Using different lenses to explore the association between an agriculture nutrition intervention and symptoms of infectious diseases among children living in rural Ghana

Elahe Karimi Shahrbabak

School of Human Nutrition

McGill University, Montréal

April 2020

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science in Human Nutrition.

Abstract

The Sustainable Development Goal #3 calls for a reduction in child mortality caused by preventable diseases to < 25 per 1000 live births. Nutrition-sensitive agriculture interventions may contribute to this goal. This mixed-methods study examined the predictors and local perceptions of childhood diseases and evaluated the association between participation in a nutrition-sensitive agriculture intervention *Nutrition Links* [NL], a cluster randomized, controlled trial and illness symptoms among infants and young children living in Upper Manya Krobo District (UMKD), Ghana.

The study followed a sequential strategy. First, a secondary data analysis of NL district-wide data identified predictors of diarrhea and respiratory illness symptoms (RIS) among children <1 y old living in UMKD. The results were used to develop themes for the second phase, a qualitative data collection. Through in-depth interviews and focus group discussions, data were gathered from community members and UMKD institutional staff on beliefs about childhood illnesses, including the influence of diet. In a final phase, quantitative analyses (bivariate and binary logistic regression with clustered standard errors) served to examine associations between NL participation and diarrhea and RIS in children <5 y of age living in households that participated in the NL trial.

Data from the district-wide NL survey demonstrated a high prevalence of diarrhea (28.3%) and RIS (24.0% cough, 19.7% fever, and 13.5% cough with difficulty breathing) among infants. Child, caregiver, and household indicators associated with symptoms were integrated into the next research phase. The interviewed health staff and residents both recognized the improvement in community members' knowledge about nutrition and hygiene which supported child health. However, the two groups expressed different concerns about the barriers that residents faced in implementing their new knowledge.

Members of NL intervention communities were not as worried as those in control communities about food insecurity; the intervention households found solutions to improve children's diet, like replacing inaccessible foods with local foods promoted by NL (eggs and home garden vegetables). The NL intervention was not associated with diarrhea and RIS outcomes (fever, cough, fever & cough) among the children. However, higher maternal depression scores were associated with a 7-14% higher odds of all RIS indicators; the odds ratio for diarrhea was similar and approached significance (p=0.07). The odds of having fever & cough were higher when the maternal diet was not diverse (AOR=0.48; 95% CI:0.28, 0.82); diarrhea showed similar results (p=0.07). Children who experienced fever at baseline were twice as likely to have these symptoms at endline. The odds of having fever or fever & cough was lower with higher child hemoglobin levels. Future interventions in rural communities may help reduce childhood infectious diseases by improving communication between institutional staff and community members and addressing nutrition as well as mental health concerns.

Résumé

Le troisième objectif de développement durable vise une réduction de la mortalité infantile due à des maladies évitables à un taux de moins de 25 par 1000 naissances vivantes. Les interventions agricoles sensibles à la nutrition pourraient contribuer à cet objectif. La présente étude à méthodologie mixte a examiné des indicateurs et perceptions locales concernant les maladies infantiles et a évalué l'association entre la participation dans une intervention agricole sensible à la nutrition (Nutrition Links) [NL], un essai aléatoire et contrôlé par groupe et des symptômes de maladie, parmi les enfants vivant dans l'Upper Manya Krobo District (UMKD), au Ghana.

L'étude a suivi une stratégie séquentielle. Premièrement, une analyse de données secondaires provenant des districts de NL a identifié des indicateurs de diarrhée et de symptômes de maladies respiratoires parmi les enfants de moins de 1 an vivant dans l'UMKD. Les résultats ont été utilisés dans le développement de thèmes pour la seconde phase, une collecte de données qualitative. À l'aide d'entrevues en profondeur et de groupes de discussion, des données provenant des membres de la communauté et du personnel institutionnel de l'UMKD ont été amassées à propos des croyances sur les maladies infantiles, incluant l'influence de la nutrition. Dans la phase finale, des analyses quantitatives (bivariées et régression logistique avec erreurs types agrégées) ont permis d'examiner l'association entre la participation dans NL et la présence de diarrhée et de symptômes de maladies respiratoires chez les enfants de moins de 5 ans vivant dans des ménages participants dans le projet NL.

Les données provenant de questionnaires NL pour le district entier ont démontré une haute prévalence de diarrhée (28.3%) et de symptômes de maladies respiratoires (24.0% toux, 19.7% fièvre, et 13.5% toux avec difficulté respiratoire) parmi les enfants. Les

indicateurs relatifs aux enfants, parents et ménages associés aux symptômes ont été intégrés dans la phase de recherche suivante. Le personnel de santé ainsi que les résidents interviewés ont reconnu une amélioration des connaissances des membres de la communauté concernant la nutrition et l'hygiène soutenant la santé des enfants. Cependant, les deux groupes ont exprimé différentes préoccupations quant aux obstacles auxquels les résidents font face lorsqu'ils doivent utiliser leurs nouvelles connaissances. Les membres des communautés interventionnelles de NL n'étaient pas aussi préoccupés par l'insécurité alimentaire comparé à leurs homologues dans les communautés témoins ; les ménages interventionnels trouvaient des solutions afin d'améliorer l'alimentation de leurs enfants tel qu'en remplaçant des aliments inaccessibles par des produits locaux promus par NL (œufs et légumes de jardin). L'intervention NL n'était pas associée avec la présence de diarrhée ou de symptômes de maladies respiratoires (fièvre, toux, fièvre et toux) parmi les enfants. Toutefois, de plus hauts scores de dépression maternel ont été associés à une augmentation de 7-14% de probabilité pour tous les indicateurs de symptômes de maladies respiratoires ; les rapports de cote pour la diarrhée étaient similaires et près de la signification statistique (p=0.07). La probabilité d'avoir une fièvre ou une toux augmentait lorsque l'alimentation maternelle n'était pas diversifiée (AOR=0.48; 95% CI :0.28, 0.82); les symptômes de diarrhée ont aussi démontré des résultats comparables (p=0.07). Pour les enfants ayant éprouvé de la fièvre à l'étude de base, il était deux fois plus probable qu'ils éprouvent ces symptômes à l'étude finale. La probabilité qu'un enfant ait de la fièvre ou une fièvre et une toux était plus basse lorsque l'enfant avait un plus haut taux d'hémoglobine. Les interventions ultérieures prenant place dans des communautés rurales peuvent aider à réduire les maladies infectieuses infantiles en améliorant la communication entre le personnel institutionnel et les

membres de la communauté et en adressant les préoccupations nutritionnelles et les problèmes de santé mentale.

Author's contributions

Elahe Karimi Sharbabak (E.K) is the primary author of this thesis and was involved in most aspects of the study. Data used for analysis on Phase 1 and 2 were from Nutrition Links project and Professor Grace Marquis was the principal investigator. E.K was responsible for cleaning and analyzing the data. E.K. designed and accomplished all of the steps of this study under supervision, guidance and support of Professor Grace Marquis. Mona Z. Ghadirian supervised the field works and trained the field staffs. E.K collected the second phase of this study with the help of a research assistant and did all the data analysis with input of Prof. Marquis and her lab research assistants. Dr. Charles Palmer Larson guided and shared his input in many aspects of this study.

Acknowledgements

I am using this opportunity to express my gratitude and love to everyone who supported me to accomplish and write this thesis. I am thankful for Dr. Marquis's inspiring guidance, invaluably constructive criticism and her support which kept me sane in these 4 years with all of my ups and downs. I appreciate all of Dr. Larson's input and support in carrying out my Master's project. This study would not has been accomplished without the generous guidance and moral support of Dr. Marquis's research Lab members: Myriam, Diana, Mona,Yvonne, Aishat, Revathi, Zihan, Priscilla, and Husein; Ghana field staff: Stephen, Joanna, Gloria, Felix, Mary, Esther, Grace, Regina, and Patience; Funders of the project: Global Affairs Canada, McGill University, University of Ghana, Heifer International, and World Vision.

And finally, I want to thank my family and friends for all their love, support, for trusting me and believing in my capacity and making my heart warm.

Abbreviations

DHS: Demographic and Health Survey

AOR: Adjusted Odds Ratio

ARR: Adjusted Relative Risk

CHPS: Community based Health Planning and Service

CI: Confidence Interval

CM: Community Member

CMC: Community Member of Control arm

CMI: Community Member of intervention arm

CMM: Community Member Mother of intervention arm

CMMC: Community Member Mother of Control arm

DDS: Dietary Diversity Score

FAO: Food and Agriculture Organization

FGD: Focus Group Discussions

GAPPD: Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea

HAZ: Height-for-age Z-score

HDDS: Household Dietary Diversity Score

HIV: Human Immunodeficiency Virus

HR: Hazard Ratio

HS: Health Staff

IDI: In-Depth Interviews

LAZ: Length-for-age Z-score

MDD: Minimum Dietary Diversity

MDG: Millennium Development Goals

NL: Nutrition Links

OR: Odds Ratio

RI: Respiratory Infections

RIS: Respiratory Infectious Symptoms

RR: Relative Risk

SRQ: Self-Reporting Questionnaire

UMKD: Upper Manya Krobo District

UNICEF: United Nations Children's Fund

WAZ: Weight-for-age Z-score

WDDS: Women's Diet Diversity Score

WHO: World Health Organization

WHZ: Weight-for-height Z-score

Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction

Globally, in 2018 5.3 million children under five years of age died; most of these deaths happening in low-income countries due to infectious diseases (United Nation Inter-Agency Group. 2019). Pneumonia and diarrhea were jointly responsible for 23% of these deaths. Given that these two illnesses have similar determinants, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) developed the integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) (Figure 1) (WHO/UNICEF, 2013). This plan addressed the need for community-based action research on knowledge, perceptions, and practices related to these illnesses. The GAPPD also called for an increase in research capacity of low-resource countries to carry out integrated interventions and programs to meet the Sustainable Development Goal 3.2 which aims to reduce the under-five mortality rate to less than 25 per 1000 live births (United Nations, 2016).

