9	Development programs	Identified presence and outcomes of local development programs over the past 5 years	Group of community members
10	Events	Investigated local events (positive, negative) that affected the *colline* over the past 5 years	Group of community members

Health Center Questionnaire

The health center questionnaire focused on the services provided by each of the 11 health centers located within the 60 study *collines*. More specifically, the questionnaire gathered information on the health center's schedule, personnel, services provided, vaccinations provided, services for children and mothers provided, equipment, and medical supplies. We also indicate where the baseline and follow-up questionnaire differed.

Table 3. List of modules included in health center questionnaire

Module	Topic	Description	Respondent
1	Schedule	Identified the hours of operation for emergency services, external prevention services, prevention services for pregnant women, and prevention services for postpartum women	Health center personnel
2	Personnel	Identified the number of personnel per establishment, personnel qualifications, and the services to which they attend	Health center personnel
3	Services	Identified the health services provided by each establishment for women and children	Health center personnel
4	Vaccinations	Evaluated the availability of vaccines and vitamin A *Differences between baseline and follow-up survey modules:* • The follow-up survey also included the Pneumococcal Conjugate Vaccine (PCV) 13	Health center personnel
5	Services for children	Investigated the provision of growth monitoring services, examinations for sick children, and treatment for severely malnourished children	Health center personnel
6	Services for women	Investigated the provision of prenatal care, delivery assistance, and postnatal care	Health center personnel
7	Equipment	Evaluated the presence of equipment and material available for preventive and curative care for children and pregnant women *Differences between baseline and follow-up survey modules:* • At follow-up, types of registries (asked only as registries at baseline) were subdivided into curative consultations, growth monitoring, vaccinations, and prenatal care • Immunization cards (at baseline) were further specified as maternal health cards, child health cards, and child health passports at follow-up • Disposable needles and syringes were a single category at baseline and listed separately at follow-up • Additional items at follow-up included wheelchair, trash can, sterile dressings, sink, soap, towels/napkins, metal tongue depressor, flashlight, and a source of suction	Health center personnel
8	Medications	Evaluated the presence of medications and ruptures in their supply *Differences between baseline and follow-up survey modules:* • Co-trimoxazole and erythromycin, as well as benzylpenicillin and gentamycin, were listed together at baseline and separately at follow-up. • Additional items at follow-up included tetracycline ophthalmic ointment (for measles treatment), nystatin, praziquantel (for *schistosoma* and *taenia* treatment), diclofenac sodium, aspirin, and oral contraceptives	Health center personnel

Household and Anthropometry Questionnaire

The household questionnaire gathered information on household demographics and socioeconomic indicators, food security, participation in social assistance programs, shocks, and maternal[12] and child characteristics. The household questionnaire was based on the questions used in the Rwanda DHS (www.measuredhs.com); the Rwanda *Enquête Intégrale sur les Conditions de Vie des Ménages* (EICV 1998); and other instruments from a variety of sources, including the FANTA Household Hunger Scale (HHS), the FANTA Household Dietary Diversity Scale (HDDS) (Deitchler et al. 2010; Swindale and Bilinsky 2006), and the 20 question Self-Report Questionnaire (SRQ-20) (World Health Organization [WHO] 1994) to evaluate maternal health and stress. The WHO IYCF instrument was used to construct breastfeeding and complementary feeding indicators for children 0–23 months of age (WHO 2008; WHO 2010). All modules were adapted to the specific needs of this study. Table 4 presents the modules included in the questionnaire, the questionnaire or instrument the module was based on, and a short description of each module. We also indicate where the baseline and follow-up questionnaire differed.

Table 4. List of modules included in household questionnaire

Module	Topic	Source	Description	Respondent
1	Household roster and education	IFPRI	Collected information on the composition of the household, including designation of the head of household, a list of all household members, their age* and sex, and their relationship to the head of household, (biological) parents of the children under 5 years of age, and the highest educational level attained and activity/employment in the past month of all household members at least 3 years of age * The child's birth date was obtained from the birth certificate, the child's vaccination card, or from recall if neither document was available	Head of household (HH), spouse, or HH member over 18 years of age
2	Eligible child	IFPRI	Identified all children 0–23 months (baseline and follow-up) and 24–41 months of age (baseline only) and randomly selects the index child (baseline and follow-up)	Head of HH, spouse, or HH member over 18 years of age
3	Dwelling	EICV	Identified construction materials used for floor, walls, and roof; availability of water and electricity; fuel/energy used for cooking, lighting, etc.	Mother or HH member over 18 years of age
4	Assets	EICV, IFPRI	Identified ownership of durable household goods (in working condition), including tools for agricultural production	Mother or HH member over 18 years of age
5	Household dietary diversity	FANTA HDDS	Evaluated the diversity of the household diet in the last 24 hours	Individual in charge of food preparation, or HH member over 18 years of age
6	Participation in social programs	IFPRI	Identified all social programs that household members participate in and the benefits received from those programs *Differences between baseline and follow-up survey modules:* • A section on participation in *Tubaramure* was added at follow-up	Head of HH, spouse, or HH member over 18 years of age

[12] Data were collected on the mother or caretaker of the index child. Where the index child did not live with his/her biological mother, data were collected from the caretaker of that index child.

Module	Topic	Source	Description	Respondent
7	Shocks	IFPRI	Identified all shocks (economical, agricultural, and familial) faced by the household in the past 12 months	Head of HH, spouse, or HH member over 18 years of age
8	Food security	FANTA HHS and Household Food Insecurity Access Scale (HFIAS)	Investigated the prevalence of household hunger using the FANTA HHS *Differences between baseline and follow-up survey modules:* • At follow-up, HFIAS measured the access component of household food insecurity; the HHS was calculated from the HFIAS collected at follow-up	Individual in charge of food preparation or HH member over 18 years of age
9	Maternal knowledge	DHS, IFPRI	Evaluated knowledge on child health, health care seeking, child feeding practices, and danger signs during pregnancy *Differences between baseline and follow-up survey modules:* • Knowledge section was revised based on the content of *Tubaramure*'s BCC sessions	Mother of index child
10	Women's status	DHS, IFPRI	Evaluated women's empowerment and decision-making power	Mother of index child
11	Women's occupation and activity	IFPRI	Evaluated maternal literacy, occupation and activities	Mother of index child
12	Pre- and postnatal care	DHS	Evaluated pre- and postnatal care received	Mother of index child
13	Maternal health	IFPRI, SRQ-20	Evaluated maternal health and stress *Differences between baseline and follow-up survey modules:* • A section on the mother's dietary diversity was added at follow-up	Mother of index child
14	IYCF practices	WHO IYCF, IFPRI	Investigated breastfeeding and IYCF	Mother of index child
15	Child health	WHO IMCI, IFPRI	Evaluated preventive health care utilization, vaccination status, morbidity, and curative health care seeking	Mother of index child
16	Child development	Multiple Indicator Cluster Surveys – Round 4	Evaluated the presence of books and toys for children, child care, and child development	Mother of index child
17	Hygiene spot-check	IFPRI	Evaluated the cleanliness of the child, mother, and the interior and exterior of the house	Enumerator (direct observation)
19	Non-food expenditure	IFPRI	Identified expenditures on non-food items in the past 12 months Only used at follow-up	Head of HH, spouse, or HH member over 18 years of age
20	Non-food expenditure	IFPRI	Identified expenditures on non-food items in the past 3 months Only used at follow-up	Head of HH, spouse, or HH member over 18 years of age
21	Food expenditure	IFPRI	Identified expenditures on food items in the past 7 days Only used at follow-up	Head of HH, spouse, or HH member over 18 years of age

The anthropometry questionnaire was used to record height (or length), weigh, and Hb concentration of the index children and their mothers (**Table 5**).

Table 5. List of modules included in anthropometry questionnaire

Module	Topic	Description	Respondent
18	Child anthropometry	Child weight and length/height were measured; length or height was measured twice and a third time if the difference between the first two measurements exceeded 6 mm; weight was measured once	Index child
	Maternal anthropometry	Mother's height and weight were measured and pregnancy status recorded; maternal height was measured twice and a third time if the difference between the first two measurements exceeded 1 cm; weight was measured once	Mother and index child
	Mother and child Hb concentration	Hb concentrations of the index child and his/her mother were measured	Mother and index child

2.4.6 Field Work

Census

ISTEEBU hired and trained data collectors with previous experience conducting censuses. During this training, census workers were oriented to Cankuzo and Ruyigi provinces, organized into field teams, and instructed to visit each house within the 60 *collines* to identify all households with children under 5 (baseline) or 3 years of age (follow-up). IFPRI provided preprinted census sheets for each *sous-colline* to record the name of the head of the household and the number of household members for each household with a child meeting the age criterion.

Colline, Health Center, and Household Surveys

- **Survey firm.** The firm ISTEEBU was selected to conduct the baseline survey and the follow-up survey.
- **Survey teams.** In each survey team (22 at baseline, 8 at follow-up), there were four enumerators, two anthropometrists, and one team controller. The enumerators conducted the household survey and the anthropometrists collected and recorded the anthropometric and Hb data. The controllers were responsible for checking the quality of the data and for conducting the *colline* surveys. Two supervisors oversaw the eight controllers. The anthropometry team was responsible for conducting the health center survey. The supervisors (four at baseline, two at follow-up) reported to the coordinating team based in Bujumbura. Survey teams were assigned to specific *collines* and were monitored closely and continuously by the survey firm and IFPRI staff and consultants throughout the fieldwork. Continuous monitoring ensured that a high level of data quality was maintained and that challenges encountered during fieldwork were addressed in an efficient and timely manner.
- **Training of supervisors.** The supervisors helped pretest the French version of the questionnaire and verified and revised the Kirundi version as needed. Therefore, they were well oriented to the project prior to the training of controllers, enumerators, and anthropometrists. The supervisors attended both the 1-week training for controllers and the 4-week training for enumerators. They were trained to manage a large team of enumerators, organize the questionnaires, and monitor and report progress and problems to ISTEEBU.
- **Training of controllers.** Twenty-two controllers completed 1 week of specialized training using lectures, role-plays, discussions of potential responses, and discussions of how to code responses. Following this training course, all controllers participated in the enumerator training. Controllers assisted the enumerator training process by leading small group role-plays.

- **Training of enumerators.** A variety of methods were used to train the enumerators in the use of the survey questionnaire over the course of 4 weeks. These included lectures, role-plays, discussions of potential responses, and discussions of how to code responses. The controllers and enumerators were continuously evaluated during the training. Each week, a short written test was used to evaluate their understanding of the questionnaire. The final selection of controllers and enumerators was based on a short field-based evaluation at the end of the training.
- **Standardization of the anthropometry team.** The fieldworkers who conducted the anthropometric measurements were carefully trained for 2 weeks in the use of the equipment and the recording of anthropometric data. Their training included lectures, videos, and equipment demonstrations and was followed by practical exercises in the measurement of height and weight of infants, children, and mothers. The fieldworkers were then standardized (Cogill 2003) in the measurement of height and weight. First, the trainer and all fieldworkers measured the height and weight of five children 0–41 (baseline) or 0–23 (follow-up) months of age and their mothers with each fieldworker measuring each child twice. A spreadsheet was created to compute the precision and accuracy of all trainees. A second round of standardization was organized for those needing more practice. Based on the results of the standardization, the most accomplished anthropometrists were selected.
- **Training on the collection of capillary blood.** The members of the anthropometry team were trained to collect capillary blood from mothers and children using a sterile spring-loaded lancet. This method standardized the depth of the puncture and minimized the need to puncture more than once. Enumerators were trained on the proper procedure for taking the sample and measuring the Hb concentration using portable Hemocue machines. Training covered proper techniques for sterile sample collection, including how to use a sterile lancet and making sure a new set of sterile gloves was used for each sample. The enumerator used an alcohol swab to clean the area to be pricked both before and after the procedure and also applied a small bandage when finished. Each enumerator was supplied with a small plastic container to collect the waste from the procedure. The enumerators were also trained in the correct techniques to collect the blood sample in the micro-cuvette to minimize the need to repeat the procedure.
- **Administration of the health center questionnaire.** The anthropometrists administered the health center questionnaire to at least one health professional per health center facility.
- **Administration of the *colline* questionnaire.** Each *colline* questionnaire was conducted using a group interview methodology. The questionnaire was completed by at least two controllers who ensured that a consensus was reached on all responses.
- **Administration of the household and anthropometry questionnaires.** Information sessions were organized in each *colline* before the survey work began. The information sessions explained the purpose of the survey to the community members; provided reasons for measuring children's and mothers' height, weight, and Hb; and requested the cooperation of community members. The enumerators reviewed each questionnaire before leaving the household where it was administered. At the end of each day, the controllers reviewed each questionnaire for accuracy, logical patterns, and legible writing. Enumerators and anthropometrists were asked to return to households when missing data or other problems were observed.
- **Handling of questionnaires.** Upon completion of each household interview, the enumerators submitted their questionnaires to their respective controller. The controller recorded the number of questionnaires completed per age group and *sous-colline* to monitor whether the quotas were reached. Once all the questionnaires in the *sous-collines* in a single *colline* were completed, the controller gave the completed package to her or his respective supervisor. The supervisors then checked the questionnaires that they received from controllers for quality. The supervisors recorded

and reported the total number of questionnaires completed by *colline* and age group to the coordinators. Questionnaires were grouped according to *colline*, commune, and province, and then transported back to ISTEEBU in Bujumbura for data entry.

2.4.7 Data Entry and Cleaning

Data Entry

ISTEEBU developed a data entry program using CSPro and provided 10 data entry clerks with an interface resembling the paper questionnaire. Two different data entry clerks entered each of the health center, *colline*, household, and anthropometry questionnaires into the CSPro program. At the end of the data entry period, lists of inconsistencies between the first and second entry of the same questionnaire were generated and mistakes corrected.

Data Cleaning

The data were transferred to Stata (StataCorp Stata Statistical Software: Release 13) and standard data cleaning checks were performed. All observations with problems were listed and verified using the paper questionnaires.

Variable Creation

From the data collected, new variables were also created to summarize health center, household, and individual characteristics more concisely. Many of these variables were based on norms and standards provided by international organizations and the government of Burundi. The variables created in this study are summarized below.

Health center variables. We compared the information obtained from the health center questionnaires to the national guidelines for health centers (Ministère de la Santé Publique et de la Lutte contre le SIDA 2012a and 2012b). These guidelines describe the qualifications of essential personnel; the recommended characteristics of the facilities; and the essential equipment, medications, and supplies that each health center should stock.

- **Personnel.** An A2-level nurse has completed 4 years of nurse training after 10th grade. An A3-level nurse has completed 2 years of training after 10th grade. A nutritionist is an A3-level nurse with specialized nutrition training. An A2-level laboratory technician has completed 4 years of specialized training after 10th grade. (Training requirements for other personnel are not described.)
- **Total number of services for sick children.** This value sums the availability of eight essential services for sick children: measure body temperature, measure weight, chart weight, offer antibiotics, offer acetaminophen for fever, provide health education, evaluate immunization status, and evaluate vitamin A status (range of the created variable 0 to 8, with 0 indicating that none of the 8 services was available and 8 indicating that all of them were available).
- **Total number of services for children with diarrhea.** This value sums the availability of four essential services for children with diarrhea: ORS, oral serum, zinc supplementation, and onsite intravenous solution in the case of severe diarrhea (range 0 to 4).
- **Total number of prenatal care components.** This value sums the availability of eight essential service components offered during prenatal visits: measure weight, measure abdomen, measure blood pressure, offer tetanus vaccine, distribute iron folate or iron and folate, offer education sessions, administer albendazole or mebendazole for deworming, and administer niclosamide for *taenia* deworming (range 0 to 8).

- **Rupture in the supply chain.** A health center experienced a rupture in the availability of essential vaccines or medications if personnel reported that they experienced a shortage of any duration during the past 6 months.

Household characteristics. The following household variables were created.

- **Dependency ratio.** The ratio of economically dependent household members (aged under 15 or over 60 years) to economically active ones (between 15 and 60 years of age).
- **Cleanliness of mothers, children, and interior and exterior of dwellings.** These variables were constructed from spot-check observations conducted at the time of the interviews. Fieldworkers[13] noted the cleanliness of hands, face, hair, and clothes of mothers and children, and noted the presence of garbage, feces, dust, or dirty clothes around dwellings. The variables describe the proportion of people or premises scoring "clean" on all counts.[14]
- **Assets.** Household asset ownership was summarized in six different count variables: the total number of household goods, the total number of agricultural tools and equipment, the total number of small animals, the total number of medium-sized animals, the total number of large animals, and the total number of motorbikes or bikes.
- **Household hunger scale.** Constructed according to FANTA guidelines (Ballard et al. 2011; Deitchler et al. 2010), with scores assigned to a set of three questions about meals and hunger ("no food to eat of any kind in your household"; "go to sleep at night hungry"; "go a whole day and night without eating"), based on the frequency of occurrence (never = 0; rarely or sometimes = 1; often = 2) over the past 4 weeks. A total score (range of 0 to 6) was calculated and the following classifications made: 0–1, "little or no hunger"; 2–3, "moderate hunger"; 4–6, "severe hunger."
- **Household dietary diversity score.** Constructed according to FANTA guidelines (Swindale and Bilinsky 2006), the food preparer in each household was asked if the household had consumed food from 12 predefined food groups[15] in the past 24 hours, providing a simple score ranging from 0 to 12.
- **Household food insecurity access scale (HFIAS).** Constructed according to FANTA guidelines (Coates et al. 2007), with scores assigned to a set of nine questions ("worry household would not have enough food"; "unable to eat preferred foods"; "eat limited variety"; "eat unwanted foods"; "eat smaller meals"; "eat fewer meals"; "no food to eat in your household"; "go to sleep at night hungry"; "go a whole day and night without eating"), based on the frequency of occurrence (never = 0; rarely = 1; sometimes = 2; often = 3) over the past 4 weeks. The sum of these responses is the household score (range of 0 to 27). A complex tabulation plan classifies households as food secure, mildly food insecure, moderately food insecure, or severely food insecure.

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[13] Fieldworkers were extensively trained on this instrument but no formal standardization was conducted.

[14] For mothers, fieldworkers were asked to assess the cleanliness of hands, hair, clothes, and face. Possible answers were "clean," "dirty," or "dusty." The same variables and answers were used for the children. Mothers and children were classified as "clean" if the fieldworker recorded "clean" for all items. The outside of the house was evaluated with respect to the need for cleaning and for the presence of human feces, animal feces, and garbage. The inside of the house was evaluated with respect to the need to be swept, the presence of animal feces, the water stored at home being covered, and the presence of dirty clothes. The outside of the house was classified as "clean" if the fieldworkers recorded "no" for all items. The same approach was followed for the inside of the house.

[15] The 12 HDDS food groups are: cereals and grains; roots and tubers; legumes, nuts, and pulses; milk and dairy products; eggs; meat and poultry; fish and seafood; fruits; vegetables; oils and fats; sugar, honey, sweets, and snacks; and miscellaneous.

Maternal characteristics. The following variables were created to describe maternal characteristics.

- **Maternal literacy.** Literacy was evaluated by asking mothers to read one of two sentences. The women were classified as literate if they could read the entire sentence, partially literate if they could read a little, and illiterate if they could not read the sentence at all.
- **Maternal knowledge.** Mothers were asked a series of questions to assess their knowledge of danger signs during pregnancy and for childhood illnesses, how to care for a sick child or a child recovering from an illness, appropriate IYCF practices regarding breastfeeding and complementary feeding, and optimal hygiene practices for the prevention of diarrhea. Separate variables were created to describe the proportion of mothers responding correctly to each knowledge question within these four categories.
- **Maternal dietary diversity.** Maternal diet was calculated based on international standards and using a nine-food-group dietary diversity score (Kennedy et al. 2011). Based on the mother's 24-hour dietary recall, all foods and liquids consumed were classified into one of nine food groups (starchy staples, dark green leafy vegetables, vitamin A-rich fruits and vegetables, other fruits and vegetables, organ meat, flesh foods, eggs, legumes/nuts/seeds, and milk and milk products). Data to create these variables were collected only at follow-up. Dietary diversity included CSB consumption (contributed to the starchy staples and legumes/nuts/seeds groups).

Preventive health care practices. Preventive health care practices reported by mothers were evaluated in relation to national recommendations, detailed in the text below.

- **Prenatal care.** The total number of prenatal care visits was compared to the national recommendation of four visits per pregnancy (Ministère de la Santé Publique 2010). Receipt of specific prenatal care services were examined in relation to the national protocol to be followed by medical staff (Ministère de la Santé Publique/WHO 2007; Ministère de la Santé Publique 2010). Burundi's Ministry of Health recommends that all pregnant women take daily iron-folate prenatal vitamins with the dosage of 60 mg iron and 400 µg folic acid.
- **Postnatal care.** Mothers are advised to see a medical professional with their newborns within 4 days of the birth of their child. In settings where the prevalence of anemia among pregnant women is greater than 40%, all women should continue receiving the same iron-folate dosage listed above for 3 months postpartum (Ministère de la Santé Publique 2010).
- **Preventive child care practices.** The standards for growth monitoring, vitamin and mineral supplement use, and vaccination coverage were based on national (or, if not available, international) standards. Information about child weight, supplements, and vaccinations were provided by the child's vaccination card. Information about these preventive care visits was recorded directly from the vaccination card if the primary caregiver presented the card at the time of the interview. If the primary caregiver could not present the vaccination card, she was asked to recall the preventive care that the child had received. The following variables were created.

- **Growth monitoring visits.** According to UNICEF (2002) guidelines, children aged 0–23 months should be taken to a clinic monthly for growth monitoring and children aged 24–42 months should be taken to a clinic every 3 months for growth monitoring.[16]
- **Vitamin and mineral supplements.** According to national recommendations,[17] children should begin receiving vitamin A supplements at 9 months and continue receiving vitamin A every 6 months until 5 years of age.
- **Vaccination.** The national vaccination schedule (**Table 6**) was used to calculate the percentage of children fully immunized according to their age. To construct this variable, a 1-month grace period was added to each recommended vaccination age. Children older than this calculated age (and younger than the next recommended age plus a 1-month grace period) with all recommended vaccinations for that age were considered fully immunized. Only information recorded from vaccination cards was used to construct these variables, and vaccination information collected from maternal reports was considered missing.

Table 6. National vaccination schedule for Burundi

Age	Vaccination
Birth (0 weeks)	BCG,* Polio-0
6 weeks	DPT1-HiB1-HepB1,** Polio-1
10 weeks	DPT2-HiB2-HepB2, Polio-2
14 weeks	DPT3-HiB3-HepB3, Polio-3
9 months	Measles

* Bacille Calmette-Guérin (tuberculosis vaccine)

** Vaccines for diphtheria, pertussis, and tetanus (DPT), *haemophilus* influenza B (HiB), and hepatitis B

IYCF practices. The WHO IYCF practices instrument (WHO 2010) was used to construct the WHO-recommended indicators for breastfeeding and complementary feeding of children 0–23 months of age.

- **Child ever breastfed.** Proportion of children 0–23 months of age ever given breast milk (based on historical recall of the primary caregiver).[18]
- **Early initiation of breastfeeding (within 1 hour of birth):** Proportion of children 0–23 months of age that were put to the breast within 1 hour of birth (the indicator relies on the historical recall of the primary caregiver).[19]

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[16] The *Tubaramure* process evaluation conducted in 2011 found that activities were limited to growth monitoring (not growth monitoring and promotion). In most cases, only the weight was recorded, and even when moderately malnourished children were identified, they were not counseled or referred for treatment (Olney et al. 2013).

[17] WHO's current recommendation is to start supplementation at 6 months. The Burundi recommendation is thus different from WHO's.

[18] The actual WHO indicator is the proportion of mothers who have given birth in the last 2 years who ever gave breast milk to the last child born.

[19] The actual WHO indicator is the proportion of mothers who have given birth in the last 2 years who were put to the breast within 1 hour of birth.

- **Exclusive breastfeeding of children among children under 6 months of age.** Proportion of children 0–5 months of age who were given nothing but breast milk (no other liquids or solids) in the past 24 hours. The indicator does not report the percentage of children under the age of 6 months who were exclusively breastfed; it only defines the percentage of children under 6 months of age who were exclusively breastfed in the last 24 hours. The indicator likely overestimates the children who were exclusively breastfed.
- **Predominant breastfeeding among children under 6 months of age.** Proportion of children 0–5 months of age given breast milk and specific other liquids,[20] but no solids, in the past 24 hours. Those children classified as exclusively breastfed by the previous indicator are also classified as predominantly breastfed.
- **Continued breastfeeding at 1 year of age (12–15 months).** Proportion of children 12–15 months of age who were breastfed in the past 24 hours.
- **Continued breastfeeding to 2 years of age (20–23 months).** Proportion of children 20–23 months of age who were breastfed in the past 24 hours.
- **Age-appropriate breastfeeding.** Proportion of children from birth to 6 months of age given only breast milk in the past 24 hours, and proportion of children 6–23 months of age who received breast milk, as well as solid, semi-solid, or soft foods, during the past 24 hours.
- **Bottle feeding.** Proportion of children 0–23 months of age fed using a bottle in the past 24 hours.
- **Milk feeding frequency for non-breastfed children (≥ 2 milk feedings/day).** Proportion of non-breastfed children 6–23 months of age given at least two milk feeds in the past 24 hours.
- **Introduction of solid, semi-solid, or soft foods (6–8 months).** Proportion of children 6–8 months of age given solid, semi-solid, or soft foods in the past 24 hours.
- **Consumption of iron-rich or iron-fortified foods.** Proportion of children 6–23 months of age who were fed iron-rich food (or food that was fortified with iron and made especially for children) in the previous 24 hours. In Burundi, food fortified with iron can include CSB and other cereal-based fortified food products.
- **Minimum dietary diversity (≥ 4 food groups).** Proportion of children 6–23 months of age who consumed food from at least four food groups (out of seven nutrient-rich food groups[21]) in the past 24 hours. Dietary diversity included CSB consumption (contributed to the grains, roots, and tubers and legumes, nuts, and pulses groups).
- **Minimum meal frequency.** Proportion of children, both breastfed and non-breastfed, given a minimum number of meals in the past 24 hours. For breastfed children aged 6–8 months, the minimum number of meals was set at two, for breastfed children aged 9–23 months, the minimum number of meals was set at three, and for non-breastfed children the number of meals was set at four.

[20] This includes certain liquids, such as water or water-based drinks, fruit juice, ritual fluids and ORS, drops, or syrups (vitamins, minerals, medicines), but excludes non-human milk and food-based fluids.

[21] The seven food groups were: grains, roots, and tubers; legumes, nuts, and pulses; milk and dairy products; eggs; flesh foods; vitamin A-rich foods; and other fruits and vegetables.

- **Minimum acceptable diet.** Proportion of children 6–23 months of age who received the minimum acceptable diet. This indicator was calculated for both breastfed and non-breastfed children. For breastfed children, it was defined as meeting both the minimum dietary diversity and the minimum meal frequency requirements; for non-breastfed children, it was defined as having received at least two milk feedings, having consumed food from at least four food groups (out of six nutrient-rich food groups[22]), and the minimum meal frequency in the past 24 hours.

Anthropometric measures. Mothers' anthropometric data were used to construct the following indicators.

- **Maternal body mass index (BMI).** Calculated for non-pregnant women as weight (kg)/height^2 (m). Three BMI categories were created: underweight (BMI < 18.5), normal weight (BMI ≥18.5 and < 25), and overweight/obese (BMI ≥ 25) (WHO Expert Committee on Physical Status 1995).
- **Maternal and child Hb and anemia.** Hb concentrations vary with altitude. The Hb concentration values were thus adjusted according to international guidelines (International Nutritional Anemia Consultative Group 2002; Stevens et al. 2013; WHO 2011a) and using the following formula:

$$measured\ Hb\ + \frac{(0.32 * (\text{altitude} * 0.0033)) - (0.22 * (\text{altitude} * 0.0033)^2)}{10}\ \text{if altitude} > 1{,}000\ \text{m}$$

Anemia was defined for non-pregnant women as having an Hb concentration less than 12 g/dL and for pregnant women and children as having an Hb concentration less than 11 g/dL. Severe anemia was defined for non-pregnant women as having an Hb concentration less than 8 g/dL and for pregnant women and children as having an Hb concentration less than 7 g/dL (WHO 2011a; WHO 2011b).

Child development indicators. Children's motor and language development were assessed by parental report using a predefined list of motor and language milestones ranked in order to reflect a generally accepted sequence of achievement. The motor milestone scale consists of 30 motor milestones ranging from the first milestone of a child being able to hold his or her head straight to the 30th milestone of skipping using alternate legs. The language milestone scale consists of 21 milestones and ranges from the first—making sounds while playing alone—to the 21st—talking about things that took place in the past. The scales are adapted from ones previously used in Tanzania (Olney et al. 2009; Stoltzfus et al. 2001). Items are ordered to reflect the sequence of motor and language development and are derived from the Griffiths and McCarthy scales (Griffiths 1970; McCarthy 1972).

Milestone achievement was assessed for children older than 3.9 months. Parents were asked if their child had achieved each of the motor and language milestones. Once three milestones were recorded as not being achieved, the interviewer stopped asking about the remaining milestones. In addition to the parental report, children were asked to demonstrate key motor milestones, such as crawling, walking with and without assistance, and standing alone (WHO Multicentre Growth Reference Study Group 2006).

The impact of the *Tubaramure* program on child development (motor and language development) was examined by looking at differences between groups from baseline to follow-up on the highest language and motor milestones attained. Highest attained milestone was defined as the highest milestone reported

[22] The six food groups were: grains, roots, and tubers; legumes, nuts, and pulses; eggs; flesh foods; vitamin A-rich foods; and other fruits and vegetables.

by the parent. Impacts were assessed for the full sample of children between 4 and 23 months of age and then within two age ranges (4–11 months and 12–23 months).

2.4.8 Data Analysis and Impact Estimation

Descriptive analyses were conducted for the *colline*, health center, and household data. In the case of the *colline* and household data, the analyses serve to provide information on the context of the study area and to ascertain differences among the four study arms at baseline (balance among study arms). Double difference estimates were used to determine the impact of *Tubaramure* on key outcomes at the household level. *Tubaramure* did not specifically aim to improve *colline* and health center characteristics; therefore, no impact of the program is assessed. In the case of the health centers, which all benefited from *Tubaramure* services (no control group), only baseline and follow-up indicators were compared. All data were analyzed using Stata Release 13.

Colline: Descriptive Analyses

Colline-level results are presented as percentages or means and standard deviations (SD) as appropriate. Results are presented by study group, and final sample sizes are reported in the results tables in Section 3. To compare results among the four study arms at baseline and follow-up, we used the following linear model for continuous and dichotomous variables:

$$y_i = \beta_0 + \beta_1 S_{i1} + \beta_2 S_{i2} + \beta_3 S_{i3} + \varepsilon_i$$

where y_i is the variable or indicator of interest for observation *i* and three dummy variables (S_i) indicate assignment to one of the three treatment arms. A joint F-test was used to determine whether there were statistically significant differences among the study arms. For categorical variables, the Pearson chi-square statistic was converted into an F statistic.

Results were considered significantly different among the four study arms if $p < 0.05$. Variables that have significant differences between the study arms are marked with an asterisk (*) in the results tables. For categorical variables, the asterisk is placed in the row of the last category.

Health Center: Descriptive Analyses

Results for the 11 health centers are presented as counts or as means and SDs as appropriate. *Tubaramure* health service interventions were implemented in all health centers regardless of whether they were located in a control or treatment arm; therefore, results are not differentiated by study arm. Because of the small sample size, statistical tests were not used to compare differences between baseline and follow-up.

Household: Descriptive Analyses and Impact Estimation

Descriptive analyses. Similar to the *colline* analyses, the variables or indicators of interest are presented as percentages or means and SDs as appropriate in the household, maternal, and child results sections. All tables present the variables and indicators by study group, and, when appropriate, results are presented according to child age. The final sample sizes for each table are reported in the tables.

To compare results among the four study arms at baseline and follow-up, we used the following linear model for continuous and dichotomous variables:

$$y_i = \beta_0 + \beta_1 S_{i1} + \beta_2 S_{i2} + \beta_3 S_{i3} + \varepsilon_i$$

where y_i is the variable or indicator of interest for observation *i.* We included three dummy variables ($S_{i.}$) for the study arms. For data collected at the household level, the standard errors of the parameters were adjusted for the (potential) lack of independence between observations in the same *colline* by using a clustered sandwich estimator. A joint F-test was used to determine whether there were statistically significant differences among the study arms.

For categorical variables, the Pearson chi-square statistic was adjusted for the lack of independence between clusters with the second-order correction of Rao and Scott (1984) and converted into an F statistic.

Results were considered significantly different among the study arms if $p < 0.05$. Variables that have significant differences among the study arms are marked with an asterisk (*) in the results tables. For categorical variables, the asterisk is placed in the row of the last category.

Impact estimation. Program impact was estimated using the following double difference *colline*-fixed effect model. This model compares the change in the outcomes from baseline to follow-up among study groups.

$$y_{t=0,1} = \beta_0 + \beta_1 T_j + \beta_2 S_i + \beta_3 T_j S_i + \beta_4 C + \beta_i X_{i,t=0} + \varepsilon$$

where T_j is time (baseline or follow-up), S_i is the assigned study arm, and C is a vector representing *colline*-level fixed effect. The coefficient β_3 represents the estimated treatment effect of the program. By using *colline*-level fixed effects, the model controls for unobserved *colline* characteristics that did not change between baseline and follow-up. To reduce residual noise and maximize power, baseline covariates ($X_{i,t=0}$) were added to the model for some outcomes. The covariates included in the model are indicated in the footnotes of each table.

As indicated above, data on some outcomes are only available at follow-up (e.g., maternal dietary diversity). The simple difference model was used to estimate impact on these outcomes.

$$y_{t=1} = \beta_0 + \beta_1 S_i + \beta_i X_{i,t=0} + \varepsilon$$

The coefficient β_1 represents the estimated treatment effect of the program in this model.

The standard errors (SE) of all estimated parameters were adjusted for the (potential) lack of independence between observations in the same *colline* by using a clustered sandwich estimator. We conducted intent-to-treat analyses. One-sided tests were used when there was a clear a priori hypothesis of the direction of the effect and are indicated in the footnotes of each table.

