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Risk of environmental enteropathy and stunting among rural Ethiopian children

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Abstract

Risk of environmental enteropathy and stunting among rural Ethiopian children

By
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Introduction/Background: Child undernutrition is a major public health problem globally. Stunting is linear growth retardation among children under 3 years of age which results from a range of multifaceted factors. Poor sanitation, hygiene and water quality collectively constitute a household environment which can predispose young children to the risk of developing environmental enteropathy (EE). There is limited evidence documented from research or programs on the effect of the household environment on child nutritional outcomes.

Objective: The objective of this study is to assess the relationship between the household WASH (water quality, sanitation and hygiene) environment and stunting among children 6-36 months of age from rural Ethiopia.

Method: Data were analyzed from the baseline survey of a cross sectional observation study conducted by the Nutrition at Center (N@C) project of CARE Ethiopia . This project is currently working in the north east part of Ethiopia. A total 2123 children age 0-36 months and their mothers or primary caregivers were included in this survey. A logistic regression model was employed to run the analysis. Both bivariate and multivariate regressions were performed using IBM SPSS Statistics Version 20 and WHO Anthro version 3.2.2.

Results: About 55% children are stunted (HAZ <-2SD) and have poor household WASH indicators. The latter are key constituents of EE risk. A summative index of EE components was used in the binary logistic regression. Results of logistic regression indicates that households with a higher risk of EE [OR 1.273, p value= 0.007, CI (91.067-1.518)] are more likely to have stunted children.

Conclusion: The household WASH environment constitutes a risk of developing EE and mediates its effect on health and nutrition outcomes. Improvement of household WASH environment along with nutrition interventions can potentially prevent stunting among young children.

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Chapter I: Introduction

Context of project

In low and middle income countries, compromised physical health and mental development are a major public health concern. Poor health and mental development are intimately linked with undernutrition [1]. Stunting, wasting, and micronutrient deficiencies are estimated to cause nearly 3.1 million child deaths annually [2]. Chronic undernutrition accounts for one third of mortality in children less than 5 years of age, reduced child educational outcomes, reduced productivity in adult age, and increased risk of stunting. In 2011, according to WHO Child Growth Standards, 165 million children less than 5 years were stunted. The highest prevalence of stunted children is in certain countries in East Africa (42%) and West Africa and South-Central Asia (36%) [3].

Child undernutrition is one of the major public health problems in Ethiopia, the largest and most populous country in the Horn of Africa. According to the Ethiopian Demographic and Health Survey (EDHS) 2011, stunting, underweight and wasting are 44%, 29% and 10% respectively among children under 5 years of age[4]. CARE Ethiopia is currently implementing a five-year (2013-2017) project, Nutrition at the Center (N@C), to improve overall nutritional status in Amhara Region, Ethiopia.

N@C is a multi-sectoral multi-year project of CARE Ethiopia, designed to improve the nutritional status of women (15-49 years), children less than 3 years of age, and anemia among

children under 2 years of age and women of reproductive age (15-49 years) in Ebinat and Simada woredas of Amhara Region. The project specifically aims to improve infant and young child and maternal nutrition related behaviors, utilization of maternal, child health and nutrition services and household (HH) adoption of appropriate hygiene and sanitation practices as well as increase availability and equitable access to nutrient-dense food.

To provide benchmark information on factors affecting child and maternal nutritional status, CARE Ethiopia conducted a baseline survey in the N@C project woredas; two intervention woredas (Ebinat and Simada) and one control (Tach Gaynt). The control woreda was included as the project follows a quasi-experimental design. All the three woredas are located in the northern highland part of Ethiopia known as a chronically food insecure area. The baseline data collection was completed in February 2014.

From recent research studies across the globe, evidence suggests that child undernutrition is also deeply rooted in changes in the gut morphology and underlying chronic inflammation, thereby affecting linear child growth [5]. The first two years of child's life is considered the most critical time for linear growth and changes that occur within this time period are irreversible [6]. Nutritional interventions, which generally include exclusive breastfeeding, age appropriate complementary feeding, personal hygiene and safe drinking water, have been found effective to prevent and delay the onset of intestinal infections [7]. However, a systematic review shows that these interventions still fail to achieve expected growth improvements among young children. Average length-for-age score was improved by only 0.2-0.5 SD [8]. A modeling study by Bhutta el al. (2008), showed that including all known existing interventions like exclusive breastfeeding,

complementary feeding and micronutrient supplementation, designed to improve nutrition with 99% coverage, would only reduce stunting by 33%. And Water Sanitation and Hygiene (WASH) interventions with 99% coverage of the population, reduced diarrhea by 30%, which helped reduce malnutrition by only 2.4%[9].

Despite best efforts and use of standard global nutrition interventions a good percentage of stunting among children less than 3 years of age remains un-explained. This suggests that there is a knowledge gap in understanding the reasons that nutrition interventions fail to significantly reduce child undernutrition. However, one of the underlying causes of stunting is Environmental Enteropathy (EE), a subclinical condition of the small intestine that mediates the effect of the poor HH WASH environment that constitutes *risk* on stunting.

EE includes alteration in the small intestinal functionality, which poses barriers to normal absorptive phenomena, changes gut microbiota and causes persistent inflammatory status within the body. EE which often presents with or without any overt clinical symptoms. Children identified with this subclinical condition are roughly 40-50% more prone to develop stunting than others [10, 11].

Problem Statement

Nearly all published research concludes that poor sanitation, hygiene and unsafe water lead to EE. Thus, the HH WASH environment has an independent effect on the nutritional status of a child and an indirect effect through EE. Growing empirical evidence suggests that despite the adoption of optimal feeding practices, children are still trapped in a cycle of undernutrition

which leads to growth faltering. Stunting, one type of child undernutrition, is the result of the cumulative effect of impaired nutrition absorption and repeated or persistent infection which leads to continuous failing of growth with age. On the contrary, children in HHs with appropriate water, sanitation and personal hygiene practices, appropriate food intake and infection control, are likely to experience a normal age appropriate growth.

Recent studies have found that altered gut function, that is, the persistent insult of gut mucosa with pathogenic organisms, increases the risk of developing (EE) [7, 11, 12]. Empirical evidence from Gambia and Zambia suggests that changed gut morphology and underlying chronic inflammation affect nutrient absorption, thus affecting normal linear child growth [10, 13]. HHs with poor WASH conditions more often invite repeated episodes of gut infections in children which, coupled with undernutrition, impair linear growth and eventually cause stunting. However, the contribution of HH WASH environment to child growth has been underestimated because its impact has only been modeled entirely through diarrhea [9, 12] but without considering other indirect effects on stunting. Therefore, the impact of poor HH conditions further needs to be assessed. Current study suggests that EE is the underlying link that renders nutrition only interventions less effective and nutrition interventions should be integrated with WASH interventions, to disrupt the major pathways of child undernutrition.

Objectives

This thesis suggests that addressing the HH *risk* environment, *along with* the designed nutrition interventions, will be more effective in reducing undernutrition, thereby improving child growth. The prevalence of stunting, an indicator of long term malnutrition, affecting child's growth, is used as a measure of child health outcome. Hygiene, sanitation, and safe water for drinking are

indicators of HH risk environment. HH ownership of farm animals is also included as a contributing factor to the EE risk. The study further includes child anemia (a condition due to the prevalent EE risk) as a contributing factor that affects child's growth.

This study uses data from the 2014 Baseline Survey of Nutrition at the Center (N@C) project, Ethiopia. The next chapter provides a review of the literature and key concepts, how EE is defined for the purpose of this study and suggests hypotheses to assess the role of HH Water Sanitation and Hygiene (WASH) environment on child stunting. Chapter Three provides detailed explanations of the sample, measures, conceptual and statistical model, and methods of analysis used in the study. Chapter Four gives study results and Chapter Five presents conclusions, policy implications, limitations and directions for future research.

Chapter II: Literature review

Global child undernutrition

The World Health Organization (WHO) has set international standards to calculate indicators of child malnutrition prevalence. All international professional organizations, including the International Pediatric Association (IPA), the Standing Committee on Nutrition of the United Nations System (SCN) and the International Union of Nutrition Sciences (IUNS) have officially endorsed the use of WHO child growth standards for detecting and monitoring child malnutrition. The three most common indicators of child undernutrition are stunting (low height for age), wasting (low weight for height) and underweight (low weight for age).

Globally, 165 million children, which is about approximately 26% of total children under the age of 5, were stunted [i.e., height for age below (HAZ) -2SD] in 2011. This is a 35% reduction from 253 million children in 1990. In 2011, a total of 101 million children under 5 years of age or 16% were underweight [i.e., weight for age (WAZ) below -2SD] and wasting [i.e. weight for height (WHZ) below -2SD] affected a total of 52 million children around the world. On average, globally, an annual reduction rate of 2.1 percent per year in wasting is maintained, but the reduction rate of stunting varies substantially by region [3].

Child undernutrition in Ethiopia

Twenty-four countries are home to 80% of the world's stunted children. Ethiopia is one of the top ten African countries with high prevalence of undernutrition [14]. According to the Ethiopian Demographic and Health Survey (EDHS) conducted in 2011, 44% of children under 5 are stunted and 21% children are severely stunted. The highest prevalence of stunting, 57%, is

observed among children age 24-36 months. Around 10% of Ethiopian children under the age of 5 are wasted and 29% are underweight [4].

With combined efforts of the government of Ethiopia, the United Nations and other international agencies, the overall picture of undernutrition in Ethiopia has improved over the last decade. Stunting among children under 5 years was reduced by 14% from 2000 to 2011 and underweight by 28%. CARE Ethiopia has also conducted a separate baseline assessment under its "Nutrition at Center" Project. This Baseline study showed that on average 50% of children age 6-36 months are stunted and 30% of children are underweight (N@C Baseline report, Aug 2014 [15].

Determinants of stunting

UNICEF first described the nature and determinants of child undernutrition in a framework (Fig 2.1) almost two decades ago. Multifactorial causalities of child nutrition were categorized as immediate, underlying and basic contributors. The immediate causes cited in the UNICEF framework are insufficient food consumption and presence of infectious diseases; underlying causes include HH food insecurity, inadequate maternal and child care, health services and absence of healthy HH environment, which includes access to safe water, sanitation and appropriate hygiene practices; basic and underlying causes identified are formal and non-formal institutions, political and ideological superstructures, economic structure and potential resources [16].

Optimal nutritional status of children is ensured only when they have access to and consume diverse, nutrient-rich foods, receive appropriate care, have accessibility to health services and a

HH environment where safe water, sanitation and good hygiene are practiced. These factors directly influence food intake and disease, which leads to malnutrition, and therefore stunting.

Figure 2.1: UNICEF Child Undernutrition Framework
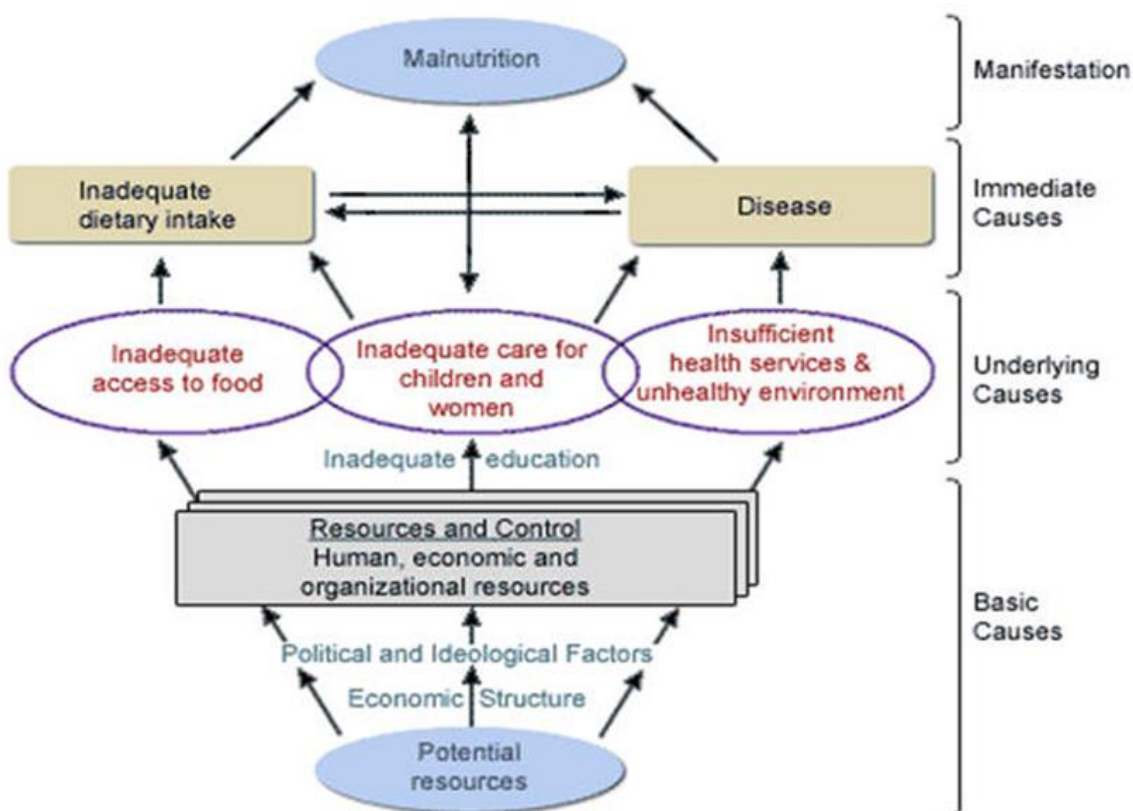
Adapted from "State of the World's Children 1998," UNICEF

The Maternal and Child *Lancet* series 2013, described a framework for actions to achieve fetal and child nutrition. This framework describes causalities and also identifies actions directly related to nutritional achievement. Immediate causes are addressed through "nutrition specific" interventions and those underlying and basic causes are addressed through a set of actions called as "nutrition sensitive" interventions [3]. The *Lancet* framework shows determinants of undernutrition and pathways to achieve optimal growth and development of children. Both UNICEF and *Lancet* frameworks suggest that interplay of undernutrition and infection among

young children eventually dispose them to a cyclical pathway of illness and declining nutritional status leading to impaired linear growth, low productivity, poor cognitive development or even death.

Household WASH environment and risk of EE

A variety of pathogens like virus, bacteria or protozoa are responsible for diarrhea. During the course of diarrhea, the body loses fluids and key nutrients. Research conducted in North and South Ethiopia suggests that the incidence of diarrhea is associated with poor hygiene practices, unsafe disposal of child stool, and inadequate water treatment within the HH [17, 18]. Continued exposure to these risk factors within the HH puts the child at risk of developing EE and episodes of diarrhea throughout early childhood. Evidence suggests that the effect of WASH interventions on linear growth is independent of its effect on diarrhea.

A pooled analysis of nine studies from five countries (Bangladesh, Peru, Ghana, Brazil, Guinea-Bissau) found that with each episode of diarrhea, the probability of stunting at 24 months increased by 2.5%, and 25% of all stunting in 24-month-old children is observed as a result of having 5 or more diarrheal episodes in the first two years of life [12, 19]. Normally children lose weight with each episode of diarrhea and fall into a cycle of catch up growth after recovery from diarrhea. Catch up growth depends on multiple factors such as the age of the children, nutritional status, diarrhea causative agent and duration of diarrhea free period following infection [20, 21]. If there are repeated infections with diarrhea, then catch up growth takes longer than usual and a deficit remains in an infant's linear growth compared to non-infected infants [20].

A major cause of diarrhea and EE among children is contamination of HH environment with fecal matter. Nearly 86% of fecal pollution in the environment comes from livestock and only 14% from humans [22]. HHs with animals further contribute to the risk of fecal matter ingestion and thus the likelihood of infectious disease in children. Higher pathogenic load resulting from ingestion of fecal matters further contributes to the risk of developing diarrhea and EE [12].

A systematic review published in the *Lancet* infectious series suggests that handwashing with soap at critical times can reduce diarrheal disease among children by 42-44% [23]. Point-of-use water treatment in the HH also plays an important role in reducing diarrhea and infection. A systemic review also suggests that improving water quality in HHs can potentially reduce diarrheal incidence by up to 40% [24]. In a nonrandomized experimental study conducted in Ethiopia, a WASH intervention delivered with sanitation education, handwashing with soap, availability of sanitary facilities at HHs, clean environment of HH, and separate housing of animals showed a mean gain of 0.33 Z score in height over a 5-year period among young children age 6-36 months (*p*=0.02) when compared to the control group [1, 25].

Acute and chronic infections in children may interfere with liner growth by depleting the body of micronutrients. This occurs due to reduced food intake during illness and impaired nutrient absorption [26]. Multiple studies suggest that recurrent infection puts a large number of pathogenic organisms in the small intestinal mucosa, thereby increasing the risk of developing EE. EE, in turn, reduces the normal absorption capacity of the gut and eventually the body is unable to support its normal metabolic activities, thus affecting growth. A deficit of key nutrients

weakens the body's defensive mechanism to fight disease. Undernutrition and infection thus initiate a cycle of growth faltering.