The Millennium Development Goals (MDG) targeted the reduction of child mortality by two-thirds by the year 2015, a target that was not achieved at the global level (United Nations, 2015). Although Ghana achieved a number of the MDG, including increasing access to safe drinking water and reducing extreme poverty by half, the goals for under-five child mortality and promoting sanitation have yet to be accomplished (United Nations Ghana, 2015). Key challenges that contributed to not meeting the MDG included socioeconomic and cultural factors at the individual and institutional levels, such as low levels of female literacy and empowerment, insufficient resources for health, inadequate

health data, and health systems with personnel of low skills and motivation. Following different and flexible approaches in developing programs is needed in Ghana where the rate of child mortality and its causes differ across the regions.

The overall aim of this thesis is to examine social, cultural, and environmental risk factors and the role that integrated interventions have in addressing child illnesses in rural Ghana.

Quantitative Research Questions:

What is the association between an agriculture-nutrition education intervention and

- Diarrhea in children under five years old in UMKD?
- Respiratory infections in children under five years old in UMKD?

Quantitative hypothesis:

(1.1) The null hypothesis is there is no significant association between an agriculture-nutrition education intervention and diarrhea

(1.2) The alternative hypothesis is there is a significant association between an agriculture-nutrition education intervention and diarrhea

(2.1) The null hypothesis is there is no significant association between an agriculture-nutrition education intervention and symptoms of RI

(2.2) The alternative hypothesis is there is there is significant association between an agriculture-nutrition education intervention and symptoms of RI

Qualitative objective:

Explore the beliefs of the health personnel, community opinion leaders, community members, and caregivers in relation to the prevention of diarrhea and respiratory infections among children under five years in Upper Manya Krobo District.

Qualitative Research Questions:

What are the beliefs of community members (opinion leaders and caregivers) and health staff about the role of nutrition as it relates to

- Prevention of diarrhea in children under five years old in UMKD?
- Prevention of symptoms of RI of children under five years old in UMKD?

Chapter 2. Literature Review

Risk Factors for Diarrhea and Respiratory Infections

There are some shared risk factors that the WHO identified for causes of death related to diarrhea and respiratory infectious diseases among young children, including malnutrition and absence of breastfeeding (World Health Organization, 2019) (Table 2.1). Other determinants associated with diarrhea include poor hygiene and contaminated drinking water and food while low birth weight and crowded living conditions are associated with respiratory infections (RI). Beyond these determinants, there is some evidence that other socioeconomic and environmental factors play a role in the incidence of these diseases in children.

Hatt and Waters (2006) classified determinants into three levels (proximate, intermediate, and distal). Factors in the social context, like socioeconomic status, education, cultural norms, and government policies may influence child morbidity as distal factors. Sometimes behavior is a linkage between distal and proximal factors. For instance, cultural norms may influence practicing breastfeeding, which can influence children's nutrient intake and susceptibility to infections. Higher education may influence behavior like handwashing after using the toilets, which can reduce children's exposure to waterborne contaminants. Maternal mental health is also considered as an influential determinative factor that needs to be considered (Okronipa *et al.,* 2012) as shown in the framework below (Figure 2).

Nutritional status

Moderate underweight, wasting, and stunting are defined as < -2 z-scores for weight-for-age (WAZ), weight-for-height (WHZ), and height-for-age (HAZ), respectively, based on WHO standards (WHO, 2006). For children under 24 months of age, length is used instead of height. Anthropometric deficits tend to occur together in low-income countries due to the coexistence of poverty, inadequate nutrient intakes, and diseases (McDonald *et al.,* 2013; Nandy *et al.,* 2005). Using multiple anthropometric indicators to assess nutritional status may provide a more accurate picture of child mortality risk in a given area. The risk of all-cause mortality among young children rose by nearly five times with the co-occurrence of deficiency in all three anthropometric indicators when compared to children who were not underweight wasted, or stunted (Hazard Ratio (HR) = 4.69 CI: 3.10, 7.09) in a meta-analysis study from ten pooled cohorts in low- and middle-income countries (McDonald *et al.,* 2013).

Nutritional Status and Respiratory Infection

Malnutrition is strongly and consistently associated with RI morbidity and mortality. In a pooled analysis of 10 published studies, mild anthropometric deficits for all three indicators (i.e., -2-≤ Z ≤ -1 for weight-for-age (WAZ), weight-for-height (WHZ), and height-for-age (HAZ)) were associated with an increased children's risk of RI mortality by over 50% (HR = 1.55; 95% CI:1.02, 2.37) (Olofin *et al.,* 2013). Furthermore, another study showed that stunting was associated with increased risk of failure of RI (pneumonia) treatment (adjusted RR = 1.28; 95% CI: 1.10, 1.48) (Moschovis *et al.,* 2015). A study in The Gambia revealed that the odds of having severe pneumonia increased proportionally with the severity of a child's wasting (OR = 2.3 [95% CI: 1.7, 3.1] for -1 > WHZ > -3 and OR = 8.7 [95% CI: 4.2, 17.8] for < -3 WHZ) compared to a

child with no severe pneumonia (Howie *et al.,* 2016). Moreover, the risk of severe pneumonia also was associated with severe stunting (HAZ < −3).

Nutritional Status and Diarrhea

Many studies have found an association between diarrhea and anthropometric indicators although the direction of causal relationship is often not clear because of study designs and potential confounders (Brown, 2003). In addition, nutritional status may be relevant for some etiologies of diarrhea but not others, as shown with underweight in a study from Bangladesh (Mondal *et al.,* 2009). In a multicenter study of 137 countries defined by the Global Burden of Disease Study as developing, diarrhea was a leading risk factor for stunting (Danaei *et al.,* 2016). The odds ratio for stunting increased per one additional episode of diarrhea per year (OR=1.025; 95% CI: 1.01, 1.04).

Dietary Diversity

Dietary diversity is collected with questionnaires at both the household and individual level. The use of a dietary diversity score (DDS) provides the researcher with an easy tool to assess dietary intake; an assessment at the individual level is typically used for women and young children. The Household Dietary Diversity Score (HDDS) was developed as an indicator of dietary energy more than nutrient adequacy and reflects families' access to foods and other dimensions of household food security (Kennedy *et al.,* 2011). The Women's Diet Diversity Score (WDDS) aimed to reflect the diet quality by focusing on micronutrient sufficiency. The HDDS included more food groups than the WDDS; condiments, foods containing sugar, sugary foods, and beverages were included in the former but not in the latter. The WDDS has been replaced with a newer indicator of diet, the Minimum Dietary Diversity-Women MDD-W which introduced cut-off points for dietary quality assessment (FAO and FHI 360, 2016). The minimum dietary diversity

(MDD) indicator for infants and young children was one of WHO's indicators to assess IYC practices. The recommendation for minimum dietary diversity is reached when the child consumes four out of the following seven food groups: (1) grains, roots and tubers, (2) legumes and nuts, (3) dairy products (milk, yogurt, cheese), (4) flesh foods (meat, fish, poultry, and organ meats), (5) eggs, (6) vitamin-A rich fruits and vegetables, and (7) other fruits and vegetables (Kennedy *et al.,* 2011). This recommendation is considered to represent an adequate micronutrient density of foods in 6-23 months old children. However, providing such a recommendation presented many challenges. Although analyses of sensitivity and specificity failed to validate universal cut-off points for dietary diversity score among children, the ≥ 4 food groups cut-off point had the highest sensitivity and the best sensitivity/specificity ratio. (Working Group on Infant and Young Child Feeding Indicators, 2006). A study in Mali indicated that dietary diversity represented nutrition adequacy (correlation coefficient = 0.39, $p < 0.001$); however, it did not show a good assessment of nutrient intake (Hatløy *et al.,* 1998).

Dietary Diversity and Infectious Diseases

Poor quality diet contributes to malnutrition which has been established above as a risk factor for both diarrhea and respiratory infections in children (Rodríguez *et al.,*2011). Dietary diversity is an indicator of dietary quality (World Health Organization, 2008). A 2013 Cambodian study used 24-hour dietary recalls using a 16 item food frequency questionnaire to look at the association between stunting and dietary diversity measured by the food variety score of nine food groups based on WHO's Infant and young child feeding (IYCF) model: (i) staple foods group includes bread, rice, noodles, or other grains like white potato (yam), manioc, cassava, or other tuber like commercial baby cereal, and porridge; (ii) animal source foods group includes beef, pork, lamb, goat,

rabbit or deer, chicken, duck or other birds, liver, kidney, heart or other organs; (iii) eggs; (iv) fish or shellfish; (v) milk products group includes tinned/powder or fresh milk and baby formula; (vi) green leafy/orange color vegetables group includes dark green leafy vegetables, pumpkin, carrots, squash, or sweet potato; (vii) pulses group includes beans, peas, or lentils); (viii) oils/fats group includes oils, fats, and butter; and (ix) seeds includes nuts (Darapheak *et al.,* 2013). Stunting was negatively associated with dietary diversity (Adjusted Odds Ratio (AOR) = 0.95; 95% CI; 0.91,0.99) and having animal source foods in the diet was associated with a 31% (AOR = 0.69; 95% CI: 0.54, 0.89) and 26% (AOR = 0.74; 95% CI: 0.57, 0.96) lower odds of stunting and underweight, respectively. Another notable finding of this study was that consumption of milk products led to higher risks of diarrhea (AOR = 1.46; 95% CI: 1.10, 1.92). Diarrhea prevalence was also higher in poor households that consumed fresh milk or baby formula (AOR = 1.85; 95% CI: 1.17, 2.93). Finally, a rural Bangladeshi study also found that poor dietary diversity was a predictor of stunting; a high diet diversity was associated with lower odds ratios for stunting by 5%, 26%, and 31% in children aged 6-11, 12-23, and 24-59 months, respectively (Rah *et al.,* 2010). Other socioeconomic factors like household wealth, mother's education, and living in rural areas were also associated with stunting and diarrhea (all $P < 0.05$).