Impact estimation on health care utilization. With respect to the program's effect on health care utilization, it is important to point out that the program could have improved health care utilization through two distinct pathways: increasing the supply of services in the health centers and increasing the demand for these services. We refer to the first type of impact as the "supply" effect and the second type of impact as the "demand" effect.

- **Supply effect.** The program's health strengthening activities could have improved utilization through an increase in the supply of services. As previously mentioned, the health strengthening activities were implemented in all health centers throughout Cankuzo and Ruyigi, regardless of whether they were located in one of the treatment or control *collines*. If these activities had a positive impact on health care utilization, changes over time would be observed in all study arms (i.e., including the control group). Unfortunately, the evaluation design does not allow us to attribute these changes to the *Tubaramure* program, as they might be due to other programs active in the area. However, because the *Tubaramure* program is the only program regularly active in all health centers in both provinces, it is likely that changes are due to the program's health strengthening activities.

- **Demand effect.** The second pathway of impact is through the program's BCC activities, which could have increased the demand for services. Impacts through this pathway would be observed in the *Tubaramure* treatment groups only and can thus be attributed to the program.

3. Results: *Colline* and Health Center Characteristics

3.1 *Colline* Characteristics

3.1.1 Utilities, Infrastructure, and Access to Services

Very few *collines* had access to any form of electricity (**Table 7**). One *colline* had access to electricity via the water company at both baseline and follow-up. Between the two waves of data collection, privately generated electricity (i.e., generators, solar panels, batteries) became more common in all four of the study arms. Access to landlines and mobile phones also improved between baseline and follow-up. More *collines* reported that the closest landline was within 5 km. In all but one *colline,* residents could access a mobile phone network from within the *colline*, but only 43.3% of the *collines* had a place to charge a mobile phone at follow-up, although that is considerably more than the 23.3% that could do so at baseline. During both the dry and rainy seasons, public spigots were the most common source of drinking water. Importantly, the four study arms did not differ in their access to utilities.

Table 7. Utilities and infrastructure in each *colline*[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	**60**	**15**	**15**	**15**	**15**	**60**	**15**	**15**	**15**	**15**
Electricity source										
None	96.7	93.3	93.3	100.0	100.0	76.7	80.0	73.3	80.0	73.3
Water company	1.7	0.0	6.7	0.0	0.0	1.7	0.0	6.7	0.0	0.0
Individual generator	0.0	0.0	0.0	0.0	0.0	1.7	6.7	0.0	0.0	0.0
Solar panels	1.7	6.7	0.0	0.0	0.0	18.3	13.3	20.0	13.3	26.7
Batteries	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	6.7	0.0
Distance to a landline telephone										
0 km (in *colline*)	10.0	26.7	6.7	6.7	0.0	30.9	28.6	28.6	33.3	33.3
1–5 km	11.7	6.7	6.7	20.0	13.3	16.4	28.6	14.3	13.3	8.3
6–10 km	5.0	6.7	13.3	0.0	0.0	1.8	0.0	0.0	6.7	0.0
> 10 km	73.3	60.0	73.3	73.3	86.7	50.9	42.9	57.1	46.7	58.3
Distance to a mobile phone network										
0 km (in *colline*)	88.3	93.3	93.3	86.7	80.0	98.3	100.0	100.0	100.0	93.3
1–5 km	6.7	6.7	0.0	13.3	6.7	1.7	0.0	0.0	0.0	6.7
6–10 km	3.3	0.0	6.7	0.0	6.7	0.0	0.0	0.0	0.0	0.0
> 10 km	1.7	0.0	0.0	0.0	6.7	0.0	0.0	0.0	0.0	0.0
Possible to charge mobile in the *colline*										
	23.3	20.0	40.0	6.7	26.7	43.3	40.0	46.7	33.3	53.3
Most common drinking water source: dry season										
Tap water	8.3	13.3	6.7	0.0	13.3	26.7	13.3	40.0	26.7	26.7
Public spigot	68.3	73.3	60.0	86.7	53.3	60.0	80.0	40.0	66.7	53.3
Uncovered well	3.3	6.7	0.0	0.0	6.7	1.7	0.0	0.0	6.7	0.0
River or lake	20.0	6.7	33.3	13.3	26.7	11.7	6.7	20.0	0.0	20.0
Most common drinking water source: wet season										
Tap water	15.0	20.0	20.0	0.0	20.0	36.7	26.7	53.3	33.3	33.3
Public spigot	66.7	66.7	66.7	86.7	46.7	53.3	73.3	33.3	60.0	46.7
Uncovered well	3.3	6.7	0.0	0.0	6.7	1.7	0.0	0.0	6.7	0.0
Rainwater	6.7	0.0	6.7	0.0	20.0	1.7	0.0	6.7	0.0	0.0
River or lake	8.3	6.7	6.7	13.3	6.7	6.7	0.0	6.7	0.0	20.0

[a] Values are %.

[b] Sample size at baseline did not vary.

[c] Sample size at follow-up ranged from N = 55 to 60 in the full sample; N = 14 to 15 in the T24 arm; N = 14 to 15 in the T18 arm; and N = 12 to 15 in the control arm.

* There were no statistical differences among study arms, $p < 0.05$.

At baseline, *colline* leaders reported that 61.6% of the *collin*es were within 5 km of a regular (i.e., more than weekly) market, 67.3% of a weekly market, 94.9% of a church, 60.0% of a bus stop, and 48.0% of an administrative office (**Table 8**). Access was similar at follow-up, with 61.8% of the c*ollines* within 5 km of a regular market, 56.0% of a weekly market, 100.0% of a church, 59.0% of a bus stop, and 59.6% of an administrative office. The proximity of these services did not differ across the four study arms.

Table 8. Distance to services[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	59	15	15	14	15	58	15	15	15	15
Distance to closest regular market										
0 km (in *colline*)	13.5	21.4	9.1	14.3	7.7	18.2	15.4	20.0	21.4	15.4
1–5 km	48.1	42.9	45.5	42.9	61.5	43.6	53.8	26.7	57.1	38.5
6–10 km	13.5	21.4	9.1	14.3	7.7	20.0	7.7	26.7	14.3	30.8
> 10 km	25.0	14.3	36.4	28.6	23.1	18.2	23.1	26.7	7.1	15.4
Distance to closest weekly market										
0 km (in *colline*)	34.5	20.0	42.9	14.3	60.0	22.0	36.4	14.3	15.4	25.0
1–5 km	32.8	33.3	28.6	50.0	20.0	34.0	45.5	42.9	38.5	8.3
6–10 km	8.6	13.3	0.0	14.3	6.7	36.0	9.1	35.7	30.8	66.7
> 10 km	24.1	33.3	28.6	21.4	13.3	8.0	9.1	7.1	15.4	0.0
Distance to closest church										
0 km (in *colline*)	86.4	93.3	93.3	71.4	86.7	84.5	86.7	92.9	66.7	92.9
1–5 km	8.5	0.0	6.7	14.3	13.3	15.5	13.3	7.1	33.3	7.1
6–10 km	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
> 10 km	5.1	6.7	0.0	14.3	0.0	0.0	0.0	0.0	0.0	0.0
Distance to closest bus stop										
0 km (in *colline*)	23.6	28.6	35.7	7.1	23.1	17.9	21.4	40.0	7.1	0.0
1–5 km	36.4	35.7	21.4	64.3	23.1	41.1	35.7	26.7	64.3	38.5
6–10 km	14.5	14.3	14.3	7.1	23.1	19.6	21.4	13.3	14.3	30.8
> 10 km	25.5	21.4	28.6	21.4	30.8	21.4	21.4	20.0	14.3	30.8
Distance to closest administrative center										
0 km (in *colline*)	16.0	28.6	21.4	7.7	0.0	14.0	21.4	21.4	7.1	6.7
1–5 km	42.0	21.4	42.9	53.8	55.6	45.6	42.9	42.9	64.3	33.3
6–10 km	18.0	28.6	14.3	15.4	11.1	28.1	28.6	28.6	14.3	40.0
> 10 km	24.0	21.4	21.4	23.1	33.3	12.3	7.1	7.1	14.3	20.0

[a] Values are %.
[b] Sample size at baseline ranged from N = 51 to 58 in the full sample; N = 12 to 14 in the T24 arm; N = 13 to 15 in the T18 arm; and N = 14 in the TNFP arm; and N = 12 to 15 in the control arm.
[c] Sample size at follow-up ranged from N = 50–58 in the full sample; N = 11 to 15 in the T24 arm; N = 14 to 15 in the T18 arm; N = 13 to 15 in the TNFP arm; and N = 13 to 15 in the control arm.
***** There were no statistical differences among study arms, $p < 0.05$.

3.1.2 Transportation

The primary form of transportation within the *collines* and to neighboring *collines* was walking, at both baseline and follow-up (**Table 9**). To travel to other cities and provinces, walking and bicycling were still the most common means. At baseline and follow-up, approximately 70% of *colline* respondents could access a road within the *colline,* and respondents in all but one remaining *colline* could access a road within 5 km. The vast majority of the closest roads were dirt or laterite. At follow-up, these closest roads were, on average, usable only a little more than half the year, which is 1–2 months less than reported at baseline. For more than half of the *collines*, the reported distance to the closest asphalt road in both surveys was more than 10 km. None of these transportation characteristics differed significantly among the four study arms.

Table 9. Local forms of transportation[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**60**	**15**	**15**	**15**	**15**	**60**	**15**	**15**	**15**	**15**
Primary form of transportation within the *colline*										
Bus or minibus	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0	7.1
Motorcycle	0.0	0.0	0.0	0.0	0.0	1.8	0.0	6.7	0.0	0.0
Bicycle	3.3	13.3	0.0	0.0	0.0	5.3	6.7	13.3	0.0	0.0
Walk	96.7	86.7	100.0	100.0	100.0	91.2	93.3	80.0	100.0	92.9
Primary form of transportation to nearby *collines*										
Bus or minibus	0.0	0.0	0.0	0.0	0.0	3.5	6.7	6.7	0.0	0.0
Private car	0.0	0.0	0.0	0.0	0.0	1.8	6.7	0.0	0.0	0.0
Motorcycle	0.0	0.0	0.0	0.0	0.0	1.8	0.0	6.7	0.0	0.0
Bicycle	3.3	6.7	0.0	6.7	0.0	15.8	6.7	13.3	28.6	15.4
Walk	96.7	93.3	100.0	93.3	100.0	77.2	80.0	73.3	71.4	84.6
Primary form of transportation to other cities and provinces										
Bus or minibus	15.0	33.3	6.7	6.7	13.3	15.8	13.3	13.3	15.4	21.4
Taxi	1.7	0.0	0.0	0.0	6.7	1.8	0.0	6.7	0.0	0.0
Private car	10.0	0.0	13.3	6.7	20.0	22.8	26.7	33.3	23.1	7.1
Motorcycle	5.0	0.0	6.7	13.3	0.0	3.5	0.0	0.0	0.0	14.3
Bicycle	21.7	20.0	20.0	26.7	20.0	15.8	20.0	13.3	15.4	14.3
Walk	46.7	46.7	53.3	46.7	40.0	40.4	40.0	33.3	46.2	42.9
Distance to closest road										
0 km (in *colline*)	70.0	73.3	73.3	60.0	73.3	69.5	60.0	66.7	60.0	92.9
1–5 km	28.3	26.7	26.7	33.3	26.7	27.1	33.3	26.7	40.0	7.1
6–10 km	0.0	0.0	0.0	0.0	0.0	1.7	6.7	0.0	0.0	0.0
> 10 km	1.7	0.0	0.0	6.7	0.0	1.7	0.0	6.7	0.0	0.0
Material of closest road										
Asphalt	5.0	0.0	13.3	6.7	0.0	6.8	0.0	13.3	7.1	6.7
Soil	86.7	93.3	80.0	86.7	86.7	83.1	100.0	66.7	78.6	86.7
Laterite	8.3	6.7	6.7	6.7	13.3	10.2	0.0	20.0	14.3	6.7
Number of months vehicles could be used on closest road last year										
Simple car	8.3 ± 4.7	9.7 ± 3.5	9.5 ± 4.3	7.0 ± 5.2	7.1 ± 5.2	6.6 ± 5.3	6.5 ± 5.0	8.7 ± 4.5	6.9 ± 5.6	4.4 ± 5.7
Four-wheel drive vehicle	9.9 ± 3.8	10.9 ± 2.3	10.7 ± 3.0	8.7 ± 5.0	9.2 ± 4.5	7.6 ± 4.8	5.5 ± 4.5	10.1 ± 4.0	7.8 ± 5.0	7.0 ± 5.0
Bus	6.8 ± 5.3	6.8 ± 5.2	8.5 ± 4.9	6.4 ± 5.7	5.5 ± 5.6	5.9 ± 5.6	4.2 ± 5.1	7.7 ± 5.4	6.1 ± 5.6	5.5 ± 6.3
Truck	8.0 ± 4.7	8.7 ± 4.8	8.5 ± 4.3	6.8 ± 5.1	8.1 ± 4.8	5.9 ± 5.3	4.2 ± 5.2	8.1 ± 5.1	5.9 ± 5.6	5.4 ± 5.3
Distance to closest asphalt road										
0 km (in *colline*)	6.9	6.7	13.3	0.0	6.7	14.5	13.3	26.7	0.0	16.7
1–5 km	20.7	26.7	20.0	7.7	26.7	20.0	13.3	6.7	30.8	33.3
6–10 km	3.4	0.0	0.0	15.4	0.0	9.1	6.7	6.7	23.1	0.0
> 10 km	69.0	66.7	66.7	76.9	66.7	56.4	66.7	60.0	46.2	50.0

[a] Values are mean ± SD or %.
[b] Sample size at baseline ranged from N = 58 to 60 in the full sample; and N = 13 to 15 in the TNFP arm.
[c] Sample size at follow-up ranged from N = 54 to 60 in the full sample; N = 14 to 15 in the T24 arm; N = 14 to 15 in the T18 arm; N = 12 to 15 in the TNFP arm; and N = 11 to 15 in the control arm.
* There were no statistical differences among study arms, $p < 0.05$

3.1.3 Access to Schools and Health Services

At both baseline and follow-up, at least three-quarters of the *collines* had at least one primary school (**Table 10**). In contrast, secondary schools were available in only one-third of the *collines*. For *collines* without a secondary school, the closest one was approximately 5 km away. At follow-up, the average annual cost to attend primary school was 22,596 Burundian Francs (BIF) (US$14.91[23]), considerably lower than at baseline (35,577 BIF [US$23.48]). Similarly, the cost of attending secondary school dropped from an average of 132,780 BIF (US$87.61) to 84,600 BIF (US$55.84). Most primary and secondary schools had access to latrines (90.1% and 82.2% at baseline, and 95.3% and 93.7% at follow-up, respectively). Fewer schools had access to drinking water—25.3% of primary and 50.0% of secondary schools at baseline and 40.4% of primary and 57.5% of secondary schools at follow-up. School characteristics were similar across the four study arms, with the exception that at follow-up access to drinking water at secondary schools differed among the four study arms.

[23] The exchange rate from www.oanda.com on November 1, 2012 was used (US$1 = 1,515 BIF) here and in the remainder of the document.

Table 10. School characteristics[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**60**	**15**	**15**	**15**	**15**	**60**	**15**	**15**	**15**	**15**
% of *collines* with … primary schools										
None	25.0	33.3	6.7	40.0	20.0	18.3	26.7	13.3	33.3	0.0
One	51.7	60.0	46.7	33.3	66.7	60.0	73.3	46.7	40.0	80.0
Two or more	23.3	6.7	46.7	26.7	13.3	21.7	0.0	40.0	26.7	20.0
Primary school characteristics										
Cost (in 1,000 BIF)	35.6 ± 15.1	31.5 ± 12.7	37.8 ± 17.6	35.9 ± 16.1	37.2 ± 14.5	22.2 ± 18.2	26.4 ± 24.6	21.0 ± 15.0	23.4 ± 18.4	18.1 ± 13.1
Has a latrine	90.1	94.4	93.3	83.3	88.9	95.5	98.9	96.4	93.3	93.3
Has drinking water	25.3	36.0	17.9	22.0	25.0	40.8	58.3	23.3	50.0	31.3
% of *collines* with … secondary schools										
None	65.0	53.3	60.0	66.7	80.0	66.7	66.7	60.0	66.7	73.3
One	28.3	40.0	26.7	26.7	20.0	33.3	33.3	40.0	33.3	26.7
Two or more	6.7	6.7	13.3	6.7	0.0	0.0	0.0	0.0	0.0	0.0
Distance to secondary school if none in the *colline* (km)										
	4.8 ± 2.3	3.9 ± 1.9	5.4 ± 2.5	5.4 ± 3.0	4.4 ± 1.7	4.6 ± 3.1	3.8 ± 1.5	4.0 ± 2.6	4.8 ± 3.7	5.5 ± 3.8
Secondary school characteristics										
Cost (in 1,000 BIF)	132.8 ± 107.3	107.0 ± 59.8	141.6 ± 75.6	111.1 ± 56.6	168.9 ± 178.4	84.6 ± 69.8	84.5 ± 48.6	89.1 ± 60.8	85.2 ± 88.7	80.0 ± 80.3
Has a latrine	82.2	86.1	73.8	92.4	76.7	93.7	93.9	95.8	94.4	90.7
Has drinking water	50.0	66.7	50.9	49.1	34.4	57.5*	82.7	41.7	60.6	44.1

[a] Values are mean ± SD or %.
[b] Sample size at baseline ranged from N = 37 to 60 in the full sample; N = 8 to 15 in the T24 arm; N = 8 to 15 in the T18 arm; N = 9 to 15 in the TNFP arm; and N = 12 to 15 in the control arm.
[c] Sample size at follow-up ranged from N = 39 to 60 in the full sample; N = 10 to 15 in the T24 arm; N = 8 to 15 in the T18 arm; N = 10 to 15 in the TNFP arm; and N = 11 to 15 in the control arm.
* Study arms differ, $p < 0.05$.

At follow-up, only a quarter of the *collines* had any health center (public or private), which was only slightly higher than at baseline, when one-fifth of the *colline*s had a health center. Only a few (two at baseline and one at follow-up) *collines* had a hospital within their borders (**Table 11**). At both baseline and follow-up, around three-quarters of the *collines* were located within 5 km of a health center. Access to a hospital was much more limited but improved over time: The percentage of *collines* located more than 10 km from a hospital dropped from 61.5% to 40.0%. Most health services were reached on foot at both baseline and follow-up.

Community members were also served by health services that were not specific to a health center or hospital (**Table 12**). At both surveys, most *collines* reported having at least one midwife and around half of the *collines* were served by three or more midwives. Community health workers served all but one *colline* at baseline and follow-up. Access to health services was similar across the four study arms with the exception of the types of transportation used to reach hospitals.

Table 11. Access to health services by *colline* residents[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	**60**	**15**	**15**	**15**	**15**	**60**	**15**	**15**	**15**	**15**
Facilities available in the *colline*										
Public health center	16.7	13.3	20.0	20.0	13.3	21.7	13.3	26.7	20.0	26.7
Any health center (public or private)	20.0	13.3	26.7	26.7	13.3	26.7	13.3	40.0	26.7	26.7
Hospital (all public)	3.3	0.0	0.0	6.7	6.7	1.7	0.0	0.0	6.7	0.0
Distance to closest health center										
0 km (in *colline)*	20.7	14.3	26.7	28.6	13.3	26.7	13.3	40.0	26.7	26.7
1–5 km	48.3	64.3	40.0	35.7	53.3	50.0	66.7	40.0	53.3	40.0
6–10 km	20.7	14.3	20.0	28.6	20.0	16.7	6.7	13.3	13.3	33.3
> 10 km	10.3	7.1	13.3	7.1	13.3	6.7	13.3	6.7	6.7	0.0
Distance to closest hospital										
0 km (in *colline*)	3.8	0.0	0.0	7.7	9.1	2.9	0.0	0.0	10.0	0.0
1–5 km	19.2	30.8	6.7	23.1	18.2	34.3	30.0	28.6	40.0	37.5
6–10 km	15.4	7.7	13.3	15.4	27.3	22.9	20.0	0.0	30.0	37.5
> 10 km	61.5	61.5	80.0	53.8	45.5	40.0	50.0	71.4	20.0	25.0
Transportation to health centers										
Walking	97.5	92.9	100.0	100.0	97.8	88.5	92.1	74.6	92.3	94.4
Bicycle	2.5	7.1	0.0	0.0	2.2	8.7	5.1	16.8	7.7	5.6
Transportation to hospitals										
Walking	69.3	67.9	64.4	61.1	86.4	73.0*	80.0	30.0	87.5	87.5
Bicycle	16.9	26.7	11.1	16.7	13.6	14.4*	15.0	46.4	0.0	0.0
Private car	12.8	1.5	24.4	22.2	0.0	7.3	5.0	17.9	0.0	8.3
% of *collines* with … midwives										
None	10.3	6.7	0.0	14.3	20.0	15.8	0.0	26.7	14.3	23.1
One	15.5	20.0	14.3	14.3	13.3	10.5	13.3	6.7	7.1	15.4
Two	24.1	13.3	28.6	28.6	26.7	21.1	26.7	26.7	14.3	15.4
Three or more	50.0	60.0	57.1	42.9	40.0	52.6	60.0	40.0	64.3	46.2
% of *collines* with … community health workers										
None	1.7	0.0	0.0	6.7	0.0	1.7	0.0	6.7	0.0	0.0
One	1.7	0.0	0.0	6.7	0.0	1.7	0.0	6.7	0.0	0.0
Two	70.0	60.0	60.0	73.3	86.7	70.7	78.6	53.3	80.0	71.4
Three or more	26.7	40.0	40.0	13.3	13.3	25.9	21.4	33.3	20.0	28.6

[a] Values are %.
[b] Sample size at baseline ranged from N = 51 to 60 in the full sample; N = 13 to 15 in the T24 arm; N = 12 to 15 in the T18 arm; N = 12 to 15 in the TNFP arm; and N = 8 to 15 in the control arm.
[c] Sample size at follow-up ranged from N = 33 to 60 in the full sample; N = 10 to 15 in the T24 arm; N = 7 to 15 in the T18 arm; N = 8 to 15 in the TNFP arm; and N = 8 to 15 in the control arm.
* Study arms differ, $p < 0.05$.

3.1.4 Agriculture

The types of crops, vegetables, and fruit trees grown in the study *collines* did not change fundamentally from baseline to follow-up. Among the 10 most common crops, manioc, maize, sweet potatoes, and beans were grown in nearly all *collines* (**Table 12).** Groundnuts and sorghum were grown in roughly 75% to 85% of the *collines*, and rice, pigeon peas, finger millet, and potatoes in fewer than 65% of the *collines.* Six key vegetables were also common. Amaranth and cabbage were grown in approximately half of the *collines*. Eggplant, peas, and tomatoes were grown in approximately a third of the *collines*, and around one-fifth of the *collines* grew squash. The types of crops were relatively similar across study arms, with the exception of bean production, which differed among the four study arms at follow-up.

Table 12. Most common crops and vegetables[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	60	15	15	15	15	60	15	15	15	15
Most common crops										
Manioc	100.0	100.0	100.0	100.0	100.0	96.7	93.3	93.3	100.0	100.0
Maize	95.0	93.3	86.7	100.0	100.0	96.7	100.0	100.0	93.3	93.3
Sweet potato	91.7	93.3	86.7	93.3	93.3	95.0	100.0	93.3	93.3	93.3
Beans	90.0	86.7	93.3	86.7	93.3	95.0*	100.0	80.0	100.0	100.0
Peanuts	83.3	73.3	80.0	86.7	93.3	73.3	53.3	93.3	66.7	80.0
Sorghum	78.3	60.0	80.0	93.3	80.0	75.0	66.7	93.3	66.7	73.3
Rice	61.7	53.3	60.0	53.3	80.0	63.3	46.7	73.3	53.3	80.0
Pigeon peas	58.3	60.0	60.0	60.0	53.3	50.0	26.7	53.3	73.3	46.7
Eleusine	56.7	60.0	60.0	53.3	53.3	40.0	40.0	46.7	33.3	40.0
Potatoes	55.0	73.3	53.3	53.3	40.0	58.3	73.3	73.3	53.3	33.3
Most common vegetables										
Amaranth (*lengalenga*)	53.3	60.0	33.3	60.0	60.0	53.3	66.7	53.3	53.3	40.0
Cabbage	45.0	66.7	33.3	53.3	26.7	51.7	73.3	53.3	53.3	26.7
Eggplant	38.3	46.7	33.3	40.0	33.3	43.3	53.3	46.7	40.0	33.3
Peas	38.3	60.0	33.3	26.7	33.3	26.7	33.3	33.3	40.0	0.0
Tomato	35.0	46.7	20.0	40.0	33.3	36.7	40.0	53.3	33.3	20.0
Squash	21.7	26.7	6.7	20.0	33.3	20.0	20.0	20.0	33.3	6.7

[a] Values are %.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.
* Study arms differ, $p < 0.05$.

Avocados, mangos, bananas, and pineapples were grown in over half of the *collines* (**Table 13**). Japanese plums, oranges, papayas, guavas, lemons, and coffee were also grown in a number of *collines*. The presence of fruit trees did not differ significantly among the four study arms.

Table 13. Ten most common fruit trees[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	60	15	15	15	15	60	15	15	15	15
Avocado	98.3	100.0	93.3	100.0	100.0	95.0	93.3	100.0	100.0	86.7
Mango	85.0	80.0	80.0	86.7	93.3	78.3	86.7	66.7	73.3	86.7
Banana	80.0	86.7	73.3	73.3	86.7	63.3	66.7	80.0	53.3	53.3
Pineapple	75.0	80.0	73.3	73.3	73.3	65.0	60.0	66.7	73.3	60.0
Orange	33.3	40.0	40.0	26.7	26.7	35.0	26.7	46.7	33.3	33.3
Guava	28.3	33.3	33.3	26.7	20.0	18.3	20.0	40.0	6.7	6.7
Japanese plum	26.7	33.3	13.3	33.3	26.7	25.0	33.3	33.3	13.3	20.0
Lemon	25.0	33.3	20.0	13.3	33.3	16.7	20.0	20.0	6.7	20.0
Coffee	25.0	33.3	20.0	13.3	33.3	16.7	20.0	20.0	6.7	20.0
Papaya	25.0	26.7	20.0	20.0	33.3	13.3	13.3	20.0	13.3	6.7

[a] Values are %.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.
* There were no statistical differences among study arms, $p < 0.05$.

3.1.5 Social Groups, Development Programs, and Recent Events

The leaders from all *collines* reported the presence of community associations, cooperatives, or other groups. At both surveys approximately 40% had between one and three organizations, approximately 40% between four and seven, and around 20% more than eight groups (**Table 14**). Almost all of these groups (around 98%) counted women among their members. Most groups had multiple activities, and the most common activities were agriculture (around 84% in both surveys) and animal husbandry (49.9% at baseline and 41.0% at follow-up); less commonly, groups engaged in credit, trade, beekeeping, crafts, and health. These characteristics did not differ among the four study arms.

Table 14. Presence of associations, cooperatives, and other groups[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	60	15	15	15	15	60	15	15	15	15
Community groups										
1–3 groups	35.0	40.0	40.0	33.3	26.7	41.7	46.7	26.7	46.7	46.7
4–7 groups	38.3	26.7	40.0	46.7	40.0	41.7	40.0	40.0	46.7	40.0
8+ groups	26.7	33.3	20.0	20.0	33.3	16.7	13.3	33.3	6.7	13.3
Have women members										
	97.6	97.8	96.9	96.4	99.0	97.8	100.0	99.2	96.4	95.8
Primary activities										
Agriculture	83.3	93.6	82.1	84.5	73.2	84.7	71.2	88.3	88.7	90.3
Animal husbandry	49.9	52.3	47.9	56.8	43.0	41.0	38.9	50.9	38.1	36.4
Money lending	9.4	10.3	4.5	5.0	17.3	12.1	20.5	7.5	2.4	17.8
Trade	5.9	10.1	3.2	7.1	3.0	4.7	0.0	1.5	10.7	6.3
Bee keeping	6.2	4.2	6.0	1.8	12.4	1.4	1.4	2.4	0.0	1.7
Crafts	2.6	0.8	1.4	3.4	4.8	1.5	0.0	0.0	4.8	1.1
Health promotion	2.5	3.3	1.4	3.6	1.7	3.4	4.2	7.1	2.4	0.0

[a] Values are %.
[b] Sample size at baseline ranged from N = 58 to 60 in the full sample; N = 14 to 15 in the T18 arm; and N = 14 to 15 in the TNFP arm.
[c] Sample size at follow-up ranged from N = 57 to 60 in the full sample; N = 14 to 15 in the T24 arm; N = 14 to 15 in the TNFP arm.
* There were no statistical differences among study arms, $p < 0.05$.

At follow-up, the majority of respondents in the *collines* (61.7%) reported that more new residents had arrived than residents had left over the past 5 years; this is somewhat less than the 76.7% who reported that there were more arrivals at baseline (**Table 15**). This may reflect the gradual decline of returning refugees. Regarding climate conditions during the past 12 months, respondents from more than half the *collines* (51.6% at baseline and 71.7% at follow-up) reported more rainfall than usual, and around half (both surveys) reported that it was hotter during the previous 12 months. At follow-up, notably fewer respondents from the *collines* reported that there was less rain or that is was cooler compared to baseline. The percentage reporting that living conditions had become worse during the past 3 years dropped from 83.3% to 71.2%.

Table 15. Recent historical events experienced by the *collines*[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	60	15	15	15	15	60	15	15	15	15
Migration during past 5 years										
More arrivals	76.7	73.3	73.3	80.0	80.0	61.7	60.0	66.7	53.3	66.7
More departures	11.7	13.3	13.3	6.7	13.3	15.0	13.3	13.3	20.0	13.3
Similar arrivals and departures	3.3	6.7	6.7	0.0	0.0	8.3	0.0	13.3	6.7	13.3
Neither arrivals nor departures	8.3	6.7	6.7	13.3	6.7	15.0	26.7	6.7	20.0	6.7
Rainfall during last 12 months										
A lot more than usual	48.3	73.3	46.7	46.7	26.7	46.7	40.0	46.7	66.7	33.3
A little more than usual	3.3	0.0	6.7	0.0	6.7	25.0	46.7	13.3	13.3	26.7
Same as usual	5.0	0.0	6.7	13.3	0.0	10.0	6.7	13.3	6.7	13.3
A little less than usual	15.0	13.3	0.0	13.3	33.3	13.3	6.7	20.0	13.3	13.3
A lot less than usual	28.3	13.3	40.0	26.7	33.3	5.0	0.0	6.7	0.0	13.3
Temperature during last 12 months										
A lot hotter than usual	48.3	73.3	46.7	46.7	26.7	30.0	20.0	40.0	26.7	33.3
A little hotter than usual	3.3	0.0	6.7	0.0	6.7	23.3	20.0	20.0	20.0	33.3
Same as usual	5.0	0.0	6.7	13.3	0.0	31.7	26.7	33.3	46.7	20.0
A little cooler than usual	15.0	13.3	0.0	13.3	33.3	10.0	20.0	0.0	6.7	13.3
A lot cooler than usual	28.3	13.3	40.0	26.7	33.3	5.0	13.3	6.7	0.0	0.0
Living conditions during last 5 years										
Improved	13.3	13.3	13.3	26.7	0.0	20.3	26.7	7.1	13.3	33.3
Worse	83.3	80.0	86.7	73.3	93.3	71.2	66.7	78.6	73.3	66.7
Similar	3.3	6.7	0.0	0.0	6.7	8.5	6.7	14.3	13.3	0.0

[a] Values are %.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up ranged from N = 59 to 60 in the full sample; and N = 14 to 15 in the T18 arm.
* There were no statistical differences among study arms, $p < 0.05$.

The five most common negative events experienced by *collines* in the 2 years preceding each survey were drought, flood, hail, fire, and famine (**Table 16**). There was a slight increase in the occurrence of droughts, floods, and hail storms between the baseline and follow-up surveys, and the experience of negative events did not differ significantly among the four study arms.

Table 16. Most common negative events experienced by *collines* during preceding 2 years[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Ctrl		T24	T18	TNFP	Ctrl
N	**60**	**15**	**15**	**15**	**15**	**60**	**15**	**15**	**15**	**15**
Drought	33.3	46.7	26.7	40.0	20.0	43.3	33.3	46.7	46.7	46.7
Flood	30.0	26.7	33.3	46.7	13.3	43.3	40.0	53.3	53.3	26.7
Hail	21.7	40.0	26.7	13.3	6.7	36.7	20.0	26.7	60.0	40.0
Fire	21.7	33.3	20.0	6.7	26.7	6.7	13.3	0.0	13.3	0.0
Famine	15.0	20.0	13.3	6.7	20.0	15.0	20.0	0.0	20.0	20.0

[a] Values are %.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.
* There were no statistical differences among study arms, $p < 0.05$

3.2 Health Center Characteristics

3.2.1 Infrastructure, Personnel, and Services

Changes from baseline to follow-up in the basic infrastructure of the 11 health centers—which provide services related to health promotion, preventative services, and lower-level curative care—were mostly small. Ten centers had a covered waiting area at baseline. By follow-up, covered waiting areas were available at all centers (**Table 17**). The number of health centers able to keep patients overnight for observation declined from eight to seven between baseline and follow-up, and the number with consultation rooms specifically for children under 5 years increased from one to six. At follow-up, only two health centers had no electricity; the nine with electricity relied on solar panels alone (five), an electric grid (one), or both (three).

The availability of trained staff improved from baseline to follow-up. At baseline, only five health centers staffed an A2-level nurse (4 years of nurse training after 10th grade), but nine had reached this standard at follow-up. All health centers staffed an A3-level nurse (2 years of nurse training after 10th grade) at both surveys; however, none of these A3-level nurses were specifically trained in nutrition. Along with the increased number of health centers with an A2-level nurse, there were fewer health centers with nurse's aides (nine at baseline, six at follow-up). At baseline, no A2-level laboratory technicians (4 years of training after 10th grade) were available, but seven centers employed assistant laboratory technicians. A2 laboratory technicians were available at two health centers at follow-up, and five employed assistant lab technicians. The availability of health promoters and community health workers was similar at both baseline and follow-up. There were eight health centers with health promoters. Moreover, eight centers worked with at least one community health worker, and the majority (six at baseline and seven at follow-up) had at least six community health workers.