Environmental Enteropathy

Environmental Enteropathy (EE) was recognized in the late sixties, predominantly within expatriates who were living in developing countries [27]. Though discussed and reviewed in follow-up studies during the 1970s and 1980s, there was a failure to keep the interest alive due to lack of clarity surrounding its mechanism [28]. Initially, the phenomenon was termed "Tropical Enteropathy," but in the late 1990s it was renamed "Environmental Enteropathy (EE)." Research suggests that EE is more common in populations living in poor environmental conditions. . Studies from former East Pakistan (now Bangladesh), Uganda and Vietnam, using jejunal biopsies show that individuals with this subclinical disorder also showed intestinal abnormalities [29-31].

EE is a subclinical disorder characterized by increased intestinal permeability, flattened villi resulting in malabsorption, impaired gut immune function, and infiltration of inflammatory agents into the small intestine.

EE's Pathological Pathways

Persistent exposures to fecal-oral contamination resulting from poor hygiene, contamination of water and food and several episodes of self-limited gastroenteritis might be the cause of continued small intestinal mucosal injury. This mucosal injury brings about changes in gut permeability and lymphocytic infiltration of the mucosal layer "lamina propria." This continued exposure of environmental stimuli causes a harmful state of chronic inflammation through leaky

gut, facilitating the translocation of microbes, which triggers metabolic changes in the immune response [12]. This condition increases susceptibility to infections and thereby perpetuates inflammatory responses [32, 33].

Diagnostic criteria of Environmental Enteropathy (EE)

In EE , small intestinal mucosa present with villus blunting, reduced intestinal epithelial surface area and absorptive capacity, moderate to severe crypts hyperplasia, defective mucosal barrier integrity and immune-inflammatory changes in the lamina propria [22, 34]. Along with the histological changes in the local areas of small intestine, EE brings changes in the concentration of IgG and endotoxin-core-antibody suggestive of pro-inflammatory status indicative of T-cell mediated response [35].

The diagnosis of EE primarily includes invasive procedures like jejunal biopsies or the use of sugar permeability tests (Lactulose/Mannitol, L: M), or plasma concentrations of IgG and IgG-endotoxin-core antibody (EndoCAb)[12]. There are no established biochemical parameters for the diagnosis of EE, however A classic sugar permeability test Lactulose/Mannitol (L: M) test is being used in many research studies. Scientists use UK healthy children L:M values (<0.12) as the standard reference. Values are considered abnormal when they are greater than UK healthy child standard values. For example, children in Bangladesh have reported L: M values between 0.25 and 0.32 and children in the Gambia have L: M values between 0.38 and 1.30 [5]. In Gambia, researchers studying the association between increased intestinal permeability and growth faltering found 43% of stunted children between ages 3 to 15 months were also found to have high intestinal permeability, a condition resulting from EE [36]. In addition, chronic

immunostimulation, including increased lymphocyte and platelet counts, elevated C-reactive protein, and high plasma immune-globulins (IgG), were also found in the stunted children [10, 34].

Comparing EE with other non-infectious malabsorption syndromes like tropical sprue, coeliac sprue and Crohn's Disease, there is a similarity in histological appearance in the small intestinal mucosa and inflammatory cell counts over normal concentration. However, very little is known about the etiology and serologic diagnosis of EE [5]. Most often, EE unlike diarrhea remains asymptomatic [36, 37].

Reversibility of EE among individuals

US Peace Corps volunteers who lived in Pakistan for a period of 18-24 months had a history of mild diarrhea and weight loss; their jejunal biopsies showed changes in their intestinal layer (discussed above) and absorptive capacity. These changes were resolved after 2-3 years of their return to the United States [38]. A similar study was conducted among immigrants from India and Pakistan living in New York City. Their jejunal biopsies demonstrated similar changes and intestinal absorptive capacity was reduced, but all showed reversal to typical structure of mucosa and regained usual absorptive capacity within 2-3 years of residence in the U.S[39]. Therefore, reverted histological changes in the small intestinal mucosa and permeability resulting from a change in their environment, suggests that environmental conditions can be taken into consideration as an etiologic factor of EE.

Association of EE with stunting among children

EE has been linked to living with poor HH sanitation and hygiene practices where risk of fecal matter ingestion is high. These fecal bacteria, when ingested, colonize in the small intestine and

generate a T-cell mediated immune response, leading to increased permeability the small intestine. This facilitates translocation of microbes, which in turn activate metabolic changes due to stimulated immune response. Growth faltering occurs when these changes are matched with reduced absorption, marginal dietary intake and high growth demands in the first two years of life [12]. With chronic exposure to infection, the body's immune system becomes over-activated and produces high levels of specific immune cells and cytokines. In addition to appetite suppression [40] effect, also this response potentially lowers circulating levels of nutrients, specifically vitamin A and zinc, and encourages iron storage in the liver. This adaptive response leads to metabolic derangement.

EE also causes zinc deficiency through reduced reabsorption of endogenous zinc from the small intestine [41]. Thus, zinc deficiency and EE interaction further contributes to overt clinical disease, such as diarrhea in children. Research studies from Zambia and Dhaka (Bangladesh) show an inverse relationship among undernutrition, linear growth and EE [13, 42].

Various studies note that during chronic infection episodes, energy and other nutrients are diverted towards the body's immune response to fight infection and away from growth. This adaptive response results in linear growth faltering. Thus, recurrent chronic infections or persistent subclinical infections put young children in a near-constant state of growth suppression [43]. The underlying mechanisms of EE following infection are complex (See Figure 2.2).

Figure 2.2: Environmental Enteropathy Pathological Pathway and Stunting
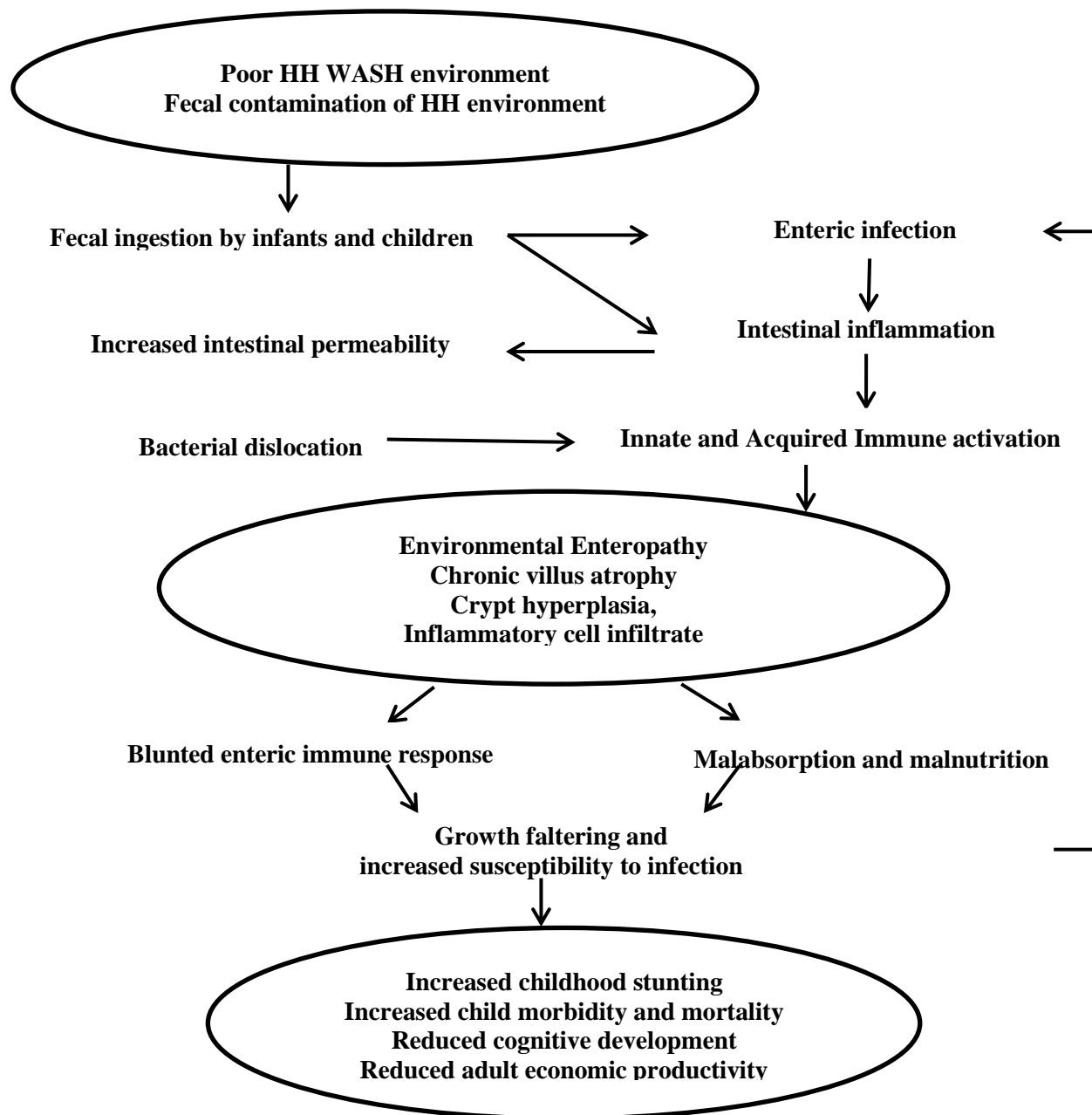
Adapted and modified from Poonum & William 2012; Peterson, et al, 2011

Socioeconomic status and EE

Poor HH WASH conditions and EE are most commonly found in HHs of lower socioeconomic

status [12]. Figure 2.2 shows the complex mechanism linking EE and stunting. Both the

UNICEF framework (Figure 2.1) and the adapted EE mechanism (Figure 2.2) show the complex interaction of socioeconomic and political determinants of undernutrition that result in substantial growth inequalities among population subgroups. Black et al. (2003) presented an analysis of population based surveys from 79 countries that showed stunting prevalence among children below 5 years was 2.47 times (range 1.00-7.64) higher in the poorest quintile of HHs than in the richest quintile [3]. EE was found to be more prevalent among families with lower reported incomes [44].

EE, nutrition and WASH interventions

A modeling study showed that all known effective interventions like micronutrient supplementation (vitamin A and Zinc), exclusive breastfeeding, complementary feeding and micronutrient supplementation during pregnancy showed that 99% coverage of these interventions globally would only reduce stunting by 33%. In the same they estimated that WASH interventions with a coverage of 99% populations would reduce diarrhea by 30%, which eventually would reduce stunting by only 2.4% [9]. Thus, evidence suggests that effect of WASH interventions on linear growth is independent of its effect on diarrhea.

Key Study Premise

We suggest that children living in HHs with poor sanitary facilities, less frequent handwashing practices at critical times by mothers/caregivers and untreated water puts young children at risk of developing EE, thereby contributing to child stunting. This study suggests that the HH WASH environment has an independent direct effect on stunting and an indirect effect mediating effect through EE. Young children who are exposed to poor sanitation or unhygienic practices or fecal

contamination are at risk of developing EE [12]. Nutrition interventions designed to address child health outcomes only are likely to be less effective than their expected program designed effect, if the risk to EE is not addressed.

Children who are living in HHs with poor environment are at, poses a higher risk for to the development of EE. Children who are living within an immediate contaminated environment are at a higher risk of exposure to parasites and fecal pathogens affecting their growth. This thesis suggests that children at risk of EE are likely to be stunted. Hygiene, sanitation, and water quality constitute the immediate HH environment that the child experiences. For the purposes of this study HH sanitation (measured by toilet type), HH hygiene (measured by handwashing at critical times, presence of soap and water at a designated place) and water quality (measured by method used to make the water safe for drinking) are considered as key components of EE risk. The study suggests that it is the poor hygiene, sanitation, and water quality environment that predisposes a child to the sub-clinical disorder of the small intestine defined as EE risk, thereby affecting his/her growth. Key study hypotheses include:

H_1: Poor HH WASH environment affects stunting.

H_2: EE mediates the growth faltering effect of poor HH WASH environment.

H_3: HHs with reduced EE risk are likely to have lower rates of child stunting.

Chapter III: Methodology, variables and model development

Nutrition at the Center (N@C) is CARE's multi-sectoral flagship program with the central goal to improve nutritional status for women (15-49 years of age) and children < 2 years of age in identified resource poor areas. Programming is supported through a central grant to CARE USA for work in four countries – Bangladesh, Benin, Ethiopia, and Zambia.

In Ethiopia, N@C builds on the existing Productive Safety Net Program (PSNP), a food security program initiated since 2005 in the same intervention area of the Amhara region. The purpose of the N@C baseline survey, the data used in the analysis of EE in Ethiopia, is to collect benchmark quantitative information on malnutrition and other immediate and distant factors impacting the nutritional status of women and children in both intervention and control districts. The information obtained from the baseline survey is expected to help CARE design interventions and set targets for the program key outcome and impact indicators, which will be monitored and compared at final evaluation [15].

Study area location

The baseline survey for the N@C Project was conducted in three woredas (districts): two were designated as intervention areas (Ebinat and Simada) and one as a control area (Tach Gaynt). The control woreda was included because of the quasi-experimental design for the final project evaluation. All three woredas are in South Gondar Zone, Amhara Region of Ethiopia. They are located in the northern highland part of Ethiopia known to be chronically food insecure. This same area has also been part of the Government's Productive Safety Net Program (PSNP) since 2005.

Fig 3.1: Map of "Nutrition at Center" Ethiopia project baseline and control districts

Intervention district characteristics

Simada

District Simada covers 2,281.72 square kilometer of area. There are 40 kebele administrations in the woreda - 39 (rural), 1(urban). The total population of the woreda is 251,751 (125,367 are male and 126,384 are female). The percentage of population under 5 is 13 and women 15-49 years is 23.9. Crop production, livestock and petty trade are the main sources of income, and

typical staple foods include cereals and some legumes. CARE, Organization for Rehabilitation and Development (ORDA) in Amhara region and Family Health International (FHI) are humanitarian organizations operating in the woreda supporting community health and nutrition interventions.

Ebinat

The total area of district Ebinat is estimated at 2,498.38 square kilometers. The woreda has 36 kebeles of which one is urban and 35 are rural. The total population is estimated at 243,221 (119,178 male and 124,043 female). Fifteen percent of the population is under 5 and 46% of the population is women of reproductive age (15 to 49 years).

Major livelihood activities in Ebinat Woreda include crop production, livestock, and petty trade, and staple food is cereals. The communities in the woreda experience chronic food shortages from year to year. There are a number of humanitarian organizations working in this target area including CARE, Concern, Professional Alliance for Development Ethiopia (PADET), Organization for Rehabilitation and Development (ORDA), Integrated Family Health Program (IFHP) and the Red Cross. CARE, PADET, IFHP and CHILD Health are involved in supporting nutrition and WASH interventions.

Survey methodology

The baseline study, conducted in 2014, used a cross-sectional survey design. The survey included interviewer administered questions, on-site observation and anthropometric measures and haemoglobin level readings to generate benchmark information. The survey targeted women

of reproductive age (15-49 years of age) who had given birth in the previous 36 months. To be eligible for the survey, a woman must have resided in the area for more than six months and her youngest baby should have lived with her during the survey time. For a child to be eligible for anthropometric measurements, he/she must have been between 6 to 36 months of age during the survey period and the child must have been 6-23 months of age to be included for anaemia testing.

Sampling frame

The sampling frame for the N@C survey was constructed using kebele level population data within the selected intervention and control districts. CARE Ethiopia staff collected the kebele level population data using government census data complemented by district and local office sources for the districts of Simada, Ebinat and Tach Gaynt. Twenty-two intervention kebeles and 10 comparison group kebeles with a total population of 223,483 provided the sampling frame.

Sample size

The survey is a cross-sectional observational study. The data was collected for children age 0-36 months and their mothers or primary care givers. The sample size was calculated using prevalence of key infant and young child feeding (IYCF) practices, anthropometric indicators, and target percent point changes expected by the end of proposed interventions.

CARE's proposed intervention intends to decrease stunting among participating children by 9% by the end of the program. For sample size estimation, prevailing baseline rate was set at $P_0 = 41\%$ [4] and expected rate of change at $P_1 = 32\%$. Using a significance level of 5%, power =

80%, difference between baseline and endline rates of 9 percentage points, with a design effect of 1.2, the study required a sample of 850 in the 18-36 month age group in the intervention area, and a sample of 425 in the comparison area.

For the Infant and Young Child Feeding (IYCF) indicators, exclusive breastfeeding is used as the key indicator for sample size determination. For sample size estimation, prevailing baseline rate was set at $P_0 = 52\%$ and expected rate of change at $P_1 = 65\%$. Using a significance level of 5%, power = 80%, difference between baseline and endline rates of 13 percentage points, with a design effect of 1.2, the study required a sample of 213 children in age groups (0-5), and (6-17) months of age. Thus, a total of 1,276 children in the intervention area was required. From the control area, 213 children were required in the age groups of (0-5) and (6-17) and 425 in the (18-36) months of age. Thus, for both intervention and control woredas, total sample size for this study was required 2,127.

Anemia status in young children was expected to be improved from the baseline prevalence of 44% to the end line prevalence of 31% (13 percentage point reduction) among participating children, 6-23 months of age. Thus, for sample size estimation with $P_0 = 44\%$, $P_1 = 31\%$, significance level = 5%, power = 80% and the difference between baseline and end line of 13 percentage points and considering a design effect of 1.2, 206 children were required in each survey area to test the assumption. Thus, the total number of young children required for assessing anemia was 412. Table 3.1 provides final baseline sample size by age group after data cleaning.