Food Security and Infectious Diseases

Food security is a tool to measure food accessibility by considering the quality and safety of the dietary intake that is accessible in a socially acceptable way (Bickel *et al., 2000).* A study conducted in rural Ethiopia found the susceptibility of having diarrhea, cough, or fever was consistently higher in children from food insecure households than secure ones (OR= 1.44, 95 % CI: 1.03, 2.02; OR =1.42, 95 % CI: 1.04, 2.02; OR = 1.53, 95 % CI:

1.09, 2.14, respectively) (Anderson *et al., 2012*). Gubert and colleagues (2016) found that severe household food insecurity had higher rates of hospitalization due to diarrhea in Brazilian children less than five years old ($p = 0.001$). In addition, children who were from severely insecure households had more reports of admission to hospital for treatment of diarrhea (AOR= 2.93; 95% CI: 1.61, 5.31) in comparison to children from mildly and moderately food insecure households. This same study found that food insecurity was associated with some of the symptoms of respiratory infections. Coughing was significantly associated with all levels of food insecurity ($p < 0.014$); severely insecure households experienced more risk of cough (AOR= 1.67; 95% CI: 1.14, 2.46). Another Brazilian study asserted that admission to hospital for common infectious disease (diarrhea or pneumonia) was 30% higher in food insecure children under five years old (adj Prevalence Ratio [aPR] = 1.3; 95% CI: 1.1, 1.6) (Poblacion *et al.,* 2016).

Ghanaian children under five years old who were living in food insecure households were also more susceptible to respiratory infection (Ohemeng *et al.,* 2015). This study also showed that severity of food insecurity was associated with an increase in reporting cough symptoms ($p = 0.009$). Ultimately, Ohemeng and colleagues (2015) found that children who lived in food insecure households were almost three times more likely to have both nasal discharge and cough (AOR= 2.92; 95% CI: 1.51, 5.66). However, they did not find any significant association between fever and food insecurity and suggested that the reason for this finding was that fever was a symptom common to many other conditions, including malaria, which was highly prevalent in the area. Similar findings of no significant associations between food insecurity and fever were reported in the Gubert *et al*. (2016) study.

Breastfeeding and Infectious Diseases

One of the main risk factors for both diarrhea and respiratory infection is not being breastfed (World Health Organization, 2019). The role of breastfeeding in children with diarrhea and respiratory infectious diseases has been widely studied by looking at breastfed vs. non-breastfed children as well as breastfeeding duration. Breastfeeding can have associations with other risk factors that are determinants of diarrhea or respiratory infectious diseases, such as stunting. The effect of breastfeeding on diarrhea, respiratory infections, and stunting in children less than five years old has been widely assessed (Lamberti *et al.,* 2011). A systematic review looked at breastfeeding in relation to risk of morbidity or mortality from diarrhea. The review revealed that non-breastfed children aged 0–5 months were almost five times more at risk of diarrhea (RR = 4.90; 95% CI; 2.93, 8.21). These findings applied to children aged 6-11 mo, whose risk more than doubled (RR = 2.63; 95% CI: 1.04, 6.65) and for children 12–23 mo (RR = 1.39; 95% CI: 1.07, 1.80). Some studies also supported the association of breastfeeding with respiratory infections. In a systematic review investigating the effect of breastfeeding on diarrhea and RI, research showed that there was protective effects against hospitalizations due to RI in breastfed children compared to non-breastfed children (pooled relative risk = 0.33; 95%CI: 0.24, 0.46) (Horta *et al.,* 2013). Lower mortality rates (pooled relative risk = 0.30; 95% CI: 0.16, 0.56) and a lower prevalence of RI were reported in breastfed children compared to non-breastfed children (pooled relative risk = 0.30: 95% CI: 0.16, 0.56) and pooled relative risk = 0.68; 95% CI: 0.60, 0.77), respectively.

Hand Washing and Infectious Diseases

Although people know about the advantages of washing hands with soap, there are many caregivers who do not wash their hands after defecation or before preparing food. For example, in Bangladesh, although 90% of the respondents were aware of hand washing

advantages, only 17% were washing their hands with soap after using the toilet (Rabii *et al.,* 2013). Thus, the feasibility and accessibility of washing hands with soap and water should be considered. In a non-randomized trial in Bangladesh, some strategies like hand-washing with soapy water, soapy water with a dedicated hand-washing station, and soapy water with a station and detergent refill were assessed for their different outcomes (Ashraf *et al.,* 2017). Ashraf and colleagues (2017) found out that while all discussed strategies promoted hand washing behavior (18%, 60% and 71%, respectively), having only the detergent refill strategy did not significantly affect hand washing. Also in their qualitative analysis, they demonstrated that the facility that was more convincing for people to use and seemed to be most cost effective was a station for hand-washing with a ready-to-use soapy water bottle as it is ready and could remind and encourage hand washing more often.

Hygiene is a well-known risk factor for diarrhea that could demonstrate its influence in several ways. Curtis and his colleagues (2011) reviewed the association between the different kinds of hygiene practices by caregivers with diarrhea in children. One of the findings was that diarrhea and respiratory infectious diseases can be reduced by 30% and 16%, respectively, by just hand washing (Figure 3). In addition, a random-effects meta-analysis by Freeman et al. (2014) of 26 observational studies showed that diverse interventions that improved hygiene decreased the risk of diarrhea by 33% (RR = 0.67; 95% CI: 0.61, 0.74). Furthermore, there was a 40% reduction in the risk of diarrhea in studies when hand washing was accompanied with soap (RR = 0.60; 95% CI: 0.53, 0.68) and by providing general hygiene education, the risk of diarrhea was 24% lower (RR = 0.76; 95% CI: 0.67, 0.86). Education about hand washing (with or without soap) (RR =

0.77: 95% CI: 0.32, 1.86) reduced risk of diarrhea more than broader hygiene education (RR = 0.97; 95% CI: 0.40, 2.36).

A review of hygiene practices reported that hand washing interventions can decrease the risk of RI up to 16% or even up to 50% when the intervention of hand washing with plain soap is implemented for >5 y old children (Curtis *et al.,* 2011). Such a finding is biologically plausible as there is some evidence that some pathogens that can cause RI can be transmitted from infected hands of one person to another person or from infected hands by contaminated tissues (Hall *et al.,* 1980).

Improved Water and Sanitation

Clean water is obtained through improved water sources including: piped water into the dwelling, piped water into yard/plot, public tap or standpipe, a tubewell or a borehole, a protected dug well, a protected spring, and rainwater. Improved sanitation includes the presence of a flush toilet, a piped sewer system, a septic tank, a flush/pour flush to pit latrine, a ventilated improved pit latrine, a pit latrine with slab, a composting toilet, and a flush/pour flush to unknown place. A comparative risk assessment analysis of 147 less developed countries, showed that unimproved sanitation is one of the leading risk factors for stunting (RR = 1.37; CI 95%: 1.33, 1.41). Among 44.1 million stunted children, 7.2 million children used unimproved sanitation (CI 95%: 6.3 million, 8.2 million) (Danaei *et al.,* 2016).

Improved Water and Sanitation and Diarrhea

Systematic reviews on assessing the association between water sanitation and diarrhea in children from low and middle resources countries found a reduction in reports of diarrhea for children under 5 y from the households with improved water in comparison to

unimproved water (overall RR= 0.72, 95% CI: 0.59, 0.88) (Wolf *et al.,* 2014*).* A later study in rural Ghana found the consistent result on reducing the risk of diarrhea with improved water supply for children (Cha *et al.,* 2015*).*

Hand washing practice was significantly associated with latrine ownership ($p<0.01$). Besides that, hand washing materials (e.g., soap, ash) and water availability near latrines also have a significant positive association with hygienic hand washing practices. (Rabbi *et al.,* 2013). On the other hand, sharing some sanitation facilities with one or more people was influential in increasing the odds of diarrhea (adjusted matched OR = 1.41; 95% CI: 1.11, 1.79). The absence of sanitation facilities increased the risk of both moderate and severe diarrhea in multi-center study (adjusted matched OR = 1.48; 95% CI: 1.15, 1.90) (Baker *et al.,* 2016). Having a defecation site with observed fecal material visible was statistically associated with moderate to severe diarrhea among children <5 y old in Mali (adjusted matched OR = 3.77; 95% CI: 1.25, 11.35) and India (adjusted matched OR = 1.43; 95% CI: 1.02, 2.00) but not other sites.

Environment Risk Factors and Respiratory Infectious Symptoms

A study in The Gambia showed an association between RIS and environmental risk factors like bed sharing with someone who suffered from coughing (AOR = 5.1; 95% CI: 3.2, 8.2) (Howie *et al.,* 2016). This study did not find any significant relationship between RIS and crowding or the other environmental risk factors such household air pollution as a consequence of non-clean fuel. In contrast, another study in Guatemala demonstrated a 18% decrease in the prevalence of pneumonia in children with a 50% reduction of exposure to a chimney stove (RR = 0.82; 95% CI: 0.70, 0.98) (Smith *et al.,* 2011).

However, in a Malawi trial where the intervention group received clean fuel, there was no variation in the incidence of pneumonia (Incidence Rate Ratio [IRR] =1.01; 95% CI: 0.91, 1.13) (Mortimer *et al.,* 2017). Other related studies suggested that inconsistent results may reflect the challenges in measuring the personal exposure to fuel and highlight the need for more informative research. (Ezzati & Baumgartner*.,* 2017).

Education and Infectious Diseases

Adult formal education may manifest its effect on infectious disease through different pathways, affecting the level of hygiene and hand washing, breastfeeding, dietary intake, and nutritional status of children. For instance, a study in Bangladesh showed that both household head and spouse education were significantly associated with hand washing practice (hand washing coefficient = 0.002 [95% CI: 0.001, 0.002] and 0.003 [95% CI: 0.002, 0.003], respectively) which is one of the determinants of diarrhea and respiratory infection (Rabbi *et al.,* 2013).

Education may also influence infection through child nutritional status. In a multilevel analysis study in Nigeria with <5 y old children, both maternal and paternal educational level were positively associated with stunting in 0-23 mo and 0-59 mo old children (Akombi *et al.,* 2017). In addition, caregiver knowledge about nutrition and feeding practices is associated with the child diet diversity and animal source food intake ($p < 0.001$) (Christian *et al.,* 2016).

Maternal Mental Health and Infectious Diseases

Child health and nutrition can be influenced by poor health seeking behaviors that are the consequence of poor maternal mental health (Ruel *et al.,* 2013). Maternal mental health disorders were linked to an increased risk of childhood infectious diseases such as diarrhea and RIS (Rahman, 2005). Caregiver's mental distress can increase the risk of

diseases via several pathways: (i) by having an impact on children's diet (human milk and complementary foods) and ultimately nutritional status, (ii) by influencing breastfeeding patterns and its impact on the immune system, (iii) by changing the quantity and quality of caring practices, and (iv) by negatively altering the use of health services (Harpham *et al.,* 2005*;* Rahman *et al.,* 2008; Ruel, *et al.,* 2013; Khan *et al.,* 2017). In 1994, WHO developed the Self-Reporting Questionnaire (SRQ) which included a list of 20 questions for measuring mental health status (Beusenberg *et al.,* 1994). The WHO did not recommend a global cut-off point but considered the difference among countries such as their background culture and language and suggested users to assess their own. Some studies in low resource countries have used a cut-off score of 6-7 for women and 4-5 for men (van der Westhuizen *et al.,* 2016) but there is variation in the literature (Harpham *et al.,* 2003).