Table 17. Health center infrastructure and personnel[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Infrastructure		
Covered waiting area	10	11
Will keep patients overnight for observations	8	7
Consultation room for children under 5 years	1	6
Electricity[d]		
Only solar panels		5
Only electricity from a grid		1
Both solar panels and grid		3
No source of power		2
Health care personnel (≥ 1)		
A2-level nurse (4 years of nurse training)	5	9
A3-level nurse (2 years of nurse training)	11	11
Nutritionist (specialized A3 nurse)	0	0
Nurse's aide	9	6
A2 laboratory technician (4 years of training)	0	2
Assistant laboratory technician	7	5
Health promoter	8	8
Number of community health workers		
0	3	3
1–5	2	1
6 or more	6	7

[a] Values are counts (i.e., number of health centers). No statistical tests were conducted.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.
[d] Information not collected at baseline.

All 11 health centers offered growth monitoring, immunizations, and vitamin A supplementation at both baseline and follow-up (**Table 18**). These three services were all offered on average 2 days a week. Routine deworming[24] was available at 10 health centers at baseline and 8 at follow-up, on average about twice a week. All 11 health centers offered curative services to sick children 7 days a week at both surveys.

Pregnant women could access prenatal services at all 11 health centers approximately 3 days a week. At both baseline and follow-up, nine health centers provided delivery assistance in the health center around 7 days a week. The number of health centers offering postpartum care increased from 10 to 11, but there was a decline in the average frequency of these services (from 5.4 to 3.6 days a week).

[24] Deworming is recommended starting at 1 year of age.

Table 18. Availability and frequency of services[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Preventative services for children under 5 years		
Growth monitoring available	11	11
Growth monitoring (days per week)	2.4 ± 2.4	1.9 ± 2.2
Immunizations available	11	11
Immunizations (days per week)	2.3 ± 0.8	2.2 ± 0.6
Vitamin A supplementation available	11	11
Vitamin A supplementation (days per week)	2.2 ± 0.8	2.0 ± 0.7
Routine deworming available	10	8
Routine deworming (days per week)	1.5 ± 1.1	1.8 ± 2.3
Curative services for children under 5 years		
Treatment of sick children	11	11
Treatment of sick children (days per week)	6.5 ± 1.8	7.0 ± 0.0
Maternal health services		
Prenatal care available	11	11
Prenatal care (days per week)	3.1 ± 1.3	3.0 ± 1.7
Delivery assistance available	9	9
Delivery assistance (days per week)	6.3 ± 2.0	7.0 ± 0.0
Postpartum care available	10	11
Postpartum care (days per week)	5.4 ± 2.3	3.6 ± 2.8

[a] Values are counts (i.e. number of health centers) or mean ± SD. No statistical tests were conducted.
[b] Sample size at baseline ranged from N = 9 to 11; mean days per week is calculated only for health centers providing that service.
[c] Sample size at follow-up ranged from N = 8 to 11; mean days per week is calculated only for health centers providing that service.

3.2.2 Components of Services

For sick children who visit a health center (**Table 19**), the number of centers offering each specific service improved considerably between baseline and follow-up for all of the services that were not already universally available at baseline. The mean number of services offered improved from 4.7 at baseline to 7.4 at follow-up. The availability of four specific services for children with diarrhea also improved, but the availability of zinc supplementation remained low. The mean number of services for children with diarrhea increased from 1.1 at baseline to 2.8 at follow-up.

Table 19. Components of services for sick children[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Services available to sick children		
Measure body temperature	11	11
Measure weight	10	11
Offer antibiotics	9	11
Offer acetaminophen or wet sponge for fever	6	11
Chart weight	5	8
Provide health education	4	11
Evaluate immunization status	4	10
Evaluate vitamin A status	3	8
Total number of services for sick children (range 0 to 8)	4.7	7.4
Services available to children with diarrhea		
ORS	8	10
Oral serum	2	10
Onsite intravenous solution if severe	1	8
Zinc supplementation	1	3
Total number of services for diarrhea (range 0 to 4)	1.1	2.8

[a] Values are counts (i.e., number of health centers) or mean. No statistical tests were conducted.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.

For women seeking prenatal care there were small improvements in the availability of services (**Table 20**). The mean number of the eight services offered improved from 5.9 at baseline to 6.7 at follow-up. This improvement is primarily attributable to the delivery of health education sessions and the administration of deworming treatment.

Table 20. Components of services for pregnant and lactating women[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Prenatal care components		
Measure weight	11	11
Measure abdomen	10	11
Measure blood pressure	10	10
Offer tetanus vaccine	10	11
Distribute iron folate or iron and folate	10	9
Offer education sessions	8	11
Administer albendazole or mebendazole for deworming	6	11
Administer niclosamide for *taenia* deworming	0	0
Total number of prenatal care components (range 0 to 8)	5.9	6.7

[a] Values are counts (i.e. number of health centers) or mean. No statistical tests were conducted.
[b] Sample size at baseline was N = 11 for prenatal care components.
[c] Sample size at follow-up was N = 11 for prenatal care components.

With regard to laboratory services (**Table 21**), the number of health centers offering HIV tests to pregnant mothers increased from 5 to 11 between baseline and follow-up. However, fewer offered urine and anemia tests, such that at follow-up these tests were each offered at only one clinic. The number of health centers offering blood tests and stool tests to children under 5 increased between baseline and follow-up—from 8 to 10 for blood tests and 4 to 9 for stool tests. Only one health center offered urine tests at each survey wave.

Table 21. Laboratory services[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Prenatal laboratory services		
HIV test	5	11
Urine test	4	1
Anemia test	2	1
Laboratory services for children under 5 years		
Blood test	8	10
Stool test	4	9
Urine test	1	1

[a] Values are counts (i.e., number of health centers). No statistical tests were conducted.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.

The number of health centers offering blood tests to confirm malaria increased from 7 to 11 between baseline and follow-up (**Table 22**). Bednets were distributed to children under 9 months at all health centers at both survey waves. Bednets were also provided to women at prenatal visits at 10 health centers at baseline and all 11 at follow-up. Bednets were not distributed to children 9 months and older at either baseline or follow-up.

Table 22. Malaria-related services[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Blood test for malaria	7	11
Bednet distribution		
Infants (under 9 months)	11	11
Pregnant women at prenatal visits	10	11
Children 9 months and older	0	0

[a] Values are counts (i.e. number of health centers). No statistical tests were conducted.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.

3.2.3 Availability of Equipment, Medication, and Supplies

At baseline, all 11 health centers reported maintaining registries and having immunization cards available (**Table 23**). When further specified at follow-up, all 11 health centers maintained registries of curative consultations, growth monitoring, vaccinations, and prenatal care. All 11 had blank maternal health cards available, and 10 had child health cards and child health passports available.

A salter scale and measuring board were available at all health centers at both surveys. Infant scales and mid-upper arm circumference (MUAC) tapes were available at 9 centers at baseline and all 11 at follow-up. A weight-for-height growth chart was present at only one health center at baseline and four at follow-up.

To maintain vaccinations at safe temperatures, at baseline, all health centers had icepacks, thermos carriers, and temperature charts for the refrigerator, but two lacked a working refrigerator. At follow-up, all had working refrigerators, and only one health center lacked a thermos carrier.

For maternal health care a *Pinard* obstetric stethoscope, adult blood pressure cuff, and measuring tape were universally available. At baseline, an adult scale was present at 10 health centers; by follow-up, all centers had an adult scale. At both waves, vaginal speculums were available in 10 of the 11 centers. The number of health centers with a delivery table decreased from nine to eight between the two survey waves, but the number with a gynecological table increased from 7 to 10. The number of health centers with pelvimeters and gynecological lamps (seven and two, respectively) did not change between the two waves. A hemoglobin tester, which was previously not available at any clinic, was present in three clinics at follow-up. Also at follow-up, three health centers had wheelchairs.

The health centers were well equipped with sterile equipment and materials. Gloves, disinfectant, sutures, disposable needles and syringes, and containers for disposing of medical waste were universally available at both survey waves. Trash cans, sterile dressings, a sink, and soap (assessed only at follow-up) were available in all health centers. The availability of wash drums and wash bottles improved between the surveys waves (from 10 to 11 and from 7 to 8 health centers, respectively). Cold decontamination containers were available at five health centers at baseline and four at follow-up. At follow-up, only five health centers had sterile towels/napkins available.

For the diagnostic and curative care of children, stethoscopes and thermometers were universally available at both survey waves. Also at both waves, an otoscope was available at 10 health centers. The number with an examination table increased from 10 to 11. A child blood pressure cuff was available at only three health centers at baseline and two at follow-up, and though a laryngeal mirror was available at one health center at baseline, it was no longer present at follow-up. At follow-up, eight health centers had a metal tongue depressor, eight had a flashlight, and six had a suction bulb or electric suction device.

Table 23. Availability of equipment[a]

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Waiting room and office furniture		
Bench	11	11
Stool	3	10
Chairs		11
Office table		10
Record keeping		
Registries[d]	11	
Registry of curative consultation[e]		11
Registry of growth monitoring[e]		11
Registry of vaccinations[e]		11
Registry of prenatal care[e]		11
Immunization card[d]	11	
Maternal health card[e]		11
Child health card[e]		10
Child health passport[e]		10

	Baseline[b]	Follow-up[c]
N	**11**	**11**
Growth monitoring equipment		
Salter scale	11	11
Measuring board	11	11
Infant scale	9	11
MUAC tape	9	11
Weight-for-height growth chart	1	4
Immunization equipment		
Ice pack	11	11
Thermos carrier	11	10
Temperature chart for refrigerator	11	11
Refrigerator	9	11
Maternal health equipment		
Pinard obstetric stethoscope	11	11
Adult blood pressure cuff	11	11
Measuring tape	11	11
Adult scale	10	11
Vaginal speculum	10	10
Delivery table	9	8
Gynecological table	7	10
Pelvimeter	7	7
Gynecological lamp	2	2
Hemoglobin tester	0	3
Wheelchair[e]		3
Sterile equipment and materials		
Sterile gloves	11	11
Disinfectant	11	11
Suture	11	11
Disposable needles and syringes[d]	11	
Disposable needles[e]		11
Disposable syringes[e]		11
Container for needles and medical waste	11	11
Wash drums	10	11
Wash bottles	7	8
Cold decontamination container	5	4
Trash can[e]		11
Sterile dressings[e]		11
Sink[e]		11
Soap[e]		11
Sterile towels/napkins[e]		5
Diagnostic and curative care equipment for children		
Stethoscope	11	11
Thermometer	11	11
Otoscope	10	10
Examination table	10	11
Child blood pressure cuff	3	2
Laryngeal mirror	1	0
Metal tongue depressor[e]		8
Flashlight[e]		8
Suction bulb or electric suction device[e]		6

[a] Values are counts (i.e., number of health centers). No statistical tests were conducted.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up did not vary.
[d] Information not collected at follow-up.
[e] Information not collected at baseline.

All health centers generally stocked key vaccines at both baseline and follow-up, but, at follow-up, more health centers had experienced stock ruptures[25,26] (**Table 24**). At baseline, there had only been a rupture in the polio supply chain (to two health centers), but, at follow-up, at least one health center reported ruptures in the supply chain of every key vaccine except tetanus.

Between baseline and follow-up, the number of health centers that stocked both 100,000 IU and 200,000 IU doses of vitamin A declined from 11 to 9. Moreover, there were more stock ruptures in both the 100,000 IU and 200,000 IU supplies. Between the two surveys, there was a decline (from 10 to 7) in the number of clinics that stocked folic acid. The number that stocked iron folate (10 health centers) remained the same; the number stocking iron sulfate pills slightly increased (from eight to nine), and fewer (from eight to five) stocked iron syrup. Generally, one or two health centers had experienced supply ruptures in their iron and folic acid supply (defined as the availability of iron folate pills or the availability of both an iron supplement and folic acid), with the exceptions of iron sulfate pills, which had not suffered a rupture at follow-up, and iron syrup, which experienced shortages in all health centers that stocked it during the 6 months preceding both surveys. ORS were stocked in all 11 health centers; one center had experienced a supply rupture at baseline and two had experienced one at follow-up. Plumpy'Nut was stocked by 10 health centers at baseline, but only 8 at follow-up, and supply ruptures were common (at six and five health centers, respectively). Only half of health centers stocked zinc at each survey.

For the treatment of infections, amoxicillin was stocked at all health centers, but, at follow-up, two had experienced recent supply ruptures. Chloramphenicol was stocked in 11 and 10 health centers at baseline and follow-up, respectively, with three and two supply ruptures, respectively. At baseline, all health centers stocked co-trimoxazole or erythromycin (often substitutable for one another) without a recent rupture. At follow-up, co-trimoxazole was stocked universally, but one health center lacked erythromycin, and four had experienced ruptures. At baseline, benzylpenicillin and gentamycin (often used in combination) were available at nine health centers (three supply ruptures). At follow-up, nine health centers stocked benzylpenicillin (two ruptures) and seven health centers stocked gentamycin (three ruptures). Moreover, at follow-up, all health centers generally stocked tetracycline ophthalmic ointment (for measles treatment) and nystatin for fungal infections, though four centers experienced tetracycline ruptures.

For the treatment of malaria, amodiaquine and artesunate were stocked in all health centers, but at both surveys three health centers had experienced recent supply ruptures. Quinine was universally available at all centers at both time points. For deworming, either albendazole or mebendazole was available at all health centers, and one had experienced a shortage proceeding each survey. For the treatment of *schistosoma* and *taenia*, only two health centers stocked praziquantel at follow-up, and one of them had experienced a shortage.

With regard to analgesics, acetaminophen was available at all health centers, with only one experiencing a recent shortage at baseline. Diazepam was stocked at 10 health centers at both surveys, and two health centers had experienced recent shortages at follow-up. Also at follow-up, diclofenac sodium was available at only seven health centers (four experiencing shortages), and aspirin was stocked at six health centers (two shortages). Oral contraceptives were stocked by 10 of the 11 health centers at follow-up, and none had experienced stock ruptures.

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[25] A stock rupture is defined as not having the product available sometime during the preceding 6 months.

[26] Note that *Tubaramure*, under FFP guidelines, was not able to purchase immunizations or medications.

Table 24. Availability of medications and supplies[a]

	Baseline[b]	Follow-up[c]
N	11	11
Immunizations and distilled water		
Polio generally stocked	11	11
Polio stock rupture	2	3
DPT-HiB-HepB generally stocked	11	11
DPT-HiB-HepB stock rupture	0	2
BCG generally stocked	11	11
BCG stock rupture	0	1
Measles generally stocked	11	11
Measles stock rupture	0	1
Tetanus generally stocked	11	11
Tetanus stock rupture	0	0
PCV 13 generally stocked[d]		11
PCV 13 stock rupture[d]		2
Distilled water generally stocked	11	11
Distilled water stock rupture	0	1
Micronutrients and supplements		
100,000 IU vitamin A generally stocked	11	9
100,000 IU vitamin A stock rupture	4	6
200,000 IU vitamin A generally stocked	11	9
200,000 IU vitamin A stock rupture	2	5
Folic acid pills generally stocked	10	7
Folic acid pills stock rupture	2	2
Iron folate pills generally stocked	10	10
Iron folate pills stock rupture	1	1
Iron sulfate pills generally stocked	8	9
Iron sulfate pills stock rupture	2	0
Iron syrup generally stocked	8	5
Iron syrup stock rupture	8	5
ORS generally stocked	11	11
ORS stock rupture	1	2
Plumpy'Nut generally stocked	10	8
Plumpy'Nut stock rupture	6	5
Zinc generally stocked	6	5
Zinc stock rupture	4	2
Antibiotics		
Amoxicillin generally stocked	11	11
Amoxicillin stock rupture	0	2
Chloramphenicol generally stocked	11	10
Chloramphenicol stock rupture	3	2
Co-trimoxazole or erythromycin generally stocked[e]	11	
Co-trimoxazole or erythromycin stock rupture[e]	0	
Co-trimoxazole generally stocked[d]		11
Co-trimoxazole stock rupture[d]		0
Erythromycin generally stocked[d]		10
Erythromycin stock rupture[d]		4
Benzylpenicillin and gentamycin generally stocked[e]	9	
Benzylpenicillin and gentamycin stock rupture[e]	3	
Benzylpenicillin generally stocked[d]		9
Benzylpenicillin stock rupture[d]		2
Gentamycin generally stocked[d]		7
Gentamycin stock rupture[d]		3
Tetracycline ointment generally stocked[d]		11
Tetracycline ointment stock rupture[d]		4
Antifungal		
Nystatin generally stocked[d]		11
Nystatin stock rupture[d]		0
Antimalarial		
Amodiaquine and artesunate generally stocked	11	11
Amodiaquine and artesunate stock rupture	3	3
Quinine generally stocked	11	11
Quinine stock rupture	0	0

N	Baseline[b] 11	Follow-up[c] 11
Anthelminthic		
Albendazole or mebendazole generally stocked	11	11
Albendazole or mebendazole stock rupture	1	1
Praziquantel generally stocked[d]		2
Praziquantel stock rupture[d]		1
Analgesic		
Acetaminophen generally stocked	11	11
Acetaminophen stock rupture	1	0
Diazepam generally stocked	10	10
Diazepam stock rupture	0	2
Diclofenac sodium generally stocked[d]		7
Diclofenac sodium stock rupture[d]		4
Aspirin generally stocked		6
Aspirin stock rupture		2
Oral contraceptives		
Oral contraceptives generally stocked[d]		10
Oral contraceptives stock rupture[d]		0

[a] Values are counts (i.e., number of health centers). No statistical tests were conducted.
[b] Sample size at baseline did not vary for “generally stocked.” Sample size for “stock rupture” is the number of health centers that generally stocked the particular item.
[c] Sample size at follow-up did not vary for “generally stocked.” Sample size for “stock rupture” is the number of health centers that generally stocked the particular item.
[d] Information not collected at baseline.
[e] Information not collected at follow-up.

4. Results: Household Characteristics

4.1 Household Demography and Housing

Mean household size was 5.8 members at follow-up and 5.6 at baseline, with an average of 2.1 adults and 3.5 children under 18 years of age per household (**Table 25**). The characteristics of the head of household did not fundamentally change between baseline and follow-up. They were on average 35 years old, and more than 90% were male. The vast majority of these household heads had very low levels of education: approximately two-fifths had no schooling, and only a fraction completed primary school. Farming was the primary occupation of the household heads; more than 75% of them farmed their own land or land owned by their family.

Housing conditions were very similar at baseline and follow-up. Nearly all households owned the house they lived in. The average household had three rooms (**Table 26**). Fewer than 1% of households shared the dwelling with another household. Housing conditions were poor: Almost all dwellings had dirt floors, and around half of the households lived under a roof made out of thatch/straw. Most of the households had walls made of adobe bricks (73.1% at baseline and 70.4% at follow-up) or rammed earth[27] (21.0% at baseline and 18.3% at follow-up).

Almost 80% of households had access to clean water (tap) at follow-up, which is higher than at baseline (72%). The time to reach the water source (36–37 minutes) remained the same (**Table 27**). The time to reach water was shorter for households in the T24 group. Only a very small percentage (0.5% at baseline and 0.7% at follow-up) of households had electricity. Almost all households (98.2% at baseline and 96.6% at follow-up) used firewood or straw for cooking. Household light sources changed between baseline and follow-up. Battery-operated equipment increased from 47.6% at baseline to 71.5% at follow-up, whereas households reporting natural combustible material or oil products dropped by half (from 30.2% to 15.4% and from 18.7% to 9.6%, respectively).

4.2 Household Assets

Nearly all households owned a house and land at both baseline and follow-up (**Table 28**). At follow-up, households owned an average of 29 household goods (around four more than at baseline) and 5 pieces of agricultural equipment (a 0.5 unit increase), two small animals (remained constant), and two medium-sized animals (a 0.3 unit increase). At both baseline and follow-up, the number of household goods and pieces of equipment was different among study groups. Very few households owned large animals, a motorbike, or a bicycle at either baseline or follow-up.

[27] Rammed earth (*pisé* in French) is a technique for building walls using raw materials, such as earth, chalk, lime, and gravel. The damp material is poured and then compacted to construct the wall.

Table 25. Characteristics of households[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
Household										
Size	5.6 ± 2.0	5.5 ± 2.0	5.7 ± 2.0	5.6 ± 2.1	5.5 ± 2.0	5.8 ± 2.0	5.8 ± 1.9	5.7 ± 2.0	5.8 ± 2.1	5.8 ± 2.0
Members under 18 years	3.4 ± 1.9	3.3 ± 1.8	3.5 ± 1.8	3.5 ± 1.9	3.4 ± 1.9	3.6 ± 1.8	3.6 ± 1.8	3.6 ± 1.8	3.6 ± 1.9	3.7 ± 1.9
Members 18 years and older	2.1 ± 0.6*	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.1 ± 0.5	2.1 ± 0.6	2.2 ± 0.6	2.1 ± 0.5	2.2 ± 0.6	2.1 ± 0.5
Members under 60 months	1.7 ± 0.6	1.7 ± 0.6	1.7 ± 0.6	1.7 ± 0.6	1.7 ± 0.6	1.8 ± 0.6	1.8 ± 0.6	1.8 ± 0.6	1.8 ± 0.6	1.8 ± 0.6
Adults (%)	42.6	43.6	42.1	42.8	42.4	40.6	41.2	40.7	41.0	40.1
Dependency ratio	1.5 ± 0.9	1.4 ± 0.9	1.5 ± 0.9	1.5 ± 0.8	1.5 ± 0.9	1.6 ± 0.8	1.5 ± 0.8	1.6 ± 0.8	1.5 ± 0.8	1.6 ± 0.9
Household head										
Age	34.7 ± 10.6	35.4 ± 11.1	35.3 ± 10.9	34.3 ± 10.2	34.1 ± 10.3	34.6 ± 10.2	34.9 ± 9.9	34.7 ± 10.3	35.2 ± 10.6	34.0 ± 10.1
Male (%)	92.2	93.0	93.4	93.5	90.0	93.4	94.9	93.5	92.8	92.8
Household head education										
None/preschool	40.2	38.3	40.5	38.1	42.0	37.9	35.0	34.8	38.5	42.2
Primary incomplete	53.8	55.9	52.9	54.3	53.5	55.9	58.8	58.0	53.8	53.5
Primary complete	1.9	2.3	2.3	1.2	1.8	1.5	2.3	1.3	1.4	1.5
Secondary incomplete	3.6	3.2	3.6	5.8	2.6	4.4	3.9	5.5	6.1	2.6
Higher education	0.2	0.0	0.5	0.5	0.0	0.3	0.0	0.6	0.2	0.1
Household head occupation										
Unemployed	1.0	1.4	0.8	1.4	0.9	1.1	1.4	0.9	1.9	0.7
Farms own or family land	76.2	77.3	75.3	73.4	78.0	76.0	75.1	74.5	74.2	78.9
Farms someone else's land	3.0	1.6	2.9	1.8	4.4	5.2	3.3	6.0	2.3	6.8
Agricultural laborer	6.3	4.6	6.0	6.2	7.3	2.8	2.8	1.8	2.3	4.1
Retailer (e.g., has a store)[d]	0.5	0.0	0.1	1.4	0.8	0.5	1.2	0.3	1.2	0.0
Market/trade	2.2	1.6	2.5	1.8	2.4	3.0	1.9	3.6	3.9	2.3
Office/institution	3.7	4.6	4.2	5.1	2.3	3.9	3.7	4.7	5.8	2.4
Manual labor	5.5	6.7	7.4	6.2	2.8	6.0	7.9	6.8	6.0	4.1
Other	1.4	2.1	0.8	2.5	1.1	1.5*	2.8	1.3	2.3	0.7

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2614 to 2623 in the full sample; N = 430 to 432 in the T24 arm; N = 865 to 870 in the T18 arm; N = 432 to 433 in the TNFP arm; and N = 885 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2606 to 2614 in the full sample; N = 429 to 432 in the T24 arm; N = 879 to 880 in the T18 arm; N = 429 to 431 in the TNFP arm; and N = 868 to 871 in the control arm.
[d] Retail is a more formal form of trade, involving keeping a premise or shop that is owned or rented. Market/trade is informal or petty trade, such as a market stall or street vending.
* Study arms differ, $p < 0.05$.

Table 26. Housing characteristics[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2612**	**432**	**880**	**430**	**871**
Owns home	97.4	97.5	96.8	97.7	97.7	97.5	97.7	96.2	97.4	98.9
Dwelling type and characteristics										
Number of rooms	3.2 ± 1.2	3.4 ± 1.3	3.3 ± 1.2	3.2 ± 1.3	3.1 ± 1.2	3.3 ± 1.2	3.5 ± 1.2	3.3 ± 1.2	3.4 ± 1.2	3.2 ± 1.2
Shared dwelling	0.6	0.5	0.6	0.7	0.7	0.7	0.9	0.8	1.2	0.3
Housing quality										
Type of floor										
Dirt	96.1	96.3	96.2	93.1	97.4	95.2*	94.4	94.1	93.2	97.6
Type of walls										
Rammed earth	21.0	7.6	19.1	18.9	30.3	18.3	7.2	16.5	17.0	26.2
Adobe bricks	73.1	87.5	77.1	70.0	63.6	70.4	83.1	73.2	64.7	64.2
Clay bricks	3.7	2.5	2.0	8.8	3.6	10.0	7.9	9.0	16.7	8.6
Cement bricks/stone	0.8	1.9	0.2	0.7	0.8	0.7	1.9	0.3	0.9	0.2
Other	1.4*	0.5	1.6	1.6	1.7	0.7	0.0	1.0	0.7	0.8
Type of roof										
Thatch/straw	50.4	44.7	49.7	48.7	54.7	46.5	40.7	46.1	40.0	53.0
Corrugated aluminum	36.8	38.9	37.2	36.7	35.4	38.7	42.8	39.1	40.0	35.6
Concrete/tile	12.8	16.4	13.1	14.5	9.9	14.8	16.4	14.8	20.0	11.4

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2608 to 2623 in the full sample; N = 430 to 432 in the T24 arm; N = 863 to 870 in the T18 arm; N = 429 to 433 in the TNFP arm; and N = 884 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2597 to 2612 in the full sample; N = 426 to 432 in the T24 arm; N = 874 to 880 in the T18 arm; N = 427 to 430 in the TNFP arm; and N = 869 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 27. Water and energy access[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2612**	**432**	**880**	**430**	**870**
Drinking water source										
Tap water	72.4	82.8	68.5	75.3	69.8	78.9	91.7	75.3	82.6	74.4
Open well	2.4	0.5	3.1	2.8	2.4	3.5	0.0	3.5	4.9	4.5
Covered well	1.6	0.7	0.5	1.8	3.0	1.8	1.9	1.1	2.1	2.2
Surface water	23.6	16.0	27.9	20.1	24.8	15.8	6.5	20.0	10.5	19.0
Time to get drinking water (minutes)	37.2 ± 38.0*	30.6 ± 26.9	39.6 ± 39.7	37.5 ± 33.3	37.9 ± 42.5	35.9 ± 40.3*	25.1 ± 26.1	36.7 ± 33.5	42.6 ± 46.4	37.2 ± 47.5
Household has electricity	0.5	0.0	0.7	0.2	0.6	0.7	0.2	1.4	0.7	0.2
Energy for cooking										
Charcoal	1.5	0.7	1.6	3.5	0.8	3.3	2.6	4.6	5.7	1.2
Firewood/straw	98.2	99.3	98.0	96.1	99.0	96.6	97.2	95.3	94.1	98.7
Other	0.3	0.0	0.3	0.5	0.2	0.2	0.2	0.1	0.2	0.1
Energy for light										
Electricity	0.5	0.0	0.7	0.2	0.7	0.7	0.2	1.3	1.2	0.2
Kerosene/oil	18.7	31.7	18.3	21.6	11.5	9.6	16.9	10.5	11.6	4.0
Candle	3.0	3.5	3.7	4.2	1.6	2.8	4.2	3.5	4.0	0.7
Battery-operated equipment	47.6	38.2	48.9	40.4	54.3	71.5	67.5	71.6	68.8	74.7
Firewood/straw/coal/dung	30.2*	26.6	28.4	33.6	32.0	15.4*	11.1	13.2	14.4	20.3

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2604 to 2623 in the full sample; N = 427 to 432 in the T24 arm; N = 863 to 870 in the T18 arm; N = 428 to 433 in the TNFP arm; and N = 884 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2575 to 2609 in the full sample; N = 425 to 432 in the T24 arm; N = 864 to 880 in the T18 arm; N = 423 to 430 in the TNFP arm; and N = 858 to 870 in the control arm.
* Study arms differ, $p < 0.05$.

Table 28. Asset ownership[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	2623	432	870	433	888	2614	432	880	431	871
% of households that own										
House(s)/apartment(s)	97.1	98.4	97.2	96.3	96.6	96.4	95.6	95.3	96.8	97.7
Plot(s) of land	97.1	97.5	97.7	97.5	96.1	98.0*	98.1	97.0	99.5	98.0
Number owned										
Household goods	24.3 ± 14.1*	27.3 ± 13.7	24.2 ± 12.8	25.4 ± 18.7	22.4 ± 12.6	28.6 ± 14.0*	30.9 ± 13.2	30.3 ± 15.3	30.7 ± 15.6	24.6 ± 11.2
Agricultural equipment	4.3 ± 2.2*	4.8 ± 2.5	4.3 ± 2.1	4.4 ± 2.4	4.0 ± 2.1	4.8 ± 2.4*	5.3 ± 2.5	4.9 ± 2.4	4.9 ± 2.6	4.5 ± 2.0
Small animals (chicken, rabbit)	1.9 ± 3.7	1.7 ± 3.0	1.8 ± 3.0	1.8 ± 3.4	2.0 ± 4.5	2.0 ± 3.4	2.0 ± 3.6	2.2 ± 3.4	1.8 ± 3.0	1.9 ± 3.3
Medium animals (goat, sheep)	1.4 ± 1.9	1.6 ± 2.2	1.3 ± 1.9	1.5 ± 1.9	1.3 ± 1.9	1.7 ± 2.3	2.0 ± 2.5	1.7 ± 2.1	2.0 ± 2.4	1.5 ± 2.2
Large animals (cow, pig)	0.3 ± 0.9	0.3 ± 0.9	0.3 ± 0.8	0.4 ± 1.1	0.2 ± 0.9	0.5 ± 1.2	0.5 ± 1.2	0.4 ± 1.1	0.5 ± 1.3	0.5 ± 1.4
Motorbike/bike	0.4 ± 0.5	0.3 ± 0.5	0.4 ± 0.5	0.4 ± 0.5	0.4 ± 0.5	0.5 ± 0.5	0.4 ± 0.5	0.5 ± 0.6	0.5 ± 0.6	0.4 ± 0.5

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline did not vary.
[c] Sample size at follow-up ranged from N = 2613 to 2614 in the full sample; and N = 879 to 880 in the T18 arm.
* Study arms differ, $p < 0.05$.

5. Results: Maternal Characteristics

Mothers were on average 28 years old at baseline and follow-up, and nearly all were the biological mother of the index child (**Table 29**). The percentage with a spouse or partner decreased from the baseline to the follow-up from around 88% to 83%. Overall, maternal education was very low: Only half had ever attended school, and of those that did, very few completed primary school. Maternal education increased somewhat between baseline and follow-up: The percentage of mothers who never attended school decreased from 52% to 46%. The percentage of illiterate mothers (almost 40%) did not change between baseline and follow-up.

At both baseline and follow-up, more than 90% of mothers reported having worked in the past 12 months. Similar to household heads, almost all reported working in farming and agriculture. The percentage not remunerated for their work was much higher at follow-up (62.6%) than at to baseline (37.7%). The mothers' perceived contribution to household expenses was quite small in both surveys.

Table 29. Maternal characteristics and activities[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
Age	28.6 ± 7.0	28.3 ± 6.8	29.0 ± 7.1	28.6 ± 6.7	28.3 ± 7.0	28.5 ± 6.6	28.6 ± 6.3	28.5 ± 6.5	29.1 ± 7.0	28.2 ± 6.5
Married	87.8*	88.7	89.8	91.2	83.9	83.3	87.5	82.5	85.8	80.7
Biological mother	99.5*	99.5	99.3	100.0	99.4	99.6	99.8	99.4	100.0	99.5
Education										
None/preschool	51.8	51.0	49.4	54.4	54.0	46.3	43.3	41.0	47.3	52.7
Primary incomplete	44.2	44.7	46.9	39.8	43.5	49.5	52.1	54.0	47.8	44.6
Primary complete	1.0	1.2	1.1	0.7	0.9	0.8	0.9	0.6	1.2	0.9
Secondary incomplete	2.7	3.2	2.5	5.1	1.6	3.3	3.7	4.4	3.7	1.7
Higher education	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Literacy										
Literate	52.0	56.0	52.6	50.3	50.2	55.9	62.7	60.2	56.1	48.1
Partially literate	9.2	9.7	9.8	11.1	7.4	4.7	4.2	3.4	4.6	6.3
Illiterate	38.8	34.3	37.6	38.6	42.4	39.4	33.1	36.4	39.2	45.6
Work during the past 12 months										
None	8.3	5.1	7.1	10.0	10.1	7.4	9.3	7.7	9.3	5.1
Year-long	70.6	71.8	69.3	67.3	73.0	73.2	69.2	75.8	71.9	73.2
Seasonal	9.4	10.4	12.7	12.4	4.2	7.8	8.4	6.9	8.1	8.2
Sometimes	11.7	12.7	10.9	10.3	12.6	11.6	13.1	9.5	10.7	13.5
Main occupation										
Unemployed	8.2	5.1	7.0	10.0	10.1	7.4	9.3	7.7	9.3	5.1
Farms own or family land	79.2	85.4	79.4	76.8	77.1	80.0	80.3	78.6	77.3	82.5
Farms someone else's land	4.6	3.9	5.0	3.0	5.2	7.6	7.6	7.2	6.5	8.5
Agricultural labor	6.3	3.2	6.8	7.2	6.8	2.1	0.5	2.0	1.4	3.2
Retail	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.5	0.1
Market/trade	0.5	0.7	0.2	0.7	0.5	1.0	0.7	1.1	2.3	0.2
Office/institution	1.0	0.9	1.4	1.9	0.2	1.5	0.9	2.7	1.6	0.3
Manual labor	0.2	0.5	0.2	0.5	0.0	0.3	0.0	0.3	0.9	0.0
Other	0.1	0.2	0.0	0.0	0.1	0.2	0.5	0.1	0.2	0.0
Earnings										
Cash	7.8	4.6	8.8	9.2	7.7	6.7	3.6	7.4	7.2	7.4
In-kind	31.0	34.9	31.1	36.4	26.1	15.9	23.8	13.9	15.3	14.3
Cash and in-kind	23.5	27.8	25.0	21.8	20.6	4.8	4.9	4.2	2.3	6.5
Other compensation	0.0	0.0	0.1	0.0	0.0	10.0	4.6	14.7	8.4	8.8
Nothing	37.7	32.7	35.0	32.6	45.7	62.6	63.2	59.9	66.8	63.0
Mother's perceived contribution to household expenses										
Nothing	23.6	27.3	22.4	21.7	23.8	30.1	35.0	30.0	28.8	28.5
Almost nothing	17.0	15.7	20.0	14.8	15.7	14.6	13.7	14.3	15.6	14.8
A little	46.7	42.6	44.6	54.7	46.8	40.3	40.5	40.6	39.3	40.5
All/almost all	12.8	14.4	13.0	8.8	13.7	15.0	10.9	15.1	16.3	16.2

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2406 to 2623 in the full sample; N = 410 to 432 in the T24 arm; N = 809 to 870 in the T18 arm; N = 390 to 433 in the TNFP arm; and N = 797 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2421 to 2614 in the full sample; N = 391 to 432 in the T24 arm; N = 812 to 880 in the T18 arm; N = 391 to 431 in the TNFP arm; and N = 827 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

6. Results: Child Characteristics

Index children were on average between 12 and 13 months old (**Table 30**). In the baseline sample, 47.7% were boys, and in the follow-up sample, 51.1% were boys.