Table 3.1: Survey sample size included in the analysis by age group

Age in months	Baseline
0-5	410
6-23	927
24-35	795
Total (0-36)	2,123

Study design

The study follows a quasi-experimental design. Quasi-experimental design uses an intervention and comparison group, but assignment of the participants to the groups is non-random.

Selection of participants

Across the kebeles within the selected districts, a probability proportional to size (PPS) sample of 1,276 women in the intervention kebeles, and 851 women in the comparison kebeles was drawn, which in turn provided the total number of women to be interviewed within each kebele. A population based survey was conducted to secure a total sample of 2,127 women who had given birth within the last 36 months, whose child is currently living, and who resides permanently in the selected districts.

Survey tool

Baseline survey questionnaires were adapted from WHO recommended standard indicators for measuring infant and young child feeding indicators[45] and CARE's Step by Step Guide for Data Collection [46]. For anthropometric measures, standardized WHO/UNICEF methods were used to measure and calculate underweight, stunting and wasting compared to 2006 WHO reference populations [47]. The survey questionnaire was originally designed by CARE and refined after two rounds of field tests following enumeration team training. CARE Ethiopia and

Dadimos (local consulting firm) finalized the translation to the Amharic language that was used as the standardized tool for the survey. There were 21 modules in the survey with modules S and Z designed for anthropometric measurements and blood sample test results for anemia (Appendix 1). The anemia section, aside from the general survey consent, included its own consent form. The questionnaire included the following sections organized into 10 categories and 21 modules ranging from A to Z.

1. Information : Household, youngest children, and mother (Module A, B, C, & D)

2. Food security (Module E to Module J)

3. Mothers' 15-49 health (Module K),

4. Nutrition (Module L and M),

5. Child health (Module N)

6. WASH (Module O and P)

7. Women empowerment (Module Q with four subclusters)

8. Safety net participation (Module R)

9. Mother anthropometry (ht, wt, MUAC) and anemia (Module S)

10. Child anthropometry (wt, ht, oedema) and anemia (Module Z)

Enumerator training

A schedule for training of supervisors and enumerators was designed by the CARE Ethiopia team with input from Dadimos. The field supervisory, data collection, entry and quality control staff were recruited from the survey woredas, Debre Tabor area and Bahir Dar town. The recruitment and selection process was undertaken in consultation with the CARE field office in Debre Tabor.

The field survey team was comprised of 70 enumerators and seven supervisors with three additional enumerators on the waiting list who attended two weeks of classroom and field exercise supported training. To compensate for drop outs, an additional six individuals were brought on board in the middle of the training. Four days prior to the end of the training course, seven anemia sample collectors were also trained.

The training for blood sample collectors focused on how to ask for consent; how to take a blood sample, sample size and sampling frame for anemia test targets; how to coordinate with the enumerators and age disaggregated targets per kebele; and how to operate hemocue machine including fitting and disassembling the parts, calibration, cleaning and keeping the machines and their parts safe.

Data collection

The baseline data collection was conducted in February 2014. Dadimos held a series of discussions with the CARE team in order to prepare and effectively coordinate the field work. To ensure data quality Dadimos, in consultation with CARE Ethiopia, developed a comprehensive field manual which provided a road map for survey, data collection and report submission to CARE Ethiopia. Each data collection team was comprised of one supervisor, 10 enumerators and one blood sample collector. The enumerators were organized to work in pairs accompanied by a field guide. In accordance with the field data manual, the field team moved to Simada district first and started the data collection on Feb 09, 2014.

Data entry quality control protocol

A double data entry protocol was followed in this survey. The data entry template was developed by CARE using CSPro 5.1. This template was adjusted by the Dadimos team based on the final

questionnaire agreed upon after the field test. A total of 12 data entry clerks were recruited from Bahir Dar and Debre Tabor towns based on their experience and familiarity with the software. They were trained for five days and carried out the data entry in Debre Tabor while the data collection was in progress. To ensure quality of data, every questionnaire was entered twice and regularly checked for consistency between entries. Any discrepancies were resolved by referencing the paper questionnaire.

Data analysis

Shell tables were designed by the CARE USA team based on the study objectives, survey questions and possible relationships of the variables of interest. IBM SPSS Statistics Version 20 and WHO Anthro version 3.2.2 were used to complete the analysis.

Statistical model

The conceptual framework guiding this analysis is shown in Figure 3.1. This framework was developed after completing the literature review and by assessing available measures in the baseline database, which showed a theorized relationships among EE risk factors and stunting.

This study suggests that children at risk of EE are likely to be stunted. Hygiene, sanitation, and water quality constitute the immediate HH environment that the child experiences. For the purposes of this study, HH sanitation (measured by toilet type), HH hygiene (measured by hand washing at critical times, presence of soap and water at a designated place) and water quality (measured by method used to make the water safe for drinking) are considered as key components of EE risk. HH ownership of farm animals was also included as a contributing factor to EE risk. The study further includes child anemia (an occurring condition due to the prevalent

EE risk) as a contributing factor that affects growth.

Figure 3.1: Proposed Theoretical Model
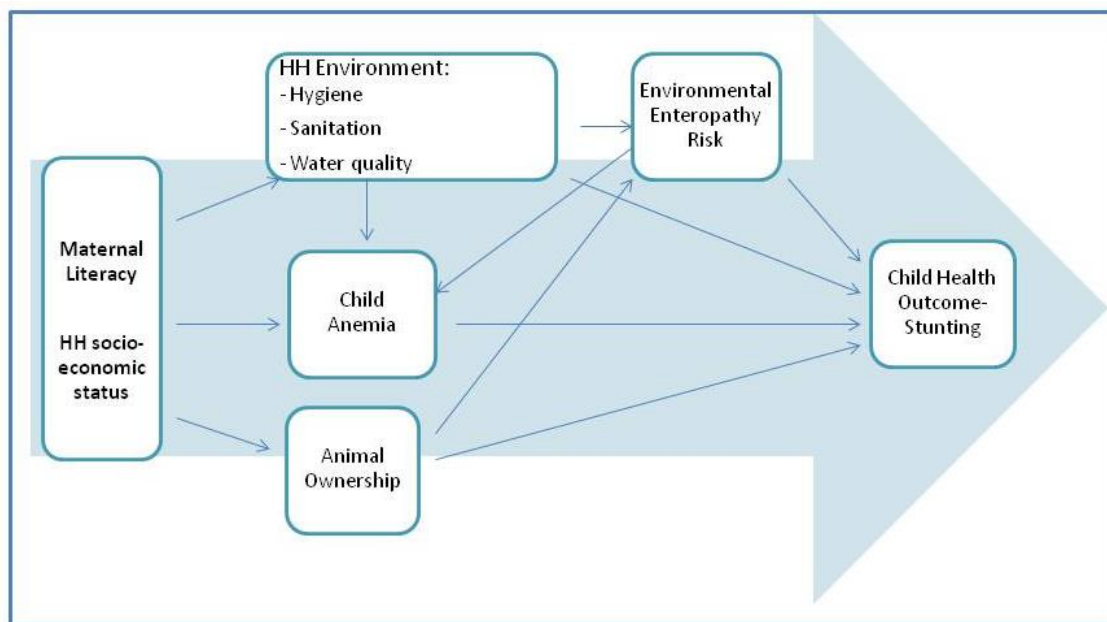
The study used binary logistic regression to analyze the influence of EE risk on stunting. Logistic regression is a statistical technique used to model the probability of discrete (binary or multinomial) outcomes. Logistic regression analysis provides more efficient and powerful insights into what attributes are more or less likely to predict an event outcome in a population of interest by estimating the probability of its occurrence. Binary logistic regression is a form of regression that is used when the dependent variable is dichotomous and the independent variables are continuous, categorical variables, or both. Logistic regression applies maximum likelihood estimation after transforming the dependent variable into a logit variable (the natural log of the odds or probability of the outcome occurring or not). Maximum likelihood estimation (MLE) is the method used to calculate the logit coefficients.

Variables and measures

Women are primary care givers and directly influence child health outcomes. An emergent body of literature suggests hygiene and sanitation practices followed by the mother also affect a child's growth. Practicing good infant and young child feeding practices, along with standard sanitation and hygiene practices, will likely help improve nutritional outcomes in children.

N@C project at Ethiopia collects measures for HH hygiene, sanitation, water and child health anthropometrics that help test the key hypothesis that prevailing HH EE risk affects child growth. Measures of HH risk environment for the purposes of this study include hygiene, sanitation, water quality, and animal ownership (see Table 3.8).

Table 3.2: Concepts and measures on anthropometry and mother's literacy

Concept	Questionnaire Items
Stunting & Under-weight	
Anthropometry Measures	
	May I weigh and take the height of your child?
	Weight __ __.__ kg
	Height __ __.__ cm
Mothers/Caregiver	
	Can you read this sentence to me? "*I like to go to the market.*"
	1= Cannot read at all
	2= Able to read only parts of the sentence
	3= Able to read whole sentence
	4= Not available in the language
	5= Blind/Visually Impaired

Height-for-age (HAZ) z-score measures height relative to age. Low HAZ (< - 2sd) relative to a child of the same sex and age in the reference population is referred to as "stunting." A child is considered stunted if the HAZ is below -2sd. WHO Anthrop software was used to assess stunting proportions. A mother is considered literate if she is able to read the whole sentence or parts of it (category either 2 or 3).

Table 3.3: Concept and measures on HH toilet facilities

Concept	Questionnaire Items
Sanitation	
What kind of toilet facilities do members of your household usually use	
	1= Flush/pour flush to piped sewer system
	2= Flush/pour flush to septic tank
	3= Flush/pour flush to pit latrine
	4= Flush/pour flush to elsewhere
	5= Flush/pour flush to unknown/not sure/don't know
	6= Ventilated improved pit latrine
	7= Pit latrine with slab
	8= Pit latrine without slab/open
	9= Composting toilet
	10= Bucket
	11= Hanging toilet/hanging latrine
	12= No facilities/bush/field
	13= Other

Categories (1-6, and 9) are considered as improved toilet facilities. Categories (7, 8 and 11-13) are defined as not improved toilet facilities.

Table 3.4: Concepts and measures of child defecation

Concept	Questionnaire Items
Sanitation	
The last time (child name) passed stool, where did he/she defecate?	
	1= Used potty
	2= Used washable diaper
	3= Used disposable diaper
	4= Went in his/her clothes
	5= Went in the house
	6= Went outside of house/yard
	7= Used latrine
	8= Don't know

Categories (1-3 and 7) are considered as "child does not openly defecate" whereas categories (4-6 and 8) are considered as "child defecates openly."

The same questionnaire also asked about the standard handwashing behavior, in order to understand mothers' hygiene practices (Table 3.5). For the purposes of this study, handwashing behavior at the three critical times defined below is a measure of mother's hygiene. These are the three times when the child is at a greater risk of being exposed to parasites or pathogens. Response category "always" is considered as the best practice and categories "never" or "sometimes" are considered as lack of hygiene.

Table 3.5: Concept and measures on handwashing at the three critical times

Concept	Questionnaire Items	
Hygiene		
When do you usually wash your hands?		
	1= After toilet use	(Never, Always, Sometimes)
	2= Before feeding the child	(Never, Always, Sometimes)
	3= After changing the baby	(Never, Always, Sometimes)

Questionnaires were completed through direct observation in the HHs about presence of water "yes" or "no" and soap (a-d) at specific place to facilitate handwashing by mothers/primary caregivers (Table 3.6).

Table 3.6: Concept and measures on soap and water availability at HH for handwashing

Concept	Questionnaire Items
Presence of Water and Soap (observe only)	
Is the water present at the specific place for hand washing?	
	1= Yes
	2= No
Is the soap present at the specific place for hand washing?	
	a = Bar soap
	b = Detergent (powder/liquid/paste)
	c = Liquid soap (including shampoo)
	d = Other

The drinking water quality is defined by the indicator "if water is treated safe for drinking" using any method defined through categories (a-h) (Table 3.7).

Table3.7: Concepts and measures on water quality

Concept	Questionnaire Items
Water Quality	
What do you usually do to treat water to make safer to drink	
	a= Boil water
	b= Add bleach/chlorine
	c= Strain it through a cloth
	d= Use water filter (ceramic/sand/composite/etc)
	e= Solar disinfection
	f= Let it stand and settle
	g= Use purifying tablets
	h= Other (specify)
	I= Don't know

For the purposes of this study, dichotomous versions of the above measures were developed based on the categories defined above. HH sanitation environment is measured by combining the toilet facility type (improved vs not improved, Table 3.3) and child defecation (not open vs open, Table 3.4) into a single measure. Mothers' hand-washing behavior (see Table 3.5) and presence of soap and water at a designated place for handwashing (see Table 3.6) is defined as HH hygiene environment that child is mostly exposed.

Table 3.8: Variable Final Categories

Concept	Measure
HH Sanitation	
	0 = Improved toilet facilities/No Open Defecation
	1 = No Improved toilet facilities/Open HH/Child defecation
HH Hygiene	
	0 = HW at 3 critical times & both soap-water present
	1 = No HW at 3 critical times & no soap-water present
HH Water Quality	
	0 = More than 1 method to treat water safe for drinking
	1 = Don't follow any method to treat water safe for drinking
Mother's Literacy	
	0 = Illiterate
	1 = Literate

Animal ownership	
0= No	
1= Yes	
Poverty Status	
1= Poorest/Lower Middle	
2= Middle/Upper Middle	
3= Highest	
Stunting (dependent variable)	
0 = (=> -2sd) Not Stunted	
1 = (< -2sd) Stunted	

Source: N@C Ethiopia Baseline Survey, 2014

A dichotomous measure was developed by combing the response "always" for handwashing at three critical times and if the water and soap is present at the designated handwashing place. Similarly, a dichotomous measure was developed for the "water quality" based on the categories defined above (see Table 3.7).

Poverty quintiles were computed using the DHS asset based approach and used to define HH poverty status. Quintiles 1 and 2 were combined to define category 1 poorest and lower middle; quintiles 3 and 4 were combined to define category 2 middle and upper middle, and the fifth quintile was defined as the highest category, category 3 (see Table 3.8).

HH sanitation, hygiene and water quality are regarded as the prevailing immediate HH environment to which a child is continuously exposed. For each measure, risk was defined by dichotomous category 1 (see Table 3.8). Empirical analysis allowed us to examine the proposed theorized relationships between these context specific measures of EE risk and child health outcomes.

CHAPTER IV: RESULTS

This chapter presents results of bivariate and multivariate analyses. In addition to simple descriptive statistics, cross tabulations are used to understand variation among dependent and independent variables defined in Tables 3.8 and 4.2. Binary logistic regression was used to assess the relative influence of predictors used in the model.

Table 4.1: Characteristics of study sample

Variable	N	%
Sanitation		
Toilet facility type		
0 = Improved	347	20.2
1 = Not Improved	1375	79.8
Child defecation		
0 = No open defecation	265	15.4
1 = Open defecation	1457	84.6
Hygiene		
Handwashing (at 3 critical times)		
0 = Wash hands	602	35.0
1 = Do not wash hands	1120	65.0
Soap for handwashing		
0 = Yes soap present	599	34.8
1 = No soap present	1123	65.2
Water for handwashing		
0 = Yes	259	15.0
1 = No	1463	85.0
Animal ownership		
0 = No	292	17.0
1 = Yes	1430	83.0
Child anemia		
0 = Anemia	144	37.3
1 = Not anemic	242	62.7

Source: N@C Ethiopia Baseline Survey, 2014

Table 4.1 suggests that the majority of HHs do not have improved toilet facilities and most of the children openly defecate and are less likely to follow good hygiene practices. The majority of HHs owns one or more types of animals. The findings indicate that more than half of the children in this sample of the study have anemia.

Table 4.2: Final measures for bivariate and multivariable analyses

Variable	Measure	N	%
HH Sanitation			
	0 = Improved toilet facilities/No open defecation	554	32.2
	1 = No Improved toilet facilities/Open HH/Child defecation	1168	67.8
HH Hygiene			
	0 = HW at 3 critical times and both soap-water present	692	40.2
	1 = No HW at 3 critical times & no soap-water present	1030	59.8
HH Water Quality			
	0 = Use 1 or more methods to treat water safer for drinking	409	23.8
	1 = Don't use any method to treat water safer for drinking	1313	76.2
Mother's Literacy			
	0 = Illiterate	1151	66.8
	1 = Literate	691	33.2
Poverty Status			
	1 = Poorest/Lower Middle	689	40.0
	2 = Middle/Upper Middle	691	40.1
	3 = Highest	342	19.9
Stunting (dependent variable)			
	0 = (=> -2sd) Not stunted	745	45.6
	1 = (< -2sd) Stunted	890	54.4

Source: N@C Ethiopia Baseline Survey, 2014

Baseline survey results of N@C project shown in Table 4.2 suggest that 60% or more surveyed HHs have a HH environment that poses a greater EE risk to the children. Around 66.8% of mothers are illiterate and belong to a poor or middle socio-economic group. N@A baseline

survey analysis suggests the current stunting prevalence rate is 54.4% among children 6-36 months of age, which is higher than the prevailing national stunting rate of 41% of Ethiopia [4].