A systematic review and meta-analysis from 11 low-resource countries revealed that maternal depression or having symptoms of depressive disorder was associated with an increase in the risk of growth retardation among children ([underweight OR= 1.5; 95% CI: 1.2, 1.8], [stunting OR: 1.4; 95% CI: 1.2, 1.7]) (Surkan *et al,* 2011). A prospective cohort study of infants age 6 to 12 months in rural Pakistan demonstrated that prenatal mental disorder such as depression was associated with increased relative risks of being underweight [unadjusted RR= 4.0, 95% CI: 2.1,7.7 and 2.6, 95% CI: 1.7,4.1] and stunted 4.4, 95% CI: 1.7, 11.4 and 2.5, 95% CI: 1.6, 4.0). In addition, it increased the risk of having five or more episodes of diarrhea per year (RR= 2.4, 95% CI: 1.7, 3.3) (Rahman *et al.,* 2004). Results from a cross-sectional study found a similar association for reports of diarrhea episodes or RIS with maternal mental health assessment using the Self-Reporting Questionnaire (SRQ) (Nguyen *et al, 2014).* This study demonstrated that

children from mothers with poor mental health assessment (SRQ≥ 7) had a higher risk of diarrhea in Bangladesh, Vietnam, and Ethiopia (AOR= 1.67, 95% CI: 1.22, 2.25; AOR= 2.11, 95% CI: 1.61, 2.76; and adj OR= 1.83, 95% CI 1.47, 2.27, respectively) and had two times more odds in reporting upper respiratory infectious symptoms (AOR= 1.41, 95% CI: 1.15, 1.73; AOR= 2.05, 95% CI: 1.61, 2.62; and AOR= 2.10, 95% CI: 1.72, 2.57, respectively).

In summary, diarrhea and respiratory infectious diseases are leading causes of morbidity and mortality among children under 5 years of age. There are abundant research studies that demonstrate individual, social, cultural, and environmental determinants of both conditions. This complexity of determinants is seen in Ghana. An integrated agriculture intervention may provide the opportunity to implement community-based research that could be an initiative for improving child nutrition and health.

Table 2.1 Risk factors for causes of deaths related to diarrhea and respiratory infections among under five years old children (World Health Organization, 2019*)*

Disease	Risk Factors	Prevention
Pneumonia, or other acute respiratory infections	Low birth weight	Vaccination
	Malnutrition	Adequate nutrition
	Non-breastfeeding	Exclusive breastfeeding
	Overcrowded conditions	Reduction of household air pollution
Diarrhea	Non-breastfeeding	Exclusive breastfeeding
	Unsafe drinking water and food	Safe water and food
	Poor hygiene practices	Adequate sanitation and hygiene
	Malnutrition	Adequate nutrition
		Vaccination

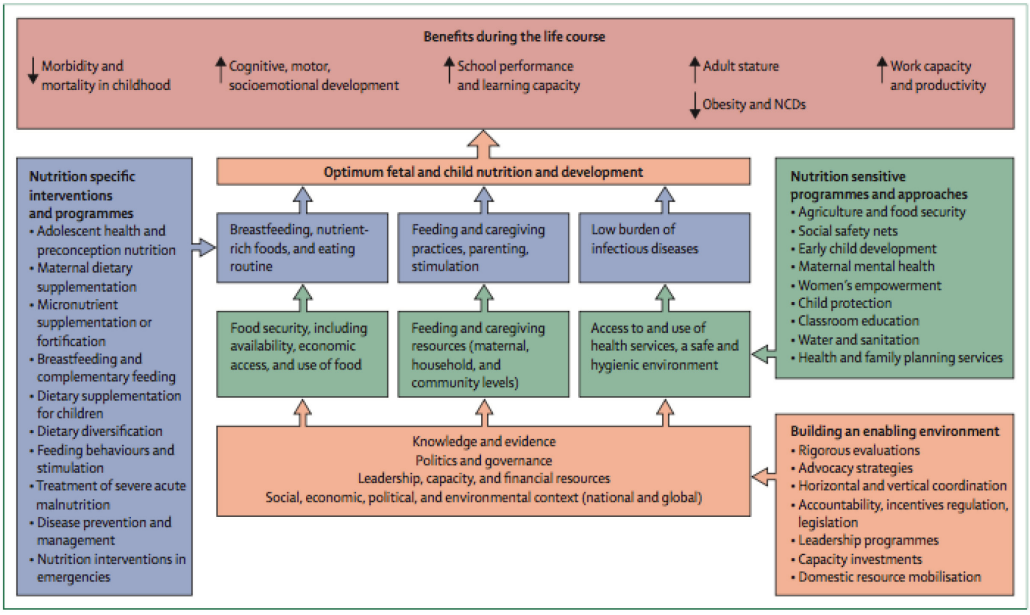
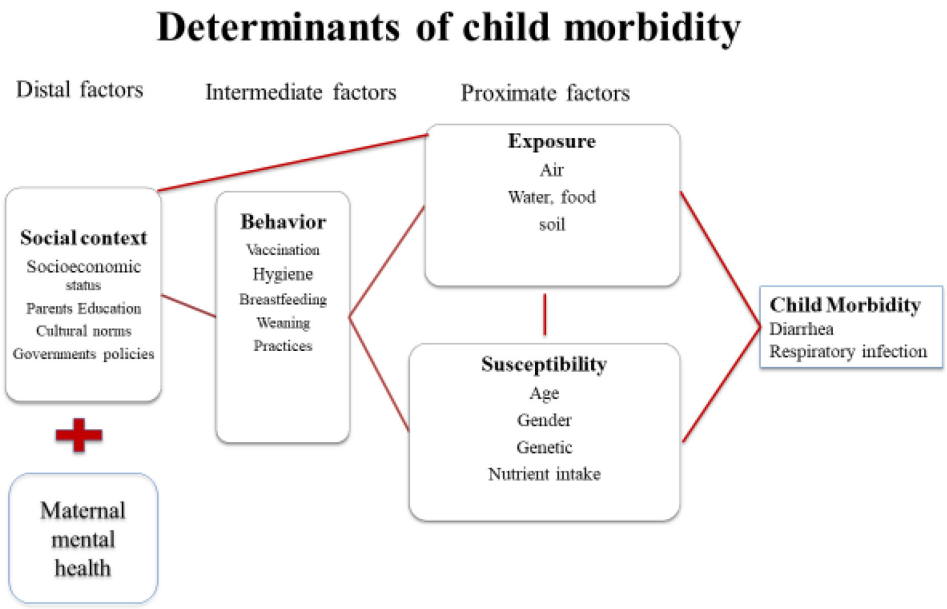


Figure 1. Framework of Global Strategy for Women's and Children's Health (Black *et al.,* 2013)



Modified from: Hatt, L. E., & Waters, H. R. (2006).

Figure 2. Conceptual framework showing three levels of determinants of morbidity

	Specific behaviour	Biological plausibility	Risk modelling	Observational studies	RCTs
Handwashing with soap by carers	After own or child's toilet, before eating	Strong	Strong	Large effect	Large effect
Safe food handling	Food preparation, storage	Strong	Strong in developed countries	Inconclusive	No studies
	Weaning food preparation, storage	Strong	Some	Inconclusive	Inconclusive
Safe stool disposal	Use of toilets, nappies, potties	Strong	No studies	Large effect	No studies
Surface cleansing	Kitchen and toilet cleaning	Plausible	Reasonable in developed countries	Inconclusive	Inconclusive
Solid waste disposal	Burning, disposal service	Plausible	Limited	Large effect	No studies
Fly control	Insecticiding, trapping	Strong	Some	Large effect	Large effect
Removing animal faecal matter	Restricting contact with chicken, pig, cow, buffalo excreta	Plausible	No studies	Large effect	No studies

RCTs=randomised controlled trials.

Table 1: **Evidence for the ability of specific hygiene practices to prevent diarrhoeal disease**

Figure 3. The effects of specific hygiene behaviors on prevention of diarrhea disease. (Curtis *et al.,* 2011)

Chapter 3. Methods

Study Site

The Upper Manya Krobo District (UMKD) was formed in 2008 and is located in the Eastern region of Ghana, a sub-Saharan West African country. The district has six sub-districts and 198 communities; the 2010 census estimated the population at 72,092 (Ghana Statistical Service, 2012). The majority of the region (87%) is rural and the main occupations include subsistence and commercial farming and trading. Fishing activities are also common among sub-districts located near the Volta Lake. Most of the population belong to the Krobo ethnicity and the main religion practiced in the district is Christianity, followed by Islam and traditionalism. (Ghana Statistical Service *et al.,* 2015)

Study Design

This study design follows a sequential mixed-methods with three phases. The research approach integrated quantitative and qualitative methods to collect, analyze, and interpret data on symptoms of childhood illness and their determinants. Phase 1 was a quantitative secondary analysis of data from the baseline survey of the Nutrition Links project (Marquis *et al.,* 2018) of rural Ghanaian infants that helped refine a list of discussion topics. Then in Phase 2, qualitative data on the pre-determined discussion topics were gathered through in-depth interviews and focus group discussions. Finally, a quantitative analysis was carried out in Phase 3 to examine the outcomes of interest. The first phase analysis was initiated in July 2017; the second phase data collection was completed between September and November 2017 and the analysis for the second and third phase was iterative and began in September 2017.

Nutrition Links project. Between 2013 and 2018, an integrated development project (Nutrition Links, NL) was implemented in the UMKD. It included district-wide institutional-capacity building and three randomized controlled trials in distinct

communities to improve complementary feeding in young children and adolescence girls' life choices. Only the NL agriculture-nutrition education trial to improve child feeding is relevant to the present study; it has been described in detail elsewhere (Marquis et al. 2018). Briefly, the 12-month trial included 500 women with young children who were enrolled in two waves over a two-year period and randomly assigned to one of two study groups. Those in the intervention group engaged in poultry raising for egg production, home gardens, beekeeping (during the first wave only), nutrition education, agricultural training, gender equality training, and mother-to-mother support groups. Those in the control group received their usual government services.