Table 30. Child characteristics[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2613**	**432**	**879**	**431**	**871**
Age (months)	12.8 ± 6.8	12.3 ± 7.0	12.9 ± 6.7	12.4 ± 6.6	13.2 ± 6.8	12.3 ± 6.6*	12.1 ± 6.5	12.1 ± 6.8	11.9 ± 6.5	13.0 ± 6.5
Sex (boys)	47.7	46.8	47.7	48.5	47.7	51.1	50.2	52.3	50.3	50.7

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2622 to 2623 in the full sample; and N = 887 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2612 to 2613 in the full sample; and N = 870 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

7. Results: *Tubaramure* Participation

7.1 Enrollment and Participation in *Tubaramure*

At follow-up, approximately 95% of respondents in treatment *collines* were aware of *Tubaramure,* and between 75% and 85% claimed that they either had participated previously or were participating currently (**Table 31**). Both the program awareness and beneficiary status differed significantly among the four groups: The control group was less often aware of the program and less often had been a beneficiary. In the T18 group, those who were not current beneficiaries were almost equally split into past beneficiaries or households never having participated in the program. Approximately three-quarters of the control group respondents were also aware of *Tubaramure*, and a few (4.1%) claimed that they were either current or past program beneficiaries. Among those who reported that they were beneficiaries and lived in treatment *collines*, 11.8% were *Tubaramure* leader mothers, and approximately half could produce a beneficiary card. Among current beneficiaries, nearly all were aware that *Tubaramure* provided rations, 80.1% mentioned BCC as a program activity, and only 26.4% brought up the cooking demonstrations. The percentage who were leader mothers, who could produce a beneficiary card, and who were aware of the various program components did not differ significantly among the three treatment arms.

Among those who never participated in *Tubaramure*, approximately one-third of respondents in each of the three treatment arms reported that they had not met program requirements (**Table 32**). Compared to the control group, those in the treatment groups more often reported that they did not meet program requirements or that they were refused registration. Program requirement included being able to show their ration card and *Tubaramure* beneficiary card at the distributions. Those in the control arm did not participate because the program was not available to them.

7.2 Participation in *Tubaramure* Program Activities

Almost 80% of current beneficiary mothers attended a food distribution in the last month (**Table 33**). In the case that the beneficiary could not attend, 64.9% reported to have an alternate available to pick up rations. Among those with an alternate, 92.2% had sent the alternate at some point. Nearly all participants reported that they received the types of food expected (i.e., CSB and oil) at the last distribution, but slightly fewer (93.7%) claimed to have received the entire expected ration. When the complete ration was not received, more than half did not know why they did not receive the entire quantity, and almost 20% reported that there was insufficient food available[28]; the perceived reasons differed significantly among the three treatment arms. On average, *Tubaramure* participants traveled more than 1.5 hours to the distribution site; 86.6% walked and 13.4% took bicycles. The majority (80.4%) did not receive help carrying home food from the last distribution. Overall, respondents' food distribution experiences at the most recent distribution event did not differ significantly among the three treatment arms.

During the previous 4 months, beneficiary mothers (mothers of the children 0–23 months) had attended 3.1 distributions, whereas the alternate had attended 1.1 (**Table 34)**. Among program participants, missing a food distribution was rare (did not differ significantly from 0), but absences were caused by illnesses, lack of a beneficiary card, and lack of information about the distribution. The total number attended differed among the three treatment arms; beneficiaries of the TNFP arm had attended slightly fewer distributions. During the previous 4 months, respondents received the complete ration on an average of 4.0 occasions, and lacked part of the ration on an average of 0.2 occasions. Having received

[28] Note that this information was obtained through self-report. Beneficiaries may not be fully aware that the quantity of food received changes when the beneficiary child reaches 6 months of age.

the complete ration in the last four distributions differed significantly among the three treatment arms, and was least common in the TNFP group.

Among beneficiaries, 84.3% reported ever participating in a *Tubaramure* care group,[29] but only 46.0% had attended a care group during the last month (**Table 35**). Most (98.5%) reached care group meetings on foot. During the previous 4 months, beneficiary respondents had attended, on average, 4.3 meetings and missed 1.1. As care groups should meet every 2 weeks, the expected number of care groups attended over a 4-month period is eight. The results thus indicate that attendance is considerably lower than intended by the program design. In addition, the low reported number of care groups missed (1.1 instead of the expected 3.7) appears to indicate either that care groups are not regularly organized or that women are not always aware that they are being held. Reasons for missing a care group meeting were primarily attributable to an illness of the beneficiary or a family member. Among those who had participated in a care group, 46.2% reported that a cooking demonstration had ever been offered, and it had been 3.6 months since the last demonstration.[30] Overall, care group experiences did not differ significantly among the three treatment arms.

Only 31.1% of beneficiary respondents had ever received a visit by a *Tubaramure* leader mother, and, on average, the last visit was approximately 3 months ago (**Table 36**). The duration since the most recent visit differed significantly among the three treatment groups and was shortest in the TNFP arm. These respondents reported that during these visits leader mothers discussed if previous lessons are being applied (51.3%), reviewed previous lessons (22.5%), discussed the index child's health (21.6%), discussed the mother's health (16.1%), addressed any difficulties applying the lessons (14.8%), discussed the health of others (14.0%), and reviewed material missed during absences (7.6%). Characteristics of leader mother visits differed significantly only in that TNFP mothers were more likely to report that their leader mother discussed identifying difficulties in applying the lessons.

[29] We refer to beneficiary care groups. Participation in leader mother care groups was not assessed.

[30] Cooking demonstrations had not been fully launched at the time of the 2012 survey.

Table 31. *Tubaramure* program awareness and participation[a]

	Follow-up[b]				
		Study arm			
	Full sample	T24	T18	TNFP	Control
N	**2611**	**432**	**879**	**431**	**869**
Aware of *Tubaramure*	88.2*	94.4	95.4	97.0	73.5
Beneficiary status					
Current beneficiary	45.1	73.5	55.4	79.3	2.4
Past beneficiary	9.3	6.3	20.3	5.2	1.7
Never a beneficiary	45.6*	20.2	24.4	15.5	95.9
Leader mother[c]	11.8	9.7	12.8	12.5	–
Beneficiary card[c]					
Yes, presented	51.4	41.1	57.2	52.6	–
Yes, not presented	30.9	35.0	29.6	28.9	–
No	17.8	23.9	13.2	18.5	–
Program awareness; % who mentioned[c]					
Rations	99.2	99.7	99.6	98.2	–
BCC	80.1	75.9	81.2	82.5	–
Cooking demonstrations	26.4	27.2	25.2	27.5	–

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size ranged from N = 1107 to 2611 in the full sample; N = 308 to 432 in the T24 arm; N = 477 to 879 in the T18 arm; N = 321 to 431 in the TNFP arm; and N = 839 to 869 in the control arm.
[c] Sample limited to current *Tubaramure* participants.
* Study arms differ, $p < 0.05$.

Table 32. Reasons for non-participation in *Tubaramure* (among current non-beneficiaries)[a]

	Follow-up[b]				
		Study arm			
	Full sample	T24	T18	TNFP	Control
N[c]	2614	432	880	431	871
Why never participated in *Tubaramure*					
Help not available	0.1	0.0	0.5	0.0	0.0
Husband did not want to	0.1	0.0	0.0	1.5	0.0
Site too far	0.1	0.0	0.5	0.0	0.0
Transportation	0.1	0.0	0.5	0.0	0.0
Did not meet program requirements	12.1*	37.2	36.0	27.3	1.9
Dislike program requirements	0.3	0.0	1.0	3.0	0.0
Inconvenient dates/times	0.1	0.0	0.5	0.0	0.0
Not enough time	0.1	0.0	0.5	0.0	0.0
Wait at distribution site	0.1	0.0	0.5	0.0	0.0
Dislike course	0.3	0.0	0.5	1.5	0.1
Program unavailable	64.7*	0.0	3.8	3.0	92.5
Does not know	0.9	1.2	1.4	3.0	0.5
Registration refused	2.3*	3.5	2.6	3.7	0.8
Other	6.0*	8.3	9.3	4.6	2.3

[a] Values are %. All estimates account for clustering.
[b] Sample size at follow-up ranged from N = 1165 to 2614 in the full sample; N = 86 to 432 in the T24 arm; N = 210 to 880 in the T18 arm; and N = 803 to 871 in the control arm.
[c] Sample limited to current non-participants.
* Study arms differ, $p < 0.05$.

Table 33. *Tubaramure* food distribution experiences (most recent, among current beneficiaries)[a]

	Follow-up[b]				
		Study arm			
	Full sample	T24	T18	TNFP	Control
N[c]	**1138**	**317**	**484**	**337**	**–**
Attendance					
Attended last month's food distribution	79.3	80.7	80.8	75.7	–
Months since last food distribution attended	1.6 ± 3.2	1.4 ± 3.0	1.5 ± 3.2	1.8 ± 3.3	–
Alternate support					
Available to pick up rations	64.9	70.7	67.4	56.1	–
Has ever attended food distribution[d]	92.2	94.6	93.6	86.8	–
Who attended last food distribution					
Respondent	70.5	66.5	70.5	74.3	–
Alternate	29.5	33.5	29.5	25.7	–
Food received at last distribution					
CSB	99.9	100.0	99.8	100.0	–
Oil	99.5	99.4	99.6	99.4	–
All foods expected	99.6	100.0	100.0	98.8	–
All quantities expected	93.7	93.0	94.1	93.6	–
Why not all food(s) expected					
Did not bring food ration bucket	1.4	0.0	3.7	0.0	–
Insufficient food	19.4	32.0	14.8	10.0	–
Does not know	58.3*	32.0	66.7	80.0	–
Other	20.8*	40.0	14.8	5.0	–
Time (minutes) to reach food distribution	99.1 ± 81.5	104.8 ± 74.7	103.5 ± 88.4	88.7 ± 78.2	–
Transport to last food distribution					
Walking	86.6	79.7	87.7	91.5	–
Bicycle	13.4	20.3	12.3	8.5	–
Car	0.1	0.0	0.2	0.0	–
Help to carry food from last distribution					
None	80.4	83.2	77.2	82.5	–
Household member	8.4*	7.0	11.3	5.7	–
Other family member	4.6	4.1	4.4	5.4	–
Other person	6.4	5.4	6.9	6.6	–

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at follow-up ranged from N = 72 to 1138 in the full sample; N = 25 to 317 in the T24 arm; N = 27 to 484 in the T18 arm; and N = 20 to 337 in the TNFP arm.
[c] Sample limited to current *Tubaramure* participants.
[d] Sample limited to those reporting an alternate available to pick up food rations.
* Study arms differ, $p < 0.05$

Table 34. *Tubaramure* food distributions (last 4 months, among current beneficiaries)[a]

	Follow-up[b]				
		Study arm			
	Full sample	T24	T18	TNFP	Control
N[c]	**1129**	**316**	**482**	**334**	**–**
Food distributions in last 4 months					
Number attended	3.1 ± 1.4	2.9 ± 1.5	3.2 ± 1.4	3.1 ± 1.3	–
Number alternate attended	1.1 ± 1.4	1.4 ± 1.6	1.0 ± 1.4	0.9 ± 1.3	–
Total number attended	4.2 ± 1.0*	4.3 ± 1.0	4.2 ± 0.8	4.0 ± 1.1	–
Number missed	0.0 ± 0.3	0.0 ± 0.4	0.1 ± 0.3	0.0 ± 0.2	–
Why food distribution not attended					
Beneficiary mother ill	8.3	0.0	4.2	17.6	–
Family member ill	12.5	0.0	16.7	11.8	–
Site too far	8.3	28.6	8.3	0.0	–
No beneficiary card	4.2	14.3	4.2	0.0	–
Beneficiary name missing	16.7	0.0	16.7	23.5	–
Insufficient food	2.1	14.3	0.0	0.0	–
Poor quality	2.1	0.0	4.2	0.0	–
Did not know distribution details	8.3	14.3	4.2	11.8	–
Learned distribution details late	2.1	0.0	4.2	0.0	–
Does not know	6.4*	0.0	13.0	0.0	–
Number of times complete food ration received	4.0 ± 0.9*	4.1 ± 0.7	4.1 ± 0.8	3.7 ± 1.1	–
Number of times complete food ration not received	0.2 ± 0.7	0.2 ± 0.7	0.2 ± 0.8	0.2 ± 0.7	–
Why complete ration not received					
Beneficiary name missing	5.8	6.7	6.3	4.0	–
Insufficient food	19.4	30.0	16.7	12.0	–
Rescheduled distribution	9.7	13.3	8.3	8.0	–
Fraud	8.7	10.0	8.3	8.0	–
Age of child	12.6*	20.0	4.2	20.0	–
Other	1.9	3.3	2.1	0.0	–
Does not know	42.7*	20.0	54.2	48.0	–

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at follow-up ranged from N = 47to 1129 in the full sample; N = 7 to 316 in the T24 arm; N = 23 to 482 in the T18 arm; and N = 17 to 334 in the TNFP arm.
[c] Sample limited to current *Tubaramure* participants.
* Study arms differ, $p < 0.05$.

Table 35. *Tubaramure* care group participation (among current beneficiaries)[a]

	Follow-up[b]				
		Study arm			
	Full sample	T24	T18	TNFP	Control
N[c]	**1137**	**317**	**483**	**337**	**–**
Ever participated	84.3	82.0	84.7	86.1	–
Attended last month	46.0	40.5	45.4	51.8	–
Transportation to last care group meeting					
Walking	98.5	98.7	98.4	98.5	–
Bicycle	0.5	0.9	0.5	0.0	–
Other	1.0	0.4	1.1	1.5	–
Number attended in last four months	4.3 ± 4.2	3.6 ± 3.2	4.6 ± 4.6	4.6 ± 4.4	–
Number missed in last four months	1.1 ± 1.5	0.8 ± 1.0	1.3 ± 1.6	1.1 ± 1.7	–
Why missed care group					
Beneficiary mother ill	24.3	31.1	23.4	20.1	–
Family member ill	42.7	37.7	48.1	38.3	–
Husband did not want to	0.2	0.0	0.4	0.0	–
Weather	4.5	3.3	5.5	3.9	–
Site too far	5.3	4.9	5.5	5.2	–
Transportation	0.6	1.6	0.4	0.0	–
Inconvenient date and time	12.5	9.8	12.8	14.3	–
Rescheduled	3.7	1.6	3.8	5.2	–
Time/long wait	3.9	4.1	3.4	4.5	–
Did not know meeting details	16.2	17.2	17.4	13.6	–
Learned meeting details late	2.5	3.3	2.1	2.6	–
Arrived late	1.4	0.8	0.9	2.6	–
Dislike other beneficiary moms	0.2	0.0	0.0	0.6	–
Does not like to go	0.2	0.0	0.0	0.6	–
Other	0.6	0.0	0.4	1.3	–
Cooking demonstrations					
Months since last time	3.6 ± 4.7	3.1 ± 3.6	3.9 ± 5.2	3.7 ± 4.9	–
Offered at care group	46.2	45.5	46.6	46.2	–

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at follow-up ranged from N = 511 to 1137 in the full sample; N = 122 to 317 in the T24 arm; N = 235 to 483 in the T18 arm; and N = 154 to 337 in the TNFP arm.
[c] Sample limited to current *Tubaramure* participants.
* There were no statistical differences among study arms, $p < 0.05$.

Table 36. *Tubaramure* home visits by leader mothers (among current beneficiaries)[a]

	Follow-up[b]				
		Study arm			
	Full sample	T24	T18	TNFP	Control
N[c]	**760**	**209**	**319**	**232**	**–**
Leader mother visited	31.1	28.2	30.4	34.5	–
Months since last visit by leader mother	2.9 ± 3.6*	3.2 ± 3.6	3.2 ± 4.0	2.1 ± 2.9	–
Topics covered in visits					
Reviewed previous lessons	22.5	20.3	22.7	23.8	–
Discussed if lessons are being applied	51.3	59.3	46.4	51.2	–
Identified difficulties applying lessons	14.8*	11.9	10.3	22.5	–
Meeting absences	7.6	3.4	9.3	8.8	–
Child health	21.6	25.4	16.5	25.0	–
Own health	16.1	20.3	11.3	18.8	–
Other health	14.0	13.6	11.3	17.5	–
Other	30.1	27.1	36.1	25.0	–
Does not know	2.1	0.0	4.1	1.3	–

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at follow-up ranged from N = 219 to 760 in the full sample; N = 59 to 209 in the T24 arm; N = 92 to 319 in the T18 arm; and N = 67 to 232 in the TNFP arm.
[c] Sample limited to current *Tubaramure* participants.
* Study arms differ, $p < 0.05$.

8. Results: Household Impact

8.1 Household Hygiene and Sanitation

Though one-quarter of households used unsafe drinking water (as discussed in Section 4), the vast majority (96.7% at baseline and 94.0% at follow-up) did not treat their drinking water (**Table 37)**. *Tubaramure* modestly decreased the percentage of households that did not treat their water by 3–5 percentage points (significant in the T18 and TNFP groups), but, overall, very few households treated their drinking water (**Table 38**). The percentage of households that covered their drinking water increased in all study groups, from 75.8% at baseline to 90.7% at follow-up. However, households in all study arms (including the control) made similar changes, and the differences between each treatment arm and the control arm were not significant. At baseline, most households discarded (48.7%), composted (46.2%), or buried (12.1%) their trash. *Tubaramure* increased the percentage of households that composted their trash by 13 to 17 percentage points (significant in all three treatment groups).

The percentage of households that reported having a bednet (57.4% at baseline and 54.1% at follow-up) and the mean number of bednets owned by these households (2.0 at baseline and 1.5 at follow-up) both decreased slightly between baseline and follow-up. Households owning bednets did not consistently use them[31]: At baseline 43.4% of households reported that at least one member slept under a bednet and 36.2% reported that all members slept under bednets. There was little change at follow-up when these values were 46.4% and 36.7%, respectively. No significant impact by *Tubaramure* on bednet ownership or use was observed.

The majority of households (73.2% at baseline and 83.9% at follow-up) had soap available and the majority of mothers reported using it on the day of the interview or the previous day (**Table 39**). Despite owning soap, it was rarely used at key handwashing times. At both baseline and follow-up, no more than 10% of mothers reported using soap to wash a child's hands or their own hands after defecation, after cleaning a child, before feeding a child, or before preparing food. Using soaps to wash one's own hands before eating was slightly more common (20.4% at baseline and 27.2% at follow-up). The percentage of mothers that had used soap on the current or previous day increased between 3 and 9 percentage points (statistically significant for the T18 group) (**Table 40**). *Tubaramure* had a modest positive impact of 4–6 percentage points on whether mothers used soap after defecating, but it did not significantly affect soap use in any other circumstances.

At both baseline and follow-up, fewer than one-fourth of mothers and fewer than one-third of children were considered "clean" in a spot-check of hands, hair, clothes, and face (**Table 41**). Of homesteads, 32.2% of exteriors and 4.7% of interiors were considered clean at baseline, and 37.0% and 4.5%, respectively, were considered clean at follow-up. *Tubaramure* improved cleanliness on all four domains (**Table 42**). The percentage of clean mothers increased between 5 and 8 percentage points, and the percentage of clean children increased between 2 and 10 percentage points (both of these were statistically significant in T18 and TNFP groups). The percentage of households with clean exteriors and interiors improved between 2 and 7 percentage points (only significant for interiors in the T18 arm).

8.2 Household Food Security, Hunger, and Dietary Diversity

Food insecurity (i.e., the ability of a household to access food, as measured by the HFIAS) was prevalent at follow-up: Nearly half of households were severely food insecure and another third moderately food

[31] Peak malaria season in Burundi is from November to March. Thus, reported bednet use in this survey (conducted from October to December) is most likely at its highest.

insecure (**Table 43**). Only around 10% were considered food secure. Household hunger (measured by HHS, which uses the last three items of the HFIAS and reflects the most severe food insecurity experience) confirmed the severity of food insecurity: About 10% were experiencing severe hunger and 37% moderate hunger at baseline. The percentage of hungry households dropped to approximately 8% (severe) and 20% (moderate) at follow-up. Household dietary diversity was also low: Households consumed on average food from 4 food groups (out of a possible 12) during the previous day at both the baseline and follow-up. Nearly 70% of households reported having consumed food from fewer than four food groups.

Tubaramure reduced food insecurity (as measured by the HFIAS) by an average of 2 to 3 units (on a scale from 0 to 27) (statistically significant in all three treatment groups) (**Table 44**). The percentage of severely food insecure households decreased by 9–18 percentage points (statistically significant in all three treatment groups). Likewise, the percentage of food secure households increased by 5–8 percentage points (statistically significant in all three treatment groups). The decline in household hunger appears to confirm the improvement in food security, but the changes were statistically significant only in the TNFP group. *Tubaramure* also led to a modest decline in the percentage of households with a dietary diversity score below four in the T18 (significant) and TNFP (not significant) groups.

Table 37. Hygiene and sanitation[a]

	Baseline[1]					Follow-up[c]				
	Full sample[3]	Study arm				Full sample[3]	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	2623	432	870	433	888	2614	432	880	431	871
Drinking water treatment methods										
Nothing	96.7	96.8	96.2	95.8	97.5	94.0	93.5	92.2	90.9	97.5
Boiling	2.3	2.1	2.8	2.8	1.8	4.0	5.3	4.5	5.3	2.1
Other	1.0	1.2	1.0	1.4	0.7	2.1*	1.2	3.3	3.7	0.5
Drinking water storage										
Uncovered container	24.1	24.3	25.5	25.6	21.9	9.1	6.9	9.2	9.8	9.7
Covered container	75.8	75.7	74.3	74.1	78.0	90.7	92.8	90.4	90.0	90.2
No storage	0.1	0.0	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.1
Garbage disposal[d]										
Discarded in a public space	48.7	40.0	47.8	48.7	53.7	36.4*	27.3	32.4	28.4	48.9
Burned	1.3	1.4	0.8	1.4	1.6	0.3	0.2	0.3	0.9	0.1
Buried	12.1	13.2	11.9	10.9	12.4	8.3	6.7	6.6	12.3	8.8
Composted	46.2	51.6	47.2	47.6	41.8	64.6*	76.2	71.9	68.8	49.5
Fed to pigs/animals	0.6	0.2	0.5	0.7	0.9	0.7	0.5	0.6	1.2	0.8
Bednets										
Households with bednets	57.4	59.5	60.3	59.4	52.5	54.1	53.2	60.9	57.5	46.0
If yes, number of bednets	2.0 ± 1.0*	2.2 ± 0.9	2.0 ± 1.0	2.1 ± 1.0	1.9 ± 1.0	1.5 ± 0.8	1.6 ± 0.7	1.6 ± 0.8	1.6 ± 0.8	1.5 ± 0.7
Households that used a bednet previous night[e]	43.4	47.7	44.9	44.3	39.2	46.4	45.4	53.0	48.5	39.3
All household members slept under a bednet previous night[e]	36.2	39.9	7.13	38.4	32.6	36.7	34.1	42.3	39.5	30.9

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 1497 to 2623 in the full sample; N = 255 to 432 in the T24 arm; N = 525 to 870 in the T18 arm; N = 255 to 433 in the TNFP arm; and N = 462 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 1411 to 2614 in the full sample; N = 229 to 432 in the T24 arm; N = 534 to 880 in the T18 arm; N = 247 to 431 in the TNFP arm; and N = 401 to 871 in the control arm.
[d] Households reported all garbage disposal methods, and totals are greater than 100%.
[e] Calculated for all households, irrespective of bednet ownership.
* Study arms differ, $p < 0.05$

Table 38. Hygiene and sanitation: impact[a]

	Impact[b]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Drinking water treatment methods			
Nothing	−3.17 ± 2.01	−3.84 ± 1.68*	−4.64 ± 2.12*
Drinking water storage			
Uncovered container	−5.33 ± 4.08	−4.43 ± 3.52	−3.94 ± 4.13
Garbage disposal[c]			
Discarded in a public space	−6.88 ± 7.94	−9.57 ± 7.39	−14.53 ± 6.26*
Burned	0.24 ± 1.03	0.96 ± 0.75	0.97 ± 0.81
Buried	−3.49 ± 4.57	−2.35 ± 4.42	4.59 ± 4.66
Composted	16.47 ± 4.32*	16.70 ± 4.45*	13.01 ± 3.82*
Fed to pigs/animals	0.30 ± 0.58	0.18 ± 0.66	0.55 ± 0.94
Bednets			
Households with bednets	0.10 ± 4.76	6.54 ± 4.14	4.11 ± 7.45
If yes, number of bednets	−0.13 ± 0.08	−0.02 ± 0.10	−0.06 ± 0.14
Households that used a bednet last night[d]	−2.68 ± 5.20	7.33 ± 4.96	3.34 ± 5.86
Household members who slept under a bednet last night[d]	−4.55 ± 4.835	6.20 ± 4.75	1.97 ± 5.66

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 2908 to 5237.
[c] Households reported all methods of garbage disposal used, hence totals sum up to more than 100%.
[d] These percentages were calculated for all households, irrespective of having a bednet.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 39. Soap use[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2617**	**432**	**869**	**432**	**884**	**2613**	**432**	**880**	**431**	**870**
Soap; % of mothers who										
Have available in household	72.5	76.9	73.1	71.8	70.2	82.5	86.6	84.9	83.3	77.6
Used it today or yesterday	73.2	78.9	72.2	73.6	71.2	83.9*	88.2	87.4	84.9	77.8
When used soap today or yesterday; % of mothers who washed										
Child's hands	9.4	12.1	9.9	7.9	8.3	6.0	6.0	7.7	6.3	4.3
Own hands after defecation	4.4	5.3	3.8	5.3	4.1	9.6*	13.2	10.1	12.1	6.1
Own hands after cleaning child's defecation	5.1	6.5	4.4	6.3	4.4	4.8	6.3	3.6	8.1	3.6
Own hands before feeding child	8.8	9.5	8.2	8.6	9.0	10.4	10.2	10.9	11.8	9.3
Own hands before preparing food	7.2	7.0	6.3	7.4	7.9	8.6	8.6	7.7	9.5	9.0
Own hands before eating	20.4	19.8	19.5	23.5	20.2	27.2	26.9	28.9	26.7	25.9

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2612 to 2617 in the full sample; N = 430 to 432 in the T24 arm; N = 868 to 869 in the T18 arm; and N = 430 to 432 in the TNFP arm.
[c] Sample size at follow-up ranged from N = 2612 to 2613 in the full sample; and N = 879 to 880 in the T18 arm.
* Study arms differ, $p < 0.05$.

Table 40. Soap use: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Soap; % of mothers who			
Have available in household	2.89 ± 4.43	4.76 ± 4.31	4.94 ± 4.81
Used it today or yesterday	3.18 ± 3.49	8.90 ± 4.19*	4.99 ± 4.17
When used soap today or yesterday; % who of mothers washed			
Child's hands	−1.64 ± 2.94	1.95 ± 2.61	2.50 ± 2.57
Own hands after defecation	5.87 ± 2.77*	4.24 ± 1.79*	4.69 ± 2.35*
Own hands after cleaning child's defecation	0.57 ± 1.74	0.07 ± 1.30	2.48 ± 2.52
Own hands before feeding child	0.73 ± 3.40	2.67 ± 2.51	3.50 ± 3.07
Own hands before preparing food	0.66 ± 3.19	0.24 ± 2.19	1.00 ± 2.94
Own hands before eating	1.91 ± 5.15	4.26 ± 3.54	−1.96 ± 4.08

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 5224 to 5230. One-sided tests are reported for all indicators.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 41. Spot-check observations[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2615**	**432**	**869**	**431**	**886**	**2611**	**432**	**879**	**431**	**871**
Mothers all clean	23.9	20.1	23.9	22.8	26.2	23.9	23.0	24.9	26.7	22.0
Children all clean	29.6	30.7	26.6	28.8	32.3	27.3	25.3	30.0	28.3	25.0
Exteriors all clean	32.2	30.9	32.8	31.3	32.7	37.0	40.0	38.2	35.7	34.8
Interiors all clean[d]	4.7	6.8	4.1	2.9	5.5	4.5	4.2	5.9	3.7	3.6

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 1198 to 2615 in the full sample; N = 147 to 432 in the T24 arm; N = 439 to 869 in the T18 arm; N = 210 to 431 in the TNFP arm; and N = 402 to 886 in the control arm.
[c] Sample size at follow-up ranged from N = 780 to 2611 in the full sample; N = 142 to 432 in the T24 arm; N = 256 to 879 in the T18 arm; N = 107 to 431 in the TNFP arm; and N = 275 to 871 in the control arm.
[d] It was often not possible to observe the interior of the house, which led to a large number of missing values.
* Study arms differ, p < 0.05.

Table 42. Spot-check observations: impact[a]

	Impact[b,c]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Mothers all clean	7.03 ± 5.01	4.97 ± 2.62*	7.78 ± 3.54*
Children all clean	1.93 ± 4.43	10.47 ± 2.87*	6.61 ± 3.85*
Exteriors all clean	6.62 ± 6.85	3.00 ± 4.18	1.89 ± 4.73
Interiors all clean[d]	1.61 ± 3.10	4.46 ± 2.21*	3.70 ± 2.43

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 1978 to 5226. One-sided tests were used for all indicators.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
[d] It was often not possible to observe the interior of the house, which led to a large number of missing values.
* Impact estimate significantly different from 0, p < 0.05.

Table 43. Household hunger and dietary diversity[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
Household food insecurity access scale (HFIAS)										
Score (range 0 to 27)						11.7 ± 7.3*	10.2 ± 7.0	11.2 ± 7.4	10.8 ± 7.2	13.3 ± 7.0
Categories										
Food secure						10.2	11.1	11.7	14.4	6.1
Mildly insecure						6.9	9.3	8.4	5.6	4.8
Moderately insecure						33.4	39.9	31.5	34.3	31.6
Severely insecure						49.5*	39.7	48.4	45.7	57.5
Household hunger scale (HHS)										
Score (range 0 to 6)	1.5 ± 1.6	1.3 ± 1.5	1.5 ± 1.5	1.5 ± 1.6	1.6 ± 1.6	1.0 ± 1.4*	0.7 ± 1.3	0.9 ± 1.4	0.8 ± 1.3	1.2 ± 1.6
Categories										
Little-to-no hunger	52.6	59.7	50.9	51.5	51.2	72.1	82.1	72.6	77.0	64.3
Moderate hunger	37.3	33.3	38.1	38.1	38.0	20.0	10.9	20.2	16.7	25.9
Severe hunger	10.1	6.9	10.9	10.4	10.7	7.9*	7.0	7.2	6.3	9.8
Household dietary diversity score (HDDS)										
Score (range of 0–9)	4.0 ± 1.6	4.2 ± 1.6	4.0 ± 1.6	4.0 ± 1.8	3.8 ± 1.5	3.9 ± 1.6*	3.9 ± 1.5	4.2 ± 1.7	4.1 ± 1.6	3.6 ± 1.4
HDDS < 4	65.5	63.7	63.6	62.1	70.0	68.1*	69.0	61.5	61.9	77.3

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2617 to 2623 in the full sample; N = 868 to 870 in the T18 arm; N = 431 to 433 in the TNFP arm; and N = 886 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2595 to 2614 in the full sample; N = 428 to 432 in the T24 arm; N = 871 to 880 in the T18 arm; and N = 865 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 44. Household hunger and dietary diversity: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Household food insecurity access scale (HFIAS)			
Score (range 0 to 27)	−3.10 ± 0.75*	−2.13 ± 0.65*	−2.56 ± 0.83*
Categories			
Food secure	5.05 ± 2.17*	5.63 ± 1.87*	8.30 ± 2.83*
Mildly insecure	4.46 ± 1.63*	3.60 ± 1.45*	0.75 ± 1.66
Moderately insecure	8.33 ± 3.86*	−0.06 ± 2.60	2.77 ± 3.89
Severely insecure	−17.84 ± 4.41*	−9.17 ± 3.23*	−11.81 ± 3.43*
Household hunger scale (HHS)			
Score (range 0 to 6)	−0.23 ± 0.25	−0.27 ± 0.17	−0.38 ± 0.19*
Categories			
Little-to-no hunger	8.94 ± 7.15	8.19 ± 4.73	12.78 ± 5.64*
Moderate hunger	−10.18 ± 5.30	−5.68 ± 3.48	−9.27 ± 3.81*
Severe hunger	1.25 ± 3.60	−2.50 ± 2.61	−3.51 ± 2.87
Household dietary diversity score (HDDS)			
Score (range 0 to 9)	0.01 ± 0.22	0.43 ± 0.15*	0.31 ± 0.21
Low diversity (HDDS <4)	−1.75 ± 6.34	−9.20 ± 4.41*	−7.17 ± 5.21

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 2595 to 5237.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for HDDS score and negative effects for HFIAS score, HHS score and % HDDS<4.
* Impact estimate significantly different from 0, $p < 0.05$.