Bivariate analysis

Table 4.3 provides results of bivariate cross-tabulation between final concepts developed for the purposes of this study, and stunting. Fifty-two percent or more children are likely to be stunted, given the HH's sanitation, hygiene, and water quality environment.

Table 4.3: Final measures and stunting - bivariate analysis

Variable Measure	Stunting	
	No	**Yes**
HH Sanitation		
0 = Improved toilet facilities/No open defecation	246 (46.9)	278 (53.1)
1 = No Improved toilet facilities/Open HH/Child defecation	499 (44.9)	612 (55.1)
HH Hygiene		
0 = HW at 3 critical times and both soap-water present	305 (47.2)	341 (52.8)
1 = No HW at 3 critical times & no soap-water present	440 (44.5)	549 (55.2)
HH Water Quality		
0 = Use 1 or more methods to make water safe for drinking	188 (48.0)	204 (52.0)
1 = Don't use any method to make water safe for drinking	557 (44.8)	686 (55.2)
Animal Ownership		
0 = No	119 (43.6)	153 (56.3)
1 = yes	626 (45.9)	737 (54.1)
Child Anemia		
0 = Anemia	55 (40.4)	81 (59.6)
1 = Not anemic	117 (49.6)	119 (50.4)
Mother's Literacy		
0 = Illiterate	488 (44.9)	598 (55.1)
1 = Literate	257 (46.8)	292 (53.2)
Poverty Status		
1 = Poorest/Lower Middle	299 (45.8)	354 54.2)
2 = Middle/Upper Middle	292 (44.4)	365 (55.6)
3 = Highest	154 (47.4)	171 (52.6)

Source: N@C Ethiopia Baseline Survey, 2014

Sixty percent of the children are likely to be stunted if the child has anemia. Animal ownership, though considered an additional contributing factor to the HH EE risk for the purposes of this study, shows that even in a HHs with no animals the stunting prevalence is 56%. This suggests that sanitation, hygiene, water quality and anemia may be greater contributors to EE risk, thereby affecting child growth.

Multivariate analysis

Table 4.4 reports results on the multivariable analyses. The results of the regression analysis suggest that HHs with unimproved toilet facilities and open defecation are more likely to have stunted children (OR 1.556; p-value 0.055). Additionally, HHs where mothers do not follow good hygiene practices are more likely to have stunted children (OR 1.557; p-value 0.042). Similarly, HHs with poor drinking water quality are more likely to have stunted children (OR 1.574; p-value 0.072). However, the results indicate that if a child is not anemic it is less likely that the child will be stunted. Animal ownership does not show a significant odds ratio, though the direction of the odds (1.128) is positive, suggesting HH animal ownership may be a contributing factor to EE. Thus, HHs with poor sanitation, hygiene, and water quality are more likely to have stunted children compared to those HHs with improved sanitation, hygiene and water quality environment.

This prevailing poor sanitation, hygiene, and water quality environment predisposes a child to EE risk, thereby potentially affecting his/her growth.

Table 4.4:   Logistic regression-1 results: Children stunted at (6-36) months of age compared to those who are not

Measure	p-value	Exp (β)	95% CI	
HH Sanitation				
0 = Improved toilet facilities/No open defecation				
1 = No Improved toilet facilities/Open HH/Child defecation	0.055	1.556*	[0.990	2.445]
HH Hygiene				
0 = HW at 3 critical times and both soap-water present				
1 = No HW at 3 critical times & no soap-water present	0.042	1.557**	[1.016	2.386]
HH Water Quality				
0 = Use 1 or more methods to make water safe for drinking				
1 = Don't use any method to make water safe for drinking	0.072	1.574*	[0.960	2.582]
Animal Ownership				
0 = No				
1 = yes	0.660	1.128	[0.659	1.929]
Child Anemia				
0 = Anemia				
1 = Not anemic	0.079	0.674*	[0.434	1.047]
Mother's Literacy				
0 = Illiterate				
1 = Literate	0.343	0.886	[0.475	1.653]
Poverty Status				
1 = Poorest/Lower Middle				
2 = Middle/Upper Middle	0.721	1.090	[0.680	1.746]
3 = Highest	0.703	0.886	[0.475	1.653]

Source: N@C Ethiopia Baseline Survey, 2014
** Significant at p < 0.05;   * significant at p < 0.1

The summative index of the EE risk component measures (HH Sanitation; HH Hygiene; HH Water Quality) shown in the regression Table 4.4 above were included in Table 4.5. Regression results suggest that HHs with a higher risk of EE (OR 1.273; p-value = 0.007) are more likely to have stunted children.

Table 4.5:   Logistic regression-2 results: Children stunted at (6-36) months of age compared to those who are not

Measure	p-value	Exp (β)	95% CI	
EE Risk Index				
HH Risk (0-6)	0.007	1.273**	[1.067	1.518]
Animal Ownership				
0 = No				
1 = yes	0.604	1.151	[0.678	1.954]
Child Anemia				
0 = Anemia				
1 = Not anemic	0.076	0.673*	[0.435	1.043]
Mother's Literacy				
0 = Illiterate				
1 = Literate	0.399	0.830	[0.538	1.280]
Poverty Status				
1 = Poorest/Lower Middle				
2 = Middle/Upper Middle	0.599	1.134	[0.710	1.810]
3 = Highest	0.684	0.880	[0.477	1.624]

Source: N@C Ethiopia Baseline Survey, 2014
** Significant at $p < 0.05$;   * significant at $p < 0.1$

This result is similar to the results of the regression model presented in the Table 4.4, again suggesting that EE risk mediates the effect of prevailing HH environment as measured by sanitation, hygiene, and water quality for the purposes of this study. Child anemia and animal ownership show similar results as the first regression model reported in Table 4.4.

Results from both regression models presented in Table 4.4 and Table 4.5 indicate that HHs with poor sanitation, hygiene, and water quality environment are likely to have stunted children. Both bivariate and multivariate analyses suggest that HH sanitation, hygiene, water quality and child anemia are more likely to expose the child to EE risk, and children from these HH are likely to be stunted.

CHAPTER V: DISCUSSION AND CONCLUSION

Analyses presented in this thesis, support the theorized relationship between HH sanitation, hygiene, water quality, EE, and child undernutrition. Bivariate and multivariate regression analyses both support the underlying key hypotheses that it is the poor hygiene, sanitation, and water quality environment that predisposes a child to the subclinical disorder risk defined as EE, thereby affecting growth.

Optimum nutrient dense food is necessary to continue normal growth patterns for children, but not sufficient to guarantee normal linear growth of young children [32]. Nutrition interventions targeting appropriate complementary feeding behaviors with micronutrient supplementation have proven limited in their effect to reduce stunting among young children [8]. There is growing evidence that HH sanitation, hygiene and water quality (WASH) environment profoundly affect child linear growth [25, 32, 48]. A range of structural and functional changes are observed in the gut among young children who are living in HHs with poor WASH environment [12, 35, 37, 49].

The data presented in this study shows that the majority of the HHs (N=1,168, 68%) do not have improved toilet facilities and children openly defecate. About 60% (N=1,030) of the mothers/caregivers of the children do not wash their hands with soap and water at three critical times - after toilet use, before feeding the child, after changing the child. About 76% of the HHs (N=1,313) do not use any method to treat drinking water. These prevailing HH conditions constitute an environmental risk that expose a child to EE.

Multivariate regression analysis shows that HHs with higher EE risk [OR 1.273, p value= 0.007, CI (1.067-1.518)] are more likely to have stunted children. This result is similar to the

observations noted in a randomized controlled trial study in Sudan [50] where children living in HHs with poor sanitation and water failed to achieve normal growth compared to those living in HHs with good sanitation and hygiene, thus supporting the first two hypotheses (H_1 and H_2) that poor WASH environment affects child growth and that EE mediates the growth faltering effect. The results presented in this thesis also suggest that HHs with lower EE risk are likely to have less stunted children which supports study hypothesis H_3.

Among young children, infection and stunting are intertwined. Children who are living in HHs with poor water quality, inadequate sanitation and unhygienic conditions tend to develop more parasitic infections, as they are at a greater risk of fecal matter ingestion which is likely to alter gut function [51]. Chronic exposure to fecal matters alters gut morphology, changes normal absorptive functional capacity and over activates the body's immune system, these changes collectively contribute to developing a subclinical condition known as EE [12, 35]. Growth falters when these changes lead to reduced nutrient absorption by atrophied villi which coupled with marginal dietary intake, divert energy from growth during the high growth demands of the first two years of life [43, 52].

A contaminated HH environment thus mediates its growth faltering effect through EE. This again supports our hypothesis that EE mediates the growth faltering effect of a poor HH WASH environment and is also a major contributor to child's malnutrition. A recent study from rural Bangladesh also presented similar findings. Children living in the HHs with poor sanitation, hygiene and water quality conditions have been found to have higher parasitic infection, poor growth and high levels of EE biomarkers [51].

Young children are exposed to pathogens through different routes, but most commonly by the fecal-oral route. If this pathway is disrupted, potential risk to developing EE can be mitigated. Thus, HHs with reduced EE risk are likely to have children with normal growth.

Overall, empirical analysis lends support to the key study premise that EE is the underlying link that renders "nutrition only" interventions less effective. Children at risk of EE are likely to be stunted. The analysis supports the premise that an integrated approach that addresses the HH risk environment, along with nutrition interventions, will be more effective in improving child nutrition and health outcomes.

In summary, diverse nutrition interventions adopted in programs targeted to improve child nutritional status are still inadequate. We conclude that the following should be considered when designing nutrition interventions:

- Nutrition interventions focused on food access and nutrient supplements alone are likely to be less effective in reducing stunting.
- Malnutrition is not only due to lack of diversity, consistency, frequency and quality of food, but also due to HH WASH environment and EE. The continued persistence of undernutrition then also needs to be defined as an "*enteric infectious disease*" that leads to diarrhea that not only exacerbates poor nutrition, but also depletes the body of key micronutrients such as zinc and iron; deficiency of these major micronutrients also contributes toward growth faltering.

- Anemia also co-exists with stunting and is prevalent in developing countries. Pathways of EE that affect a child's growth theoretically may also lead to anemia, which in turn further perpetuates growth faltering, but this link has drawn little attention.

- Most often it is observed that older siblings are also the caregivers for young children. Social Behavior Change Communication (SBCC) strategy and counseling materials directed to these older siblings need to be expanded to accommodate EE.

- Improper food storage also affects diet quality. Children with poor quality diet are also at risk of stunting because nutrition interventions that overlook the link between the quality of the diet and EE potentially expose the child to "*aflatoxin*" (a fungal metabolite) that contaminates inadequately stored crops.

Policy implications

The study results lend support to the need for long term integrated program interventions. Nutrition interventions focusing only on infant and young child feeding (IYCF), improving maternal knowledge around child nutrition and care giving and nutrient supplements may not be enough to reduce the risk and extent of child stunting. Interventions inclusive of sanitation and hygiene components, and water quality, will help reduce EE risk and likely will have a synergistic effect in stunting reduction.

There is also a need to develop and disseminate knowledge modules that help HH members, especially mothers and caregivers, to understand what EE risk is, its causal pathways and consequences, and ways to address this risk. Findings also support the need for advocacy to draw

attention of government and NGOs to this underlying link that reduces the effectiveness of nutrition interventions.

Contribution

Despite data and measurement limitations, empirical findings support the theoretical assertion that children predisposed to EE risk likely will be stunted. Theoretically, the study provides support to the argument that understanding pathological pathways of EE risk and reducing this risk have a role in child nutrition and health outcomes. Methodologically, the study shows the difficulty in measuring the concept, due to unavailability of non-clinical measures. This suggests that there is an absolute value for further research in developing standard EE measures, understanding the underlying link between EE specific nutrition interventions and stunting or child health outcomes in general.

Limitations

- Data were collected based on the mother/caregiver recall. Availability of observational data would have provided more insights into the behaviors that contribute to EE risk.

- Unavailability of validated non-invasive bio-markers to assess EE, such as Mannitol Lactulose (M/L), limits the understanding of risk causal pathways.

- Indirectly measuring the effect of EE risk on stunting through diarrhea masks the actual prevailing risk and effect.

- The study did not include any measures of maternal knowledge regarding what is EE and the risk it poses to the child health.

EE is not a specific focus of N@C, Ethiopia program. However, data collected in the program include the measures needed in this study to define and understand the risk EE poses.

There is scant literature that draws attention to the EE risk and its link to child nutrition and health outcomes. There is a need for additional research to understand and explore the pathways through which EE risk influences maternal and child nutrition and health outcomes, looking at questions such as: 1) *How do the actions of adults and children expose them to environment contaminants? and 2) Do different types of animals in the HH contribute differently to environment contamination?*

Due to the lack of available non-bio EE measures, results presented here need to be understood and interpreted within the limitations of this study.

Reference

1. Ngure, F.M., et al., *Water, sanitation, and hygiene (WASH), environmental enteropathy, nutrition, and early child development: making the links.* Ann N Y Acad Sci, 2014. **1308**: p. 118-28.

2. Bhutta, Z.A., et al., *Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?* Lancet, 2013. **382**(9890): p. 452-77.

3. Black, R.E., et al., *Maternal and child undernutrition and overweight in low-income and middle-income countries.* Lancet, 2013. **382**(9890): p. 427-51.

4. Central Statistical Agency [Ethiopia] and ICF International, *Ethiopia Demographic and Health Survey, 2011.* 2011.

5. McKay, S., et al., *Environmental enteropathy: new targets for nutritional interventions.* Int Health, 2010. **2**(3): p. 172-80.

6. Black, R.E., et al., *Maternal and child undernutrition: global and regional exposures and health consequences.* Lancet, 2008. **371**(9608): p. 243-60.

7. Campbell, D.I., P.G. Lunn, and M. Elia, *Age-related association of small intestinal mucosal enteropathy with nutritional status in rural Gambian children.* Br J Nutr, 2002. **88**(5): p. 499-505.

8. Dewey, K.G. and S. Adu-Afarwuah, *Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries.* Matern Child Nutr, 2008. **4 Suppl 1**: p. 24-85.

9. Bhutta, Z.A., et al., *What works? Interventions for maternal and child undernutrition and survival.* Lancet, 2008. **371**(9610): p. 417-40.

10. Campbell, D.I., M. Elia, and P.G. Lunn, *Growth faltering in rural Gambian infants is associated with impaired small intestinal barrier function, leading to endotoxemia and systemic inflammation.* J Nutr, 2003. **133**(5): p. 1332-8.

11. Lunn, P.G., C.A. Northrop-Clewes, and R.M. Downes, *Intestinal permeability, mucosal injury, and growth faltering in Gambian infants.* Lancet, 1991. **338**(8772): p. 907-10.

12. Humphrey, J.H., *Child undernutrition, tropical enteropathy, toilets, and handwashing.* Lancet, 2009. **374**(9694): p. 1032-5.

13. Hautvast, J.L., et al., *Consequences of infections for three-month length increment in young children in rural Zambia.* Acta Paediatr, 2000. **89**(3): p. 296-301.

14. Bryce, J., et al., *Countdown to 2015 for maternal, newborn, and child survival: the 2008 report on tracking coverage of interventions.* Lancet, 2008. **371**(9620): p. 1247-58.

15. Etsub B/Selasie, M.T., *Baseline Assessment Report of Nutrition at Center Project, CARE Ethiopia.* 2014, CARE USA: US. p. 35-38.

16. *The State of the World's Children* 1998, UNICEF: US. p. 23-25.

17. Godana, W. and B. Mengistie, *Determinants of acute diarrhoea among children under five years of age in Derashe District, Southern Ethiopia.* Rural Remote Health, 2013. **13**(3): p. 2329.

18. Sinmegn Mihrete, T., G. Asres Alemie, and A. Shimeka Teferra, *Determinants of childhood diarrhea among underfive children in Benishangul Gumuz Regional State, North West Ethiopia.* BMC Pediatr, 2014. **14**: p. 102.

19. Checkley, W., et al., *Multi-country analysis of the effects of diarrhoea on childhood stunting.* Int J Epidemiol, 2008. **37**(4): p. 816-30.

20. Checkley, W., et al., *Effects of Cryptosporidium parvum infection in Peruvian children: growth faltering and subsequent catch-up growth.* Am J Epidemiol, 1998. **148**(5): p. 497-506.

21. Wierzba, T.F., et al., *The interrelationship of malnutrition and diarrhea in a periurban area outside Alexandria, Egypt.* J Pediatr Gastroenterol Nutr, 2001. **32**(2): p. 189-96.

22. Ahmed, T., et al., *An evolving perspective about the origins of childhood undernutrition and nutritional interventions that includes the gut microbiome.* Ann N Y Acad Sci, 2014.

23. Curtis, V. and S. Cairncross, *Effect of washing hands with soap on diarrhoea risk in the community: a systematic review.* Lancet Infect Dis, 2003. **3**(5): p. 275-81.

24. Arnold, B.F. and J.M. Colford, Jr., *Treating water with chlorine at point-of-use to improve water quality and reduce child diarrhea in developing countries: a systematic review and meta-analysis.* Am J Trop Med Hyg, 2007. **76**(2): p. 354-64.

25. Fenn, B., et al., *An evaluation of an operations research project to reduce childhood stunting in a food-insecure area in Ethiopia.* Public Health Nutr, 2012. **15**(9): p. 1746-54.