Ethical Approval

The NL trial was registered at ClinicalTrials.gov (NCT01985243). Ethical approval was obtained from both McGill University Research Ethical Board (806-1113 and 822-0514) and Noguchi Memorial Institute for Medical Research (NMIMR) at the University of Ghana (060/13-14) (Appendix1). Written consent forms were signed, or thumb prints were obtained before collecting data from the participants in the survey (mothers who also signed for their child as well), focus group discussion, and in-depth interviews.

Phase 1 methods

The specific aim of this phase was to identify predictors of diarrhea and RIS (fever, cough, and rapid or difficulty breathing when cough was reported [later referred to as 'cough with difficulty breathing']) among infants under twelve months to refine the specific topics of discussion for the second phase of data collection.

Participant selection

The NL first survey was carried out in the six subdistricts of UMKD with 1096 households between November 2013 and June 2014. Communities were excluded only if

they were not accessible for more than two weeks during the year; children were excluded if they had a medical condition affecting their ability to eat or their growth.

Data collection

The field staff collected from the child's mother data on child, maternal, and household characteristics. Using a face-to-face survey, field staff asked caregivers about children's recent experience of infectious symptoms, breastfeeding, and complementary feeding. The presence of illness symptoms in children was based on caregivers' recall of the past seven days (diarrhea, cough, cough and difficulty breathing) or the last two weeks (fever) prior to conducting the survey. The symptoms were explained as diarrhea (3 or more watery stools/24 hours); fever (determined without a thermometer); cough without or with breathing faster than usual with short, rapid breaths or have difficulty breathing). Only those children with a cough were asked if they had difficulty breathing.

Data on exclusive breastfeeding status was documented only for infants < 6 months of age. The mother was asked if the child received any foods other than breast milk at any time between birth and time of data collection. Dietary intake of children ≥ 6 months of age was collected with a 17-item food list to record their consumption during the day and night prior to conducting the survey. Anthropometric measurements, using standard procedures, included length and weight. Length was measured twice to the nearest 0.1 cm with a stadiometer (Shorr Productions, Maryland, USA) and weight was measured twice to the nearest 100 g with a digital scale (Tanita Corporation of America, Illinois, USA). The mean values of length and weight were used; staff repeated the measurement if the first and second values were not within acceptable precision as recommended by the WHO (World Health Organization, 2006).

Field staff also collected data on maternal formal educational attainment and household characteristics including the presence of soap or detergent for hand washing and source of drinking water. Data on household food security was collected using the 15-item Latin American and Caribbean Food Security Scale that documented participants' experience over the past month (Food and Agriculture Organization, 2012).

Analysis

A total of 912 infants who were < 12 months of age and who had complete data were included in the analysis for this phase. The primary outcomes of childhood diarrhea and RIS as well as exclusive breastfeeding were used as dichotomous variables (present/not present). To compute a dichotomous variable for minimum diet diversity, the 17-item food list was reduced to a 7-item food group score (grains, roots, and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin-A-rich fruits and vegetables; and other fruits and vegetables) and then categorized as diverse (≥ 4 food groups) or not diverse (< 4 food groups) (World Health Organization, 2008). Consumption of animal source food was obtained from the food list that included six groups (organ meats (liver, kidney, heart, gizzard, and other organ meats); flesh meat; poultry (chicken, duck, guinea fowl); egg; fish, shellfish and other seafood; and dairy products) and was used as a dichotomous variable (consumed at least one type of animal source foods, yes/no).

Children's length was converted to length-for-age Z-scores (LAZ) using the WHO growth reference; stunted was used as a dichotomous variable (yes= <-2 LAZ-score; no=≥ -2 LAZ-score) (World Health Organization, 2006). Maternal formal education was categorized into three levels (none, primary, and secondary and above). Household food security scale was classified based on affirmative answers to 15 items from the Latin

American and Caribbean Food Security Scale questionnaire and was used as a variable with four categories (secure, mildly insecure, moderately insecure, and severely insecure) as recommended (Food and Agriculture Organization, 2012).

Bivariate analyses used chi-squared or Fisher's exact test to test the association of child, maternal, and household indicators with symptoms of infectious diseases. All reported statistically significant associations had at least a $p<0.05$. The results were used to guide the themes for the qualitative data collection in Phase 2.

Phase 2 methods

The specific aim of the second phase was to explore the beliefs of the community members and opinion leaders, caregivers, and health personnel in relation to the prevention of diarrhea and respiratory infections (RI) among children under five years in UMKD.

Participant selection

Focus group discussions (FGD) and in-depth interviews (IDI) were used. The initial plan for eight FGD and 14 IDI was made based on our estimation of reaching saturation (i.e., additional data collection does not add new information [Morse *et al.,* 2002]). The participant selection criteria are shown in Table 3.1.

Data collection

Semi-structured interview questionnaires and focus group discussion guides were developed based on the literature and the Phase 1 analysis. Both questionnaires and focus group discussion guides were piloted in non-NL intervention communities. The final tools are in Appendix 2. Five local research assistants were hired to conduct the IDI and FGD. Each received training to become familiar with the data collection tools in both local languages (Krobo, Ewe) and English. The research assistants were also trained

on how to back-translate all interviews to English to provide an opportunity for the researcher to add probing questions and ensure the quality of the interviews. Most of interviews and FGD were conducted in a quiet place within the communities or local clinic. All interviews and FGD were tape recorded and back translated to English. Written English transcripts of the interviews and FGD were checked by two non-project professionals to ensure that the back-translations were accurate.

Analysis

The transcript data from the IDI and FGD were organized based on the a priori identified themes that provided the structure for the questionnaires and guides as well as new themes that emerged during the process of data collection. Initially, the data were coded deductively. However, coding and analysis was an iterative process using both inductive and deductive themes, allowing for new theme to emerge also during the process of analysis. All data were coded through the MAXQDA software (version 8.1.0) by the researcher. Thematic analysis was used to conceptualize the meaning of each themes through their subthemes. All themes were classified into three groups of respondents: health staff, intervention group community members, and control group community members to capture the similarity and difference in their viewpoints on the discussed topic. Quotes were used in the results section to represent the main points that emerged.

Phase 3 methods

The third phase examined the association between participation in an agriculture-nutrition education intervention and the reporting of diarrhea and RIS among children under five years old in UMKD.

Participants selection

This analysis used data used from surveys of 500 mothers and their children who participated in the NL agriculture-nutrition education trial. The trial took place in three of the six subdistricts in UMKD which were used in Phase1 of this study.

Data collection

This final phase used only child, maternal, and household variables that had been identified to be related to the primary outcomes of interest through the literature, a designed conceptual framework prior to the beginning the study, or the first and second phases of this study. The variables for most outcomes (diarrhea, cough, fever) and predictors (child age, sex, and stunting; household source of water, and presence of soap for handwashing) have been described in Phase 1. The data collection of additional predictors is discussed here. Child hemoglobin concentration was measured with Hemocue photometer system (HemoCue, Inc., Lake Forest, California) and reported as g/L. Data on maternal mental health status was collected through the Self-Reporting Questionnaire (SRQ) with 20 items to reflect symptoms of mental health (Beusenberg *et al.,* 1994). Maternal diet data were collected with a 13-item questionnaire on food consumption over the past seven days.

Analysis

The variables representing the outcomes of interest diarrhea were described in Phase 1. In addition, a composite dichotomous variable of cough and fever (present/ not present) was computed by merging these two symptoms. For the variable minimum maternal dietary diversity we recategorized diets into 10 food groups (grains, roots, and tubers; pulses; nuts and seeds; dairy products; meat, poultry, and fish; eggs; dark leafy green vegetables;

other vitamin-A-rich fruits and vegetables; other vegetables; other fruits) and then a cut-off point of 5 was used for the binary variable (< 5 food groups=No, not diverse; ≥ 5 food groups=Yes, diverse) (FAO and FHI 360, 2016). Data on household food security was classified based on the 15-item Food Insecurity Experience Scale; however, all categories of food insecurity (mild, moderate, severe) were combined to make a dichotomous variable (secure and insecure) (Food and Agriculture Organization, 2012). In this analysis, the SRQ score was used as a continuous variable.

Descriptive, bivariate, and multi-variable analyses were used. The analysis used Chi-squared or Fisher's exact test for categorical variables and independent Student's t-test for continuous variables to test child, maternal, and household characteristics by the NL study group. Multivariable binary logistic regression with clustered standard errors from SPSS (version 23) was used to test covariates and their interaction with the intervention on the main outcomes (diarrhea, RIS) and other predictors. Backwards stepwise variable selection was used to remove predictors with $p>0.10$ except for intervention which was kept in all of the final models. Lower scores of categorical variables were used as reference for analysis. The model for cough with difficulty in breathing was not stable and was not used.

Table 3.1. Participant selection criteria for focus group discussions and in-depth interviews

Method	Target	# events	Selection criteria	n
FGD[1]	Community members	4 intervention[2] 4 control	(i) Participated in at least one food demonstration or gender education session[3] (ii) Level of accessibility of the community (iii) Both sexes represented in same groups	7-14/group
FGD	Caregivers	2 intervention 2 control	(i) Level of accessibility of the community (ii) Mother of <5 y old children (iii) Children of both sexes	5-8/group
IDI	Opinion leaders	7 intervention 7 control	(i) Level of accessibility of the community (ii) Position in community (iii) Both sexes represented	14
IDI	Health staff	12	(i) Level of participation in the training (ii) Position (level of performance in training session) (iii) Community/subdistrict they represent (iv) Both sexes represented	12

[1] FGD: focus group discussion; IDI: in-depth interview
[2] Intervention and control communities in the Nutrition Links trial

Chapter 4. Results

The results are presented by phase.