9. Results: Maternal Impact

9.1 Feeding, Care, and Health Knowledge of Mothers

Only around half of the respondent mothers knew that abdominal pain may signal pregnancy complications at baseline; this dropped to 39.0% at follow-up (**Table 45**). Fewer than 30% mentioned vaginal bleeding at baseline, but this increased to 38.7% at follow-up. The percentage of mothers mentioning lack of fetal movement increased dramatically from 2.0% to 48.7% between surveys. Other danger signs requiring immediate medical attention were mentioned by fewer than 15% of the respondents at both baseline and follow-up. The percentage of mothers who could name at least two danger signs in pregnancy dropped by more than 10 percentage points, to 48.3%, at follow-up. A similar picture of limited and declining knowledge was observed for danger signs during childhood illnesses. Except for fever (mentioned by about 95% in both surveys), none of the danger signs was mentioned by more than 45% of the mothers. The percentage of mothers who mentioned at least two dangers signs dropped from 64.7% to 59.3%. The *Tubaramure* program had no significant effect on mothers' knowledge of danger signs during pregnancy or for childhood illnesses (**Table 46**).

Only around 10% of mothers reported—incorrectly—that sick children should be breastfed less (**Table 47**, data collected only at follow-up). Around one-fifth wrongly believed that sick children should be provided with less liquid, and around 30% thought that they should be given less food. The percentage of mothers who erroneously believed that breast milk, liquid, and food intake should be reduced during convalescence was considerably smaller (approximately 2.0%, 7.2%, and 6.5%, respectively).

Tubaramure had a large positive effect on mother's knowledge of appropriate feeding for sick children. The intervention increased the percentage of mothers aware of the need to increase breastfeeding for sick children under 6 months by 13–16 percentage points and for children 6–24 months by 13–15 percentage points (statistically significant in the T24, T18, and TNFP groups), resulting in fewer mothers reporting that a sick child should be fed less or the same (**Table 48**). Similarly, the intervention increased the percentage of mothers aware that a sick child 6–24 months of age should be provided more liquid by 7–13 percentage points (statistically significant in the T24 and T18 groups) and more solid food by 7–9 percentage points (statistically significant in the T18 group). The positive impact of the intervention on maternal knowledge of how to feed a child recovering from illness was smaller and generally did not reach statistical significance.

More than 95% of mothers knew that a baby should be breastfed immediately or very soon after birth and that a baby should be fed colostrum, both at baseline and follow-up (**Table 49**). Very few, however, knew that a malnourished mother is capable of producing enough milk to adequately feed her child (2.4% at baseline and 4.1% at follow-up). When asked about the benefits of exclusive breastfeeding, more than three-quarters of the mothers mentioned benefits related to child health and nutrition, and this increased from 77.1% to 82.4% from baseline to follow-up. Only around 2% mentioned lactational amenorrhea as a benefit of exclusive breastfeeding at both baseline and follow-up. Mothers stated that it was appropriate to stop breastfeeding at around 32 months of age at baseline and 34 months of age at follow-up, which meets the WHO recommendation for continued breastfeeding for the first 2 years of life or beyond. Only around 10% of the mothers knew that they could continue breastfeeding when pregnant again. Most mothers (62.1%) wrongly believed that if they are unable to breastfeed a child under 6 months of age that the child should be fed cow's or goat's milk; this belief differed among treatment arms and was more common in the T24 arm. Fewer than one-fifth suggested breast milk be fed to a child in the mother's absence (data collected only at follow-up)

The program did not have a consistent significant impact on maternal breastfeeding knowledge (**Table 50**).

Table 45. Knowledge of pregnancy and childhood illness danger signs among mother[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2622**	**432**	**870**	**433**	**887**	**2614**	**432**	**880**	**431**	**871**
Danger signs of pregnancy; % who mentioned										
Vaginal bleeding	27.2	25.8	28.1	24.9	28.2	38.7	41.2	39.4	35.5	38.3
Abdominal pain	48.2	45.7	49.4	52.1	46.3	39.0	44.7	36.3	41.1	38.0
Persistent back pain	13.6	16.1	15.3	14.6	10.3	6.7	8.4	4.8	8.8	6.7
Vaginal discharge	7.1*	3.8	7.3	9.6	7.1	5.2	4.2	5.8	6.0	4.6
Swollen hands/face	3.8	2.6	2.9	4.7	4.7	1.6	3.0	1.1	1.4	1.5
Severe headache/vision trouble	3.4	3.3	3.7	4.7	2.6	3.2	3.5	3.3	4.4	2.4
Regular contractions before 37 weeks	4.3	3.6	3.6	5.2	4.9	2.4	1.6	3.1	1.9	2.3
No fetal movement	2.0	2.2	1.5	2.7	2.0	48.7	51.5	50.2	51.0	44.5
At least two signs	58.7	53.1	60.6	65.0	56.4	48.3	51.5	47.8	50.8	46.0
Danger signs of childhood illness; % who mentioned										
Cannot drink/breastfeed	25.6	29.6	24.9	27.9	23.1	30.7	28.9	30.8	29.7	31.9
Symptoms intensify	40.9	40.7	39.4	39.3	43.3	24.9	25.0	23.0	32.0	23.4
Fever	94.5	93.3	94.9	94.2	94.7	95.6	94.7	96.0	95.6	95.8
Rapid breathing	8.2	8.6	7.0	8.1	9.2	5.2	5.1	4.7	5.3	5.6
Difficulty breathing	9.5	10.9	9.2	11.8	8.1	6.4	7.9	5.7	6.5	6.4
Bloody stools	12.0	10.6	11.7	14.5	11.6	11.6	13.2	10.9	13.9	10.3
Difficulty swallowing	2.9	3.9	3.2	1.8	2.5	1.6	1.2	2.2	1.4	1.4
At least two signs	64.7	66.4	63.6	67.7	63.5	59.3	58.6	58.2	64.5	58.3

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2518 to 2622 in the full sample; N = 416 to 432 in the T24 arm; N = 843 to 870 in the T18 arm; N = 415 to 433 in the TNFP arm; and N = 844 to 887 in the control arm.
[c] Sample size at follow-up ranged from N = 2597 to 2614 in the full sample; N = 427 to 432 in the T24 arm; N = 874 to 880 in the T18 arm; and N = 865 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 46. Knowledge of pregnancy and childhood danger signs among mothers: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Danger signs of pregnancy; % who mentioned			
Vaginal bleeding	6.33 ± 8.07	1.69 ± 8.99	0.91 ± 8.02
Abdominal pain	7.90 ± 6.01	−4.63 ± 6.32	−2.47 ± 6.83
Persistent back pain	−3.98 ± 4.81	−6.92 ± 3.97	−2.29 ± 4.04
Vaginal discharge	2.93 ± 2.85	1.00 ± 2.45	−1.07 ± 2.80
Swollen hands/face	3.64 ± 1.52*	1.41 ± 1.26	−0.10 ± 1.43
Severe headache/vision trouble	0.30 ± 1.29	−0.23 ± 1.53	−0.11 ± 1.36
Regular contractions before 37 weeks	0.61 ± 1.90	1.92 ± 1.82	−0.94 ± 2.16
No fetal movement	7.01 ± 4.57	6.13 ± 4.08	5.72 ± 4.64
At least two signs	9.61 ± 8.67	−2.24 ± 8.46	−3.98 ± 10.27
Danger signs of childhood illness; % who mentioned			
Cannot drink/breastfeed	−9.27 ± 5.45	−2.88 ± 4.29	−6.39 ± 5.33
Symptoms intensify	4.52 ± 4.96	3.50 ± 4.81	12.23 ± 5.09*
Fever	0.44 ± 1.95	0.08 ± 1.11	0.50 ± 1.35
Rapid breathing	0.21 ± 2.02	1.30 ± 2.43	1.00 ± 2.74
Difficulty breathing	−1.43 ± 2.53	−1.92 ± 2.13	−3.81 ± 2.97
Bloody stools	3.73 ± 4.26	0.35 ± 3.45	0.70 ± 4.84
Difficulty swallowing	−1.72 ± 1.47	0.01 ± 1.40	0.61 ± 1.22
At least two signs	−2.36 ± 5.53	−0.17 ± 6.09	2.32 ± 4.71

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 5115 to 5236.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 47. Knowledge of feeding practices for sick children among mothers[a]

	Follow-up[b]				
		Study arm			
	Full sample	**T24**	**T18**	**TNFP**	**Control**
N	**2614**	**432**	**880**	**431**	**871**
Feeding a sick child					
Breastfeeding (< 6m)					
Less	9.1	6.3	7.2	7.1	13.5
Same	21.4	17.3	19.2	19.8	26.4
More	69.0	75.9	73.3	72.4	59.7
Breastfeeding (6–23 m)					
Less	10.1	7.9	7.7	10.0	13.7
Same	23.3	19.5	21.8	19.0	28.8
More	66.0	71.9	70.1	70.1	56.8
Providing liquids (6–23 m)					
Less	21.1	17.6	21.7	20.4	22.6
Same	18.4	15.3	16.7	16.5	22.5
More	60.1	66.8	61.6	62.2	54.2
Providing solid foods (6–23 m)					
Less	27.9	25.2	26.5	24.4	32.3
Same	24.3	25.5	21.7	26.2	25.4
More	47.4	48.8	51.4	49.0	41.9
Feeding a child recovering from illness					
Breastfeeding (< 6m)					
Less	1.5	1.4	1.8	1.2	1.5
Same	17.6	17.6	15.9	15.3	20.4
More	80.7	81.0	82.2	83.3	77.8
Breastfeeding (6–23 m)					
Less	2.0	2.3	1.7	2.6	1.8
Same	17.3	16.7	15.9	15.8	19.6
More	80.6	80.8	82.3	81.7	78.2
Providing liquids (6–23 m)					
Less	7.2	7.4	7.2	7.4	7.1
Same	18.6	19.2	18.2	14.8	20.4
More	74.0	73.4	74.7	76.8	72.2
Providing solid foods (6–23 m)					
Less	6.5	5.6	6.5	6.5	7.0
Same	20.6	22.0	19.9	17.4	22.2
More	72.8	72.0	73.6	75.9	70.7

[a] Values are %. All estimates account for clustering.
[b] Sample size ranged from N = 2591 to 2614 in the full sample; N = 428 to 432 in the T24 arm; N = 873 to 880 in the T18 arm; N = 424 to 431 in the TNFP arm; and N = 866 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 48. Knowledge of feeding practices for sick children among mothers: impact[a]

	Impact[b]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Feeding a sick child			
Breastfeeding (< 6m)			
Less	−7.20 ± 2.93*	−6.29 ± 2.73*	−6.43 ± 2.92*
Same	−9.15 ± 2.85*	−7.20 ± 2.13*	−6.63 ± 3.15*
More	16.23 ± 4.38*	13.61 ± 3.63*	12.71 ± 4.49*
Breastfeeding (6–23 m)			
Less	−5.77 ± 2.95	−5.94 ± 2.87*	−3.69 ± 2.90
Same	−9.33 ± 3.59*	−7.00 ± 2.30*	−9.79 ± 2.83*
More	15.09 ± 4.41*	13.28 ± 3.56*	13.24 ± 4.32*
Providing liquids (6–23 m)			
Less	−4.98 ± 2.66	−0.91 ± 2.81	−2.20 ± 3.04
Same	−7.19 ± 1.98*	−5.80 ± 1.95*	−6.03 ± 2.80*
More	12.63 ± 3.87*	7.40 ± 3.24*	7.99 ± 4.00
Providing solid foods (6–23 m)			
Less	−7.03 ± 3.13*	−5.78 ± 2.61*	−7.90 ± 3.79*
Same	0.09 ± 2.88	−3.67 ± 1.87	0.84 ± 3.42
More	6.94 ± 4.30	9.46 ± 2.78*	7.05 ± 4.01
Feeding a child recovering from illness			
Breastfeeding (< 6m)			
Less	−0.11 ± 0.64	0.33 ± 0.77	−0.34 ± 0.92
Same	−2.78 ± 2.59	−4.42 ± 2.20*	−5.06 ± 2.41*
More	3.23 ± 2.84	4.44 ± 2.19*	5.50 ± 3.02
Breastfeeding (6–23 m)			
Less	0.48 ± 0.85	−0.13 ± 0.87	0.72 ± 1.11
Same	−2.97 ± 2.72	−3.71 ± 2.43	−3.86 ± 2.72
More	2.60 ± 2.99	4.07 ± 2.47	3.48 ± 2.66
Providing liquids (6–23 m)			
Less	0.29 ± 1.77	0.04 ± 1.65	0.31 ± 1.58
Same	−1.22 ± 3.08	−2.25 ± 2.04	−5.59 ± 2.49*
More	1.16 ± 3.39	2.44 ± 2.57	4.58 ± 3.12
Providing solid foods (6–23 m)			
Less	−1.45 ± 1.75	−0.53 ± 1.83	−0.51 ± 1.61
Same	−0.17 ± 3.31	−2.27 ± 2.48	−4.76 ± 3.01
More	1.27 ± 4.08	2.91 ± 3.24	5.15 ± 3.86

[a] Values are simple difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 2591 to 2614.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 49. Breastfeeding knowledge among mothers[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2620**	**432**	**869**	**433**	**887**	**2614**	**432**	**880**	**431**	**871**
% who knew that										
Baby should be breastfed immediately or during first hours after birth	95.2	95.1	94.6	97.0	94.9	95.5	95.4	96.5	97.0	93.8
Baby should be fed colostrum						97.8	98.8	98.0	97.0	97.6
Malnourished mother can produce enough good milk	2.4	2.3	2.2	3.0	2.5	4.1	7.0	3.9	1.9	4.1
% who mentioned relation of exclusive breastfeeding to:										
Child health and nutrition	77.1	79.9	74.9	80.1	76.6	82.4*	85.6	83.9	83.5	78.8
Lactational amenorrhea	2.2	3.2	2.5	2.1	1.5	2.3*	1.6	2.8	4.2	1.0
Appropriate age to stop breastfeeding (months)	32.1 ± 7.5	31.0 ± 7.9	32.4 ± 7.1	31.7 ± 7.4	32.5 ± 7.5	33.7 ± 9.6*	33.4 ± 9.3	33.6 ± 9.4	31.9 ± 10.0	34.8 ± 9.5
Believe mother can continue breastfeeding when pregnant						10.5	12.0	9.9	10.3	10.6
If not with child < 6 months, what to feed; % mentioned:										
Breast milk						18.4	20.6	17.7	22.5	15.8
Powdered milk						11.4	13.2	10.6	14.2	10.0
Baby formula						7.4	8.4	7.4	6.7	7.1
Cow's or goat's milk						62.1*	70.4	62.7	60.8	57.9
Nothing or does not know						16.1*	10.9	16.3	13.2	20.0

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2572 to 2622 in the full sample; N = 425 to 432 in the T24 arm; N = 849 to 870 in the T18 arm; N = 428 to 433 in the TNFP arm; and N = 870 to 887 in the control arm.
[c] Sample size at follow-up ranged from N = 2582 to 2614 in the full sample; N = 425 to 432 in the T24 arm; N = 871 to 880 in the T18 arm; N = 426 to 431 in the TNFP arm; and N = 857 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 50. Breastfeeding knowledge among mothers: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
% who knew that:			
Baby should be breastfed immediately or during first hours after birth	1.46 ± 2.07	3.13 ± 2.45	1.18 ± 1.89
Baby should be fed colostrum	1.25 ± 0.78	0.37 ± 0.92	−0.61 ± 1.11
Malnourished mother can produce enough good milk	2.91 ± 2.09	−0.08 ± 1.19	−2.85 ± 1.61
% who mentioned relation of exclusive breastfeeding to:			
Child health and nutrition	3.42 ± 5.11	6.63 ± 5.06	0.98 ± 5.04
Lactational amenorrhea	−1.15 ± 1.60	0.75 ± 1.37	2.54 ± 1.35*
Appropriate age to stop breastfeeding (months)	0.18 ± 0.94	−1.10 ± 0.76	−2.09 ± 1.01*
Believe mother can continue breastfeeding when pregnant	1.38 ± 2.32	−0.74 ± 1.91	−0.36 ± 1.63
If not with child < 6 months, what to feed; % mentioned:			
Breast milk	4.76 ± 4.89	1.88 ± 2.24	6.66 ± 2.80*
Powdered milk	3.19 ± 3.69	0.60 ± 3.28	4.15 ± 3.72
Baby formula	1.23 ± 2.14	0.29 ± 1.73	−0.40 ± 1.98
Cow’s or goat’s milk	12.44 ± 4.51*	4.78 ± 4.34	2.86 ± 5.97

[a] Values are double difference impact estimates ± SE in percentage points when data from both surveys were available and simple difference impact estimates ± SE when only follow-up data were available. All estimates account for clustering.
[b] Sample size ranged from N = 2582 to 5233.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

The majority of mothers were aware of the importance of a sufficient quantity of food to prevent malnutrition among children (75.1% at baseline and 69.9% at follow-up) (**Table 51**). Fewer mothers were familiar with the importance of dietary quality (around 39% in both surveys) or the contribution of illness (approximately one-third and one-fourth at baseline and at follow-up, respectively). When asked about foods essential for child growth, no more than 60% of mothers at baseline or follow-up mentioned any animal-source foods (such as meat, dairy, and eggs). The most commonly mentioned foods essential for children's growth were vegetables (77.8% at baseline and 85.5% at follow-up), cereals (50.9 % and 40.2%), beans (49.3% and 59.8%), and fruits (44.7% and 48.5%). Micronutrient knowledge was limited in both surveys, with fewer than 40% of women identifying yellow- or orange-colored fruits or vegetables as vitamin A-rich foods and fewer than 15% mentioning animal-source foods in both surveys. Only green leafy vegetables were mentioned by more than half of mothers (57.3% at baseline and 59.9% at follow-up). A little more than half of the mothers were aware that vitamin A deficiency could cause poor immunity in children, whereas only 5.2% were aware that vitamin A deficiency could have vision-related consequences (data collected only in the follow-up survey). For iron-rich foods, mothers primarily identified green leafy vegetables (93.8%); fewer than half mentioned animal-source foods (45.9%), and fewer than 1 in 10 mentioned special baby foods or CSB (data collected only at follow-up). Knowledge of the iron-rich characteristics of special baby foods and CSB differed among groups and was more common in treatment arms. At baseline, around 60% of mothers thought that iron deficiency could cause poor immunity, and a similar percentage knew that it could delay development. These percentages did not fundamentally change at follow-up. Other key consequences of iron deficiency (such as weakness and fatigue) were mentioned by fewer than 30% of mothers in both surveys.

The intervention had no clear impact on the percentage of mothers who knew the reasons for child malnutrition or the foods essential for child growth (**Table 52**). The program had a significant impact (11–15 percentage points) on the percentage of mothers identifying yellow- and orange-colored fruits and vegetables as rich in vitamin A (statistically significant in all groups). A similar significant program effect (14–20 percentage points) was found for the percentage mentioning green leafy vegetables. The intervention did not, however, change the percentage of mothers who knew the consequences of vitamin A deficiency. A similar picture was found for iron deficiency. The program clearly increased awareness of iron-rich foods, with estimated program impacts of 2–8 percentage points on the percentage of mothers mentioning special baby foods, CSB, and green leafy vegetables as rich in iron (statistically significant in all cases, with the exception of green leafy vegetables among the T18 group). *Tubaramure* had a modest (1–2 percentage points) impact on the percentage of mothers mentioning delayed education/schooling as a consequence of iron deficiency (significant in the T24 and T18 groups). No observable impact was found on knowledge of other key consequences, such as child development, fatigue, or weakness. Interestingly, positive impact estimates (3–12 percentage points, statistically significant for the TNFP group) were found for the percentage of mothers mentioning poor immunity, even though this is not a well-established consequence of iron deficiency.

Table 51. Malnutrition knowledge among mothers[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
Reasons for child malnutrition; % who said:										
Insufficient amount of food	75.1	75.5	76.6	77.4	72.5	69.9	67.3	72.3	70.1	68.6
Irregular meals	7.5*	4.4	7.7	9.0	8.1	6.0	6.3	5.5	8.1	5.5
Diseases	33.6	36.8	34.0	35.6	30.7	26.6	26.0	24.7	28.3	28.2
Early weaning	19.1*	24.3	19.0	15.9	18.3	9.6	9.0	10.2	9.5	9.3
Lack of affection during feeds	1.0	0.9	0.8	2.1	0.8	0.9	0.7	1.4	0.7	0.7
No food variety	39.4	32.6	39.8	37.9	43.1	39.5	40.4	38.0	41.5	39.7
Foods essential for child growth; % who mentioned:										
Bread/rice/oatmeal	50.9	44.4	50.6	48.5	55.6	40.2	39.1	38.2	40.6	42.6
Oatmeal with milk	13.6	14.6	12.8	13.6	13.9	11.8	14.4	10.9	15.1	9.9
Meat, chicken	19.7	19.0	20.0	21.9	18.7	26.7*	25.2	31.1	29.2	21.8
Fish	24.5	19.7	26.6	21.2	26.4	29.8	29.9	29.7	30.6	29.5
Eggs	9.6	13.2	9.0	9.7	8.4	9.6	10.6	10.3	11.6	7.2
Fruits	44.7	48.4	46.6	40.2	43.2	48.5*	48.1	51.7	52.9	43.4
Vegetables	77.8	81.0	78.2	77.4	76.2	85.5	88.2	85.5	87.5	83.1
Milk	16.4*	21.5	15.5	17.1	14.6	11.1	10.0	10.9	13.0	10.9
Beans	49.3	48.8	49.4	45.7	51.2	59.8	62.0	60.5	61.7	57.2
Any animal-source food	56.0	56.7	55.4	55.7	56.3	59.4	57.6	60.7	62.9	57.3
Foods perceived as vitamin A rich; % who said:										
Fruits/vegetables (yellow/orange color)	39.4*	34.3	36.8	39.0	44.5	36.9	36.3	36.9	43.4	34.0
Green leafy vegetables	57.3*	53.2	54.1	54.5	63.9	59.9*	59.0	60.9	66.6	56.1
Eggs	10.3	12.5	10.0	9.2	9.9	9.4	10.6	10.1	11.6	7.0
Liver	3.7	4.4	2.4	5.5	3.8	3.0	3.7	2.6	5.3	2.0
Breast milk	12.5	13.0	10.9	15.0	12.6	6.8	4.6	6.1	10.2	7.0
Cow's milk	11.8	10.4	11.0	13.9	12.3	11.5	9.0	10.3	14.4	12.5
Consequences of vitamin A deficiency among children; % who mentioned:										
Vision						5.2	4.9	5.6	6.8	4.3
Poor immunity						57.0	51.6	58.1	61.6	56.2

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
Foods perceived as iron rich; % who said:										
Meat						45.9	50.9	46.0	46.2	43.1
Special baby food						2.7*	3.7	3.1	3.7	1.3
CSB						8.3*	10.6	8.5	12.8	4.7
Green leafy vegetables						93.8	96.5	94.1	94.9	91.6
Consequences of iron-deficiency among children; % who said										
Difficulty in school	1.5	0.7	1.3	2.1	1.9	1.0*	1.2	1.3	1.6	0.3
Altered development	57.6*	63.9	51.7	62.4	57.9	53.1	51.6	51.2	59.6	52.4
Slow growth	17.9	19.0	17.1	17.3	18.4	16.4	18.8	15.2	17.9	15.6
Poor immunity	58.9	62.3	58.8	54.0	59.7	65.3	70.6	64.5	68.0	62.2
Fatigue	11.6	9.0	11.3	12.9	12.6	3.6	4.6	2.8	4.4	3.4
Weakness	27.5	25.5	27.0	30.0	27.7	13.8	17.1	12.7	14.2	13.1

[a] Values are %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2620 to 2622 in the full sample; N = 869 to 870 in the T18 arm; and N = 886 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2589 to 2614 in the full sample; N = 426 to 432 in the T24 arm; N = 875 to 880 in the T18 arm; N = 425 to 431 in the TNFP arm; and N = 863 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 52. Malnutrition knowledge among mothers: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Reasons for child malnutrition; % who said:			
Insufficient amount of food	−4.24 ± 5.20	−0.40 ± 4.60	−3.13 ± 4.26
Irregular meals	4.47 ± 2.58*	0.31 ± 3.43	1.36 ± 3.47
Diseases	−8.29 ± 4.49	−7.23 ± 4.09	−5.36 ± 4.79
Early weaning	−6.40 ± 3.54	0.08 ± 3.13	2.53 ± 3.65
Lack of affection during feeds	−0.17 ± 0.82	0.66 ± 0.68	−1.33 ± 0.89
No food variety	11.25 ± 5.74*	1.54 ± 4.69	6.64 ± 5.28
Foods essential for child growth; % who said:			
Bread, rice, oatmeal	7.64 ± 4.96	0.55 ± 4.39	4.42 ± 6.26
Oatmeal with milk	3.62 ± 3.62	2.07 ± 4.11	5.64 ± 3.61
Meat, chicken	3.02 ± 2.87	7.75 ± 3.37*	3.51 ± 4.58
Fish	7.86 ± 3.72*	0.50 ± 4.15	6.89 ± 4.00*
Eggs	−1.31 ± 2.46	2.65 ± 1.89	3.19 ± 3.66
Fruits	−0.34 ± 5.21	5.25 ± 4.82	12.18 ± 3.99*
Vegetables	0.24 ± 3.50	0.32 ± 3.81	2.76 ± 3.57
Milk	−8.10 ± 2.69	−1.22 ± 3.28	−0.70 ± 3.89
Beans	7.87 ± 4.72	5.16 ± 4.13	10.06 ± 4.92*
Any animal-source food	0.28 ± 4.29	4.33 ± 5.14	6.64 ± 5.70
Foods perceived as vitamin A rich; % who said:			
Fruits/vegetables (yellow/orange color)	12.64 ± 5.74*	10.85 ± 5.34*	14.53 ± 5.74*
Green leafy vegetables	13.71 ± 5.53*	14.71 ± 4.40*	19.78 ± 4.63*
Eggs	1.16 ± 3.55	2.91 ± 3.01	5.21 ± 4.35
Liver	0.97 ± 1.91	1.80 ± 1.45	1.27 ± 2.42
Breast milk	−2.81 ± 3.66	0.80 ± 3.65	0.70 ± 4.07
Cow’s milk	−1.78 ± 3.85	−1.10 ± 3.52	0.10 ± 4.58
Consequences of vitamin A deficiency among children; % who said:			
Vision	0.65 ± 1.58	1.31 ± 1.11	2.54 ± 2.11
Poor immunity	−4.56 ± 5.39	1.86 ± 3.53	5.45 ± 4.57

	Impact[b,c]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Foods perceived as iron-rich; % who said:			
Meat	5.25 ± 4.00	4.35 ± 2.87	3.19 ± 3.45
Special baby food	2.44 ± 0.86*	1.80 ± 0.80*	2.45 ± 1.43*
CSB	5.94 ± 2.44*	3.81 ± 1.28*	8.05 ± 1.66*
Green leafy vegetables	4.92 ± 1.79*	2.48 ± 2.09	3.29 ± 1.85*
Consequences of iron-deficiency among children; % who said:			
Delays studies	2.03 ± 0.92*	1.54 ± 0.79*	1.13 ± 1.15
Delays development	−6.57 ± 5.83	5.10 ± 4.52	2.49 ± 5.37
Slow growth	2.91 ± 4.18	0.82 ± 4.17	3.47 ± 3.15
Poor immunity	6.47 ± 5.66	3.26 ± 4.87	11.56 ± 3.68*
Fatigue	4.67 ± 2.35*	0.65 ± 2.09	0.49 ± 3.32
Weakness	5.94 ± 4.47	−0.07 ± 5.45	−1.87 ± 4.16

[a] Values are double difference impact estimates ± SE in percentage points when data from both surveys were available and simple difference impact estimates ± SE when only follow-up data were available. All estimates account for clustering.
[b] Sample size ranged from N = 2589 to 5235.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

Knowledge related to adequate complementary feeding practices was limited. At baseline, around 63% of mothers knew that 6 months is the correct age to introduce foods and liquids other than breast milk. At follow-up (when questions were asked separately for liquids and foods), around 60% mentioned 6 months as the appropriate age for liquids and around 30% believed it was later. The percentage knowing the correct age was considerably lower for the introduction of foods (44.9%), and more than half of the mothers wrongly responded that foods should be introduced after 6 months of age.

At follow-up, around 30% of the mothers erroneously believed that the appropriate food consistency for children 6–8 months of age should be liquid like water (question not asked at baseline) (**Table 53**). For children 12–23 months, nearly all mothers (99.1%) reported that the food should be either thick like a paste or semi-solid like a puree.

When asked about the number of times a child 6–8 months of age should be fed solid (i.e., complementary) foods, the average reported minimum frequency was 2.6 times per day at baseline and 2.9 times per day at follow-up. When compared to the WHO guidelines of at least twice daily for this age group, the majority of mothers (92.9% at baseline and 96.2% at follow-up) knew the minimum frequency; however, when compared to the *Tubaramure* guidelines of thrice daily, 52.7% of mothers at baseline and 71.5% at follow-up stated the minimum frequency. Knowledge of the correct feeding frequency for children 12–23 months of age was considerably lower. Mothers reported an average minimum of 2.9 meals daily at baseline and 3.0 at follow-up. Compared to the WHO guidelines of at least 3 meals per day for this age group, 70.5% of mothers at baseline and 79.5% at follow-up stated at least the minimum frequency. However, the percentage who knew the *Tubaramure* recommended frequency of at least four meals per day was considerably lower, with 13.8% and 20.6% at baseline and follow-up, respectively. At follow-up, almost all (98.3%) knew that a child 6–8 months of age cannot always eat without help (question not asked at baseline), whereas only 70.1% knew this for children 12–23 months of age.

Tubaramure significantly reduced the percentage of mothers who thought that liquids other than breast milk can be introduced before 6 months of age (6–9 percentage points, statistically significant in all groups) (**Table 54**). The program had a similar but smaller effect on the percentage who thought that foods can be introduced before 6 months of age (2–3 percentage points, statistically significant in all groups). *Tubaramure* significantly increased the percentage of mothers who thought that liquids should be introduced after 6 months of age in the T24 and TNFP groups (no effect in the T18 group). Importantly, the program did not reduce the percentage of mothers who wrongly believed that complementary foods should be introduced after 6 months of age.

Tubaramure consistently decreased the percentage of mothers who believed that foods for children 6–8 months of age should be liquid, like water (2–5 percentage points), but it did not reach statistical significance for any group. *Tubaramure* increased the percentage of mothers who knew the *Tubaramure*-recommended feeding frequency for children 6–8 months by 4–19 percentage points (significant in the T18 and TNFP groups). It also increased the percentage of mothers who knew the WHO-recommended frequency for children 12–23 months (4–9 percentage points, significant in the T18 and TNFP groups) and the *Tubaramure*-recommended frequency for this age group (5–7 percentage points, significant in the T18 group).