26. Campos, F.A., H. Flores, and B.A. Underwood, *Effect of an infection on vitamin A status of children as measured by the relative dose response (RDR).* Am J Clin Nutr, 1987. **46**(1): p. 91-4.

27. Desai, H.G., et al., *'Flat' jejunal mucosa in the tropics.* Indian J Med Sci, 1969. **23**(1): p. 1-5.

28. Haghighi, P. and P.L. Wolf, *Tropical sprue and subclinical enteropathy: a vision for the nineties.* Crit Rev Clin Lab Sci, 1997. **34**(4): p. 313-41.

29. Colwell, E.J., et al., *Jejunal morphological characteristics in South Vietnamese residents.* Jama, 1968. **206**(10): p. 2273-6.

30. Cook, G.C., S.K. Kajubi, and F.D. Lee, *Jejunal morphology of the African in Uganda.* J Pathol, 1969. **98**(3): p. 157-69.

31. Lindenbaum, J., A.K. Alam, and T.H. Kent, *Subclinical small-intestinal disease in East Pakistan.* Br Med J, 1966. **2**(5530): p. 1616-9.

32. Solomons, N.W., *Environmental contamination and chronic inflammation influence human growth potential.* J Nutr, 2003. **133**(5): p. 1237.

33. Fagundes-Neto, U., et al., *Tropical enteropathy (environmental enteropathy) in early childhood: a syndrome caused by contaminated environment.* J Trop Pediatr, 1984. **30**(4): p. 204-9.

34. Prendergast, A. and P. Kelly, *Enteropathies in the developing world: neglected effects on global health.* Am J Trop Med Hyg, 2012. **86**(5): p. 756-63.

35. Korpe, P.S. and W.A. Petri, Jr., *Environmental enteropathy: critical implications of a poorly understood condition.* Trends Mol Med, 2012. **18**(6): p. 328-36.

36. Lunn, P.G., *The impact of infection and nutrition on gut function and growth in childhood.* Proc Nutr Soc, 2000. **59**(1): p. 147-54.

37. Ramakrishna, B.S., S. Venkataraman, and A. Mukhopadhya, *Tropical malabsorption.* Postgrad Med J, 2006. **82**(974): p. 779-87.

38. Lindenbaum, J., C.D. Gerson, and T.H. Kent, *Recovery of small-intestinal structure and function after residence in the tropics. I. Studies in Peace Corps volunteers.* Ann Intern Med, 1971. **74**(2): p. 218-22.

39. Gerson, C.D., et al., *Recovery of small-intestinal structure and function after residence in the tropics. II. Studies in Indians and Pakistanis living in New York City.* Ann Intern Med, 1971. **75**(1): p. 41-8.

40.   Wong, S. and J. Pinkney, *Role of cytokines in regulating feeding behaviour.* Curr Drug Targets, 2004. **5**(3): p. 251-63.

41.   Manary, M.J., et al., *Perturbed zinc homeostasis in rural 3-5-y-old Malawian children is associated with abnormalities in intestinal permeability attributed to tropical enteropathy.* Pediatr Res, 2010. **67**(6): p. 671-5.

42.   Mondal, D., et al., *Contribution of enteric infection, altered intestinal barrier function, and maternal malnutrition to infant malnutrition in Bangladesh.* Clin Infect Dis, 2012. **54**(2): p. 185-92.

43.   Dewey, K.G. and D.R. Mayers, *Early child growth: how do nutrition and infection interact?* Matern Child Nutr, 2011. **7 Suppl 3**: p. 129-42.

44.   Menzies, I.S., et al., *Geography of intestinal permeability and absorption.* Gut, 1999. **44**(4): p. 483-9.

45.   WHO. *Indicators for assessing infant and young child feeding practices*. 2008 [cited 2014 Oct 28]; Available from: http://www.who.int/nutrition/publications/infantfeeding/9789241596664/en/index.html.

46.   CARE USA, *Infant and Young Child Feeding Practices: collecting and using data: a step by step guide*. 2010, USA: CARE USA.

47.   WHO. *The WHO Child Growth Standards*. 2006 [cited 2014 Oct 28]; Available from: http://www.who.int/childgrowth/en/.

48.   Francis Muigai Ngure, J.H.H., Purnima Menon and Rebecca Stoltzfus1, *Environmental Hygiene, Food Safety and Growth in less than Five Year Old Children in Zimbabwe and Ethiopia.* The journal of the Federation of American Societies for Experimental Biology, 2013. **27**(2): p. 243.

49.   Kosek, M., et al., *Assessment of Environmental Enteropathy in the MAL-ED Cohort Study: Theoretical and Analytic Framework.* Clin Infect Dis, 2014. **59 Suppl 4**: p. S239-47.

50.   Merchant, A.T., et al., *Water and sanitation associated with improved child growth.* Eur J Clin Nutr, 2003. **57**(12): p. 1562-8.

51.   Lin, A., et al., *Household environmental conditions are associated with enteropathy and impaired growth in rural Bangladesh.* Am J Trop Med Hyg, 2013. **89**(1): p. 130-7.

52.   Arnold, B.F., et al., *Cluster-randomised controlled trials of individual and combined water, sanitation, hygiene and nutritional interventions in rural Bangladesh and Kenya: the WASH Benefits study design and rationale.* BMJ Open, 2013. **3**(8): p. e003476.

Appendix-1

Table of content of survey questionnaire

CARE Ethiopia
NUTRITION AT THE CENTER PROGRAM
BASELINE HOUSEHOLD SURVEY 2013

A.   Household identification and summary

Household Identification

	AREA	CODE	RESPONSE
A1	Country	01=Benin 03=Bangladesh 02=Ethiopia 04=Zambia	|__|__|
A2	Region name: _____		CODE:|__|__|
A3	District name: _____		CODE:|__|__|
A4	Subdistrict name: _____		CODE:|__|__|
A6	Village name: _____		CODE:|__|__|
A7	Household number (1-XX)		|__|__|

Interview Information

A8	Date of interview	|__|__| dd	|__|__| mm	20|__|__| yy

		INITIALS	STAFF CODE OR DATE
A9	Name of lead interviewer (3 Initials & code)		|__|__|
A10	Field supervisor review (3 initials & code)		|__|__|
A11	Survey Completed	01 = Yes 02 = No	

FOR DATA ENTRY USE ONLY	INITIALS	CLERK CODE	DATE OF ENTRY/CHECK
First Data Entry Write data clerk 3 initials and date)			
Second Data Entry Write data clerk 3 initials and date)			
Supervisor Check Write supervisor check and date)			

SCREENING QUESTION AND CONSENT

CONSE NT	Hello. My name is ___ and I work with LOCAL FIRM and a non-government organization. What is your name? Nice to meet you. Our team is in your village today and we would like to ask you questions from our survey. The information we collect will be used for planning, implementation and evaluation of a program. We are interviewing the mothers who have children less than 3 years of age. Do you have any children 3 years of age or less?	
	Child 1	☐ 0 to <6 ☐ 6 to <12 ☐ 12 to <18 ☐ 18 to <24 ☐ 24 to <36
	Child 2	☐ 0 to <6 ☐ 6 to <12 ☐ 12 to <18 ☐ 18 to <24 ☐ 24 to <36
	Child 3	☐ 0 to <6 ☐ 6 to <12 ☐ 12 to <18 ☐ 18 to <24 ☐ 24 to <36
	SELECTED CHILD AGE	☐ **0 to <6** ☐ **6 to <12** ☐ **12 to <18** ☐ **18 to <24** ☐ **24 to <36**

Record <u>time</u> the interview started in 24 hour format	HOUR	|__|__|
	MINUTES	|__|__|

CONSE NT	You have been selected at random to participate in this survey. We will be working with the Federal Ministry of Health to improve your health and well-being of as well as the health and well-being of your children and household. To do so, we would like to ask you questions about your household, agricultural practices, the types of food you have, food diversity, gender and group participation. We would like to take height, weight and upper arm measurements from you; and length and weight measurement of one of the selected child (NAME THE CHILD) less than -+three years of age. [IF ANEMIA TESTING: We will also test you and children less than three years of age for anemia, or low iron in the blood by taking a small sample of blood (prick from finger or heel) and will conduct the test immediately in front of you and share the results. I will describe this more in-depth later.]

	We will not record any personal information which will be able to identify you with your responses, and your answers will be kept confidential. Please know, your participation is completely voluntary and you may choose not to participate at any time and to stop the survey at any time. Do you have any questions for me?		
A16	Do you agree to participate in the survey? Enumerator: Is the respondent a mother of a child between the age of 0 and 36 months of age, AND does the respondent agree to participate in the survey?	01 = Yes 02 = No	If 02→ thank them for their time and END survey

B.   Child Information

The information below is collected for the living child of the women being interviewed. This child should be less than three years of age: between 0 and 36 months of age.

NO.	QUESTIONS AND FILTERS	RESPONSE CODE		SKIP TO
	What is the name of your child? *Enumerator instruction: Identify the target child and write name*			
B1	Is (child's name) male or female?	01=Male 02=Female		
B2	Does (child's name) have a health passport/child card/immunization card? (& other language)	01= Yes 02=No		
B3	When is the child's birthdate (actual age of child)	Write birthdate 98 98 98 = don't know	|__|__| |__|__| 20|__|__| DD MM YY	
B5	*Enumerator: VERIFY DO NOT READ* *How was (child's name) age verified?*	01=Yes, Health passport (or health card, other document) 02= Yes, Mother's recall 03 = Other document 04= N/A, Not verified, not applicable		
B4	How old is (child's name)? *NOTE: Write actual age of child (Refer to month conversion/seasonal or event calendar)*	Write age in <u>completed</u> months 00= Less than 30 days 98= Don't	|__|__|	

		know		
B7	What was (child's name) weight at birth	Write in kilograms 98.8 = Don't know	|__|__|.|__|	
B8	*Enumerator: VERIFY DO NOT READ* *Was (child's name) weight verified:*	01= Yes, Health passport 02= Yes, Mother's recall 03= N/A, Not verified, not applicable		

C. Mother's Information

INSTRUCTIONS: Ensure that this is administered to the biological mother of the target child identified (less than 36 months of age). If this mother was not the respondent to a previous module, re-introduce the survey and obtain verbal consent.

Read: I would like to start by asking you a couple questions about you and your children.

NO.	QUESTIONS AND FILTERS	RESPONSE CODE		SKIP TO
C0	What is your date of birth? *Respondent is not eligible if birthdate is before current date 1964 or after 1998*	Write birthdate 98 98 98 = don't know	|__|__| |__|__| 19|__|__| dd mm yy	
C1	How old are you? *ENUMERATOR: Verify the age at last birthday. Verify with C0*	Write age in years	|__|__|	If age <15 or >49 END SURVEY
C2	What is your current marital status?	01 = Married (monogamous) 02= Married (polygamous) 03= Divorced or separated 04= Widowed 05= Single (Never married) 06= Cohabitating with partner (monogamous) 07= Cohabitating with partner (polygamous)		If 05, 06 or 07 → C4
C3	How old were you at the time of your first marriage?	Write age in years 98 for DK	|__|__|	
C4	Who is the head of your household?	01 = Male-headed household 02 = Female-headed household 03 = Joint (male and female) headed		

		household	
C5	What is your relationship to the head of the household?	01 = Self (Female headed) 02 = Spouse of HHH 03 = Sibling of HHH 04 = Child of HHH 05 = Parent of HHH 06 = Grandchild of HHH 07 = Grandparent of HHH 08 = Other	
C6	Have you ever received formal education (attend school)?	01= Yes 02= No	If 02→ C8
C7	What is the highest level of education that you have completed?	01= Some primary (grade 1-4) 02= Completed primary (grade 5-8) 03= Some secondary (grade 9-11) 04= Completed secondary (completed grade 12) 05 = Some higher education 06= Completed higher education 07 = Adult education 08= Vocational school 98 = Don't know	
C8	Can you read this sentence to me? *Enumerator: Show respondent card with sentence on it. "I like to go to the market."* *Circle response describing their reading ability*	01= Cannot read at all 02= Able to read only parts of sentence 03= Able to read whole sentence 04= Not available in language (specify) ‾‾‾‾‾ 05= Blind/visually impaired	
C9	How many times have you been pregnant?	Write in response |__|__| 98= Don't know	
C10	Are you currently pregnant?	01= Yes 02= No 08 = Don't know	
C11	How many living children do you have?	Write in response |__|__| 98= Don't know	

D. Basic information of household characteristics

Read: Now I would like to ask you a few questions about your household and the type of things your household owns.

NO.	QUESTIONS AND FILTERS	RESPONSE CODE		SKIP TO
D1	How many people stay in this household? *How many people (all ages) share food from the same pot?*	Write number	|__|__|	
D1a	Is your household currently participating in the productive safety net program (PSNP)?	01=Yes 02= No		
D2	Does your household own any agricultural land?	01 = Yes 02 = No		
D3	Do you own your house?	01 = Yes 02 = No		

D4	I'm going to ask you about farm animals. How many… does your household own?
	     a. Cattle/ (may be left as it is)
	     b. Goat
	     c. Sheep
	     d. Chickens
	     e. Pigs
	     f. Horse
	     g. Donkey
	     h. Mule
	     i. Other
		Write number of animals
		
		 00= None
		 95= 95+
		 98= Don't know
			a. |__|__|
			 b. |__|__|
			 c. |__|__|
			 d. |__|__|
			 e. |__|__|
			 f. |__|__|
			 g. |__|__|
			 h. |__|__|
			 i. |__|__|
				If all '00'
				 →D6a

D5	At night, are there any farm animals kept inside the house where you/your family members sleep?	01= Yes 02= No		If 02→D6a
D6	What type of farm animals are kept inside the house at night when you/your family members sleep?	a. Cattle/cow b. Goat c. Sheep d. Chickens e. Pigs f. Horse g. Donkey h. Mule i. Other		
D6a	Do you keep any other animals inside the house at night where you sleep (including pets)?	01= Yes 02=No		

Instructions: If you are not inside the household; ask the mother to visit the house (and see the interior and exterior).

D7	<u>Main </u>material of the floor. *Enumerator: Observe and record one response*	01= Earth/Sand/Animal dung 02= Bamboo 03= Stone/Brick 04= Cement 05= Tile 06= Vinyl strip 07= Other (specify)_____	
D8	<u>Main </u>material of the roof. *Enumerator: Observe and record one response*	01= Grass roof 02= Metal roof 03= Stone or tile roof 04= Plastic alone 05= Plastic plus grass 06= Asbestos 07= Other (specify)_____	
D9	<u>Main </u>material of the exterior walls. *Enumerator: Observe and record one response*	01= Earth/Sand/Mud/Clay 02= Bamboo, corn stalks 03= Stone/ Fired Brick 04= Cement 05= Tile 06= Vinyl strip 07= Mud brick or wattle 08= Other (specify)_____	
D11	Does your household have any mosquito nets that can be used while sleeping?	01= Yes 02=No	If 02→D15
D12	How many insecticide treated mosquito nets (ITN) does your household have?	Write number of ITN 00 = None in household |__|__|	
D13	Did you sleep under the mosquito net last night?	01=Yes 02= No	
D14	Did your [CHILD'S NAME]sleep under the mosquito net last night?	01=Yes 02= No	
D15	Where is cooking usually done?	01= In a room used for living or sleeping 02 = In a separate room in the same building used as a kitchen 03= In a separate building used as kitchen 04 = Outdoors 05= Other (specify): _____	
D16	Do you have electricity, solar power or generator in your home?	01 = Yes 02 = No	

| D17 | Does your household own any of the following:

Read all responses, circle all that apply | a. Bicycle
b. Radio
c. Bed
d. Mobile/other Telephone
e. Television
f. Refrigerator
g. Cart pulled by animal
h. Watch/Clock
i. Sewing Machine
j. Motorcycle
k. Car/Truck
l. Tractor
m. Small generator (for irrigation)
n . Other (specify)_____ | |

E. Agriculture production, access to food

Read: This section asks about the household's production of food, access to land, and where you get the food you eat.

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
E1	What are the main sources of household food that you consume? Read all responses, circle all that apply	a. Produce food b. Purchase food c. Food for work d. Government food aid e. NGO food aid f. Trade/Borrowfood g. Charity h. Other (specify):_____	If "a" is <u>not</u> circled → E3
E2	Who usually grows the food you produce for consumption? Read all answers, circle all that apply	a. Self (respondent) b. Husband c. Other female family members/clan d. Other male family members/clan e. Neighbors f. Farm collective g. Don't know h. Other (specify):_____	

READ: Now I am going to ask you a series of questions about the land your household lives on, uses for productive purposes -- that is leases or sharecrops, owns or rents out. I would like you consider not only the land your household uses now, but also the land your household may have used over the last six months. By piece of land, I mean one continuous piece, which is used predominantly for the same purposes and managed by the same person or group of people. I will first ask about the homestead, followed by any home/kitchen garden production.