Phase 1 results

In this preliminary phase, we analyzed the NL baseline survey data to help identify predictors of diarrhea and respiratory illness symptoms for the purpose of developing themes for the qualitative data collection phase. The survey was completed with 912 caregivers in three subdistricts of UMKD and included information on a wide range of child, maternal, and household characteristics. In the previous 7 days, about one-quarter of the children were reported to have episodes of diarrhea (255/901; 28.3%) and cough (218/910; 24.0%), and more than one tenth (123/910;13.5%) had cough with difficulty breathing. One-fifth (180/912; 19.7%) had fever in the past two weeks. Some of documented characteristics were associated with these illness symptoms (Table 4.1). Exclusive breastfeeding and not being stunted were negatively associated with diarrhea and the combined indicator of cough and difficulty breathing, respectively. Dietary indicators (diverse diet and consumption of animal source foods) were not associated with any of the illness symptoms. Poorer household food security was associated with higher prevalence of diarrhea and fever. The indicators that were positively associated with the symptoms of fever and of cough with difficulty in breathing were caregiver education and household use of soap for handwashing. The child, caregiver, and household indicators associated with symptoms were integrated into the next research phase. For example, given the high prevalence of diarrhea and the observed association of diarrhea and household food insecurity, phase 2 included in-depth questions and

probes to examine these relationships (e.g., *What made it hard for you to provide the foods that you think are beneficial for your children to not get diarrhea).*

Phase 2 results

The second phase of the research used qualitative methods to explore beliefs about prevention and treatment of diarrhea and RIS among children under 5 y. A total of 12 rural health staff who were delivering their services in both control and intervention communities as well as 14 opinion leaders (7 in intervention and 7 in control communities) were interviewed. In addition, 12 focus groups were conducted: eight with community members (men and women together) and four with caregivers. Intervention and the control communities were equally represented in the focus groups. A total of 56 community members and 24 caregivers participated. The results capture the participants' discussion about diarrheal diseases and RIS in children under 5 years of age. The presentation is provided separately for health staff and community members (including leaders and caregivers) to highlight the different perspectives of these groups. The primary subthemes were (1) use of health services (western vs traditional medicine, factors that determine use), (2) hygiene behaviors (personal cleanliness, environment cleanliness, food safety, child care), and (3) nutrition.

Use of health services. The primary concern that emerged from the health staff was caregivers' lack of understanding about actions needed to respond to symptoms of infectious diseases. They believed caregivers sought treatment from traditionalists and herbalists as a first step for disease prevention or treatment.

... just that they don't really see the urgency of the effect of it till they realize the situation is getting worse before they seek for help. They say [it] is a normal diarrhea. (Health staff 12)

... sometimes delay from the mother, the child will be sick doing home medication then it will come to the ... [worse point)] before they will bring the child to the facility. We can't also do anything then ... (Health staff 7)

They believe it is someone who is doing [it to] them [diseases]. So, they will not consult the doctor first, but they will rather consult the pastors before they consult the doctors. So, the disease has gotten to the worse stage before they will come to us. (health staff 9)

Other perceptions on residents' use of health facilities emerged from the discussion with staff. One issue that came out of the discussion was that the caregiver could not solely decide the health care of the child and use of the health facilities. Others– such as the father, extended family members, or key community members – may have had a role in the decision. The staff also mentioned that in some communities there is really poor access to health services because of the nature of the roads or the residents not having any or affordable transportation. The limited means of transportation and money for fuel was seen as a barrier to the staff's ability to provide health coverage in the communities. Having trained and committed volunteers, nurses in Community based Health Planning and Service CHPS in communities, national health insurance and the presence of projects such as the Nutrition Links facilitated access to health services.

…and then sometimes too, husband's support is not there. And they will have to wait for the husband to come from wherever he has gone to before sending the child to the clinic. And the decision maker, which is the in-law, the in-law will tell you lets pray for this child for sometimes and you cannot take the child from the in-law. So the decision makers for sometimes, contribute to all these problems. … (Health staff 6)

Because we don't have ambulance, and then our roads, that is the challenges. Even now the road was a little bit proper, but formally, it wasn't good at all. So, the drivers here, when you call them, they charge a big amount. So that is the problem. But we have a driver who usually takes them, if only he is around. (Health staff 2)

Now, we are even extending our self to many places. And now, we have a lot of CHPS centers … formally, it was monthly that we go, but now we visit them every week. Because when a child has a problem, they take the child to the CHPS. (Health staff 6)

… if you take a community like community B, people come in and go and they see a lot of activities going on at least. The nurses also interact with them per day, but … those in the hinter land. How often do we go there? … look we have one motor bike … I have to make sure that when [I] am going, I carry everything once. I carry all my activities over there once and come back because going there, fuel is even costing. (Health staff 1)

I know last year, the World Vision trained volunteers on community case management, they also trained the nurses as well … they procure some drugs for volunteers to use. It is home base care so… just that the drugs were not enough but the volunteer had the

drugs. We sent it to 19 communities. They were able to treat some minor cases like the diarrhoea, the minor cough, the coughs like pneumonia and stuff using amoxicillin and malaria so if they are not able to go to the health centre … (Health staff 12)

They (some communities) value their health, they value the people that they are serving, like the volunteers, so they respond to whatever call that you placed on them as compared to other volunteers in other communities (Health staff 1)

Those with insurance seek care from the health families (Health staff 12)

Well, for me because of mother-to-mother support group [started by Nutrition Links], … because we are always with them during the meeting we express our solutions so[it] is like now if they are facing the same problem, they can easily came to you and then asked you 'madam this and that', so if maybe the person needs some simple counselling then you just give the person but if the person has to receive for medical advice, then you just refer the person… (Health staff 2)

The discussion topics of the community members in reference to the use of health services for RIS and diarrhea was similar to that of the health staff but reflected different concerns. The community members discussed what they considered appropriate treatment at home for the conditions and when a visit to the health services was needed. Previous training was considered enough to cure the children sometimes. Health services were needed if the child did not get better.

Like in our communities here we have some tree that is herbs when children are having diarrhea and we don't go to hospital or let say if the distance to the doctor is far, we also know some small things like roots medicine or leaves that we give to cover them .(IDI_CMC 6)

Please sometimes, when child started coughing you think it just a normal cough but as times goes on and the child was still coughing then you don't have to at home with the child. You have to send the child to the clinic. (IDI_CM 2)

Please I don't know the beginning of the respiratory infection or the causes neither the presentation or the end of the disease/ But what I normally do is to send the child to the clinic. (IDI_CM 2)

Presence of a close CHPS compound appeared to facilitate the decision to use the health services – saving time and money. Finally, community members suggested that health services were less needed because the children were not falling sick with the training from the Nutrition Links project.

Previously there was no clinic in our community here unless you go to Asesewa and by the time to get car to send the person, then time will be much spent or it will be too late, but now the clinic is closer to us in our community and at times they do have visits always to check on the children. (IDI_CM1)

They have been saying that now the weighing is here and the treatment that they have been now bringing it here, and we have not been going to Asesewa again. because

sometimes you don't have money and you have to go to Asesewa, then it becomes problem. But now whether you have the money or not, they will come and attend to us. (IDI_CM 4)

... this training has changed our way of thinking ... Now the training has helped us and our children are no more falling sick. (FGD_CM I)

In summary, health staff expected the residents to seek treatment from health services as a first step to prevent the severity of the outcome. In contrast, because of cultural practices, prior education that community members had received, and lack of resources (time and money), the residents sought health solutions first within their community. Both health staff and community members recognized the barriers of transportation and money. The value of having health services within the community was also recognized by both types of respondents.

Hygiene behaviors. Many of the health staff discussed the importance of having knowledge about food safety, personal hygiene, and cleanliness of the household environment as key approaches to prevent diarrhea and RIS. Many staff recognized improvements in communities' hygiene knowledge and behaviors because of the education that they were providing to them, but some noted that the practices were not always done correctly. They also discussed barriers to these same practices, especially accessing clean water.

"Now they understand the diarrhea, they understand that when you eat something that is unclean, you can get diarrhea … and we told them on how to handle foods so now they understand very well" (health staff 10)

… They should wash their hands, sweep the environment before cooking and they have accepted it and they are doing it." (health staff 4)

Interviewer: and you made mentioned, Nutrition Links reduces diarrhoea in children, and what factors did you think attributed to this change? Respondent: The hand washing and then hygiene before preparing the meals and then feeding the child. (Health staff 6)

Interviewer: what is the most challenging issue for them in terms of making sure their children are consuming clean water? Respondent: laughing....mmm they think the rain water and the bore hole water they are clean so they don't find any challenge." (Health staff 9)

..mostly majority of them are drinking from the streams… some are trying to get a borehole they are not getting, and then like [Community A] here for instance, they has a borehole but the water is not good. Either it has a salty taste and moreover too when you fetch it down within a minute then the colour changes aahhaaa so in that case, the community prefer to drink from the stream rather than the borehole. (health staff 8)

They don't boil because they have been drinking this water since their infancy and they don't have a problem…So if you are telling them to boil it, you are adding work to them, or you are troubling them. (Health staff 6)

They know it is important for them to wash their hands, but they don't know the way of washing hands properly. (Health staff 8)

Residents demonstrated their understanding about practicing good personal hygiene and environmental cleanliness to prevent infectious diseases. They talked about the importance of the timing of hand washing. However, they were also provided the barriers to handwashing – the primary being perceived lack of time.

When we talk of hygiene, is the way of keeping our body clean as well as our environment. If we want to prepare food for our children, when should clean our hands with soap and water. The water should be running water but not stagnant water. And after preparing the food, we should cover it fine. We must make sure that, the food cooked well; They must get proper drinking water and we should dress them always, uhhuh and our foods should be neat always. (FGD _CMC 2)

Respondent: sanitation in the community…. As I swept the surrounding, but leaving polythene bags, some will eat and leave them on the floor some will even have left over foods in them, also the children going to toilet just around, we must not do that. So we must not allow polythene bags loitering around in the community, children must not defecate anyhow and anywhere and also you will sweep, collect and dump it

close to the house, I feel when we do that it will give us sicknesses and we will not be healthy" (IDI_CMC 4)

why this person doesn't have diarrhea is because the parents of that person have time for him. If the child go to play and comes back the parents wash the hands for him before he eats. The utensils that they use in preparing food are covered so there is no illness that will affect them to get diarrhea. (FGD_CMC 1)

In our villages here, when we fetch the water is clean so when we fetch and sieve it then we pour to the drinking pot fine and we drink, we don't do anything to it, the water is clean. (IDI_CMC 6)

The discussions with the health staff and residents both demonstrated that there is community knowledge about the relationship between hygiene and infectious diseases. However, the definition and level of concern about clean water differed between the two groups. Whereas, in general, health staff considered water from taps or bore holes or treated water (e.g., tippy tap or boiled) to be "clean", the residents considered "clean" water to also include that which they used and did cause illness (sometimes this included river water).