Table 53. Complementary feeding knowledge among mothers[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2621**	**432**	**869**	**433**	**887**	**2613**	**432**	**880**	**431**	**871**
Age of introduction of food/liquids other than breast milk; % who said										
Before 6 months	16.5	16.4	18.6	13.2	16.0					
At 6 months	63.1	60.9	61.8	65.6	64.3					
After 6 months	19.9	22.5	19.1	20.8	18.9					
Does not know	0.5	0.2	0.5	0.5	0.8					
Age of introduction of liquids other than breast milk; % who said										
Before 6 months						13.3	9.0	11.7	11.8	17.8
At 6 months						57.6	52.2	62.7	55.7	56.1
After 6 months						28.3	38.1	25.0	32.0	24.9
Does not know						0.8*	0.7	0.6	0.5	1.1
Age of introduction of foods other than breast milk; % who said										
Before 6 months						2.1	1.4	1.6	0.9	3.6
At 6 months						44.9	37.5	49.8	45.3	43.4
After 6 months						52.9	61.1	48.6	53.5	52.7
Does not know						0.2	0.0	0.0	0.2	0.3
Food consistency for child 6–8 months										
Thick like a paste						2.1	1.6	1.8	2.3	2.4
Liquid like water						29.3	27.1	27.8	29.6	31.8
Semi-solid like puree						68.6	71.3	70.4	68.1	65.8
Food consistency for child 12–23 months										
Thick like a paste						50.9	48.6	48.0	49.0	55.9
Liquid like water						0.9	1.6	0.7	0.2	1.2
Semi-solid like puree						48.2	49.8	51.3	50.8	43.0
Feeding frequency for child 6–8 months										
Number of meals per day	2.6 ± 0.8*	2.8 ± 0.8	2.6 ± 0.7	2.5 ± 0.8	2.5 ± 0.8	2.9 ± 0.8*	3.0 ± 0.8	2.9 ± 0.8	3.0 ± 0.8	2.7 ± 0.7
Correct feeding frequency (WHO ≥ 2 meals/day)	92.9	95.6	93.8	93.1	90.6	96.2	98.1	96.8	97.0	94.2
Correct feeding frequency (*Tubaramure* ≥ 3 meals/day)	52.7	62.4	52.6	49.5	49.6	71.5*	77.7	74.1	80.0	61.5
Feeding frequency for child 12–23 months										
Number of meals per day	2.9 ± 1.0	2.9 ± 0.7	2.9 ± 0.8	2.8 ± 0.8	2.8 ± 1.3	3.0 ± 0.8	3.1 ± 0.8	3.1 ± 0.8	3.1 ± 0.9	2.9 ± 1.0
Correct feeding frequency (WHO ≥ 3 meals/day)	70.5	75.0	70.5	68.0	69.5	79.5	82.4	82.5	81.6	74.1
Correct feeding frequency (*Tubaramure* ≥ 4 meals/day)	13.8	16.2	14.6	13.5	11.9	20.6*	23.6	23.8	23.5	14.6
Knows that child cannot always eat without help										
6–8 months						98.3	98.4	98.3	97.9	98.4
12–23 months						70.1	71.8	72.0	72.9	66.1

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2582 to 2621 in the full sample; N = 425 to 432 in the T24 arm; N = 855 to 869 in the T18 arm; N = 430 to 433 in the TNFP arm; and N = 871 to 887 in the control arm.
[c] Sample size at follow-up ranged from N = 2592 to 2613 in the full sample; N = 430 to 432 in the T24 arm; N = 876 to 880 in the T18 arm; N = 426 to 431 in the TNFP arm; and N = 860 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 54. Complementary feeding knowledge among mothers: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Age of introduction of liquids other than breast milk; % who said			
Before 6 months	−8.75 ± 2.14*	−6.09 ± 1.99*	−5.96 ± 2.69*
At 6 months	−3.94 ± 4.50	6.58 ± 2.93*	−0.46 ± 4.21
After 6 months	13.14 ± 4.89*	0.09 ± 3.30	7.10 ± 3.50*
Does not know	−0.45 ± 0.52	−0.58 ± 0.45	−0.68 ± 0.46
Age of introduction of foods other than breast milk; % who said			
Before 6 months	−2.17 ± 0.85*	−1.97 ± 0.72*	−2.63 ± 0.75*
At 6 months	−5.90 ± 5.77	6.37 ± 5.32	1.95 ± 5.14
After 6 months	8.41 ± 5.76	−4.06 ± 5.37	0.79 ± 5.33
Does not know	−0.34 ± 0.20	−0.34 ± 0.20	−0.11 ± 0.31
Food consistency for child 6–8 months			
Thick like a paste	−0.79 ± 0.90	−0.60 ± 0.70	−0.11 ± 0.86
Liquid like water	−4.73 ± 2.90	−4.03 ± 3.18	−2.18 ± 3.56
Semi-solid like puree	5.52 ± 3.07	4.64 ± 3.24	2.29 ± 3.87
Food consistency for child 12–23 months			
Thick like a paste	−7.26 ± 5.73	−7.87 ± 4.58	−6.92 ± 4.48
Liquid like water	0.47 ± 0.70	−0.47 ± 0.51	−0.92 ± 0.45*
Semi-solid like puree	6.80 ± 5.80	8.34 ± 4.65	7.84 ± 4.58
Feeding frequency for child 6–8 months			
Number of meals per day	0.05 ± 0.07	0.19 ± 0.07*	0.32 ± 0.06*
Correct feeding frequency (WHO ≥ 2 meals/day)	−0.56 ± 1.93	−0.30 ± 1.57	0.42 ± 1.88
Correct feeding frequency (*Tubaramure* ≥ 3 meals/day)	4.06 ± 4.48	9.80 ± 4.45*	18.74 ± 5.29*
Feeding frequency for child 12–23 months			
Number of meals per day	0.11 ± 0.10	0.16 ± 0.10	0.25 ± 0.12*
Correct feeding frequency (WHO ≥ 3 meals/day)	3.58 ± 3.71	7.78 ± 3.79*	8.72 ± 4.43*
Correct feeding frequency (*Tubaramure* ≥ 4 meals/day)	4.84 ± 3.88	6.38 ± 3.67*	7.20 ± 5.07
Knows that child cannot always eat without help			
6 to 8 months	−0.01 ± 0.70	−0.10 ± 0.62	−0.48 ± 0.81
12 to 23 months	5.67 ± 4.88	5.89 ± 3.43*	6.76 ± 4.16

[a] Values are double difference impact estimates ± SE in percentage points when data from both surveys were available and simple difference impact estimates ± SE when only follow-up data were available. All estimates account for clustering.
[b] Sample size ranged from N = 2588 to 5228.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for “knows correct feeding frequency according to WHO,” “knows correct feeding frequency according to *Tubaramure*,” and “knows that child cannot always eat without help.”
* Impact estimate significantly different from 0, $p < 0.05$.

Even though nearly all mothers knew that soap is needed for handwashing, the importance of washing hands in relation to different activities was not well understood (**Table 55**). The majority of mothers correctly stated that it was important to wash one's hands before eating (95.4% at baseline and 90.7% at follow-up). At baseline, fewer than half (42.1%) mentioned that hands should be washed before feeding a child; this percent increased slightly at follow-up (47.9%). The percentage who mentioned washing hands after using the toilet increased from 45.7% at baseline to 62.4% at follow-up, but only around 20% in both surveys mentioned washing hands after cleaning a child who had defecated. The average number of specific activities mentioned as key times for handwashing was 2.0 at baseline and 2.2 at follow-up, and, at follow-up, the number of practices mentioned differed significantly among treatment arms.

Nearly all mothers in both surveys mentioned using soap to wash their hands. Very few (2.4%) mentioned using ash to wash their hands at baseline, and 10.8% mentioned using ash at follow-up. The use of ash when soap was not available was included in the BCC lessons. The most commonly known strategies to prevent worms were washing the child's hands (around 65% in both surveys) and careful food preparation (around 30% in both surveys). When asked about how to purify drinking water, the majority of mothers (67.8% at baseline and 77.0% at follow-up) mentioned at least one correct method of water purification.

The *Tubaramure* intervention had a large positive effect on maternal knowledge of appropriate times for handwashing (**Table 56**). The percentage of mothers who mentioned several of the specific activities increased: after toilet use by 16–21 percentage points (statistically significant in the T24, T18, and TNFP groups), before feeding a child by 5–14 percentage points (statistically significant in the T18 and TNFP groups), and after cleaning a child who defecated by 1–10 percentage points (statistically significant in the TNFP group). *Tubaramure* also led to a small (0.23–0.37) but significant increase in the number of practices mentioned (statistically significant in the T24, T18, and TNFP groups). The program increased the percentage of mothers naming ash as an appropriate handwashing product from baseline to follow-up by 7–13 percentage points (statistically significant in the T24, T18, and TNFP groups). The program had no clear effect on maternal awareness of appropriate worm-protection methods, and no significant effect was observed on knowledge of appropriate methods for purifying drinking water.

Table 55. Hygiene knowledge among mothers[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
Appropriate time for handwashing; % who said										
Before eating	95.4	95.1	94.6	95.4	96.3	90.7*	88.2	90.7	87.9	93.4
After using the toilet	45.7	44.0	46.0	46.7	45.8	62.4*	70.1	67.3	69.4	50.2
Before feeding a child	42.1	50.5	40.1	38.3	41.9	47.9*	55.0	48.2	52.7	41.8
After cleaning a child who defecated	18.4*	22.5	21.3	15.5	15.1	22.1*	24.8	24.3	26.5	16.3
Number of handwashing practices mentioned	2.0 ± 0.9	2.1 ± 0.9	2.0 ± 0.9	2.0 ± 0.8	2.0 ± 0.9	2.2 ± 0.9*	2.4 ± 0.8	2.3 ± 0.8	2.4 ± 0.9	2.0 ± 0.8
Appropriate handwashing products; % who said										
Soap (any)	99.3	99.5	99.5	98.6	99.3	99.5	98.8	99.9	99.1	99.5
Ash	2.4	2.1	2.8	1.8	2.4	10.8*	14.2	12.2	17.2	4.6
Mud/sand	1.3	2.5	0.9	1.2	1.1	0.7	0.7	0.9	0.7	0.6
Appropriate worm-protection methods for children; % who said										
Wash hands	65.1	66.4	63.3	70.4	63.5	63.9	70.1	60.5	66.1	63.2
Cut fingernails	5.6	6.7	3.7	5.5	7.1	5.4	5.1	5.8	5.8	5.1
Wear pants	2.3	3.2	2.8	2.3	1.2	1.4*	1.9	0.9	2.8	0.9
Adequate food preparation	33.8	31.5	32.1	37.2	35.1	30.2	31.3	31.5	32.9	27.0
Wear shoes	1.2	2.1	1.0	1.2	0.9	1.2	0.7	1.5	2.6	0.5
Give treated water	10.9	11.3	10.2	12.3	10.6	13.4	12.3	14.4	13.0	13.0
Appropriate purification methods for drinking water; % who said										
Boiling	64.7	61.6	66.4	67.0	63.4	75.1	75.6	75.5	75.4	74.3
Chlorine	3.1	3.9	3.1	4.2	2.1	1.9	1.9	1.7	3.0	1.6

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2619 to 2623 in the full sample; N = 867 to 870 in the T18 arm; N = 432 to 433 in the TNFP arm; and N = 887 to 888 in the control arm.
[c] Sample size at follow-up ranged from N = 2610 to 2614 in the full sample; N = 431 to 432 in the T24 arm; N = 879 to 880 in the T18 arm; and N = 868 to 871 in the control arm.
* Study arms differ, $p < 0.05$.

Table 56. Hygiene knowledge among mothers: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Appropriate time for handwashing; % who said			
Before eating	−4.12 ± 2.46	−1.07 ± 1.69	−4.79 ± 1.83
After using the toilet	21.34 ± 5.32*	16.44 ± 5.19*	17.61 ± 5.71*
Before feeding a child	4.98 ± 4.91	8.03 ± 4.49*	14.03 ± 4.34*
After cleaning a child who defecated	1.11 ± 4.60	1.85 ± 3.51	9.91 ± 3.83*
Average number of handwashing practices mentioned	0.23 ± 0.08*	0.25 ± 0.08*	0.37 ± 0.07*
Appropriate handwashing products; % who said			
Soap (any)	−0.94 ± 0.78	0.12 ± 0.57	0.22 ± 0.84
Ash	9.99 ± 2.89*	7.26 ± 2.75*	13.07 ± 3.07*
Mud/sand	−1.29 ± 1.11	0.53 ± 0.68	0.07 ± 0.62
Appropriate worm-protection methods for children; % who said			
Wash hands	4.27 ± 4.40	−2.33 ± 5.10	−4.38 ± 6.74
Cut fingernails	0.17 ± 2.53	3.90 ± 2.06*	1.91 ± 1.78
Wear pants	−1.05 ± 1.04	−1.53 ± 1.34	0.72 ± 1.06
Adequate food preparation	7.96 ± 4.94	7.13 ± 4.89	3.42 ± 6.34
Wear shoes	−0.94 ± 1.08	0.85 ± 0.67	1.73 ± 1.16
Give treated water	−1.46 ± 4.00	1.74 ± 4.15	−2.09 ± 3.76
Appropriate purification methods for drinking water; % who said			
Boiling	2.93 ± 5.95	−2.70 ± 5.20	−3.04 ± 5.36
Chlorine	−1.60 ± 1.53	−0.94 ± 1.57	−0.74 ± 1.96

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 5230 to 5237. One-sided tests were used for all indicators.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

9.2 Pre-, Peri-, and Postnatal Health Care Practices

The use of at least some prenatal services with a trained medical provider was nearly universal, but the quality of the care received could be improved (**Table 57**). The average number of prenatal visits increased from 3.2 at baseline (with 35.4% having received at least four recommended visits) to 3.7 at follow-up (56.3 % with at least four visits). On average, mothers at follow-up reported that their first prenatal visit when pregnant with the index child occurred earlier (4.3 months of pregnancy) than at baseline (5.1 months). Whereas regular weighing of pregnant women (around 95% in both surveys) and the provision of tetanus vaccines (almost two-thirds) were common, the provision of other prenatal services was not. Only about 40% had their blood pressure taken at both surveys. At baseline, fewer than 40% received a blood test; this percentage increased to two-thirds at follow-up. Very few (13.1% at baseline and 15.4% at follow-up) provided a urine sample. About one-third of women at baseline and one-fourth at follow-up were told where to seek help in case of pregnancy complications, but no more than one-fifth were told how to identify pregnancy danger signs.

At baseline, the use of a few key preventive measures during pregnancy, including sleeping under bednets (58.1%) and consuming iron supplements (72.1%), were reportedly practiced by the majority of mothers. The percentage of women who reported having taken iron supplements during pregnancy dropped dramatically to 56.0% at follow-up. At both time points, women began taking the supplements only toward the end of the second trimester (at 5.2–5.6 months, near the average time of the first prenatal visit) and continued taking the supplements for only about 2 months. The drop in the use of iron supplements does not appear to be a consequence of changes in the availability of these supplements at the health center, as the availability of iron sulfate and iron folate tablets was fairly stable between baseline and follow-up in the surveyed health centers (Table 24, page 42). Steps to prevent malaria increased over time: About 58% of the mothers at baseline and 70% at follow-up reported that they had slept under a bednet during most of their pregnancy. The percentage who received anti-malarial drugs also increased, from 17.3% to 22.2%.

At baseline, the prevalence of night-blindness (a sign of vitamin A deficiency) was high. Nearly 6% of the women interviewed had experienced night blindness during pregnancy, which exceeded the 5% mark established by the WHO and reinforces a WHO (2009) report underscoring the extent of vitamin A deficiency in Burundi among pregnant women and preschool children. At follow-up, the percentage experiencing night blindness was 3.2%, below the WHO 5% cutoff.

Tubaramure had no significant impact on the already high percentage of mothers who received prenatal care or on which health professionals mothers consulted for prenatal care (**Table 58**). The program did, however, increase the demand[32] for prenatal services: It increased the total number of prenatal visits (0.14–0.31 additional visits, statistically significant for the T24 and T18 groups), increased the percentage of mothers who had at least four prenatal visits by 12–19 percentage points (statistically significant for all groups), and resulted in women having their first prenatal visit a week to 10 days earlier in pregnancy (significant in all groups). The only possible supply effect on the types of services received during prenatal visits was observed for providing a blood sample, which increased in all study groups from baseline to follow-up. The intervention did not have a clear consistent effect on the demand for these services. It increased the percentage of mothers who had their weight taken by 1–6 percentage points (statistically significant for the T24 group), had their blood pressure taken by 3–14 percentage points

[32] As pointed out previously, the program could have improved health care utilization through two distinct pathways: increasing the supply of services in the health centers (through the *Tubaramure* health strengthening activities) and increasing the demand for these services (through the *Tubaramure* BCC strategy). We refer to these types of impact as the “supply” and “demand” effects.

(statistically significant for the T24 group), and gave a urine sample by 3–11 percentage points (statistically significant for the T24 and TNFP groups). However, no effect was found on the percentage who received a tetanus vaccination, had their height measured, or gave a blood sample.

As shown in Table 57, there was a dramatic drop in the proportion of women taking iron during pregnancy between baseline and follow-up, the opposite of what would be expected if *Tubaramure* had had a positive supply effect. *Tubaramure* had no consistent demand effect either. Note that the decline in the use of iron supplements over time was not as large in the TNFP group as it was in the control group and that the difference in the declines between the two groups was statistically significant (see Table 57). No demand impact was found on when mothers began supplementation or the number of iron pills taken per month. There was a very small positive effect on the duration of supplementation (7 days or less, statistically significant for the T18 and TNFP groups). The changes over time in the use of malaria prevention were seen in all groups, which suggests a possible *Tubaramure* supply effect.

Table 57. Use of prenatal care services among mothers[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm: T24	T18	TNFP	Control	Full sample	Study arm: T24	T18	TNFP	Control
N	**2580**	**422**	**862**	**426**	**870**	**2601**	**429**	**876**	**431**	**865**
Received any prenatal care; % yes	99.0	98.1	98.7	99.3	99.4	99.8	99.8	99.7	100.0	99.9
Had prenatal care; % who consulted:										
Doctor	5.7	10.6	4.6	4.3	5.2	5.2	3.5	4.8	9.8	4.3
Nurse/midwife/medical assistant	95.8	92.8	96.8	97.4	95.4	96.5	97.7	97.4	94.2	96.2
Trained traditional midwife	0.3*	0.0	0.4	0.2	0.5	0.1	0.2	0.0	0.0	0.1
Untrained traditional midwife	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1
Prenatal care visits										
Total number of visits	3.2 ± 1.0	3.2 ± 1.0	3.2 ± 1.1	3.2 ± 1.0	3.2 ± 0.9	3.7 ± 1.0*	3.7 ± 1.0	3.8 ± 1.0	3.7 ± 1.0	3.5 ± 0.9
% who had four visits	35.4	33.6	35.3	35.9	36.0	56.3*	58.5	64.8	57.9	46.0
Month of pregnancy at first visit	5.1 ± 1.4	5.0 ± 1.4	5.1 ± 1.4	5.0 ± 1.4	5.0 ± 1.4	4.3 ± 1.3	4.3 ± 1.3	4.2 ± 1.3	4.2 ± 1.3	4.6 ± 1.4
Month of pregnancy at last visit	8.3 ± 0.9	8.3 ± 0.7	8.3 ± 0.9	8.3 ± 0.8	8.2 ± 1.1	8.4 ± 0.8	8.4 ± 0.9	8.4 ± 0.8	8.4 ± 0.9	8.4 ± 0.8
Prenatal care; % who went to										
Public facility	97.9	98.8	98.0	95.2	98.7	97.6	98.6	97.0	95.1	99.1
Private facility	2.1	1.2	2.0	4.8	1.3	2.4	1.4	3.0	4.9	0.9
Prenatal services provided; % who										
Received tetanus vaccination	65.6	69.8	66.2	63.7	63.9	63.6	69.6	64.9	63.8	59.0
Had weight taken	94.3	93.6	94.5	94.6	94.3	95.7*	99.1	95.2	97.0	94.0
Had height taken	51.4	53.2	46.4	63.4	49.7	55.4	60.9	49.8	68.2	52.1
Had blood pressure taken	37.3	37.2	33.1	46.0	37.4	40.5	50.1	35.6	48.7	36.5
Gave a urine sample	13.1	12.9	12.1	17.6	12.1	15.4*	22.8	14.2	20.9	10.4
Gave a blood sample	38.7	50.0	30.9	46.5	37.2	65.1*	74.9	58.1	76.9	61.6
Pregnancy complications; % told										
How to detect signs	19.7	17.5	18.3	22.4	20.9	16.7	22.4	15.5	16.0	15.3
Where to seek help if complications arose	31.7	32.8	28.4	33.6	33.6	25.9	29.1	28.6	23.0	23.0
Supplementation										
% who took iron	72.1	73.7	74.9	68.9	70.0	56.0	58.2	56.3	61.0	52.1
Months pregnant when supplementation began	5.6 ± 1.4	5.5 ± 1.4	5.5 ± 1.4	5.7 ± 1.4	5.6 ± 1.4	5.2 ± 1.5	5.1 ± 1.4	5.2 ± 1.4	5.2 ± 1.5	5.2 ± 1.5
Duration of supplementation	1.9 ± 1.3	2.0 ± 1.4	1.9 ± 1.3	1.8 ± 1.3	1.9 ± 1.3	1.7 ± 1.3*	1.8 ± 1.4	1.9 ± 1.4	1.7 ± 1.4	1.5 ± 1.2
Number of pills per month	25.2 ± 10.4	24.5 ± 11.9	26.5 ± 8.8	23.6 ± 11.6	25.1 ± 10.3	27.6 ± 8.7	27.3 ± 9.2	27.4 ± 9.1	27.1 ± 9.6	28.1 ± 7.2
During pregnancy; %										
Experienced night blindness	5.8	5.1	5.6	7.0	5.6	3.2	5.5	2.7	4.1	2.2
Received anti-malarial medication	17.3	17.3	16.9	15.3	18.6	22.2	22.2	24.1	20.5	21.0
Slept under a bednet	58.1	57.1	61.5	61.1	53.8	69.4	69.8	73.0	74.9	62.7

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 1498 to 2580 in the full sample; N = 245 to 422 in the T24 arm; N = 522 to 862 in the T18 arm; N = 231 to 426 in the TNFP arm; and N = 500 to 870 in the control arm.
[c] Sample size at follow-up ranged from N = 1144 to 2601 in the full sample; N = 205 to 429 in the T24 arm; N = 385 to 876 in the T18 arm; N = 210 to 431 in the TNFP arm; and N = 344 to 865 in the control arm.
* Study arms differ, $p < 0.05$.

Table 58. Use of prenatal care services among mothers: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Received any prenatal care; % yes	1.18 ± 0.73	0.43 ± 0.41	0.21 ± 0.35
Had prenatal care; % who consulted:			
Doctor	−6.25 ± 5.01	0.88 ± 2.87	6.47 ± 3.25
Nurse/midwife/medical assistant	4.43 ± 3.66	−0.12 ± 2.39	−4.06 ± 2.90
Trained traditional midwife	0.57 ± 0.33	−0.03 ± 0.34	0.09 ± 0.32
Untrained traditional midwife	−0.12 ± 0.12	−0.12 ± 0.12	−0.35 ± 0.26
Prenatal care visits			
Total number of visits	0.18 ± 0.10*	0.31 ± 0.10*	0.14 ± 0.11
% who had four visits	14.85 ± 5.20*	19.06 ± 5.30*	11.86 ± 4.98*
Month of pregnancy at first visit	−0.27 ± 0.15*	−0.35 ± 0.13*	−0.25 ± 0.14*
Month of pregnancy at last visit	−0.10 ± 0.08	−0.06 ± 0.07	−0.10 ± 0.08
Prenatal care; % who went to			
Public provider	1.0 ± 1.0	1.0 ± 2.0	0.0 ± 2.0
Prenatal services provided; % who			
Received tetanus vaccination	4.59 ± 5.07	3.52 ± 4.33	4.79 ± 4.69
Had weight taken	5.79 ± 2.52*	0.85 ± 2.75	2.71 ± 3.10
Had height taken	4.54 ± 6.57	−0.04 ± 5.56	1.53 ± 6.18
Had blood pressure taken	13.54 ± 7.27*	2.57 ± 6.74	2.95 ± 5.99
Gave a urine sample	11.43 ± 4.58*	3.34 ± 2.85	4.66 ± 2.26*
Gave a blood sample	0.66 ± 8.76	2.21 ± 8.08	5.49 ± 6.98
Pregnancy complications; % told			
How to detect signs	10.50 ± 4.59*	2.69 ± 3.43	−0.49 ± 4.84
Where to seek help if complications arose	7.44 ± 4.58	10.80 ± 3.68*	0.21 ± 5.84
Supplementation			
% who took iron	2.91 ± 6.47	−0.88 ± 7.04	10.50 ± 6.26*
Months pregnant when supplementation began	0.02 ± 0.16	0.09 ± 0.13	−0.17 ± 0.14
Duration of supplementation	0.17 ± 0.17	0.23 ± 0.14*	0.26 ± 0.15*
Number of pills per month	−0.28 ± 1.28	−1.98 ± 0.97	−0.02 ± 1.39
During pregnancy; % who			
Experienced night blindness	3.67 ± 2.34	0.40 ± 2.18	0.71 ± 1.88
Received anti-malarial medication	2.88 ± 4.39	4.98 ± 4.18	2.86 ± 4.52
Slept under a bednet	3.73 ± 3.57	2.10 ± 2.83	4.96 ± 3.95

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 2642 to 5177.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for total number of prenatal care visits, completing a minimum of 4 prenatal care visits, % who received specific prenatal service components, % counseled about pregnancy complications, % who took iron supplements, and the number of iron pills taken per month. The a priori hypothesis was a negative effect for months pregnant at first iron supplementation and months pregnant at first prenatal care visit.
* Impact estimate significantly different from 0, $p < 0.05$.

The percentage of mothers delivering at a public health facility increased dramatically, from 57% at baseline to 76% at follow-up (**Table 59**). Eight percent of women gave birth while in transit at both baseline and follow-up. Only around 60% of all births (irrespective of the place of delivery) were attended by a trained health professional at baseline; this percentage increased to around 77% at follow-up. The already high percentage of mothers reporting at baseline that their newborn infants were immediately cleaned (i.e., dried off) (86%) and wrapped (two important strategies to prevent hypothermia) (86%), further increased to 89.2% and 92.2% at follow-up, respectively. The percentage of newborns weighed at delivery increased from 58.7% to 73.7%.

Tubaramure had no demand effect on where mothers delivered, who attended the deliveries, or on the services received at delivery (**Table 60**). The clear positive changes over time shown in Table 60, however, may have been caused by *Tubaramure*'s health strengthening activities.

Nearly all women at both baseline and follow-up received at least some postpartum medical care following the birth of their index child. However, the use of preventive health measures was much lower than during pregnancy at both baseline and follow-up. Almost all mothers were examined by a health professional within 6 weeks of delivery, and only about 20% (as reported in both surveys) were checked immediately after birth (**Table 61**). The average time elapsing before the first postnatal visit slightly dropped from 1.0 week at baseline to 0.7 weeks at follow-up. Most commonly, a nurse, midwife, or medical assistant at a public institution performed check-ups at both time points. The percentage of women taking iron supplements after giving birth (3.3% at baseline and 4.0% at follow-up) remained very low.

There is no indication that the program had any meaningful supply or demand effect on any of the postnatal care outcomes (**Table 62**).

9.3 Maternal Diet and Nutritional Status

The average women's dietary diversity score among mothers at follow-up was 4.0 (data not collected at baseline) (**Table 63**). More than 75% of mothers reported that in the previous 24 hours they had consumed dark green leafy vegetables, vitamin A-rich fruits and vegetables, starchy staples, and legumes/nuts. Consumption of other food groups was much less common: Only about one-third had consumed other fruits and vegetables; one-fourth had consumed meat and fish; and fewer than 2% reported consumption of organ meat, eggs, and dairy products. Intake of CSB in the previous 24 hours was reported by only around 2% of mothers at baseline and approximately 38%–56% at follow-up in the *Tubaramure* groups. As would be expected, CSB consumption was highest in current CSB beneficiary families (around 75%, 60%, and 58% in the T24, T18, TNFP arms, respectively). Surprisingly, a substantial proportion of mothers who reported being past beneficiaries reported consuming CSB in the past 24 hours. Current beneficiaries consumed CSB around 4 days per week and around 1.5 times per day. The frequency of consumption in "past" and "never" beneficiaries was lower.

Tubaramure had a small positive impact on dietary diversity (ranging from 0.32 to 0.48 food groups, statistically significant in all groups) (**Table 64**). The largest impact was found on the legumes group (17–20 percentage points, statistically significant in all groups), a direct consequence of CSB consumption. The program increased consumption of fruits and vegetables: There was a significant impact on the consumption of vitamin A-rich fruits and vegetables in the T24 group (7 percentage points) and a significant impact on other fruits and vegetables in the T18 (13 percentage points) and the TNFP group (11 percentage points). *Tubaramure* also increased the percentage of women who consumed eggs by 1–2 percentage points (statistically significant for the T24 and T18 groups). Dairy consumption increased only in the TNFP group (2 percentage points).

Table 59. Delivery services used by mothers[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2575**	**422**	**861**	**426**	**869**	**2598**	**427**	**875**	**431**	**865**
Location of delivery; % who delivered at										
Public institution	57.1	57.6	56.2	65.3	53.6	75.5	72.4	74.9	76.0	77.2
Private institution	1.5	1.2	1.7	2.4	0.9	1.9	1.4	2.8	3.1	0.7
At home	33.5	30.6	35.0	25.4	37.3	14.5	17.1	13.2	12.2	15.7
In transit	8.0	10.7	7.1	6.9	8.2	8.1	9.0	9.0	8.7	6.4
Medical staff at birth; % with presence of:										
Doctor	5.3	6.7	4.3	6.6	5.1	5.0	4.4	4.7	8.4	4.0
Nurse/midwife/medical assistant	55.1	54.5	55.4	63.6	50.8	72.1	69.8	71.3	72.2	74.1
Trained traditional midwife	19.6	19.2	20.8	14.6	21.1	13.4	16.4	15.8	9.7	11.3
Untrained traditional midwife	9.6	12.1	8.1	6.6	11.4	4.7	5.2	4.1	3.9	5.3
Parent/friend	9.6	8.5	10.6	8.7	9.5	3.8	4.4	3.4	3.9	3.8
Nobody	6.0	5.5	6.0	6.1	6.1	4.0	3.7	3.7	4.6	4.0
Services received at delivery: % who said:										
Child immediately cleaned	85.7	85.4	85.5	88.4	84.8	89.2*	87.1	87.8	93.3	89.5
Child wrapped before placental delivery	85.9*	86.2	88.5	84.5	83.8	92.2	93.3	91.1	92.5	92.5
Child weighed	58.7	60.8	58.3	66.2	54.3	73.7	81.1	72.2	73.9	71.5

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 2398 to 2575 in the full sample; N = 376 to 422 in the T24 arm; N = 808 to 861 in the T18 arm; N = 389 to 426 in the TNFP arm; and N = 801 to 869 in the control arm.
[c] Sample size at follow-up ranged from N = 2418 to 2598 in the full sample; N = 395 to 427 in the T24 arm; N = 813 to 875 in the T18 arm; N = 404 to 431 in the TNFP arm; and N = 806 to 865 in the control arm.
* Study arms differ, $p < 0.05$.

Table 60. Delivery services used by mothers: impact[a]

	Impact[b]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Location of delivery; % who delivered at			
Public institution	−8.13 ± 8.96	−5.48 ± 8.75	−12.32 ± 9.06
Private institution	0.40 ± 0.79	1.18 ± 1.50	0.65 ± 1.94
At home	7.81 ± 8.22	0.44 ± 9.74	8.29 ± 8.41
In transit	−0.08 ± 2.92	3.87 ± 3.54	3.38 ± 2.84
Medical staff at birth; % with presence of:			
Doctor	−1.37 ± 2.91	1.11 ± 2.32	2.58 ± 2.51
Nurse/midwife/medical assistant	−7.32 ± 8.57	−7.68 ± 8.17	−14.24 ± 8.78
Trained traditional midwife	6.82 ± 6.50	5.03 ± 4.66	4.55 ± 4.75
Untrained traditional midwife	−1.00 ± 2.71	2.13 ± 2.62	3.29 ± 2.51
Parent/friend	1.65 ± 2.38	−1.22 ± 2.38	1.06 ± 2.57
Nobody	0.32 ± 2.39	−0.26 ± 1.81	0.72 ± 2.02
Services received at delivery: % who said:			
Child immediately cleaned	−2.64 ± 4.63	−2.23 ± 3.39	0.57 ± 3.54
Child wrapped before placental delivery	−1.27 ± 3.33	−5.87 ± 2.04*	−0.34 ± 2.82
Child weighed	3.82 ± 6.27	−3.72 ± 5.65	−9.54 ± 5.23

[a] Values are double difference impact estimates ± SE. All estimates account for clustering.
[b] Sample size ranged from N = 4816 to 5173.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 61. Postnatal care[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2579**	**422**	**863**	**426**	**870**	**2596**	**427**	**875**	**431**	**865**
Postnatal check-up										
% who received check-up immediately after birth	21.9	24.9	19.9	23.8	21.4	20.8	25.1	19.2	23.9	18.9
Time elapsed before first check-up (weeks)	1.0 ± 1.7	0.8 ± 1.5	1.1 ± 2.1	1.3 ± 1.4	0.9 ± 1.4	0.7 ± 4.5	0.5 ± 1.0	1.1 ± 7.6	0.4 ± 0.6	0.8 ± 2.7
% received examination by health professional within 6 weeks	99.1	99.0	99.4	99.0	98.9	99.1	100.0	98.2	100.0	98.8
Postnatal check-up conducted by										
Doctor	14.6	21.9	12.8	13.7	12.6	14.8	15.9	17.6	18.4	9.1
Nurse, midwife or medical assistant	85.4	78.1	87.2	86.3	87.4	85.2	84.1	82.4	81.6	90.9
After birth, % who received postnatal care at										
Public institution	96.6	96.2	95.9	92.9	99.5	97.4	100.0	95.8	95.0	98.8
Private institution	3.2	3.8	3.5	7.1	0.5	2.6	0.0	4.2	5.0	1.2
At home	0.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Postnatal supplements										
% who took iron supplements	3.3	3.8	4.2	2.3	2.5	4.0	7.5	3.4	4.7	2.7
Duration of supplementation (months)	0.8 ± 0.9	1.0 ± 0.9	0.7 ± 0.8	0.8 ± 1.0	0.7 ± 0.9	1.0 ± 1.4	1.1 ± 1.6	1.1 ± 1.1	1.2 ± 1.6	0.6 ± 1.0
Number of pills per month	21.4 ± 14.7	24.0 ± 17.6	18.8 ± 12.7	21.6 ± 24.4	23.8 ± 11.7	20.5 ± 12.8	22.4 ± 12.2	17.3 ± 13.6	25.0 ± 10.4	18.6 ± 14.4

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 45 to 2579 in the full sample; N = 9 to 422 in the T24 arm; N = 20 to 863 in the T18 arm; N = 5 to 426 in the TNFP arm; and N = 11 to 870 in the control arm.
[c] Sample size at follow-up ranged from N = 55 to 2596 in the full sample; N = 19 to 427 in the T24 arm; N = 20 to 875 in the T18 arm; N = 9 to 431 in the TNFP arm; and N = 7 to 865 in the control arm.
* Study arms differ, $p < 0.05$.