E3	Do you have any <u>plot (or plots) of land</u> that you use to grow food for family or personal consumption?	01 = Yes 02 = No	If 02 → E13
E4	Who owns the <u>plot of land</u>?	01= You (Respondent) 02= Your husband 03= Both you and your husband 04= Other Male relative 05= Other Female relative 06= Land owner 07= Neighbor 08= Company 09= Other (specify):_____ 98= Don't know	If 01 or 03 → E6
E5	How did you get access to grow on the <u>plot of land</u> that you use to grow food for personal or family consumption? *Read all answers, circle ONE*	01= Rented in (cash) 02= Sharecropped in 03= Borrowed (no payment) 04= Other (specify)_____ 08= Don't know	
E6	Do/Did you have to obtain resources from someone (i.e., money, seeds, tools, animals) to grow food for personal or family consumption?	01= Yes 02= No	If 02 → E8
E7	Who provides you with the resources (i.e., money, seeds, tools, animals) to grow food for personal or family consumption? *Read all answers, circle all that apply*	b. Your Husband c. Other Male relative d. Other Female relative e. Land owner f. Neighbor g. Private company h. Government program i. Non-government organization j. Religious organization k. Other (specify):_____	
E8	What types of food do you PRODUCE on this <u>plot(s) of land</u> *Read all answers, circle all that apply*	a. Grains: wheat, corn, oats, rice, sorghum millet b. Roots or tubers: White potatoes, manioc, cassava, sweet potato c. Pulses/legumes/nuts e.g. chicken peas, peas, beans, groundnuts etc d. Meat, poultry, fish, e. Eggs f. Milk and milk products g. Vitamin A-rich plant foods	

		(Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, mangoes, papayas, or other locally grown food that is rich in Vitamin A) h. Dark green, leafy vegetables i. Other fruits or vegetables j. Coffee, tea, k. Other (specify) _____	
E9	What are the main uses of foods you PRODUCE on this plot of land? *Read all answers, circle all that apply*	a. Personal/Family Consumption b. Sale c. Barter trade d. Other (specify): _____	
E10	Who usually decides which foods you PRODUCE on this plot of land?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other Family 07= Other (specify)_____	
E11	Which foods do you SELL from your plot of land? Read all answers, circle all that apply	a. Grains: wheat, corn, oats, rice, sorghum millet b. Roots or tubers: White potatoes, manioc, cassava, sweet potato c. Pulses/legumes/nuts e.g. chicken peas, peas, beans, groundnuts etc d. Meat, poultry, fish e. Eggs f. Milk and milk products g. Vitamin A-rich plant foods (Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, mangoes, papayas, or other locally grown food that is rich in Vitamin A) h. Dark green, leafy vegetables i. Other fruits or vegetables j. Coffee, tea, k. None l. Other (specify): _____	If "k"→ E13

E12	Who usually decides which foods you SELL on this <u>plot of land</u>?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other Family 07= Other (specify) _____	

E13	Do you have a <u>home/kitchen garden</u> that you use to grow food for family or personal consumption?	01 = Yes 02 = No	If 02→E23
E14	Who owns the <u>home/kitchen garden</u>?	01= You (Respondent) 02= Husband 03= Both you and your husband 04= Other Male relative 05= Other Female relative 06= Land owner 07= Neighbor 08= Company 09= Other (specify): _____ 98 = Don't know	If 01 or 02 → E16
E15	How did you get access to the <u>home/kitchen garden</u> that you use to grow food for personal or family consumption? *Read all answers, circle ONE*	01= Rented in (cash) 02= Sharecropped in 03= Borrowed (no payment) 04= Other (specify)_____ 05= Don't know	
E16	Do/Did you have to obtain resources from someone (i.e., money, seeds, tools, animals) to grow food on your <u>home/kitchen garden</u> for personal or family consumption?	01= Yes 02= No	If 02 → E18
E17	Who provides you with the resources (i.e., money, seeds, tools, animals) to grow food on your <u>home/kitchen garden</u> for personal or family consumption? *Read all answers, circle all that apply*	b. Husband c. Male relative d. Female relative e. Land owner f. Neighbor g. Private company h. Government program i. Non-government organization j. Religious organization k. Other (specify): _____	
E18	What types of food do you	a. Grains: wheat, corn, oats, rice, sorghum	

	PRODUCE on this <u>home/kitchen garden?</u> *Read all answers, circle all that apply*	millet b. Roots or tubers: White potatoes, manioc, cassava, sweet potato c. Pulses/legumes/nuts e.g. chicken peas, peas, beans, groundnuts etc d. Meat, poultry, fish e. Eggs f. Milk and milk products g. Vitamin A-rich plant foods (Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, mangoes, papayas, or other locally grown food that is rich in Vitamin A) h. Dark green, leafy vegetables i. Other fruits or vegetables j. Coffee, tea k. Other (specify) _____	
E19	What are the main uses of foods you PRODUCE on your <u>home/kitchen garden</u>? *Read all answers, circle all that apply*	a. Personal/Family Consumption b. Sale c. Barter trade d. Other (specify): _____	
E20	Who usually decides which foods you PRODUCE on this <u>home/kitchen garden</u>?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other Family 07= Other (specify) _____	
E21	Which foods do you SELL from your <u>home/kitchen garden</u>? *Read all answers, circle all that apply*	a. Grains: wheat, corn, oats, rice, sorghum millet b. Roots or tubers: White potatoes, manioc, cassava, sweet potato c. Pulses/legumes/nuts e.g. chicken peas, peas, beans, groundnuts etc d. Meat, poultry, fish e. Eggs f. Milk and milk products g. Vitamin A-rich plant foods (Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, mangoes, papayas, or other locally grown food that is rich in Vitamin A) h. Dark green, leafy vegetables	If circle "k"→ E23

		i. Other fruits or vegetables j. Coffee, tea k. None l. Other (specify): _____	
E22	Who usually decides which foods you SELL from this <u>home/kitchen garden</u>?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other Family 07= Other (specify) _____	

E23	What types of food do you have to buy Read all answers, circle all that apply	a. Grains: wheat, corn, oats, rice, sorghum millet b. Roots or tubers: White potatoes, white yams, manioc, cassava, sweet potato c. Pulses/legumes/nuts e.g. chicken peas, peas, beans, groundnuts etc d. Meat, poultry, fish e. Eggs f. Milk and milk products g. Vitamin A-rich plant foods (Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside, mangoes, papayas, or other locally grown food that is rich in Vitamin A) h. Dark green, leafy vegetables i. Other fruits or vegetables j. Coffee, tea k. Cooking related items (sugar, oil, salt, flour) l. Snacks (sugar, junk foods) m. Other (specify): _____	

F. Food preservation and storage

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
F1	In the last 12 months, did the household preserve any fruits and/or vegetables for use later in the year?	01= Yes 02= No	If 02→ F5
F2	If yes, what methods of food preservation did you use?	a. Solar drying b. Other drying	

	Read all answers, circle all that apply	c. Canning d. Salting e. Pickling f. smoking g. Other (specify): _____	
F3	What varieties of fruits and vegetables did you preserve? Read all answers, circle all that apply	a. Pumpkin b. Citron c. Banana d. Kale e. Cabbage f. Lettuce g. Carrot h. Tomato i. Citrus j. Red pepper k. Garlic l. Onion m. Mango n. Papaya o. Lemon p. Orange q. Other (specify)------------------	

F4	What amount (kilos) did you preserve of these varieties in the last 12 months	Write response in kilograms
		  95.0 = 95 kilos or more
		  98.8 = Don't know |__|__|.|__|	

F5	During the last post-harvest period, did you store any food crops (cereals, legumes) that you grew?	01= Yes 02= No	If 02→Module G
F6	What variety of crops did you store? Read all answers, circle all that apply	a. Chicken pea b. Pea c. Teff d. Sorghum e. Flaxseed f. Maize g. Millet h. Wheat i. Barely j. Bean k. Haricot bean l. Oats m. Lentil n. Grass pea o. Red pea p. Other (specify)------------------	

F7	What was the main method(s) of storage that the household used for this crop over the last 12 months? Read all answers, circle all that apply	a. Improved locally made structure/granary b. Modern storage structure like cribs or silos c. Sealed/tight containers d. Improved cereal banks e. Improved community storing facilities f. Traditional storage g. Other (specify): _____	
F8	What is the purpose of the crop(s) being stored? Read all answers, circle all that apply	a. Food for household consumption b. To sell for higher price c. Seed for planting d. Other (specify): _____	

G.   Agriculture Extension

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
G1	In the past 12 months, have you ever met, or been visited by an agricultural extension worker	01= Yes 02= No	
G2	In the past 12 months, have ever met, or been visited by a livestock/fisheries extension worker	01= Yes 02= No	

H.   Coping Strategy Index [not applicable for Ethiopia Baseline]

I.   Household Hunger Scale

NO.	QUESTION	RESPONSE CODES	SKIP TO
I1	In the past 4 weeks/30 days was there ever **no food** to eat of any kind in your house because of lack of resources to get food?	01 =Yes 02= No	If 02→I3
I2	How often did this happen in the past [4 weeks/30 days]?	01= Rarely (1-2 times) 02= Sometimes (3-10 times) 03= Often (more than 10 times)	
I3	In the past [4 weeks/30 days]did you or any household member (including children) go to sleep at night hungry because there **was not enough food**?	01 =Yes 02= No	If 02→I5
I4	How often did this happen in the past [4 weeks/30 days]?	01= Rarely (1-2 times) 02= Sometimes (3-10 times) 03= Often (more than 10 times)	
I5	In the past [4 weeks/30 days] did you or any household member (including children) go a whole day without eating anything at all because there **was not enough food**?	01 =Yes 02= No	If 02→Module J

I6	How often did this happen in the past [4 weeks/30 days]?	01= Rarely (1-2 times) 02= Sometimes (3-10 times) 03= Often (more than 10 times)	

J.   Women's Diet Diversity Score

READ: Now I would like to know about the kind of food you consume during a normal/typical day.

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP
J1	Was yesterday a special day of celebration or fasting? *Clarification special day includes: celebration, or feast day where you ate special foods or more food than normal. It also includes fasting day where you ate less than usual*	01 = Yes 02 = No	If 02→J3
J2	How many days ago was a "normal" day where special kinds of foods were not eaten, or no one in the household ate more or less than usual or did not eat because of fasting?	Write number of days |__|__|	

READ:Please describe the foods (meals and snacks) and drinks that you took yesterday (or last "normal" day), both during the day and night, whether at home or outside the home. Let's begin with the first thing you took in the morning and continue up to the late evening..

Enumerator instructions: When composite dishes (soup, stew) are mentioned, asked for the list of ingredients. When the respondent has finished, probe for meals and snacks not mentioned.

NO.	FOOD GROUP	EXAMPLES	RESPONSE CODES	
			Yes	No
J3	a. CEREALS	Corn/maize, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products…) (Injera (flat bread), Kolo (roasted cereals), bread	1	2
	b. VITAMIN A RICH VEGETABLES AND TUBERS	Pumpkin, carrot, squash or sweet potatoes that are orange inside. (e.g. kale, cabbage, sweet pepper)	1	2
	c. WHITE ROOTS AND TUBERS	White potatoes, white cassava, other foods made from roots (e.g. other options)	1	2
	d. DARK GREEN LEAFY VEGETABLES	Dark green/leafy vegetables including wild ones + locally available vitamin A rich leaves such as cassava leaves, local cabbage, kale, spinach	1	2
	e. OTHER VEGETABLES	Other vegetables (e.g. tomato, onion), including wild vegetables	1	2
	f. VITAMIN A	Ripe mangoes, apricots (fresh or dried), ripe papaya, dried	1	2

	RICH FRUITS	peaches, other locally available vitamin A rich fruits		
	g. OTHER FRUITS	Other fruits, including wild fruits	1	2
	h. ORGAN MEAT	Liver, kidney, heart or other organ meats or blood-based foods	1	2
	i. FLESH MEATS	Beef, pork, lamb, goat, wild game, chicken, or other birds	1	2
	j. EGGS	Chicken, duck, guinea fowl or any other egg	1	2
	k. FISH	Fresh, dried fish, shellfish or small, dried fish	1	2
	l. LEGUMES, NUTS AND SEEDS	Beans, peas, chicken peas, lentils, nuts, seeds or foods made from these	1	2
	m. MILK AND MILK PRODUCTS	Milk, cheese, yogurt, skimmed milk or other milk products	1	2
	n. OILS AND FATS	Oil, fats or butter added to food or used for cooking	1	2
	o. OTHEROILS	Foods made from palm oil	1	2
	p. OTHER	Specially fortified foods (e.g. Corn soya blend (CSB) foods fortified with micronutrient powder, plumpy'nut, other Ready-to-Use Therapeutic Foods or lipid-based nutrient supplement?	1	2
	r. OTHER SPICES, CONDIMENTS	Spices (black pepper, salt), condiments (soy sauce, hot sauce), fish powder	1	2
	s. OTHER SWEETS	Sugar, honey, sweetened soda, sweetened juice or sugary foods such as chocolates, candies, cookies, pastries and cakes (including biscuits)	1	2
	t. OTHER SALTY READY-MADE SNACKS	High fat, salty, pre-packaged foods, typically eaten between meals as convenience	1	2
	u. OTHER BEVERAGES	Coffee, tea, alcohol beverages, areke (local alchohol), local beer (*Tela* or *Korefe*)or any other local examples	1	2
	v. OTHER (Write in)		1	2

K. Maternal health/pregnancy

Read: Now, I have several questions about your last (most recent) pregnancy.

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
K1	During your last pregnancy, did you attend antenatal care (ANC) or pre-baby care?	01= Yes 02= No	If 02→K5
K2	How many times did you attend ANC?	01= One time 02= Two times 03= Three times 04= Four times (or more) 08= Don't know, don't remember	
K3	Whom did you see for ANC service?	01= Health personnel doctor 02= Nurse/midwife 03= Auxiliary midwife 04= Other person traditional birth attendant 05= Health extension workers 06= Other (specify)_____	
K4	Where did you receive ANC?	01= Your home 02= Other home 03= At government hospital 04= At government health center 05= At government health post 06= Other government sectors (specify) 07= At private hospital/clinic 08= Other private medical sector (specify) -- 09= Other (specify)_____	
K5	During your last pregnancy, did you take any intermittent preventive treatment (IPT) or any medicine to prevent malaria? (list the local brand name, show example)	01= Yes 02= No 08 = Don't know/remember	
K6	During your last pregnancy, did you take any iron tablets?(list the local brand name, show example of iron tablet)	01= Yes 02= No 08= Don't Know	If 02→K8
K7	During your last pregnancy, how long did you take iron tablets?(describe local name, show example of iron tablet)	01= Less than 30 Days 02= 30 to 59 Days 03= 60 to 89 04= 90 Days or more 08= Don't know	
K8	During your last pregnancy, where	01= At home	

	did you deliver your child?	02= At government hospital 03= At government health center 04= At government health post 05= At private hospital/clinic 06= At parent's home 07= Other (specify) _____	
K9	During your last pregnancy, who assisted you in the delivery of yourchild?	01= Traditional Birth Attendant 02= Skilled Birth Attendant 04= Traditional Healer 05= Midwife 06= Medical Nurse 07= Medical Doctor 08=Family Member 09= Health extension worker 10= Neighbor 11= Other (specify) _____	
K10	After your last <u>delivery</u>, did you attend post-natal care (PNC)(after baby care)?	01= Yes 02= No	If 02→ Module L
K11	How many days after your last delivery did you attend PNC care?	Write number of days |__|__| 98= Don't know	
K12	Where do/did you attend PNC care?	01= Your home 02= Other home 03= At government hospital 04= At government health center 05= At government health post 06= Other government sectors (specify) 07= At private hospital/clinic 08= Other private medical sector (specify) -- 09= Other (specify)_____	

L.   Infant and Young Child Feeding Practices (IYCF)

NO.	QUESTIONS AND FILTERS	RESPONSE CODES
Instructions and verification: Copy the child's name. Verify the date of birth from Module B.		
	Copy the name of child from Module B	
L2	Age of child in months (copy from B4)	|__|__|

Read: I would like to ask you some questions about how you have been feeding CHILD'S NAME from birth until now.

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	RESPONSE	SKIP TO
L3	Did you ever breastfeed CHILD'S NAME?	01= Yes 02= No		If 02→L5
L4	How soon after birth did you first put (CHILD'S NAME) to your breast?	01= Immediately 02= In less than one hour 03= One hour to less than 24 hours 04= One day (24 hours or more) 08= Don't know		
L5	After CHILD'S NAME was born, what did you do with your first milk (colostrum)?	01= Gave it to your child 02= Threw it away 08= Don't know		
L6	In the first 3 days after birth, did you give (CHILD'S NAME) anything in addition to breast milk?	01= Yes 02= No		If 02→L8

L7	What else did you give CHILD'S NAME in the first 3 days after birth? DO NOT read all answers, circle all that apply		One time	More than one time	
		a. Animal milk	1	2	
		b. Plain water	1	2	
		c. Sugar or glucose water	1	2	
		d. Gripe water	1	2	
		e. Sugar-salt-water solution (ORS)	1	2	
		f. Fruit juice	1	2	
		g. Infant formula	1	2	
		h. Tea	1	2	
		i. Coffee	1	2	
		j. Honey	1	2	
		k. Herbal infusion	1	2	
		l. banana	1	2	
		m. Butter	1	2	
		n. dates	1	2	
		o. Local beer (tela)			
		p. Other (specify):_____			

| L8 | Are you currently breastfeeding CHILD'S NAME? | 01= Yes
02= No
08= Don't Know | | If 02→L10 |

L9	Yesterday, did you breastfeed CHILD'S NAME during the day and night?	01= Yes 02= No 08= Don't Know	

L10. Read: I would like to ask you about liquids that CHILD'S NAME may have had yesterday during the day and at night.