Nutrition. Health staff mentioned that there had been an increase in nutrition knowledge, in part due to the education that staff received and the participatory activities in the communities. There was also a change in the cultural beliefs about feeding children in rural communities. However, the last three quotes below about diarrhea

suggest an inconsistent or incomplete understanding. There remained gaps between residents' knowledge and practice.

...before that, when they came for weighing, we do the health talk and also one-on-one counselling. But after we start[ed] the mother-to-mother support group, then that you will see that mothers gathered ... you see this one coming with her experiences, and I do not even know about [the] same little little mistake that they hide. They were thinking like it is nothing but when they brought it out the other mothers were able to correct the mistake and we even show them the right thing to do. So it has help[ed] us seriously (Health staff 2)

The feeding of the children has changed a little because they now realized that their local foods are good for the children. So there was an improvement. (Health staff 6)

For the food aspect, we tell them cold foods that are exposed to the environment can be affected by these flies transmission, aahha. So, though they are aware, but what I see, I don't think they relate it to the cause of diarrhea. (Health staff 8)

The staff also provided examples of barriers for the community members to put their knowledge into practice (e.g., time, cultural practices) and provided examples of facilitators to increase the transfer of knowledge to practice (e.g., demonstrations and monitoring from staff). The health staff noted that increased education and training have helped them to understand the facilitators and barriers in providing consultations, to relate better with the community members, and to monitor them more regularly.

In this community they don't have time; they don't have much time to take care of their children and monitor their growth. However, based on what we have learnt, there has been a change in this regard (health staff 9)

With the breastfeeding, mothers believe that they have practiced what their grandmothers and grandfathers have taught them. So, there are times that they will not listen to what we are telling them on breastfeeding practices. They will want to do what has been done for many generations in the past. Even with this, we are still doing our best. (Health staff 8)

What facilitates the growth of children has to do with what we tell the mothers to do. The education that we give to the mothers concerning the health and growth of their children and the subsequent visits we make to them to correct those mistakes helps them to monitor the growth of their children. (health staff 5)

... we have to come back to the community ... so we go[on] the schedule with them, when they want us to come and the time we would go there and then demonstrate or prepare with them the food they have to give to the child. Starting from breakfast, lunch and then to supper in addition to their snacks. then we display all the food groups where then can be chosen the foods from those that are common with them within the communities. ... When we come to you and you are preparing something, we try to probe to know what you are doing, what you are adding to the food, what are you using for it and then we also add up if they are [missing] some things. (Health staff 5)

.. because of these growing things in the community and rearing the animals, I think as the nutrition officer has been saying the malnutrition level has improved, if the mother or the parents in the communities who are into this activity take proper care of it, it can last longer to be able to cater for the family and help other people as well … (Health staff 2)

The health staff shared their viewpoint about the residents' beliefs about foods which may cause infectious diseases or can be used to prevent or treat these diseases. The quotes below provide some examples.

They take mangos, so the education is, you wash the mango with salt and water; but if you pick it and you eat it without washing it, it will cause diarrhea. They believe when the child is taking mango, they will say, ehh, you will get diarrhea, oo. (Health staff 6)

… they believe in egg, that if a child eat[s an] egg, he/she becomes a thief or it would bring some sickness upon the child. But we made them to believe that [it] is not like that. So now, we are on it and they are changing gradually. (Health staff 3)

… So what did you think resident think were the causes of respiratory infectious diseases. Respondent: They think it was the cold weather and the eating of maize. (Health staff 2)

Community members were asked to talk about their beliefs about food consumption in relation to prevention and treatment of illness. They talked about particular foods that caused illness and should be avoided (e.g., maize, pepper [hot sauce]).

If you give your child corn porridge frequently he can get respiratory infection." (FGD_CMC 4)

There are a lot of foods. When you give plantain with kontomire stew to your child, I think he will not have diarrhea but when you eat banku with "hot" pepper, even you the older one, you will have diarrhea so the child too will "run". (FGD_CMC 3)

In general, they primarily talked about the role of poor hygiene in food preparation as an important determinant of illness. They also suggested particular foods (e.g., coconut water, palm oil) and herbal medicines to treat disease.

Some of the parent, if they prepare food, they don't mode it nicely but they would put all in the plate it will spent 3 days in the plate … and they would eat that left over food which is not heated it you do so you child will not be in good health condition. (FGD_CMC4)

if the child has respiratory infection, we use a herb called "gegenkuger" the leaf is very sweet. You will cook it and give the water to the child to drink and it will stop. We have another one call "kangale", you will dig it and put the root into water. Give it to the child frequently, it will stop it. If we do all this and it is not working, then you can send the child to the hospital. (FGD_CMMC 1)

you have to give the child coconut water and add … to drink and it will stop (FGD_CMMC2)

when the child has diarrhoea, I use palm oil to prepare gari … (FGD_CMMC2)

we give them the water on the rice water or on the kenkey to drink because whiles he has diarrhoea, he will be losing water so this water will be replaced by the ones you are giving (FGD_CMMC 2)

Some members from communities that participated in education from the Nutrition Links project mentioned foods that they are eating to stay healthy to prevent diseases (e.g., eggs, green leafy vegetables). Providing nutritious food that can make the child strong was suggested as a way to prevent or treat diseases. However, the definition of nutritious food varied among different communities (e.g., what they meant by balanced diet differed).

Yes please foods that prevent our children from disease are fruits and leaves like beans, kontomire and let me say these nutritious foods prevent them from getting disease. (FGD_CMC4)

Finally, communities also discussed about some of their barriers and facilitators that were playing a role in providing children with nutritious food. Whereas the participants in

control communities focused on these barriers (reflecting food insecurity), those in the intervention communities discussed more the solutions to the barriers.

sometimes it come from poverty and we don't always have time. Someone has the food to give to the child but because she don't have time, she will not do it and also someone may not have the food. that there will be shortage. Meanwhile the child will eat, sometimes you give the child cassava to eat meanwhile that is not the food to eat. so, poverty. (FGD_CMC 1)

Money is the problem. Those in the city when they give birth, they prepare tea and fried egg with bread for them. in the afternoon, they prepare vegetable soup or use leafs for stew with egg. In the evening, you eat banku with soup, that makes you good but in this community, we only add a little salt fish to the pepper and that is what we do. Most people in the community don't know how to eat leaves. I know how to eat it but majority of the Krobos here don't know how to eat it. (FGD_CMMC 1)

"when cooking rice for the child or even you the grown ups, we were buying oil and tin tomatoes, even what is not ideal to us and when the child eats he gets problems but now, with our training, when you want to cook you use alefu and kontomire [local greens], add some eggs and cook. There is medicine in it also. (FGD_CM 4)

In summary, many of the topics about nutrition and illness were similar between the health staff and the community members. The health staff discussed improvement in delivering their health messages and in promotion of local foods to the communities as they had more chances of engaging with communities and doing a follow-up with them at

growth promotion clinics, food demonstrations, and diverse Nutrition Links project activities. The community members were more focused on the barriers to put their knowledge into practice. There was a difference between Nutrition Links control and intervention communities. Whereas the residents of control communities expressed concern about food insecurity when they talked about appropriate diets for disease prevention, the NL intervention community members found solutions to improve diets, such as substituting inaccessible foods (meat, market vegetables) with local foods promoted by the project (eggs, home garden produce).

Overall summary and link to the next phase

Some of the themes in this second phase came from the review of the literature and the quantitative analyses; others emerged during the qualitative process. For example, the theme of handwashing was commonly reported in the literature and was associated with at least one symptom of childhood illness in the Phase 1 analysis. The interviewed health staff and residents both recognized the community's knowledge about hygiene messages and barriers that sometimes did not let them implement these practices properly. These qualitative results provided a picture of the perceptions and the beliefs of health staff and community members that allowed us to identify the modifiable factors following participation in the Nutrition Links project to be examined against the presence of symptoms of diarrhea and respiratory infections.

Phase 3 results

The final phase of research explored the association between the Nutrition Links intervention and the report of diarrhea and RIS among children under five years old. The quantitative analysis included 500 caregivers and their children from 213 control and 287

intervention households. The participants were a subsample of those included in Phase 1; the data were extracted from baseline and endline surveys. This secondary analysis used only child, caregiver, and household variables that had been identified to be related to the outcomes of interest through the literature, *a priori* conceptual framework, or the first and second phases of this thesis.

Children demonstrated a high prevalence of poor nutritional indicators in these communities at endline. Almost half of the children were anemic (46.1%) and about one-fifth of them were stunted (17.7%). Caregivers reported a high frequency of children who experienced symptoms of illness in the recent past. At baseline, this included 25.5% of children with fever in the past 2 weeks and 31.4% with cough and 34.5% with diarrhea in the 7 days prior to the survey. At endline, this included 31.4% of children with fever in the 2 weeks and 32.6% with cough and 14.3% with diarrhea in the 7 days prior to the survey. About one quarter (26.3%) of the mothers did not meet the recommended minimum diversity in their diet. More than half (58.9%) of the mothers had a SRQ score ≥ 7 which reflected the presence of mental distress.

Children in the intervention group were about 2 mo older than the children in the control group (Table 4.2). Report of having fever at baseline in the intervention group was about 30% lower than in the control group. The intervention households were better off than the control households, as shown by better food security, use of improved water source for drinking, and having a place for washing their hands.

Multivariable logistic regression was used to test covariates for fever, cough, fever & cough, and diarrhea (Table 4.3). Being in the intervention arm of the Nutrition Links

project was not associated with any illness outcome. Baseline values of the illness symptoms were predictors for fever and cough (p=0.06). Other factors were also associated. The odds of having fever were lower with being male. Having a higher child hemoglobin level was associated with lower odds of fever and fever & cough. Mothers who had a minimally diverse diet were less likely to report the presence of fever & cough and diarrhea (p=0.08) in their children. Finally, maternal SRQ was consistently positively associated with the odds of having all four outcomes (for diarrhea, p=0.07).