Table 62. Postnatal care: impact[a]

	Impact[b,c]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Postnatal check-up			
% who received check-up immediately after birth	2.84 ± 4.55	2.10 ± 4.30	2.76 ± 4.77
Time elapsed before first check-up (weeks)	−0.07 ± 0.39	0.32 ± 0.67	−0.75 ± 0.37*
% received examination by health professional within 6 weeks	0.89 ± 1.62	−1.21 ± 2.14	1.82 ± 2.04
Postnatal check-up conducted by			
Doctor	−3.77 ± 7.33	4.57 ± 5.15	7.03 ± 5.12
Nurse, midwife, or medical assistant	3.77 ± 7.33	−4.57 ± 5.15	−7.03 ± 5.12
After birth, % who received postnatal care at			
Public institution	5.40 ± 2.80	0.68 ± 2.86	4.26 ± 1.47*
Private institution	−5.40 ± 2.80	−0.08 ± 2.69	−4.26 ± 1.47*
At home	0.00 ± 0.00	−0.60 ± 0.54	0.00 ± 0.00
Postnatal iron supplementation			
% who took iron supplements	3.79 ± 2.06*	−0.80 ± 0.88	2.44 ± 1.40*
Duration of supplementation (months)	0.36 ± 0.45	0.42 ± 0.52	1.06 ± 0.52*
Number of pills per month	1.33 ± 4.47	7.04 ± 4.41	6.83 ± 3.96*

[1] Values are double difference impact estimates ± SE. All estimates account for clustering.
[2] Sample size ranged from N = 100 to 5174.
[3] One-sided tests were conducted. The a priori hypothesis was a positive effect for attending a postnatal check-up and receiving postnatal iron supplementation. The a priori hypothesis was a negative effect for the time before the first check-up.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 63. Maternal consumption and dietary diversity[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2584**	**427**	**863**	**425**	**869**	**2614**	**432**	**880**	**431**	**871**
Dietary diversity (range 0 to 9)						4.1 ± 1.2*	4.1 ± 1.1	4.3 ± 1.2	4.2 ± 1.2	3.8 ± 1.2
Maternal consumption in previous 24 hours										
Starchy staples						86.8	86.1	88.1	88.4	85.2
Dark green leafy vegetables						85.8	87.3	87.5	81.4	85.6
Other vitamin A-rich fruits and vegetables						85.2	88.4	86.9	85.6	81.6
Other fruits and vegetables						37.8*	34.6	43.7	42.4	31.1
Organ meat						1.3	0.5	1.5	3.0	0.7
Meat and fish						26.9	22.3	30.6	28.2	24.7
Eggs						1.8	2.5	2.3	1.9	0.9
Legumes and nuts						81.3*	89.3	86.3	86.8	69.7
Milk and milk products						1.3	1.2	1.1	2.6	0.8
CSB consumption										
% who consumed in the last 24 hours										
All	2.2	2.3	2.2	2.4	2.1	31.2	56.3	38.3	46.2	4.0
Current *Tubaramure* benefit						63.6	74.5	60.4	57.6	63.6
Past *Tubaramure* benefit						14.0	33.3	12.5	13.3	14.0
Never *Tubaramure* benefit						6.0	5.6	6.0	6.5	6.0
Number of days consumed in the last week										
All						2.0 ± 2.7*	3.4 ± 2.9	2.5 ± 2.8	3.3 ± 2.9	0.2 ± 0.9
Current *Tubaramure* benefit						4.2 ± 2.6	4.4 ± 2.6	4.2 ± 2.6	4.1 ± 2.7	4.2 ± 2.6
Past *Tubaramure* benefit						0.8 ± 1.8	1.4 ± 2.2	0.7 ± 1.7	1.4 ± 2.3	0.8 ± 1.8
Never *Tubaramure* benefit						0.3 ± 1.3	0.4 ± 1.4	0.3 ± 1.2	0.3 ± 1.1	0.3 ± 1.3
Times per day consumed in the last week										
All						1.3 ± 1.1*	1.3 ± 1.0	1.2 ± 1.2	1.4 ± 1.3	0.5 ± 0.5
Current *Tubaramure* benefit						1.4 ± 1.2	1.4 ± 1.0	1.4 ± 1.4	1.5 ± 1.3	1.4 ± 1.2
Past *Tubaramure* benefit						0.9 ± 0.8	1.0 ± 0.5	0.9 ± 0.9	1.0 ± 0.7	0.9 ± 0.8
Never *Tubaramure* benefit						0.6 ± 0.5	0.7 ± 0.6	0.5 ± 0.5	0.4 ± 0.4	0.6 ± 0.5

[a] Values are mean ± SD or %. All estimates account for clustering.

[b] Sample size at baseline did not vary.

[c] Sample size at follow-up ranged from N = 30 to 2614 in the full sample; N = 3 to 432 in the T24 arm; N = 19 to 880 in the T18 arm; N = 4 to 431 in the TNFP arm; and N = 58 to 871 in the control arm.

* Study arms differ, $p < 0.05$.

Table 64. Maternal consumption and dietary diversity: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Dietary diversity (range 0 to 9)	0.32 ± 0.13*	0.48 ± 0.12*	0.40 ± 0.13*
Maternal consumption in previous 24 hours			
Starchy staples	0.94 ± 3.43	2.88 ± 1.83	3.23 ± 2.44
Dark green leafy vegetables	1.64 ± 2.71	1.87 ± 2.69	−4.24 ± 3.47
Other vitamin A-rich fruits and vegetables	6.81 ± 4.06*	5.31 ± 3.53	4.03 ± 3.66
Other fruits and vegetables	3.42 ± 5.20	12.59 ± 5.84*	11.27 ± 4.51*
Organ meat	−0.23 ± 0.42	0.79 ± 0.53	2.33 ± 1.24*
Meat and fish	−2.38 ± 3.62	5.87 ± 3.74	3.53 ± 5.28
Eggs	1.63 ± 0.87*	1.35 ± 0.60*	0.94 ± 0.78
Legumes and nuts	19.67 ± 3.95*	16.69 ± 3.72*	17.12 ± 4.12*
Milk and milk products	0.35 ± 0.78	0.33 ± 0.57	1.75 ± 0.68*

[a] Values are double difference impact estimates ± SE in percentage points when data from both surveys were available and simple difference impact estimates ± SE when only follow-up data were available. All estimates account for clustering.
[b] Sample size ranged from N = 2590 to 2614. One-sided tests were conducted for all outcomes.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

The vast majority of non-pregnant mothers (83.5% at baseline and 81.4% at follow-up) had a normal BMI (**Table 65**). Those that fell outside of the normal range were more likely to be underweight (13.4% at baseline and 14.7% at follow-up) than overweight (3.1% at baseline and 3.8% at follow-up). On average, mothers weighed 50 kg and were 156 cm tall in both surveys. About 3% of the mothers were of short stature (i.e., less than 145 cm tall) at both baseline and follow-up. Short stature increases the odds of complications during childbirth. Consistent with the decrease in the use of iron supplements during pregnancy, mean Hb dropped from 12.6 g/dL at baseline to 12.1 g/dL at follow-up. This drop in Hb is reflected in a steep increase in the prevalence of anemia, from about 30% of the mothers at baseline to nearly 45% at follow-up. Severe anemia was virtually absent among the women in both surveys.

No significant impact of *Tubaramure* was observed for maternal weight or BMI (**Table 66**). The program had a modest protective effect on Hb and anemia, i.e., the overall decrease in Hb levels (and increase in anemia) observed between surveys was lower in the *Tubaramure* groups. The estimated effect on mean Hb of 0.07 to 0.23 g/dL did not reach statistical significance (p-values 0.12, 0.09, and 0.35 in the T24, T18, and TNFP groups, respectively). *Tubaramure* had a 4.2–7.5 percentage point effect on anemia prevalence (significant in T24; p-values in the T18 and TNFP groups were 0.08 and 0.19, respectively).

Table 65. Anthropometric status of mothers[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2582**	**428**	**857**	**425**	**874**	**2595**	**430**	**877**	**425**	**865**
Weight (kg)[d]	50.2 ± 6.6	50.9 ± 8.0	50.3 ± 6.2	50.4 ± 7.0	49.8 ± 5.9	50.1 ± 6.3	50.2 ± 6.1	50.3 ± 6.4	50.5 ± 6.6	49.8 ± 6.0
Height (cm)	155.7 ± 6.2	156.5 ± 6.2	155.7 ± 6.6	156.1 ± 6.0	155.0 ± 5.8	155.8 ± 5.8	156.2 ± 6.2	155.9 ± 5.7	155.9 ± 5.5	155.2 ± 5.9
% less than 145 cm	2.8	2.6	2.3	3.3	3.2	2.5	2.6	1.9	2.1	3.4
BMI										
Mean BMI[d]	20.7 ± 2.9	20.8 ± 2.9	20.8 ± 3.8	20.7 ± 2.3	20.7 ± 2.1	20.7 ± 2.2	20.5 ± 2.1	20.7 ± 2.2	20.8 ± 2.3	20.7 ± 2.1
Underweight (BMI < 18.5)	13.4	11.0	14.4	14.7	12.8	14.7	14.9	15.2	14.7	14.2
Normal (BMI 18.5–24.9)	83.5	85.0	82.1	82.5	84.7	81.4	81.0	80.6	81.4	82.5
Overweight (BMI ≥ 25)	3.1	4.0	3.5	2.7	2.5	3.8	4.1	4.2	3.9	3.3
Hemoglobin/anemia										
Mean Hb (g/dL)	12.6 ± 1.6*	12.9 ± 1.6	12.6 ± 1.5	12.9 ± 1.6	12.4 ± 1.6	12.1 ± 1.6*	12.4 ± 1.5	12.1 ± 1.6	12.2 ± 1.5	11.8 ± 1.6
% anemic[e]	30.8*	25.9	30.8	26.1	35.5	44.6*	36.3	42.5	40.0	53.2
% severely anemic[f]	0.5	0.5	0.4	0.7	0.6	1.0	0.2	1.3	0.5	1.3

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 552 to 2582 in the full sample; N = 98 to 428 in the T24 arm; N = 170 to 857 in the T18 arm; N = 94 to 425 in the TNFP arm; and N = 181 to 874 in the control arm.
[c] Sample size at follow-up ranged from N = 561 to 2595 in the full sample; N = 93 to 430 in the T24 arm; N = 215 to 877 in the T18 arm; N = 90 to 425 in the TNFP arm; and N = 158 to 865 in the control arm.
[d] Weight and BMI are reported only for women who reported not being pregnant at the time of the interview.
[e] The cutoff for anemia was 12 g/dL for non-pregnant women and 11 g/dL for pregnant women.
[f] The cutoff for severe anemia was 8 g/dL for non-pregnant women and 7 g/dL for pregnant women.
* Study arms differ, $p < 0.05$.

Table 66. Anthropometric status of mothers: impact[a]

	Impact[b]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Weight (kg)[c]	−0.78 ± 0.70	−0.08 ± 0.47	0.03 ± 0.68
BMI			
Mean BMI[c]	−0.21 ± 0.27	−0.16 ± 0.21	0.13 ± 0.23
Underweight (BMI < 18.5)	2.40 ± 3.00	−0.33 ± 2.27	−1.96 ± 2.87
Normal (BMI 18.5–24.9)	−1.64 ± 3.09	0.73 ± 2.29	1.73 ± 2.85
Overweight (BMI ≥ 25)	−0.76 ± 1.55	−0.41 ± 1.17	0.23 ± 1.44
Hemoglobin/anemia			
Mean Hb (g/dL)	0.17 ± 0.15	0.23 ± 0.17	0.07 ± 0.18
% anemic[d]	−7.55 ± 4.36*	−6.57 ± 4.57	−4.22 ± 4.76
% severely anemic[e]	−0.98 ± 0.74	0.16 ± 0.73	−0.97 ± 0.82

[1] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[2] Sample size ranged from N = 1113 to 5165. One-sided tests were used for maternal hemoglobin and anemia variables including: adjusted values, maternal anemia, and maternal severe anemia. The anemia and hemoglobin estimates further controlled for altitude, child age, maternal age and maternal education.
[3] Weight and BMI are reported only for women who reported not being pregnant at the time of the interview.
[4] The cutoff for anemia was 12 g/dL for non-pregnant women and 11 g/dL for pregnant women.
[5] The cutoff for severe anemia was 8 g/dL for non-pregnant women and 7 g/dL for pregnant women.
* Impact estimate significantly different from 0, $p < 0.05$.

10. Results: Child Impact

10.1 IYCF Practices[33]

Breastfeeding practices among this population were optimal in many aspects at baseline and continued to show improvement at follow-up. Nearly all of the children 0–23 months of age (99.2% at baseline and 99.4% at follow-up) had ever been breastfed and most (80.7% at baseline and 90.3% at follow-up) were reportedly put to the breast within 1 hour of birth (**Table 67**). Almost three-quarters of infants under 6 months of age (78.1%) were exclusively breastfed during the preceding 24 hours at baseline, and this percentage increased to 90% at follow-up. Nearly 90% of infants under 6 months were predominantly breastfed at baseline and 95% at follow-up. In addition, almost all children were still breastfed at 1 year of age, and many (77.6% at baseline and 82.8% at follow-up) of the children were still being breastfed at 2 years of age. The high percentage of exclusive breastfeeding and continued breastfeeding explains the high rate of age-appropriate breastfeeding (85.6% at baseline and 91.3% at follow-up). The use of bottles was virtually nonexistent, with less than 1% reporting to have used a bottle to feed their child in the past 24 hours in both surveys. Although breastfeeding practices were quite good in general, among children who were not breastfed (7.3%), very few (3.3% at baseline and 4.1% at follow-up) received at least two milk feeds per day as recommended.

Of children aged 6–8 months, more than 90% had started eating complementary foods in both surveys. The quality of the complementary foods and the feeding frequency, however, were suboptimal, but improved dramatically from baseline to follow-up. Only a small percent of children 6–23 months of age (16.6%) had consumed iron-rich foods in the past 24 hours at baseline, but this had increased considerably to 47.5% at follow-up. At baseline, only about one-third of children received the minimum number of meals recommended for their age (at least two for breastfed children 6–8 months of age, at least three for breastfed children 9–23 months of age, and at least four for non-breastfed children), and the percentage of children receiving the minimum (WHO-recommended) meal frequency dropped with age, from around 40% in children 6–11 months to around 30% in older children. At follow-up, the percentage receiving the minimum number was noticeably higher (46.0%) and did not differ among the age groups. Note that the percent of mothers who knew the WHO-recommended feeding frequency (around 96% and 80% for children 6–8 and 11–23 months, respectively, at follow-up; see Table 53) was considerably higher than the proportion feeding their children the minimum number of meals. At baseline, fewer than 25% of the children were found to have consumed foods from at least four different food groups in the past 24 hours. This percentage increased with age, but was still low (around 30%) for the oldest children. At follow-up, the percentage with minimum dietary diversity had increased considerably (11%–16%) in all age groups. Only 8.1% of the children were classified as receiving a minimal acceptable diet at baseline; this proportion increased dramatically between baseline and follow-up, but remained relatively low at 20.1%.[34] Based on this indicator, the youngest children were found to be worst off, with only 5.5% (baseline) and 16.6% (follow-up) receiving a minimally acceptable diet.

CSB was consumed by only around 3% of children (6–23 months) in the previous 24 hours at baseline. At follow-up, 55%–60% of children in the T24 and TNFP groups and around 39% in the T18 group

[33] Note that the IYCF practices are assessed using the WHO IYCF indicator cutoffs, which might be different from the WHO guidance for complementary feeding.

[34] This indicator was calculated for both breastfed and non-breastfed children. For breastfed children, it was defined as meeting both the minimum dietary diversity and the minimum meal frequency requirements. For non-breastfed children, it was defined as having received at least two milk feedings, having consumed foods from at least four food groups (out of six nutrient-rich food groups), and meeting the minimum meal frequency in the past 24 hours.

reportedly consumed CSB in the day preceding the survey. The lower proportion in the T18 group is due to the fact that beneficiaries in this group did not receive program benefits after the child reached 18 months of age. As would be expected, CSB consumption was highest in current CSB beneficiary families (around 75%, 63%, and 67% in the T24, T18, and TNFP groups, respectively). Surprisingly, a considerable proportion of households that were no longer in the program (13%–27%) and who had never been in the program (9%–12%) reported having fed CSB to their child in the past 24 hours. Beneficiary children consumed CSB 2–3 days per week and in around 11 meals in the past week. The frequency of consuming CSB in “past” and “never” beneficiaries was lower (around 1.0 and 0.5 days per week, respectively).

The program did not have a significant effect on breastfeeding practices, with the exception of an increase in the percentage of children who were still breastfed at 1 year (1–6 percentage points, significant in the T24 group) (**Table 68**). The impact estimates for the proportion of children receiving complementary foods between 6 and 8 months of age were consistently positive (2–9 percentage points), but did not reach statistical significance (note that sample size for this indicator was very limited). The consumption of CSB led to a significant increase in the percent of children consuming iron-rich or iron-fortified foods (28–40 percentage points, statistically significant in all treatment and age groups). *Tubaramure* increased the proportion of children receiving the minimum recommended number of meals by 8–26 percentage points (statistically significant for the T18 and TNFP groups; $p = 0.08$ in T24). The largest impact was found in children 6–11 months and children 18–23 months. The program also led to an estimated increase of 7–12 percentage points on the percent of children receiving the minimum dietary diversity. Finally, *Tubaramure* had a positive impact on the percentage of children consuming a minimally acceptable diet (5–13 percentage points, statistically significant for the T18 and TNFP groups, p-value in T24 0.126).

Table 67. IYCF practices[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2592**	**427**	**864**	**427**	**874**	**2608**	**430**	**879**	**431**	**868**
Breastfeeding										
Child ever breastfed	99.2	99.8	99.2	99.3	99.0	99.4*	99.5	99.3	100.0	99.2
Early initiation of breastfeeding (within 1 hour of birth)	80.7	78.4	83.0	82.3	78.7	90.3*	91.8	90.7	93.0	87.7
Exclusive breastfeeding among children < 6 months of age	78.1	82.5	81.5	78.9	71.8	90.4	94.6	92.5	86.5	87.3
Predominant breastfeeding among children < 6 months of age	88.5	90.3	88.3	89.6	87.1	95.3	96.8	96.3	92.5	94.9
Continued breastfeeding at 1 year (12–15 months)	97.1	96.9	98.1	95.2	97.3	97.3*	100.0	97.9	97.2	95.3
Continued breastfeeding at 2 years or age (20–23 months)	77.6	70.0	80.1	76.9	78.5	82.8	84.6	80.7	88.9	81.4
Age-appropriate breastfeeding	85.6	85.3	86.8	85.9	84.4	91.3*	94.6	91.4	90.7	89.8
Bottle feeding	0.9	0.9	1.4	1.2	0.2	0.6	0.2	1.3	0.2	0.3
Milk feeding frequency for non-breastfed children (≥ 2 feedings/day)	3.3	5.9	3.4	3.7	1.6	4.1	27.3	0.0	7.1	1.9
Complementary feeding										
Introduction of solid, semi-solid, or soft foods (6–8 months)	93.5	97.6	93.5	88.9	93.6	92.3	93.2	94.6	91.4	89.8
Consumption of iron-rich or iron-fortified foods										
All (6–23 months)	16.6	16.7	15.8	19.9	15.7	47.5*	66.1	53.0	66.3	24.8
6–11 months	11.7*	12.1	11.6	18.3	8.4	41.9*	55.6	50.5	55.6	19.7
12–17 months	19.0	19.4	17.4	20.0	20.1	55.1*	76.3	62.2	78.3	26.4
18–23 months	18.4	18.1	17.7	21.6	18.1	45.5*	67.3	46.5	65.2	28.3
Minimum meal frequency										
All (6–23 months)	32.8*	37.8	33.9	24.6	33.1	46.0*	48.9	50.2	53.1	37.1
6–11 months	40.7	45.1	43.9	27.6	41.9	48.8	50.5	52.1	56.1	41.0
12–17 months	29.9	40.6	31.6	27.0	24.1	45.0*	44.5	52.1	53.0	34.6
18–23 months	29.5	30.1	28.9	18.7	33.3	44.1	52.1	46.8	49.4	36.1
Minimum dietary diversity (≥ 4 food groups)										
All (6–23 months)	23.7	25.2	23.6	28.6	20.8	37.0*	39.0	42.2	44.2	27.9
6–11 months	13.9*	19.0	10.6	22.6	10.3	28.4	27.4	34.1	32.0	21.8
12–17 months	26.9	30.8	26.7	31.2	22.3	42.6*	48.2	48.8	51.7	29.4
18–23 months	29.0	25.6	31.2	31.4	27.6	40.4	42.9	43.4	51.1	32.5
Minimal acceptable diet										
All (6–23 months)	8.1	11.1	8.0	7.5	7.1	20.1*	21.8	24.2	26.2	12.6
6–11 months	5.5	10.2	4.8	5.9	3.8	16.6*	14.9	22.8	20.0	10.2
12–17 months	10.2	16.7	9.0	11.8	7.2	22.6*	25.9	26.7	29.9	13.6
18–23 months	8.5	7.0	9.7	4.0	9.7	21.2*	25.8	23.2	30.0	14.0
CSB										
Child (6–23 months) ate CSB yesterday										
All	3.5	4.1	3.5	3.3	3.3	33.4*	60.2	38.8	56.1	5.1
Current *Tubaramure* benef.						67.6	74.8	63.1	66.5	
Past *Tubaramure* benef.						16.7	27.3	16.2	13.3	
Never *Tubaramure* benef.						9.9	11.6	9.5	8.7	

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2592**	**427**	**864**	**427**	**874**	**2608**	**430**	**879**	**431**	**868**
Number of days in last week child ate CSB										
All						2.2 ± 2.9	3.6 ± 3.0	2.7 ± 2.9	3.9 ± 3.0	0.3 ± 1.0
Current *Tubaramure* benef.						4.5 ± 2.6	4.5 ± 2.6	4.4 ± 2.6	4.6 ± 2.7	
Past *Tubaramure* benef.						1.1 ± 2.1	1.5 ± 2.8	1.0 ± 2.1	1.4 ± 2.3	
Never *Tubaramure* benef.						0.5 ± 1.6	0.7 ± 1.8	0.5 ± 1.5	0.5 ± 1.5	
Number of meals in last week with CSB										
All						10.2 ± 6.7	10.6 ± 7.0	10.2 ± 6.2	11.4 ± 6.9	4.7 ± 4.5
Current *Tubaramure* benef.						11.2 ± 6.7	10.8 ± 7.0	10.9 ± 6.1	11.8 ± 6.9	
Past *Tubaramure* benef.						7.6 ± 4.8	10.3 ± 6.4	7.2 ± 4.8	8.0 ± 4.5	
Never *Tubaramure* benef.						5.6 ± 5.5	5.6 ± 4.8	5.9 ± 6.2	4.4 ± 2.4	

[a] Values are mean ± SD or %. All estimates account for clustering.

[b] Sample size at baseline ranged from N = 182 to 2592 in the full sample; N = 34 to 427 in the T24 arm; N = 59 to 864 in the T18 arm; N = 27 to 427 in the TNFP arm; and N = 62 to 874 in the control arm.

[c] Sample size at follow-up ranged from N = 41 to 2608 in the full sample; N = 3 to 430 in the T24 arm; N = 27 to 879 in the T18 arm; N = 5 to 431 in the TNFP arm; and N = 0 to 868 in the control arm.

* Study arms differ, $p < 0.05$.

Table 68. IYCF practices: impact[a]

	Impact[b,c]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Breastfeeding			
Child ever breastfed	−0.41 ± 0.50	−0.05 ± 0.52	0.42 ± 0.57
Early initiation of breastfeeding (within 1 hour of birth)	4.54 ± 3.52	−1.37 ± 3.57	1.28 ± 3.53
Exclusive breastfeeding among children < 6 months of age	−2.52 ± 6.66	−4.56 ± 5.30	−6.30 ± 8.17
Predominant breastfeeding among children < 6 months of age	−0.73 ± 5.33	−0.04 ± 4.80	−2.95 ± 6.40
Continued breastfeeding at 1 year (12–15 months)	6.38 ± 3.70*	1.43 ± 2.62	2.52 ± 2.76
Continued breastfeeding at 2 years or age (20–23 months)	13.05 ± 8.55	−2.04 ± 6.20	9.27 ± 6.51
Age-appropriate breastfeeding	4.21 ± 2.86	−0.55 ± 1.92	−0.45 ± 2.20
Bottle feeding	−0.82 ± 0.54	−0.28 ± 0.68	−1.07 ± 0.94
Milk feeding frequency for non-breastfed children (≥ 2 feedings/day)	12.26 ± 11.03	−3.92 ± 3.51	7.70 ± 7.73
Complementary feeding			
Introduction of solid, semi-solid, or soft foods (6–8 months)	2.49 ± 5.77	6.23 ± 5.33	9.43 ± 9.03
Consumption of iron-rich or iron-fortified foods			
All (6–23 months)	39.60 ± 4.49*	27.61 ± 4.32*	37.16 ± 4.39*
6–11 months	29.47 ± 5.71*	28.10 ± 5.36*	26.22 ± 4.94*
12–17 months	47.81 ± 7.97*	35.05 ± 4.78*	49.14 ± 5.84*
18–23 months	38.48 ± 7.77*	18.28 ± 7.17*	32.39 ± 9.18*
Minimum meal frequency			
All (6–23 months)	8.41 ± 6.00	13.80 ± 4.28*	25.69 ± 5.18*
6–11 months	13.13 ± 10.75	15.59 ± 7.14*	34.39 ± 8.05*
12–17 months	−8.62 ± 7.68	11.61 ± 7.77	17.27 ± 7.42*
18–23 months	15.40 ± 8.38*	14.47 ± 5.16*	32.61 ± 6.60*
Minimum dietary diversity (≥ 4 food groups)			
All (6–23 months)	6.87 ± 4.03*	11.74 ± 4.66*	9.19 ± 4.28*
6–11 months	−2.67 ± 5.40	13.78 ± 5.02*	−0.05 ± 5.77
12–17 months	12.56 ± 10.49	14.49 ± 6.76*	11.73 ± 7.21
18–23 months	11.35 ± 7.94	7.28 ± 8.11	12.59 ± 9.41
Minimal acceptable diet			
All (6–23 months)	5.36 ± 4.63	11.27 ± 2.98*	13.47 ± 3.67*
6–11 months	−1.47 ± 4.22	13.61 ± 4.15*	8.54 ± 4.90*
12–17 months	3.33 ± 8.12	11.24 ± 5.74*	11.49 ± 5.89*
18–23 months	12.02 ± 7.75	8.04 ± 3.73*	19.80 ± 4.50*

[a] Values are double difference impact estimates ± SE in percentage points when data from both surveys were available and simple difference impact estimates ± SE when only follow-up data were available. All estimates account for clustering.
[b] Sample size ranged from N = 305 to 5200.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators, with the exception of bottle feeding for which the a priori hypothesis was negative.
* Impact estimate significantly different from 0, $p < 0.05$.

10.2 Child Health

The regular use of preventive health services for children 0–23 months of age appears to be uncommon and actually decreased between baseline and follow-up (**Table 69**). The majority of caregivers reportedly had a vaccination card for their children where vaccinations, micronutrient supplements, height or length, and weight could be recorded (78.7% at baseline and 93.5% at follow-up). The percentage who had the card available at the interview increased from 69.1% at baseline to 83.1% at follow-up. Fewer than one-third of children had attended growth monitoring in the past 2 months at baseline and this dropped to fewer than one-fifth at follow-up. Of these children, the percent who had their weight recorded decreased from around 87% to around 83%; the proportion who had their height or length recorded remained low at around 20%. In line with the low attendance rates at growth monitoring visits, only around 57% of the children 15–23 months of age[35] had received vitamin A in the 6 months preceding the baseline survey, and a similar percent had received it at follow-up (60%). Among the group of children with a vaccination card available, around 70% of children were fully vaccinated for their age at baseline and this dropped to 63.2% at follow-up.

The program had a positive impact (2–9 percentage points) on the percent of mothers able to show a vaccination card for their child (statistically significant for TNFP) (**Table 70**). *Tubaramure* did not have an impact on growth monitoring attendance, which declined in all study groups (see Table 69). In the small subgroup of children who had a vaccination card and who attended growth monitoring in the past 2 months (n = 1094 at baseline and follow-up combined), the program appears to have increased the proportion whose weight was recorded on the vaccination card, but this effect was not statistically significant. Finally, *Tubaramure* did not have an impact on the percentage of children having received vitamin A supplementation in the last 6 months or being fully vaccinated for one's age. The latter declined from baseline to follow-up (except for being fully vaccinated in the T24 group, which remained stable. See Table 69).

Illness was common among the children, and, alarmingly, severe illness was also common (**Table 71**). Around 44% of all children at baseline had experienced at least one symptom of illness in the past 2 weeks, and this percentage increased to around 52% at follow-up. The most commonly reported symptoms were fever (29.6% at baseline and 32.5% at follow-up), loss of appetite (27.3% at baseline and 32.3% at follow-up), coughing (31.0% at baseline and 35.6% at follow-up), and watery diarrhea (22.5% at baseline and 25.9% at follow-up). More than one in four children (25.7% and 28.0% at baseline and follow-up, respectively) had experienced severe diarrhea (defined as diarrhea with at least one of the following: fever, six or more loose stools per day, vomiting, not wanting to eat or drink, blood in the stool, or parents' belief that the illness is not getting better) in the past 2 weeks, and between 3% and 4% of children at both surveys had experienced severe respiratory problems (cough in the past 2 weeks along with difficulty or fast breathing due to chest problems).

Tubaramure had large, consistent, and positive effects on reducing child morbidity despite the increase in reported symptoms from baseline to follow-up in all study groups (**Table 72**). The program thus appears to have protected children from the overall increase in child morbidity. As compared with the control group, the program reduced the proportion of children with morbidity symptoms by 7–12 percentage points (significant in all groups). Similarly, there was an impact on the prevalence of the most common symptoms of illness (fever, lost appetite, cough, and watery diarrhea; significant in the majority of study groups) and for less common (but important) health problems, such as difficulties with drinking, loss of appetite, and vomiting. The impact estimates for severe diarrhea (a 3–8 percentage-point protective effect) did not reach statistical significance (p = 0.054 in T24). No consistent program effect was found on the prevalence of potential pneumonia.

[35] As vitamin A supplementation begins at 9 months this variable is tabulated for children 15–23 months.

Table 69. Preventive health care practices[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2617**	**431**	**870**	**431**	**885**	**2614**	**432**	**880**	**431**	**871**
Vaccination card										
Reported having a vaccination card	78.7	79.0	78.1	76.3	80.2	93.5*	96.1	90.9	95.6	93.9
Showed a vaccination card	69.1	71.8	67.8	64.7	71.4	83.1*	90.3	80.1	84.0	82.2
Growth monitoring										
Attended growth monitoring in the last 2 months	29.0	35.3	29.7	32.3	23.7	19.3*	23.4	20.1	25.1	13.7
Weight recorded on vaccination card	87.1	86.3	87.0	87.7	87.5	82.6	86.0	81.6	92.4	72.6
Height/length recorded on vaccination card	19.0	16.3	24.3	21.9	13.0	20.7	24.4	13.4	35.5	15.2
Vitamins and vaccinations										
Received vitamin A in last 6 months[d]	56.8	61.1	53.5	55.0	58.8	60.3	62.5	60.9	55.2	61.0
Fully vaccinated for age	69.6	73.5	66.0	67.3	72.1	63.2	73.8	57.9	59.0	64.7

[a] Values are %. All estimates account for clustering.

[b] Sample size at baseline ranged from N = 642 to 2617 in the full sample; N = 129 to 431 in the T24 arm; N = 214 to 870 in the T18 arm; N = 114 to 431 in the TNFP arm; and N = 184 to 885 in the control arm.

[c] Sample size at follow-up ranged from N = 445 to 2614 in the full sample; N = 90 to 432 in the T24 arm; N = 157 to 880 in the T18 arm; N = 92 to 431 in the TNFP arm; and N = 105 to 871 in the control arm.

[d] Children 15–23 months of age.

* Study arms differ, $p < 0.05$.

Table 70. Preventive health care practices: impact[a]

	Impact[b,c]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Vaccination card			
Reported having a vaccination card	3.11 ± 6.01	−0.87 ± 3.80	5.61 ± 4.32
Showed a vaccination card	7.71 ± 6.00	1.91 ± 3.39	8.51 ± 4.49*
Growth monitoring			
Attended growth monitoring in the last 2 months	−1.34 ± 5.74	0.68 ± 5.63	3.59 ± 5.95
Weight recorded on vaccination card	16.93 ± 14.15	11.26 ± 13.82	20.48 ± 14.04
Height/length recorded on vaccination card	6.33 ± 7.91	−12.55 ± 8.73	12.42 ± 7.03*
Vitamins and vaccinations			
Received vitamin A in last 6 months[d]	0.33 ± 7.85	5.97 ± 8.98	−0.87 ± 11.07
Fully vaccinated for age	6.97 ± 7.22	−0.93 ± 8.01	0.93 ± 7.26

[1] Values are double difference impact estimates ± SE in percentage points when data from both surveys were available and simple difference impact estimates ± SE when only follow-up data were available. All estimates account for clustering.
[2] Sample size ranged from N = 1087 to 5231.
[3] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
[4] Children 15–23 months of age.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 71. Child health and prevalence of morbidity symptoms[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2623**	**432**	**870**	**433**	**888**	**2614**	**432**	**880**	**431**	**871**
During the past 2 weeks, % who experienced:										
Any illness	43.9	50.7	44.5	41.9	41.0	51.9	52.3	49.9	49.5	54.8
Fever	29.6	28.8	31.6	27.6	29.0	32.5*	27.2	31.4	27.2	39.1
Convulsions	5.6	5.6	4.6	5.8	6.3	5.7	5.6	5.4	4.4	6.7
Problems drinking	17.5	16.9	18.9	17.4	16.6	19.8*	16.4	17.5	18.0	24.7
Lost appetite	27.3	29.5	28.7	25.6	25.5	32.3*	27.8	30.3	31.1	37.1
Vomited all (s)he ate/drank	15.9	14.6	16.2	16.5	16.1	20.2*	16.9	18.4	16.4	25.5
Cough	31.0*	39.4	29.9	33.2	27.0	35.6	36.1	36.6	32.2	36.1
Difficulty breathing	20.0	21.6	20.3	19.5	19.1	23.7	22.2	25.2	19.4	24.9
Bloody diarrhea	3.3	4.2	3.2	3.7	2.7	3.6	2.6	3.9	3.5	3.7
Watery diarrhea	22.5	26.0	22.6	23.0	20.4	25.9	23.9	25.1	25.7	27.7
Other type of diarrhea	8.1	6.7	7.8	7.9	9.2	8.7*	6.1	10.8	7.9	8.2
During the past 2 weeks, % who suffered from a potentially morbid illness requiring; immediate medical attention										
Severe diarrhea[d]	25.7	29.0	25.5	26.5	23.9	28.0	26.1	27.6	28.3	29.2
Potential pneumonia[e]	3.8*	5.6	4.4	1.2	3.7	3.3*	1.6	4.2	2.3	3.6

[a] Values are %. All estimates account for clustering.

[b] Sample size at baseline ranged from N = 2582 to 2623 in the full sample; N = 426 to 432 in the T24 arm; N = 851 to 870 in the T18 arm; N = 429 to 433 in the TNFP arm; and N = 873 to 888 in the control arm.

[c] Sample size at follow-up ranged from N = 2548 to 2614 in the full sample; N = 418 to 432 in the T24 arm; N = 859 to 880 in the T18 arm; N = 424 to 431 in the TNFP arm; and N = 847 to 871 in the control arm.

[d] Diarrhea with at least one of the following: fever, six or more loose stools per day, vomiting, not wanting to eat or drink, blood in the stool, or parents' belief that the illness was not improving.

[e] Cough in the past 2 weeks along with difficulty or fast breathing due to chest problems.

* Study arms differ, $p < 0.05$.