NO.	QUESTION	CODING CATEGORY		RESPONSE	SKIP TO
L10	During the last 24 hours (day or at night), did (CHILD'S NAME) receive any of the following? *Ask about every liquid. If the mother responds 'yes' circle circle '1'. If the child did not take the item, circle '2'.For questions b, c or g; if the mother says 'yes' write number of times the infant was given the liquid in the last 24 hours*	**Yes**	**No**	If 01=Yes, write number of times 98= Don't know	
	a. Plain water	1	2		
	b. Infant formula (NIDO, S26, NAN (WRITE LOCAL BRAND NAME)*(if yes, write number of times)*	1	2	|__|__|	
	c. Cow's/goat's/sheep's milk, tinned, or powdered milk , fresh milk, ultra high temperature (UHT)(WRITE LOCAL BRAND NAME – like mama, family)	1	2	|__|__|	
	d. Fruit juice or juice drinks	1	2		
	e. Broth (chicken soup, vegetable soup bean soup etc)	1	2		
	f. Other water-based liquids (e.g. Soft drinks like Pepsi, Coca Cola, Sprite, Fanta)	1	2		
	g. Sour milk or yogurt or skimmed milk, curd	1	2	|__|__|	
	h. Thin porridge (cannot pick with hands)	1	2		
	i. Tea or coffee	1	2		
	j. Vitamin syrup, cough syrup, other medicines	1	2		
	k. Oral Rehydration Salt	1	2		
	l. Any other liquid (write liquid below)	1	2		

L11: Read: Now I would like to ask you about any **foods** CHILD'S NAME had yesterday (24 hours). I am interested in whether your child had the item even if it was combined with other foods, any snacks whether at home or outside the home. Please begin when (CHILD NAME) first woke up yesterday. Did (CHILD NAME) eat anything at that time?

Interviewer instructions: This is free recall from the first food item. Please underline the food name that has been consumed, and tally after the mother has finished listing the food. If there are columns with no underlines check question L12
   a.   *Think about when (CHILD NAME) first woke up yesterday. Did (CHILD NAME) eat anything at that time?*
      ☐ *If yes: Please tell me everything (CHILD NAME) ate at that time. Underline each food*

group*Probe:* anything else? Until respondent says nothing else
☐ If no: continue to Question b).
b. What did (CHILD NAME)do after that? Did (CHILD NAME) eat anything at that time?
☐ If yes: Please tell me everything (CHILD NAME) ate at that time. Probe: Anything else? Until respondent says nothing else.
☐ Repeat Question b) above until respondent says the child went to sleep until the next day
☐ If respondent mentions mixed dishes (e.g. porridge, sauce or stew) Probe: What ingredients were in that (Mixed dish)? Probe: anything else? until respondent says nothing else.

As the respondent recalls foods, underline the corresponding food and write "1" in the column next to the food group. If the food is not listed in any of the food groups below, write the food in the box labeled 'other foods'. If foods are used in small amounts for seasoning or as a condiment, include them under the condiments food group.

When the mother has completed recalling what the child ate yesterday, review the food groups listed below. If there is a food group with no food underlined, say to the mother: 'I know you have told me everything that [NAME] ate yesterday, but just to be certain we haven't missed anything, I'd like to read you a list of foods. Please tell me if [NAME] had any of the foods I'll mention …'.

L11	Food Group	Example	Yes	No	DK
	a. CEREALS (GRAINS)	bread, rice, biscuits, or other foods made from millet, sorghum, maize, rice, wheat or grain (Injera (flat bread), Kolo (roasted cereals),	1	2	8
.	b. VITAMIN A RICH VEG &TUBERS	pumpkin, carrots, sweet potatoes, squash and other locally available vitamin-A rich vegetables that are yellow or orange inside	1	2	8
	c. WHITE TUBERS & ROOTS	White potatoes, cassava or foods made from roots	1	2	8
	d. DARK GREEN LEAFYVEG	dark green/leafy vegetables locally available vitamin-A rich leaves, for example pumpkin leaves	1	2	8
	e. OTHER VEGETABLES	other vegetables (e.g. tomatoes, cabbage, kale)	1	2	8
	f. VITAMIN A RICH FRUITS	fruits rich in vitamin A (e.g. ripe mangoes, papaya)	1	2	8
	g. OTHER FRUITS	other fruits including guava, pineapple, watermelon, melon, orange, apple, grape, banana, jackfruit or other local fruits	1	2	8
	h. ORGAN MEAT (IRON-RICH)	liver, kidney, heart or other organ meats	1	2	8
	i. FLESH MEATS	Beef, pork, lamb (mutton), goat, wild game, chicken, or other birds	1	2	8
	j. EGGS	Egg	1	2	8
	k. FISH	fresh or dried fish or shellfish	1	2	8

	l. LEGUMES, NUTS AND SEEDS	beans, peas, lentils, nuts, seeds or foods made from these	1	2	8
	m. MILK PRODUCTS	Milk (animal milk, tinned or powdered milk), cheese, yogurt or skimmed milk or other milk products	1	2	8
	n. OILS AND FATS	Oil, fats or butter or foods made with any of these	1	2	8
	o. OTHER OILS	Foods made from palm oil	1	2	8
	p.OTHER FORTIFIED FOODS	Specially fortified foods (e.g. Corn soya blend (CSB) foods fortified with micronutrient powder, plumpy'nut, other Ready-to-Use Therapeutic Foods or lipid-based nutrient supplement?	1	2	8
	r.OTHER SPICES, CONDIMENTS,	Spices (black pepper, salt), condiments (soy sauce, hot sauce) fish powderor any other local examples	1	2	8
	s. OTHER SUGARY FOODS	Cookies (cake, biscuit,), sweets, chocolates, candies, pastries	1	2	8
	t. OTHER SALTY READY-MADE SNACKS	High fat, salty, pre-packaged foods, typically eaten between meals as convenience	1	2	8
	u. OTHER (Write in)		1	2	8
	Check categories a-u		IF ALL'NO' → L12 IF AT LEAST ONE 'YES' or ALL 'DK' →L13		

NO.	QUESTION	CODING CATEGORY	RESPONSE	SKIP TO
L12	**CHECKER FOR L11, if MOTHER SAID ALL '02' = NO** Did CHILD'S NAME eat any solid, semi-solid, or soft foods yesterday during the day or night? By that I mean were any of these foods thick enough that you could have picked them up with your fingers and fed them by hand?	01= Yes *If yes repeat L11 and underline food groups in L11. Continue to L13.* 02= No 08 = Don't know		If02 or 08→ L14
L13	How many times did CHILD'S NAME eat solid, semi-solid or soft foods other than liquids yesterday during the day or night? How many times did this happen?	Write number of times 98 = Don't know	|__|__|	

L14	Did CHILD'S NAME drink anything from a bottle or nipple yesterday during the day or night?	01= Yes 02= No 08= Don't know	
L15	Yesterday, during the day or night, did CHILD'S NAME eat any iron fortified formula? *(example: locally available fortified formula)*	01= Yes 02= No 08= Don't know	
L16	Yesterday, during the day or night, did CHILD'S NAME eat any iron fortified food baby foods *(example local baby foods)*	01= Yes 02= No 08= Don't know	
L16a	At what age did you first introduce solid/semi-solid food to CHILD'S NAME?	Write age in months 98= Don't know |__|__|	

	QUESTION	CODING CATEGORY	RESPONSE	SKIP TO
L17	Have you ever seen (CHILD'S NAME) eat soil?	01= Yes 02= No		If 02→L21
L18	At what age was this behavior first observed?	Write age in months 98 = Don't Know	|__|__|	
L19	Have you ever observed this behavior in the past 30 days?	01= Yes 02= No		If 02→L21
L20	How often have you ever observed this behavior in the past 30 days?	01= Everyday 02= Once per week 03= Couple times		
L21	Have you ever seen (CHILD'S NAME) eat chicken poop?	01= Yes 02= No		If 02→ Module M
L22	At what age was this behavior first observed?	Write age in months 98 = Don't Know	|__|__|	
L23	Have you ever observed this behavior in the past 30 days?	01= Yes 02= No		If 02→ Module M
L24	How often have you observed this behavior in the past 30 days?	01= Everyday 02= Once per week 03= Couple times		

M.   Responsive Feeding

NO.	QUESTION	CODING CATEGORIES	RESPONSE	SKIP TO
M0	ENUMERATOR: VERIFY L2 Is (CHILD NAME) 6 months or older?	01= Yes 02= No		If 02→ Module N

M1	Who is the primary person responsible for feeding (CHILD NAME) the main meal?	01= Mother 02= Father 03= Grandmother 04= Aunt (Mother sister-in-law) 05= CHILD NAME'S sister/brother 06= Other (specify): _____ 08= Don't know	If 08→ Module N
M2	Most of the time do they/you do anything to encourage (CHILD NAME) to eat?	01= Yes 02= No 08= Don't know	If 02or 08→Module N
M3	What did they/you do? What did they/you say? *Probe: Did they/you say anything else?* Do not read all answers, circle all that apply	a. Offered another food or drink b. Talked/Encouraged verbally c. Praised child for eating d. Played /laughed e. Modeled eating f. Refocused the child's attention (Show cartoon, animal) g. Ordered strongly/forced child to eat h. Threatened i. Another person helps child j. Had child sitting close to me k. Let the child feed him/herself l. Let child touch the plate m. Singing, dancing, music n. Told story o. Other(specify)_____ p. Don't know	

N.   Childhood illness

Read: Think back over the last two weeks. Has (CHILD NAME) experienced any of the following symptoms?

No.	QUESTIONS AND FILTERS	RESPONSE CODES		SKIP
		Yes	No	
N1	Has (CHILD NAME)experienced <u>runny nose and cough</u> in the past two weeks?	1	2	
N2	Has (CHILD NAME) experienced <u>rapid or difficulty in breathing</u> in the past two weeks?	1	2	
N3	Has(CHILD NAME)experienced a <u>fever</u> in the past two weeks?	1	2	If 2→ N5
N4	Has(CHILD NAME)been <u>diagnosed with malaria from a health care provider</u> in the past two weeks?	1	2	
N5	In the last two weeks, has (CHILD NAME) experienced<u>threeor more loose stools</u>in a single day (within 24 hours)	1	2	
N6	Has(CHILD NAME)experienced <u>at least one stool with blood</u> in the past	1	2	

	two weeks?			
N6	Has(CHILD NAME)been <u>diagnosed with intestinal worms</u> in the past two weeks?	1	2	

O. Drinking water

Read: Great, thank you. I have some questions about your household water sources and sanitation.

NO.	QUESTIONS AND FILTERS	CODE	RESPONSE	SKIP
O1	What is the <u>primary </u>source of <u>drinking water</u> for members of your household?	01= Piped water into dwelling 02= Piped water into yard/plot 03= Public tap/standpipe 04= Tubewell/borehole 05= Protected dug well 06= Unprotected dug well 07= Protected spring 08= Unprotected spring 09= Rainwater collection 10= Bottled water 11= Cart with small tank/drum 12= Tanker truck 13= Surface water (river, dam, lake, pond, stream, canal, irrigation channels) 14= Other (specify)_____		If 01 or 02→O3
O2	How long does it take to go there, get water and come back? *Enumerator instructions: Only include time to get to water source and back. Do not include socializing or other errands*	Write number of minutes 480= 480 minutes or more (8+ hours) 988= Don't know	|__|__|__|	

O3	What is the secondary source of drinking water for members of your household?	01= Piped water into dwelling 02= Piped water into yard/plot 03= Public tap/standpipe 04= Tubewell/borehole 05= Protected dug well 06= Unprotected dug well 07= Protected spring 08= Unprotected spring 09= Rainwater collection 10=Bottled water 11= Cart with small tank/drum 12= Tanker truck 13= Surface water (river, dam, lake, pond, stream, canal, irrigation channels) 14= No secondary source 15= Other (specify)_____	If 14→O5
O4	Over the past 12 months, approximately how many months do you use your secondary water source?	01= Rarely (Less than 2 months) 02= Sometimes (2+ to 3 months of the year) 03= Often (3+ to 4 months of the year) 04= Frequently (4+ to 6 months of the year)	
O5	Who usually goes to the water source to fetch the water for your household?	01= Adult woman 02= Adult male 03= Female child (less than 15 years of age) 04= Male child (less than 15 years of age) 08 = Don't know	
O6	Do you treat your water in any way to make it safer to drink?	01= Yes 02= No 08= Don't know	If 02 or 08 → skip to O8
O7	What do you usually do to the water to make it safer to drink? Do not read, but circle all that apply	a. Boil water b. Add bleach/chlorine c. Strain it through a cloth d. Use water filter (ceramic/sand/composite/etc) e. Solar disinfection f. Let it stand and settle g. Use purifying tablets h. Other (Specify) _____ i. Don't know	
O8	Do you store water for drinking in the household?	01= Yes 02= No 08 = Don't know	If 02 or 08→Module P

O9	If Yes, what kind of containers are they, may I please see them? *(Enumerator, observe. Narrow mouthed: opening is 3 cm or less).*	01= Narrow mouthed 02= Wide mouthed 03= Both types	
O11	Who takes water from these containers? Read all answers, circle all that apply	a. Adult woman b. Adult male c. Female child (between ages 5 and 15) d. Male child (between age 5 and 15) e. Female child (less than 5 years of age) f. Male child (less than 5 years of age)	
O12	How do you remove water from the drinking water container?	01= Pouring 02= Dipping 03= Both Pouring and Dipping 04= Container has a spigot or tap 05= Other (Specify)_____ 08= Don't Know	If 01 or 04, skip to O14
O13	What do you use to remove water?	01= Same receptacle/cup used to drink from 02= Receptacle reserved for retrieving water	
O14	When were the containers cleaned last?	01= Today or Yesterday 02= Less than one week ago 03= Several Weeks ago 04= Never 05= Other (Specify)_____ 08= Don't Know/Remember	

P.   Hand washing, sanitation and disposal of child's feces

Water for other purposes, such as cooking and hand washing

NO.	QUESTIONS AND FILTERS	CODE	RESPONSE	SKIP
P1	What is the <u>primary</u> source of water used by your household for <u>other purposes, such as cooking and hand washing</u>?	01= Piped water into dwelling 02= Piped water into yard/plot 03= Public tap/standpipe 04= Tubewell/borehole 05= Protected dug well 06= Unprotected dug well 07= Protected spring 08= Unprotected spring 09= Rainwater collection 10=Cart with small tank/drum 11= Tanker truck 12= Surface water (river, dam, lake,		If 01 or 02 →P3

		pond, stream, canal, irrigation channels) 13= Other (specify)_____	
P2	How long does it take to go there, get water and come back?	Write number of minutes 480= 480 minutes or more (8+ hours) 988= Don't know |__|__|__|	
P3	What is the <u>secondary</u> source of water used by your household for <u>other purposes, such as cooking and hand washing</u>?	01= Piped water into dwelling 02= Piped water into yard/plot 03= Public tap/standpipe 04= Tubewell/borehole 05= Protected dug well 06= Unprotected dug well 07= Protected spring 08= Unprotected spring 09= Rainwater collection 10=Cart with small tank/drum 11= Tanker truck 12= Surface water (river, dam, lake, pond, stream, canal, irrigation channels) 13= No secondary source 14= Other (specify)_____	If 13→P5
P4	Over the past 12 months, approximately how many months do you use your secondary water source for cooking and hand washing?	01= Rarely (Less than 2 months) 02= Sometimes (2+ to 3 months of the year) 03= Often (3+ to 4 months of the year) 04= Frequently (4+ to 6 months of the year)	

<u>Hand Washing</u>

NO.	QUESTIONS AND FILTERS	CODE RESPONSE	SKIP
P5	When do you usually wash your hands? *(Do not read responses. Allow respondent to answer first, and then ask how often by probing, with never, always or sometimes. If respondent does not mention an activity, such as "before eating", circle 01 for Never.)*		
	a. before eating	01= Never 02= Always 03= Sometimes	
	b. before preparing food	01= Never 02= Always	

NO.	QUESTIONS AND FILTERS	CODE RESPONSE	SKIP
		03= Sometimes	
	c. Before feeding the child	01= Never 02= Always 03= Sometimes	
	d. after toilet use	01= Never 02= Always 03= Sometimes	
	e. after changing a baby	01= Never 02= Always 03= Sometimes	
	f. Other	01= Never 02= Always 03= Sometimes	

Observation section:

Read: I'd like you to please show me where you store your drinking water, and also where you most often wash your hands.