Table 72. Child health and prevalence of morbidity symptoms: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
During the past 2 weeks, % who experienced:			
Any illness	−12.37 ± 6.49*	−8.69 ± 3.24*	−6.99 ± 4.09*
Fever	−11.98 ± 3.97*	−10.86 ± 2.64*	−11.05 ± 3.56*
Convulsions	−0.44 ± 1.89	0.14 ± 1.45	−1.87 ± 1.73
Problems drinking	−8.69 ± 3.35*	−9.76 ± 2.37*	−7.80 ± 3.94*
Lost appetite	−13.30 ± 4.49*	−10.20 ± 2.73*	−6.59 ± 3.13*
Vomited all (s)he ate/drank	−7.29 ± 2.35*	−7.34 ± 2.58*	−9.86 ± 3.04*
Cough	−12.48 ± 5.74*	−2.52 ± 3.60	−10.53 ± 4.38*
Difficulty breathing	−5.06 ± 3.63	−0.96 ± 2.49	−5.83 ± 3.30*
Bloody diarrhea	−2.68 ± 1.28*	−0.40 ± 1.09	−1.03 ± 1.41
Watery diarrhea	−9.64 ± 4.93*	−4.97 ± 4.37	−5.09 ± 4.47
Other type of diarrhea	0.26 ± 2.87	3.88 ± 2.45	0.78 ± 2.52
During the past 2 weeks, % who suffered from a potentially morbid illness requiring; immediate medical attention			
Severe diarrhea[d]	−8.49 ± 5.19	−3.39 ± 4.44	−4.03 ± 4.27
Potential pneumonia[e]	−3.86 ± 1.67*	−0.06 ± 1.51	1.18 ± 0.90

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 5130 to 5237. One-sided tests were used for all child morbidity symptoms, severe diarrhea, and potential pneumonia.
[c] One-sided tests were conducted. The a priori hypothesis was a negative effect for all indicators.
[d] Diarrhea with at least one of the following: fever, six or more loose stools per day, vomiting, not wanting to eat or drink, blood in the stool, or parents' belief that the illness was not improving.
[e] Cough in the past 2 weeks along with difficulty or fast breathing due to chest problems.
* Impact estimate significantly different from 0, $p < 0.05$.

The majority of children who had a fever in the past 2 weeks received a fever-reducing medication, and this proportion increased over time in all study groups (70.1% at baseline and 87.7% at follow-up) (**Table 73)**. Only around 40% of those with diarrhea at both surveys, however, had received ORS and, at both time points, 40% of mothers who had children with diarrhea reported reducing the child's liquid intake when the child suffered from diarrhea. This is considerably higher than the already high proportion of mothers who reported believing that liquid intake should be reduced in sick children (Table 47). The proportion of mothers with a severely ill child who sought care from a trained professional increased from 67.7% at baseline to 78.6% at follow-up. Very few (< 1%) sought care from someone other than a trained professional, and the remainder did not seek care at all.

The program had a significant impact of 2–15 percentage points on the proportion of children who received medication to fight a fever (significant in the T24 and TNFP groups) (**Table 74**). This indicates that in addition to the general increase found in all study groups (Table 73), which might be due to *Tubaramure*'s health strengthening activities in all health centers, the program also increased the demand for this service at the household level in the treatment arms. No significant impact was found for any of the other curative care-seeking behaviors.

10.3 Child Development

At baseline, the mean highest attained motor milestone among the full sample of children was standing alone for a long period of time, and there was no statistically significant difference across the groups (**Table 75**). At follow-up, there was a decrease in the highest average attained milestone to standing alone for a short period of time for the full sample, but there was again no statistically significant difference across the treatment groups. Among children between the ages of 12 and 23 months, there was also a decrease in the highest average motor milestone attained across the full sample (from climbing stairs to running) between the baseline and follow-up. In this age group, there was a statistically significant protective effect of the *Tubaramure* program for the TNFP arm compared to the control group in the decline of the highest average attained motor milestone (a 1.0 point effect) (**Table 76**).

With regard to language development, there were no meaningful changes in the highest average attained language milestone for the full sample or for the two age groups between baseline and follow-up (Table 75). However, the highest average attained language milestone among children in the control group declined between baseline and follow-up and stayed about the same for the children in the T24 and T18 groups (Table 75). This decline in highest attained language milestone in the control group between baseline and follow-up was more pronounced among children between the ages of 12 and 23 months of age. Conversely, there was a slight increase in the highest average attained language milestone for children in the T24 and T18 groups resulting in a significant impact of *Tubaramure* on improving children's language development among the full sample (a 0.4 and 0.6 point effect for the T24 and T18 groups, respectively), with a stronger effect among children between the ages of 12 and 23 months (a 1.1 and 0.8 point effect for the T24 and T18 groups, respectively) (Table 76).

Table 73. Treatment of illness and malnutrition[a]

	Baseline[b]					Follow-up[c]				
	Full sample	Study arm				Full sample	Study arm			
		T24	T18	TNFP	Control		T24	T18	TNFP	Control
N	**2617**	**432**	**869**	**432**	**885**	**2611**	**432**	**880**	**430**	**870**
Fever										
Received medication for fever	70.1*	59.2	71.2	65.8	76.3	87.7	89.7	85.0	89.7	88.5
Diarrhea:										
Received ORS	38.7*	41.4	42.6	45.1	29.9	43.1	51.3	39.2	49.6	40.1
Liquids given; % who were given										
Nothing or less than normal	39.8	45.2	33.9	39.8	42.9	42.6	35.0	42.6	39.7	47.5
Same as normal	16.4	17.5	17.8	10.6	17.4	14.9	16.2	17.5	11.1	13.6
More than normal	43.8	37.3	48.3	49.6	39.7	42.5	48.7	39.8	49.2	38.9
Children with symptoms requiring immediate medical attention (severe diarrhea or respiratory problems); % who:										
Sought care/advice from trained professional	67.7	53.2	73.4	68.8	70.3	78.6	82.1	80.4	72.5	78.3
Sought care/advice from somebody else	0.5	0.8	0.5	0.0	0.5	0.3	0.0	0.4	0.0	0.4
Did not seek care	31.8	46.0	26.1	31.2	29.2	21.1	17.9	19.1	27.5	21.3

[a] Values are %. All estimates account for clustering.

[b] Sample size at baseline ranged from N = 635 to 2617 in the full sample; N = 120 to 432 in the T24 arm; N = 207 to 869 in the T18 arm; N = 109 to 432 in the TNFP arm; and N = 195 to 885 in the control arm.

[c] Sample size at follow-up ranged from N = 705 to 2611 in the full sample; N = 106 to 432 in the T24 arm; N = 235 to 880 in the T18 arm; N = 117 to 430 in the TNFP arm; and N = 244 to 870 in the control arm.

* Study arms differ, $p < 0.05$.

Table 74. Treatment of illness and malnutrition: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Fever			
Received medication for fever	15.30 ± 5.92*	2.26 ± 5.06	10.34 ± 5.75*
Diarrhea			
Received ORS	−3.00 ± 8.44	−11.67 ± 6.49	−4.14 ± 8.11
Liquids given; % who were given			
Nothing or less than normal	−15.77 ± 9.69	1.95 ± 6.81	−7.98 ± 8.17
Same as normal	0.41 ± 5.54	3.33 ± 5.08	3.01 ± 5.66
More than normal	15.35 ± 9.74	−5.28 ± 8.73	4.97 ± 9.46
Children with symptoms requiring immediate medical attention (severe diarrhea or respiratory problems); % who:			
Sought care/advice from trained professional	18.55 ± 9.83	−1.94 ± 8.65	−5.23 ± 9.27
Sought care/advice from somebody else	−0.46 ± 0.97	0.49 ± 0.83	0.43 ± 0.39
Did not seek care	−18.08 ± 9.35	1.45 ± 8.49	4.80 ± 9.09

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering.
[b] Sample size ranged from N = 1340 to 5228.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for treatment of fever with medication and treatment of diarrhea with ORS.
* Impact estimate significantly different from 0, $p < 0.05$.

Table 75. Motor and language milestones attained[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	2282	358	764	373	789	2278	381	748	368	781
Highest motor milestone attained										
All (4–23 months)	15.1 ± 6.7	15.2 ± 6.6	15.4 ± 6.5	15.0 ± 6.6	14.9 ± 6.9	14.6 ± 6.3	14.4 ± 6.3	14.6 ± 6.5	14.7 ± 6.6	14.6 ± 6.0
4–11 months	8.5 ± 4.7	8.6 ± 4.4	8.8 ± 4.5	8.8 ± 5.0	8.2 ± 4.8	8.9 ± 4.6	8.9 ± 4.3	8.6 ± 4.6	8.9 ± 4.6	9.3 ± 4.6
12–23 months	19.1 ± 4.0	19.2 ± 4.1	19.2 ± 4.1	18.8 ± 4.0	19.1 ± 4.0	18.6 ± 3.9*	18.7 ± 3.9	18.7 ± 3.9	19.1 ± 3.8	18.1 ± 3.9
Highest language milestone attained										
All (4–23 months)	6.3 ± 4.3	6.2 ± 4.2	6.4 ± 4.3	6.3 ± 4.3	6.3 ± 4.3	6.1 ± 3.9	6.1 ± 4.1	6.3 ± 4.1	6.0 ± 4.0	6.0 ± 3.5
4–11 months	2.5 ± 2.2	2.5 ± 2.1	2.6 ± 2.1	2.7 ± 2.3	2.5 ± 2.2	3.0 ± 2.1	2.9 ± 2.1	2.8 ± 2.0	3.1 ± 2.6	3.2 ± 1.9
12–23 months	8.5 ± 3.6	8.3 ± 3.6	8.5 ± 3.6	8.5 ± 3.7	8.7 ± 3.4	8.3 ± 3.4*	8.5 ± 3.5	8.6 ± 3.4	8.3 ± 3.4	7.8 ± 3.1

[3] Values are mean ± SD. All estimates account for clustering.
[1] Sample size at baseline ranged from N = 856 to 2282 in the full sample; N = 134 to 358 in the T24 arm; N = 275 to 764 in the T18 arm; N = 143 to 373 in the TNFP arm; and N = 303 to 789 in the control arm.
[2] Sample size at follow-up ranged from N = 927 to 2278 in the full sample; N = 165 to 381 in the T24 arm; N = 300 to 748 in the T18 arm; N = 158 to 368 in the TNFP arm; and N = 304 to 781 in the control arm.
* Study arms differ, $p < 0.05$.

Table 76. Motor and language milestones attained: impact[a]

	Impact[b,c]		
	T24 vs. control	T18 vs. control	TNFP vs. control
Highest motor milestone attained			
All (4–23 months)	0.16 ± 0.36	0.03 ± 0.34	0.35 ± 0.36
4–11 months	−0.48 ± 0.41	−0.37 ± 0.42	−0.66 ± 0.38
12–23 months	0.44 ± 0.56	0.26 ± 0.44	1.00 ± 0.51*
Highest language milestone attained			
All (4–23 months)	0.64 ± 0.27*	0.39 ± 0.23*	0.24 ± 0.28
4–11 months	−0.08 ± 0.30	−0.20 ± 0.25	−0.21 ± 0.33
12–23 months	1.05 ± 0.40*	0.78 ± 0.32*	0.45 ± 0.35

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering and control for child sex, child age, and maternal education.
[b] Sample size ranged from N = 1779 to 4544.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for all indicators.
* Impact estimate significantly different from 0, $p < 0.05$.

10.4 Child Hemoglobin Levels and Anemia Status

The mean Hb concentration among children 6–23 months of age at baseline was 10.6 g/dL, but this decreased to 10.1 g/dL at follow-up. Correspondingly, the prevalence of anemia increased from baseline (59.8%) to follow-up (72.9%). The lowest Hb concentrations (and the highest prevalence of anemia) at both baseline and follow-up were found in children 6–11 months of age (**Table 77**). The prevalence of severe anemia among children 6–23 months increased from 2.0% to 5.1% from baseline to follow-up. We do not know what might explain this increase in anemia.

The program had a protective effect on child Hb levels, i.e., the general decline in Hb levels observed in all study groups between surveys was less steep in the *Tubaramure* group than in the control group (**Table 78**). The estimated size of the protective effect was 0.2–0.6 g/dL (significant in the T24 and T18 groups; p-value in the TNFP group 0.054). The largest impacts were found in the youngest and oldest children. The estimated reduction in the prevalence of child anemia (1–9 percentage points) was only significant in the T18 group. The largest effect on the reduction in severe anemia was found in the oldest children, with effect sizes ranging from 4 to 6 percentage points (significant in the TNFP group, p-values in the T24 and T18 groups 0.09 and 0.11, respectively).

Table 77. Child hemoglobin levels and anemia status[a]

	Baseline[b]					Follow-up[c]				
		Study arm					Study arm			
	Full sample	T24	T18	TNFP	Control	Full sample	T24	T18	TNFP	Control
N	**2565**	**426**	**849**	**421**	**869**	**2584**	**429**	**869**	**423**	**863**
Child hemoglobin: adjusted value (g/dL)										
All (6–23 months)	10.6 ± 1.6*	10.9 ± 1.4	10.4 ± 1.6	10.8 ± 1.6	10.6 ± 1.6	10.1 ± 1.7	10.4 ± 1.5	10.1 ± 1.7	10.3 ± 1.6	9.8 ± 1.7
6–11 months	10.2 ± 1.3	10.5 ± 1.1	10.0 ± 1.3	10.3 ± 1.4	10.3 ± 1.4	9.7 ± 1.5	10.1 ± 1.4	9.7 ± 1.4	9.6 ± 1.4	9.4 ± 1.5
12–17 months	10.6 ± 1.4*	11.0 ± 1.1	10.4 ± 1.5	11.1 ± 1.2	10.4 ± 1.5	10.1 ± 1.5*	10.2 ± 1.4	10.2 ± 1.5	10.6 ± 1.4	9.8 ± 1.7
18–23 months	10.8 ± 1.5*	11.1 ± 1.2	10.6 ± 1.7	11.0 ± 1.6	10.8 ± 1.4	10.1 ± 1.7*	10.7 ± 1.3	10.2 ± 1.9	10.3 ± 1.5	9.8 ± 1.7
Child anemia[d]										
All (6–23 months)	59.8*	56.6	63.7	52.7	60.8	72.9	68.5	72.1	69.3	77.5
6–11 months	71.8	73.7	77.0	72.8	65.6	83.8	79.7	86.6	80.5	85.2
12–17 months	59.6*	52.9	63.9	45.5	66.7	70.1	70.8	67.7	60.3	76.7
18–23 months	50.4	45.4	53.0	41.3	53.4	64.3	52.0	62.7	65.6	70.6
Child severe anemia[e]										
All (6–23 months)	2.0*	0.3	2.8	1.8	2.2	5.1	3.3	5.3	3.3	6.6
6–11 months	1.6	1.0	0.5	2.9	2.4	5.6	4.1	6.0	4.9	6.4
12–17 months	2.2	0.0	3.0	0.0	3.6	4.4	3.5	3.2	1.7	7.3
18–23 months	2.2*	0.0	4.4	2.9	1.0	5.3	2.0	6.6	3.3	6.3

[a] Values are mean ± SD or %. All estimates account for clustering.
[b] Sample size at baseline ranged from N = 611 to 2565 in the full sample; N = 99 to 426 in the T24 arm; N = 200 to 849 in the T18 arm; N = 103 to 421 in the TNFP arm; and N = 192 to 869 in the control arm.
[c] Sample size at follow-up ranged from N = 656 to 2584 in the full sample; N = 100 to 429 in the T24 arm; N = 216 to 869 in the T18 arm; N = 90 to 423 in the TNFP arm; and N = 232 to 863 in the control arm.
[d] Cutoff was 11 g/dL.
[e] Cutoff was 7 g/dL.
* Study arms differ, p < 0.05.

Table 78. Child hemoglobin levels and anemia status: impact[a]

	Impact[b,c]		
	T24 vs. control	**T18 vs. control**	**TNFP vs. control**
Child hemoglobin: adjusted value (g/dL)			
All (6–23 months)	0.34 ± 0.20*	0.56 ± 0.18*	0.24 ± 0.14
6–11 months	0.36 ± 0.30	0.53 ± 0.22*	0.31 ± 0.19
12–17 months	−0.16 ± 0.26	0.44 ± 0.24*	0.10 ± 0.25
18–23 months	0.61 ± 0.20*	0.58 ± 0.25*	0.29 ± 0.34
Child anemia			
All (6–23 months)	−5.61 ± 5.26	−8.69 ± 4.22*	−0.97 ± 3.53
6–11 months	−10.62 ± 10.47	−11.55 ± 8.41	−15.70 ± 6.88*
12–17 months	11.27 ± 7.54	−3.10 ± 6.19	6.70 ± 8.62
18–23 months	−11.51 ± 6.91	−7.53 ± 6.04	3.77 ± 8.05
Child severe anemia			
All (6–23 months)	−1.38 ± 2.71	−1.96 ± 1.60	−3.08 ± 1.52*
6–11 months	0.09 ± 3.67	1.71 ± 2.33	−1.87 ± 2.11
12–17 months	0.14 ± 3.36	−3.00 ± 2.67	−1.28 ± 2.48
18–23 months	−3.64 ± 2.65	−3.53 ± 2.90	−6.24 ± 3.64*

[a] Values are double difference impact estimates ± SE in percentage points. All estimates account for clustering and control for altitude, child sex, and child age.
[b] Sample size ranged from N = 1308 to 4053.
[c] One-sided tests were conducted. The a priori hypothesis was a positive effect for mean hemoglobin and a negative effect for anemia and severe anemia.
* Impact estimate significantly different from 0, $p < 0.05$.

11. Summary of Findings along the Program Impact Pathways

In this section of the report, we summarize and discuss the key findings along the primary program impact pathways that correspond to the three program components: the food component, the health component, and the BCC component. We conclude with a section on the impacts on maternal and child Hb concentrations and anemia and child development.

11.1 The *Tubaramure* Food Component

The food component of the *Tubaramure* program is expected to increase household availability of micronutrient-rich food and, in turn, consumption of such foods and to improve diet diversity. To achieve these goals, all beneficiaries enrolled in the *Tubaramure* program are supposed to receive a monthly household food ration and an individual food ration meant to be consumed by the woman while she is pregnant or when her child is under 6 months of age and by the child when it is 6–23 months of age.

The *Tubaramure* program was found to be well known by respondents, and a large proportion (75%–85%) of eligible households were either previous or current program beneficiaries. When asked about the program benefits and activities, nearly all current beneficiaries mentioned food rations. Notwithstanding the large distance to reach the distribution site (an average of 1.5 hours), missing a food distribution was rare and nearly all participants reported that they received CSB and oil as they expected. Many of the key program impacts, such as improvements in women's dietary diversity (largest effect in the legumes group, a consequence of consuming CSB) and IYCF practices, appear to be a direct consequence of receiving the food rations (for instance, consumption of CSB led to a significant increase in the proportion of children consuming iron-rich or iron-fortified foods).

As would be expected with a program providing large food rations to food insecure households, *Tubaramure* had an important positive effect on household access to food as measured by the HFIAS (Coates et al. 2007). The program reduced the percentage of severely food insecure households by 9–18 percentage points. *Tubaramure* had a minimal impact on the low level of household dietary diversity (households consumed on average foods from only 4 food groups out of a possible 12).

Tubaramure had a small positive impact (ranging from 0.31 to 0.40 food groups) on the very limited diversity of mothers' diets. The largest impact for a single food group was found for legumes, a direct consequence of CSB[36] consumption in beneficiary mothers. The program also improved all complementary feeding practices. The largest impact was seen in the proportion of children consuming iron-rich foods (a 27–40 percentage point increase), which appeared to be directly related to the increased intake of CSB. A more modest positive impact (5–26 percentage points) was found for the other three complementary practices we assessed: the proportion of children receiving the minimum recommended number of meals, the proportion of children receiving the minimum dietary diversity (which appears to be a consequence of CSB consumption), and the percentage of children consuming a minimally acceptable diet.

11.2 The *Tubaramure* BCC Component

Tubaramure's BCC strategy was designed specifically to address many of the underlying causes of undernutrition in Burundi and to encourage the adoption of best practices in health, hygiene, and nutrition. The BCC strategy was designed to be implemented by program staff, locally hired THPs, and

[36] As indicated previously, CSB, consisting of corn and soy, contributed to the starchy staples and legumes group when we assessed women's (and children's) dietary diversity.

leader mothers who are program beneficiaries selected by their fellow beneficiary mothers to teach them. Leader mothers are expected to train the beneficiary mothers in care groups (which should meet every 2 weeks) on the topics that they have most recently learned from the THP.

When asked about the program benefits and activities, four-fifths of all current beneficiaries mentioned BCC sessions. Participation in the care groups, however, was considerably less common than attending food ration distributions: Attendance was only around half of what is intended by the *Tubaramure* program design. Exposure to cooking demonstrations was even lower, as only half the mothers who had ever participated in a care group reported that a cooking demonstration had ever been offered.

11.2.1 Health and Nutrition Knowledge

The program had no significant effect on mothers' very limited knowledge of danger signs during pregnancy or for childhood illnesses. As a matter of fact, the number of signs mothers could mention decreased considerably from baseline to follow-up in both the *Tubaramure* and control groups. However, the program did substantially reduce the large proportion of mothers who previously believed that children's breast milk, liquid, and food intake should be reduced when they are ill.

Surprisingly, for a program aimed at improving child nutritional status, *Tubaramure* had no clear impact on mothers' limited knowledge of the reasons for child malnutrition or the foods essential for child growth. The program clearly increased awareness of vitamin A- and iron-rich foods, but did not change the percentage of mothers who knew the consequences of vitamin A or iron deficiency.

Tubaramure had a positive (but modest) effect on the limited knowledge related to complementary feeding. The program significantly reduced the percentage of mothers who thought that liquids and foods other than breast milk should be introduced before 6 months of age. Importantly, the program did not reduce the common belief that complementary foods should be introduced after 6 months of age. However, the program substantially increased the percentage of mothers who knew the correct feeding frequency for infants and young children.

The program dramatically increased the percentage of mothers who knew handwashing with soap is important after toilet use and before feeding a child. However, *Tubaramure* had no clear effect on maternal awareness of appropriate worm-protection methods, and no significant effect was observed on knowledge of appropriate methods for purifying drinking water.

In summary, *Tubaramure*'s impact on maternal health and nutrition knowledge was mixed, with clear improvements in knowledge related to specific optimal practices (e.g., feeding frequency) and no detectable effect in areas where key health and nutrition knowledge should be improved (e.g., danger signs, reasons for undernutrition). Several factors may explain the limited impact of the program on health and nutrition knowledge. First, mothers were exposed to only about half of the intended BCC sessions. Second, the process evaluation revealed that *Tubaramure*'s BCC strategy suffered significant delays in the design and rollout of the module on complementary feeding. As a result, only a fraction of mothers had been exposed to this module at the time of the follow-up survey. The process evaluation further showed that the leader mothers had limited technical expertise and teaching skill (Olney et al. 2013). Better delivery and utilization of the BCC strategy might have resulted in a larger impact on maternal knowledge, better health and nutrition practices, and a larger impact on nutritional status.

11.2.2 Hygiene and Sanitation Practices

Tubaramure had a modest positive impact on household hygiene and sanitation practices. The percentage of households that treated their water increased only slightly, but a considerable effect was found on the proportion of households that composted their trash rather than discarding it in a public space. The importance of composting was emphasized on a household poster provided to all *Tubaramure* households. No significant impact by *Tubaramure* on bednet ownership or use was observed. Even though most households owned soap, it was rarely used at key handwashing times. The effect of *Tubaramure* was limited to a small increase in the proportion of households reporting the use of soap after defecating. In a spot-check of hands, hair, clothes, and face of mothers and children, *Tubaramure* was found to somewhat improve cleanliness on all four domains. The percentage of households with clean exteriors and interiors also improved.

11.2.3 Impact on IYCF

Breastfeeding practices among this population were optimal in many aspects at baseline and continued to improve between surveys. *Tubaramure* did not have a significant effect on any breastfeeding practices, with the exception of an increase in the percentage of children who were still breastfed at 1 year of age. *Tubaramure* did lead to a significant improvement in complementary feeding practices.

11.2.4 Impact on Preventive and Curative Care Seeking and Child Health

Tubaramure did not have an impact on the reported attendance at growth monitoring services or any of the other types of preventive health care utilization. The general decline in growth monitoring attendance (from one-third to one-fifth in the 2 months preceding the survey), the low percentage of children having received vitamin A supplementation in the 6 months preceding the survey (57% at baseline and 60% at follow-up), and the percentage being fully vaccinated for their age (from 70% to 63%) is of great concern.

Tubaramure protected children from the overall increase in child morbidity observed from baseline to follow-up. Said differently, the increase in reported symptoms from baseline to follow-up was not as steep (or absent) in the *Tubaramure* groups as in the control group. Significant program effects were found for general morbidity symptoms and for key problems, such as fever, lost appetite, cough, watery diarrhea, difficulty drinking, loss of appetite, and vomiting.

The program had a significant positive impact on the proportion of children who received medication to fight a fever (significant in the T24 and TNFP groups). This indicates that in addition to the general increase in this indicator found in all study groups, which might be due to *Tubaramure*'s health strengthening activities, the program also increased the demand for this service at the household level in the treatment arms. No significant impact was found for any of the other curative care-seeking behaviors, which were found to be largely inadequate: Only around 40% of children with diarrhea had received ORS and approximately 40% of mothers reported reducing the child's liquid intake during diarrhea.

11.3 The *Tubaramure* Health Component

Tubaramure's health systems strengthening component aimed to improve the quality of preventative and curative care provided at public health centers. Health systems strengthening was implemented in all health centers regardless of whether they were located in a treatment or control *colline*, and the lack of a control group prevents attributing any changes in health center characteristics directly to *Tubaramure* (see Section 2.4.7). Differences between baseline and follow-up suggest that several aspects of health service delivery may have improved, and findings also reveal further areas for improvement.

11.3.1 Health Services

More health centers staffed A2 level nurses, who are the highest qualified staff members mandated for health centers, and more (though still only two) staffed an A2 level laboratory technician. Overall, key service components for sick children, children with diarrhea, and for pregnant women and mothers improved over time. However, there were several exceptions to this general trend. First, zinc supplementation was rarely offered to children with diarrhea. Additionally, when treating sick children, some health centers failed to use curative consultations as an opportunity to monitor preventative care status (chart weight, evaluate immunizations status, and evaluate having received a Vitamin A supplement every 6 month). This is a missed opportunity for families who do not otherwise seek preventative health care services for their children.

For women seeking prenatal care there were small improvements in the availability of services However, iron folate distribution was still not universal. On a more positive note, malaria and HIV testing were available to pregnant mothers at every health center, suggesting a strong potential to provide laboratory tests when other key components (e.g. training, supplies) are in place. Despite offering these tests to assess malaria and HIV, other basic laboratory services, such as urine and anemia tests, were offered in only one health center.

Medication and immunization shortages were common and likely limited successful provision of many services. Ensuring the continuous supply is a challenging but important component of successfully providing health services to these communities. However, these aspects of service delivery are beyond the scope of *Tubaramure*.

11.3.2 Impact on the Use of Pre-, Peri- and Postnatal Health Care Practices

Tubaramure had no significant impact on the already high percentage of mothers who received prenatal care or on whether mothers consulted health professionals for prenatal care. The intervention increased the “demand” for prenatal services: it increased the total number of prenatal visits, led to a substantial increase in the percentage of mothers who had at least four prenatal visits, and caused women to have their first prenatal visit a week to 10 days earlier in pregnancy. The only possible “supply” effect on the types of services received during prenatal visits was observed for providing a blood sample. Other key services, such as checking blood pressure and testing urine samples, remained unacceptably low.

An alarming finding is the dramatic drop in the proportion of women taking iron supplements during pregnancy, the opposite of what would be expected if *Tubaramure* had had a positive supply effect. The positive changes over time in the use of malaria prevention (anti-malarial medication and sleeping under a bednet) were seen in all groups, which suggests a possible *Tubaramure* supply effect.

The percentage of mothers delivering at a public health facility increased considerably, which might be due to *Tubaramure*’s health strengthening activities. Similar positive effects were found for the percentage of births attended by a trained health professional, the percentage of newborn infants immediately cleaned and wrapped (two important strategies to prevent hypothermia), and the percentage of newborns weighed at delivery.

The program had no supply or demand effect on the very low percentage of women taking iron supplements after giving birth.

11.4 Impact on Maternal Nutrition and Child Nutrition and Development

The three *Tubaramure* components discussed above (food, BCC, and health) were expected to have impacts on maternal nutrition and on child nutrition and development, as discussed below.

11.4.1 Hemoglobin Level and Anemia

Consistent with the decrease in the use of iron supplements during pregnancy, we found an overall steep increase in the prevalence of anemia of about 15 percentage points between surveys. The program's protective effect on the prevalence of anemia (4.2 to 7.5 percentage points) was modest.

A similar trend was found in children. We observed an overall decline over time in mean hemoglobin concentration among children 6 to 23 months of age and correspondingly, an increase in the prevalence of anemia (to around 73%). The intervention had a protective effect on children's Hb levels, i.e. the general decline in Hb levels observed in all study groups between surveys was less steep (0.24 to 0.56 g/dL) in the three *Tubaramure* groups than in the control group.

11.4.2 Impact on Child Development

We also observed a general decline between surveys in the highest attained language and motor milestones among children 4 to 23 months of age. The program was found to have a protective effect on the highest attained motor milestone in the TNFP group and on the highest attained language milestone in the T24 and T18 groups.

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Appendix 1. Monthly Ration Size for the *Tubaramure* Beneficiary Population

	CSB (kg)	Vegetable oil (g)	Energy/ month (kcal)	Energy/day[a] (kcal)	Energy/day/ capita[b] (kcal)
Target group[c]					
Pregnant/lactating women	6	600	27,846	915	158[c]
Children under 2	3	300	13,923	458	79[c]
Family ration	12	1,200	55,692	1,831	316
Total ration					
Pregnant/lactating women	18	1,800	83,538	2,746	474
Children under 2	15	1,500	69,615	2,288	395

[a] Energy per day is calculated using 30.42 days/month.

[b] Energy per capita is calculated based on the assumption of 5.8 average household size.

[c] Note that the individual ration is not meant to be shared, but this may be difficult to achieve, as the individual and the family ration include the same foods.

Appendix 2. List of *Collines* according to Study Treatment Arm

Province	Commune	*Colline*	Study arm[a]
Cankuzo	Cankuzo	Kabezera	T18
Cankuzo	Cankuzo	Murehe	TNFP
Cankuzo	Cankuzo	Muterero	T24
Cankuzo	Cankuzo	Nyarutiti	T24
Cankuzo	Cendajuru	Gashirwe	Control
Cankuzo	Cendajuru	Gitaramuka	TNFP
Cankuzo	Cendajuru	Kabageni	TNFP
Cankuzo	Cendajuru	Nyamugari	T18
Cankuzo	Gisagara	Gerero	T18
Cankuzo	Gisagara	Gisagara	T24
Cankuzo	Gisagara	Gitwenge	TNFP
Cankuzo	Gisagara	Kibogoye	T24
Cankuzo	Gisagara	Murago	Control
Cankuzo	Kigamba	Rujungu	T18
Cankuzo	Kigamba	Rwamvura	TNFP
Cankuzo	Kigamba	Shinge	T24
Cankuzo	Mishiha	Buyongwe 1	Control
Cankuzo	Mishiha	Mwiruzi	Control
Cankuzo	Mishiha	Rugerero	Control
Cankuzo	Mishiha	Rutsindu	T18
Ruyigi	Butaganzwa	Gikwiye	TNFP
Ruyigi	Butaganzwa	Kanyinya	TNFP
Ruyigi	Butaganzwa	Kirangara	Control
Ruyigi	Butaganzwa	Kiyabu	T24
Ruyigi	Butaganzwa	Masazi	T24
Ruyigi	Butaganzwa	Muriza	T18
Ruyigi	Butaganzwa	Nyagashubi	T24
Ruyigi	Butaganzwa	Taba	T18
Ruyigi	Butezi	Bwagiriza	T24
Ruyigi	Butezi	Muyange	TNFP
Ruyigi	Butezi	Nombe	T24
Ruyigi	Butezi	Rutegama	Control
Ruyigi	Bweru	Gatwaro	TNFP
Ruyigi	Bweru	Kirambi	T18
Ruyigi	Bweru	Mubavu	T24
Ruyigi	Bweru	Nkanda	T24
Ruyigi	Bweru	Nyarunazi	T24
Ruyigi	Gisuru	Bunyambo	T24
Ruyigi	Gisuru	Kabingo	T18
Ruyigi	Gisuru	Kabuyenge	Control
Ruyigi	Gisuru	Kinama	TNFP
Ruyigi	Gisuru	Mwegereza	T18
Ruyigi	Gisuru	Nkurubuye	Control

Province	Commune	*Colline*	Study arm[a]
Ruyigi	Gisuru	Nyabigozi	T24
Ruyigi	Gisuru	Rwerambere	TNFP
Ruyigi	Gisuru	Taba	Control
Ruyigi	Kinyinya	Bugongo	TNFP
Ruyigi	Kinyinya	Gataba	Control
Ruyigi	Kinyinya	Kabanga	TNFP
Ruyigi	Kinyinya	Kinyinya	TNFP
Ruyigi	Kinyinya	Nyakibere	Control
Ruyigi	Kinyinya	Nyamusasa	T18
Ruyigi	Kinyinya	Vumwe	Control
Ruyigi	Nyabitsinda	Nyakiyonga	Control
Ruyigi	Nyabitsinda	Nyarumuri	T18
Ruyigi	Nyabitsinda	Remba	T18
Ruyigi	Ruyigi	Bunogera	Control
Ruyigi	Ruyigi	Buruhukiro	T18
Ruyigi	Ruyigi	Rutonganikwa	T18
Ruyigi	Ruyigi	Ruyigi rural	TNFP

[a] T24: 15 *collines* assigned to the intervention arm receiving the full *Tubaramure* program from pregnancy to 24 months
T18: 15 *collines* assigned to the intervention arm receiving the full *Tubaramure* program from pregnancy to 18 months
TNFP: 15 *collines* assigned to the intervention arm receiving the full *Tubaramure* program from pregnancy to 24 months, without food rations during pregnancy
Control: 15 *collines* assigned to the control arm of the research study.
More details are provided in the text.