NO.	QUESTIONS AND FILTERS	CODE/RESPONSE	SKIP TO
P6	Can you please show me where you store your drinking water? *Observe: Are the containers covered?*	01= All are covered 02= Some are covered 03= None are covered 04= No permission to see	
P7	Thanks, can you show me where you most often wash your hands? *(Ask to see and observe. Record only one hand washing place. This is the hand washing place that is used most often by the respondent or household.)*	01 =Inside/within 10 paces of the toilet facility 02= Inside/within 10 paces of the kitchen/cooking place 03= Elsewhere in home or yard 04= Outside yard 05= No specific place 06= No permission to see	If 6→ P12
P8	***OBSERVE:*** *Is water present at the specific place for hand washing?* *Enumerator: If there is a tap or pump present at the specific place for hand washing, open the tap or operate the pump to see if water is coming out. If there is a bucket, basin, or other type of water container, examine it to see whether water is present in the container. Record observation.*	01= Yes (Water is available) 02= No (Water is not available)	

P9	*OBSERVE: Is soap or detergent present at the specific place for hand washing?* *Enumerator: record observation. Circle all that apply.*	a. Bar soap b. Detergent (powder/liquid/paste) c. Liquid soap (including shampoo) d. None	If 'a, b, c' for P9 <u>and</u> 'a, b, c' P10 → P12
P10	*OBSERVE: Is locally sourced cleansing agent present at the specific place for hand washing?* *Enumerator: Record observation. Circle all that apply.*	a. Ash b. Mud/sand c. None d. Other (specify)_____	
P11	Do you have soap/local sourced cleansing agent in your house?	01= Yes 02= No 08= Don't know; N/A	If 02 or 08 →P12
P11a	Can I please see your soap/locally sourced cleansing agent? *Circle all that apply.*	a. Soap present b. Ash present c. None available	

P12	What kind of toilet facility do members of your household <u>usually</u> use?	01 = Flush/pour flush to piped sewer system 02= Flush/pour flush to septic tank 03= Flush/pour flush to pit latrine 04= Flush/pour flush to elsewhere 05= Flush/pour flush unknown place/not sure DK where 06= Ventilated improved pit latrine (VIP) 07= Pit latrine with slab 08= Pit latrine without slab/open pit 09= Composting toilet 10= Bucket 11= Hanging toilet/hanging latrine 12= No facilities/bush/field 13= Other (specify) _____	If 12 →P15
P13	Do you share this facility with other households?	01= Yes 02= No	if 2=No → P15
P14	How many households use this facility?	Write number of households 98 = Don't know	|__|__|
P14a	Whose household members of your immediate	a. Male adults	

	family use this toilet? Do not read, circle all that apply.	b. Female adults c. Male children d. Female children e. Others		
P15	The last time (child name) passed stool, where did he/she defecate?	01= Used potty 02= Used washable diaper 03= Used disposable diaper 04= Went in his/her clothes 05= Went in house 06= Went outside of house/yard 07= Used latrine 08 =Don't know		If 07= →Module Q
P16	The last time (child name) passed stool, what was done to dispose of the stools?	01= Dropped into toilet facility/latrine 02= Buried 03= Put into container for trash 04= In yard 05= In sink or tub 06= Thrown into waterway 07= Washed or rinsed away 08= Don't know		If 1-6, →P18
P17	If "washed or rinsed away", probe where the waste water was disposed?	01= Dropped into toilet facility 02= Put into container for trash 03= In yard 04= Outside of yard 05= Into sink or tub 06= Thrown into waterway 08= Don't know		
P18	What sanitary item do you <u>usually</u> use when you are menstruating? <u>Do not</u> read answers	01 = Nothing (not menstruating) 02 = Old cloth 03 = Reusable pads 04 = Disposable pads 05= Tampons 06= Other (specify) _____ 08= Don't know		

Q.   Women's Empowerment

Mobility

Read: Now I would like to ask you about going places. Please tell me whether you can to go to the following places on your own, only if someone accompanies you, or not at all?

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
Q1	Can you go to the <u>market to buy or sell things,</u> on your own, only if someone accompanies you, or not at all?	01= Not at all 02= If someone accompanies me 03= On my own	
Q2	Can you go <u>fetch water</u>?	01= Not at all 02= If someone accompanies me 03= On my own	
Q3	Can you go to <u>training courses, including adult literacy classes</u>?	01= Not at all 02= If someone accompanies me 03= On my own	
Q4	Can you go to the <u>health facility</u> (when you are sick)?	01= Not at all 02= If someone accompanies me 03= On my own	
Q5	Can you go to a <u>community meeting</u>?	01= Not at all 02= If someone accompanies me 03= On my own	
Q6	Can you go to <u>homes of close-by</u> friends on your own, only if someone accompanies you, or not at all?	01= Not at all 02= If someone accompanies me 03= On my own	
Q7	Can you go to <u>outside the village</u>?	01= Not at all 02= If someone accompanies me 03= On my own	
Q8	Can you go to <u>church or mosque</u>?	01= Not at all 02= If someone accompanies me 03= On my own	

Community Social Capital

Read: I would now like to ask you some questions about your community. For each of the following statements do you: STRONGLY DISAGREE, DISAGREE, ARE UNDECIDED, AGREE, OR STRONGLY AGREE?

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
Q9	You can rely on people in your community to help you if you have difficulty breastfeeding your baby.	01= Strongly disagree 02= Disagree 03= Neither agree or disagree 04= Agree 05= Strongly agree	
Q10	You can rely on people in your community to help you if you can't provide your child with enough healthy food.	01= Strongly disagree 02= Disagree 03= Neither agree or disagree 04= Agree 05= Strongly agree	
Q11	You can rely on people in your community to help take care of your children/household if you need to go to health facility/institution.	01= Strongly disagree 02= Disagree 03= Neither agree or disagree 04= Agree 05= Strongly agree	
Q12	You can rely on people in your community to help deal with a violent or difficult family member.	01= Strongly disagree 02= Disagree 03= Neither agree or disagree 04= Agree 05= Strongly agree	
Q13	You can rely on people in your community to help take care of your children/household if you need to go outside the home to work.	01= Strongly disagree 02= Disagree 03= Neither agree or disagree 04= Agree 05= Strongly agree	

Household Decision-making

Read: Now, I would now like to ask you about who usually makes decisions in your household.

NO.	QUESTIONS AND FILTERS	RESPONSE CODES	SKIP TO
Q14	In your household who usually makes decisions about own <u>health care?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06=Other (specify)_____	
Q15	In your household who usually makes decisions about <u>your child's health?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06=Other (specify)_____	
Q16	In your household who usually makes decisions about <u>large household purchases</u>? *Probe: (give local examples of large purchases)*	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06=Other (specify)_____	
Q17	In your household who usually makes decisions about <u>household purchases for daily needs</u>?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06=Other (specify)_____	
Q18	In your household who usually decides <u>when you visit family/relatives or friends?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06=Other (specify)_____	
Q19	In your household who usually decides <u>when your whole household will visit family/relatives/friends</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06=Other (specify)_____	
Q20	In your household who usually decides <u>how to use money that *you*bring into the household?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father	

		06=Other (specify)_____	
Q21	In your household who usually decides how to use the <u>money *your husband*</u> brings into the household?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	
Q22	In your household who usually decides when your family will sell a <u>large asset</u> (like a cow, sheep, goat)?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	
Q23	In your household who usually decides when your family will sell a <u>small asset</u> (like a chicken)?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	
Q24	In your household, who usually decides <u>whether you can work to earn money?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	

Read: The next two questions ask about the relationship with your husband/spouse.

Q25	In your household, who usually decides <u>when you and your husband have sex?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____ 07= No husband/spouse	If 7→Skip to Q27
Q26	In your household, who usually decides <u>whether you and your husband use family planning?</u>	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	

Q27	In your household, who usually decides whether to give the baby something other than breast milk during the first 3 days after birth?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	
Q28	In your household, who usually decides when to first introduce soft or solid food to your child?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	
Q29	If there is not enough food in the household, who decides how food is shared among family members?	01= You (respondent) 02= Your husband 03= Both you and your husband 04= Mother/Father In-law 05= Mother/Father 06= Other (specify)_____	

Gender Attitude and Belief: Tolerance of Intimate Partner Violence

Read: Sometimes a husband is angry with his wife. In your opinion, is a husband justified in hitting his wife in the following situations

No.	QUESTIONS AND FILTERS	RESPONSE CODES		SKIP
		Yes	No	
Q30	Is he justified in hitting his wife, if she goes out without telling him?	1	2	
Q31	Is he justified in hitting his wife, if she neglects their children?	1	2	
Q32	Is he justified in hitting his wife, if she argues with him?	1	2	
Q33	Is he justified in hitting his wife, if she refuses to have sex with him?	1	2	
Q34	Is he justified in hitting his wife, if she did not cook the food properly?	1	2	

R. Community group and Government safety net participation

NO.	QUESTION	RESPONSE CODES			SKIP TO
		YES, there is program but NOT participa	NO program or don't know	YES there is program AND active	

		nt		participa nt	
R1	Are any …. active community programs in your village?				
a	Agriculture (example: local program name)	1	2	3	
b	WASH (example: local program name)	1	2	3	
c	Nutrition (example: local program name)	1	2	3	
d	Maternal Health (example: local program name)	1	2	3	
e	Child Health (example: local program name)	1	2	3	
f	Education (example: local program name)	1	2	3	
g	Economic Development [*Equb* (local saving)]	1	2	3	
h	Women's Empowerment (example: local program name)	1	2	3	
i	Climate Change (example: local program name)	1	2	3	
j	Other ((example: local program name) Idir	1	2	3	

		RESPONSE CODES			SKIP TO
NO.	QUESTION	YES, there is group but NOT member	NO group don't know	YES there is group AND active member	
R2	Are any …. active community groups in your village?				
a	Agriculture [community water shade development association, community irrigation users' association, community seed multiplication cooperative, Irrigation administration committee (Simada), farmer innovation group (Ebinat), community research group (Ebinat), Kebele PSNP committee]	1	2	3	
b	WASH [Kebele water asset administration committee, village level water users committee (for maintenance, labor cost and money contribution), WASHCO (water and sanitation committee)]	1	2	3	
c	Nutrition [mothers support group (Simada), women self help saving group for seed purchase and fruit and vegetable production (Simada), development army (1-5)]	1	2	3	
d	Maternal Health [development army (1-5)]	1	2	3	
e	Child Health [development army (1-5)]	1	2	3	
f	Education [Kebele education and training board, parent-teacher integrity, school clubs, village development army]	1	2	3	
g	Economic Development [*Equb* (local saving), rural saving and credit cooperative (RUSACCO) at	1	2	3	

	village level, women self help saving groups, youth self help saving groups, women IGA groups, youth IGA groups, development army (Kebele and village), animal fattening cooperative (Ebinat), bee product market cooperative (Ebinat), essence and gum producing cooperative (Ebinat)]				
h	Women's Empowerment [village level women self help saving groups, village level youth self help saving groups, females IGA groups, youth IGA groups, women development team (1- 5), youth development team (1- 5), women, youth and community forum, women, youth and parents forum (both forum work to create enabling environment for women and youth economic empowerment), gender based community conversation group at village level (Tach Gaynt)]	1	2	3	
i	Climate Change [village level natural resource conservation committee, Kebele development team (1-5 at village), energy-saving stove production association (Woreda level), landless youth association (engaged on mountain forestry – Simada), Kebele level energy-saving stove production association (to be established – Ebinat and Simada)]	1	2	3	
j	Other ((example: local program name)	1	2	3	

		RESPONSE CODES			SKIP TO
NO.	QUESTION	YES, there is program but NOT participant	NO group or don't know	YES there is program AND active participant	
R3	**Are any …. government programs (social safety net) in your village?**				
a	Agriculture [water shade development, small scale irrigation, seed multiplication, innovation and research (Ebinat), PSNP]	1	2	3	
b	WASH [Kebele and village WASH]	1	2	3	
c	Nutrition [health extension program, fruits and vegetable production, development army]	1	2	3	
d	Maternal Health [health extension program and development army]	1	2	3	
e	Child Health [health extension program and development army]	1	2	3	

f	Education [village development army]	1	2	3
g	Economic Development [rural saving and credit, self help and IGAs, development army (Kebele and village)]	1	2	3
h	Women's Empowerment [village self help and IGA, women development team (1- 5), youth development team (1- 5) and gender based community conversation group at village level (Tach Gaynt)]	1	2	3
i	Climate Change [natural resource conservation, development team (1-5 at village), energy-saving stove production (Woreda level), forestry, energy-saving stove production (planned – Ebinat and Simada)]	1	2	3
j	Other (example: local program name)	1	2	3

NO.	QUESTION	RESPONSE CODES	
		Yes	No
R4	Please tell me whether, in the last 12 months you or other members of your household has received any of the following inputs or direct assistance? *Instructions: Read all options*		
a	Food for work	1	2
b	School feeding program	1	2
c	Plot or land for household consumption	1	2
d	Seeds	1	2
e	Ag tools/implements	1	2
f	Livestock	1	2
g	Poultry	1	2
h	Fisheries	1	2
i	Vehicle	1	2
j	Sewing machine	1	2
k	Latrine (new or renovated)	1	2
l	Water pump (new or renovated for irrigation)	1	2
m	Agricultural inputs (fertilizers or seedling)	1	2
o	Other (Specify)	1	2

Record <u>time</u> the interview ended in 24 hour format	HOUR	|__|__|
	MINUTES	|__|__|

> **READ: Thank you for your time and participation. This concludes the household survey part. Next, we will take the height, weight and arm measurements of your and child under three.**

S. Mother's Anthropometry (Part I)

Read: Now I would like to take your height and weight measurements.

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	RESPONSE	SKIP TO
	MEASUREMENTS FOR MOTHER			
S1	Mother's Age	Copy from Page 5 C1	|__|__|	
S2	Pregnancy status	01=Pregnant 02= Not pregnant *but* lactating 03= Not Pregnant and *not* lactating		If 01 → S5
S3	Mother's height in centimeters	Write in measurement (centimeters) 988.8 = Don't know	|__|__|__|.|__| cm	
S4	Weight of Mother	Write in measurement (kilograms) 988.8 = Don't know	|__|__|__|.|__| kg	
S5	MUAC Measurement	Write in measurement (centimeters) 98.8 = Don't know	|__|__|.|__| cm	

Z. Child's Anthropometry (Part I)

Read: Now I would now like to take length and weight of child's name.

NO.	QUESTIONS	CODING CATEGORIES	RESPONSE	SKIP TO
Z1a.	Child's Date of Birth	Copy from Module B 98 98 98 = don't know	|__|__| |__|__| 20|__|__| dd mm yy	
Z2	Childs age in Months	Copy from Module B Write age in <u>completed</u> months 00= Less than 30 days 98= Don't know	|__|__| months	
Z3	What is the sex of (child's name)? Copy from Module B	01= Male 02= Female		
Z4	What is the weight of child	Write in kilograms 98.8= Don't Know	|__|__|.|__| kg	

Z5a.	What is the length/height of the child?	Write in centimeters 988.8= Don't know	|__|__|__|.|__|cm	
Z5b.	Was the height or length of child taken	01= Height 02= Length 08= Don't know		
Z6	Is bilateral oedema present in the child?	01= Yes 02= No		

If child is less than 24 months of age, anemia eligible, read the following:
Thank you for your participation. In addition, as part of this survey, we are asking people to take an anemia test. Anemia is a serious health problem that usually results from poor nutrition, infection or chronic disease. This survey will assist the program to develop programs to prevent and treat anemia. We would like to invite a health professional to stop by your house and administer anemia test for both you and your child. Is this OK with you?

If the child is older than 24 months of age:
Thank you for your participation.

S. Mother's Anemia (Hemoglobin) Part II

Household ID	|__|__|__|__|__|__|__|__|__|__|__|

Consent for Anemia.

As part of this survey, we are asking people to take an anemia test. Anemia is a serious health problem that usually results from poor nutrition, infection or chronic disease. This survey will assist the program to develop programs to prevent and treat anemia.

We ask that all women born between 1964 and 1998 take part in anemia testing and give a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test.

The blood will be tested for anemia immediately. The result will be kept strictly confidential [no names will be taken] and will not be shared with anyone other than members of our survey team.

You can say yes to the test or you can say no. It's up to you to decide. Do you have any questions?

			Anemia tester (blood sample collector) sign name	
S6	Do you agree to participate in the anemia test?	01=Granted 02= Refused	_____ __	If 02→ Module Z
S7	Mother's Hemoglobin (Fingerprick sample)	Write in response 98.8 = Machine Error	|__|__|.|__| g/dL	

Z. Child's Anemia (Hemoglobin) Part II

Household ID	|__|__|__|__|__|__|__|__|__|__|__|

Consent for Anemia (READ)
As part of this survey, we are asking people to take an anemia test. Anemia is a serious health problem that usually results from poor nutrition, infection or chronic disease. This survey will assist the program to develop programs to prevent and treat anemia.
We ask that all children born between January 2012 to present take part in anemia testing and give a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test.
The blood will be tested for anemia immediately. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team.
You can say yes to the test or you can say no. It's up to you to decide. Do you have any questions?

NO.	QUESTIONS	CODING CATEGORIES	RESPONSE	SKIP TO
Z7	Will you allow (CHILD NAME) to participate in the anemia test?	01=Granted 02= Refused	Enumerator sign name _____	If 02→Z9
Z8	Hemoglobin (Fingerprick sample)	Record reading 98.8= DK/Test error	|__|__|.|__| g/dL	
Z9	DO NOT READ: Write down which measurement was taken of child Result of Measurements Circle one option	01=Measured weight only 02= Measured height only 03= Measured anemia only 04= Measured weight and height only 05= Measured weight and anemia only 06= Measured height and anemia only 07= Measured weight, height and anemia 08= Child not present 09=Refused 10=Other(Specify)_____		