Table 4.1. Child, maternal, and household indicators associated with symptoms of infectious diseases among Ghanaian infants and young children in rural Upper Manya Krobo district

Indicators	Prevalence of indicators (%)	Association with illness symptoms[1,2]			
		Diarrhea	Fever	Cough	Cough with difficulty breathing
Child					
Exclusively breastfed (yes)[3]	70.4	↓ *			
Stunted (no)	88.9				↓*
Diverse diet (yes) [4]	24.1				
Animal source food consumed (yes) [4]	55.9				
Caregiver					
Formal education					↑ *
None	21.8				
Primary	42.2				
Secondary/ tertiary	36.0				
Household					
Household food insecurity [5]		↑ *	↑ *		
Secure	42.4				
Mildly insecure	27.5				
Moderately insecure	18.5				
Severely insecure	11.6				

Source of drinking water [6]		
Improved	55.0	
Unimproved	45.0	
Has soap or detergent for handwashing (yes)	76.7	↑ *

[1] n=maximum of 912. All listed associations (*) had a $p<0.05$, using Chi-squared analyses.
[2] Symptoms over the past seven days (diarrhea, cough, cough and difficulty breathing) or the last two weeks (fever). Only those children with a cough were asked if they had difficulty breathing.
[3] Exclusive breastfeeding included data from only infants < 6 months of age (n=480); diverse diet and animal source food consumption included data from only infants ≥ 6 months of age (n=427).
[4] From dietary diversity score for children: < 4 food groups=not diverse; ≥ 4 food groups=diverse. Food groups included: grains; roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin-A-rich fruits and vegetables; and other fruits and vegetables. World Health Organization (2008)
[5] Food and Agriculture Organization (2012)
[6] Improved: piped water into residence /plot, public tap/standpipe, tube well/ borehole, protected well/spring; Unimproved: unprotected well/spring, surface water, other

Table 4.2. Child, maternal, and household characteristics of Nutrition Links participants living in rural Ghana, by study group

	Study group		
Characteristics	**Intervention**	**Control**	**P value[1]**
Child			
Sex (male)	50.4 (143/284)	53.8 (112/208)	0.47
Age (mo)	38.0 ± 8.9 (263)	36.0 ± 10.2 (194)	0.03
Stunted (yes)[2]	17.7 (41/232)	17.8 (30/169)	1.00
Hemoglobin (g/l)	11.0 ± 1.4 (231)	11.0 ± 1.2 (168)	0.94
Baseline illness symptoms			
Fever past 2 wk	21.8 (62/284)	30.5 (64/210)	0.04
Cough past 7 d	33.2 (94/283)	29.0 (61/210)	0.33
Diarrhea past 7 d	35.2 (100/284)	33.5 (70/209)	0.70
Maternal			
Minimum maternal diet diversity [3]	74.9 (173/231)	72.0 (121/168)	0.57
SRQ score[4]	7.9 ± 5.0 (231)	8.5 ± 5.3 (168)	0.23
Household			
Food insecurity[5]			0.00
Secure	49.4 (114/231)	32.1 (54/168)	
Insecure	50.6 (117/231)	67.9 (114/168)	
Improved water source for drinking[6] (yes)	59.0 (125/212)	42.2 (68/161)	0.002
Has handwashing area (yes)	16.9 (39/231)	7.7 (13/168)	0.01

Has soap or detergent for handwashing (yes)	72.3 (167/231)	74.4 (125/168)	0.65

Data are % (n/N) or mean ± standard deviation (N)

[1] Analysis used Chi-squared for categorical variables and independent Student's t-test for continuous variables.

[2] Stunted: < -2 length/height-for-age

[3] Minimum maternal dietary diversity: < 5 food groups=No, not diverse; ≥ 5 food groups=Yes, diverse. Food groups included: grains, roots, and tubers; pulses; nuts and seeds; dairy products; meat, poultry, and fish; eggs; dark leafy green vegetables; other vitamin-A-rich fruits and vegetables; other vegetables; and other fruits. (FAO and FHI 360, 2016)

[4] SRQ: Self-Reporting Questionnaire with 20 items to reflect symptoms of mental health; the score ranges from 0 to 20. (Beusenberg *et al.,* 1994)

[5] Food security: classification based on the 15-item Food Insecurity Experience Scale with all categories of food insecurity combined. (Food and Agriculture Organization, 2012)

[6] Improved: piped water into residence/plot, public tap/standpipe, tube well/ borehole, protected well/spring; Unimproved: unprotected well/spring, surface water, other

Table 4.3. Multiple logistic regression model for the symptoms of infectious diseases over the previous two weeks for Ghanaian rural children at the end of the Nutrition Links project

Outcomes / Predictors	Beta	Adjusted OR	95% CI
Fever (n=393)			
Intervention[1]	0.01	1.01	0.61, 1.70
Fever at baseline (yes)	0.84	2.31	1.46, 3.63
Sex (male)	-0.64	0.53	0.36, 0.78
Hemoglobin of child (g/L)	-0.46	0.63	0.50, 0.79
Maternal SRQ score (#)[2]	0.14	1.14	1.08, 1.22
Cough (n=398)			
Intervention[1]	-0.19	0.83	0.53, 1.28
Cough at baseline (yes)	0.56	1.75	0.96, 3.18
Maternal SRQ score (#)[2]	0.07	1.07	1.01, 1.14
Fever & cough (n=394)			
Intervention	-0.00	0.10	0.62, 1.59
Minimum maternal diet diversity (yes)[3]	-0.74	0.48	0.28, 0.82
Hemoglobin of child (g/L)	-0.24	0.78	0.66, 0.94
Maternal SRQ score (#)[2]	0.13	1.14	1.08, 1.20
Soap/detergent for handwashing (yes)	0.60	1.83	0.92, 3.61

Diarrhea (n=398)

Intervention	-0.03	0.97	0.51, 1.86
Minimum maternal diet diversity (yes)[3]	-0.76	0.47	0.20, 1.09
SRQ score (#)[2]	0.07	1.07	0.99, 1.16

Multivariable logistic regression with clustered standard errors was used to test covariates and their interaction with the intervention on the main outcomes for a sample of 500 children. All models except for the 'cough and fever' also included the baseline value for that outcome (cough and diarrhea for past 7 d; fever for past 2 wk). The models tested the following endline predictors: child age, sex, hemoglobin, and stunting; maternal diet diversity and SRQ, and household food security, source of water, place for washing hands, and presence of soap for handwashing. Backwards stepwise variable selection was used to remove predictors with $p > 0.10$, except for intervention which was kept in the final models. The number of cases with complete data used for each model is shown above.

[1]Intervention group for the Nutrition Links project (reference=control group).

[2]SRQ: Self-Reporting Questionnaire with 20 items to reflect symptoms of mental health; the score ranges from 0 to 20. (Beusenberg *et al.,* 1994)

[3]Minimum maternal dietary diversity: < 5 food groups=No, not diverse; ≥ 5 food groups=Yes, diverse. Food groups included: grains, roots, and tubers; pulses; nuts and seeds; dairy products; meat, poultry, and fish; eggs; dark leafy green vegetables; other vitamin-A-rich fruits and vegetables; other vegetables; and other fruits. (FAO and FHI 360, 2016)

Chapter 5. Discussion

Using the different lens of the institutional staff and community members and the different quantitative and qualitative methodologies, this project provided a comprehensive picture of the determinants of experiencing diarrhea and RIS in the UMKD. Notably, the only factor consistently associated with the reporting of the disease symptoms was the indicator for maternal mental health, the SRQ score. Nutrition-related indicators (child hemoglobin and maternal dietary diversity) were associated with some of the symptoms. In the quantitative analysis, the Nutrition Links intervention was not associated with illness symptoms; however, in the qualitative analysis, participants reported that the intervention improved the engagement between health staff and community members, the use of health services as well as the promotion of local food and community assistance related to child health and nutrition.

Maternal mental health. Maternal mental distress has been linked to an increased risk of malnutrition and preventable infectious diseases (Rahman, 2005). Caregiver's mental distress may directly affect the risk of diseases via several pathways. This includes, having an impact on child feeding (breastfeeding and complementary feeding) as well as caring practices and use of health services (Harpham *et al.,* 2005; Rahman *et al*, 2008; Ruel *et al.,* 2013; Khan *et al.,* 2017). The final models in the present analysis for each disease symptom were unique; despite the model differences, there was a consistent association between the outcomes and the SRQ. For each one-point increase in the score for the SRQ, there was a 7% to 14% increase in risk of fever, cough, and fever & cough; the association with diarrhea was in this range although it did not quite reach significance (p=0.07). Similar results were reported by a cross-sectional study in three low- and middle-income countries (Nguyen *et al.,* 2014). That study

demonstrated that children of mothers with poor mental health (SRQ≥ 7), compared to those with good mental health (SRQ<7), in Bangladesh, Vietnam and Ethiopia had higher reports in the previous two weeks of diarrhea (AOR=1.67, 95% CI:1.22, 2.25; AOR=2.11, 95% CI:1.61, 2.76; and AOR=1.83, 95% CI:1.47, 2.27, respectively) and upper acute respiratory infectious symptoms (AOR=1.41, 95% CI:1.15, 1.73; AOR=2.05, 95% CI:1.61, 2.62; and AOR= 2.10, 95% CI:1.72, 2.57, respectively). A prospective cohort study in rural Pakistan demonstrated that maternal depression, assessed by the Schedules for Clinical Assessment in Neuropsychiatry (SCAN) with a prevalence of 25% prenatally, was associated with an increase in the risk of infants having five or more episodes of diarrhea per year (RR= 2.4, 95% CI: 1.7, 3.3) (Rahman *et al.,* 2004). In addition, there was increased relative risks of being underweight or stunted for infants at 6 and 12 months of age (underweight unadjusted RR=4.0, 95% CI:2.1, 7.7 and RR=2.6, 95% CI: 1.7, 4.1 and stunted unadjusted RR=4.4, 95% CI:1.7, 11.4 and RR=2.5, 95% CI: 1.6, 4.0, respectively). A study in the Eastern region of Ghana (the same region of this present analysis) assessed maternal mental health with the Edinburgh Postnatal Depression Scale (EPDS) in a population of women who were Human Immunodeficiency Virus (HIV)-positive, HIV-negative, or HIV-unknown (Okronipa *et al.,* 2012). At 3 months of age, depression was associated with a doubling of the number of diarrheal episodes and twice as many days of illness (both p<0.001). There was an interaction between depression and HIV status; depression increased the risk of having diarrhea only among those whose mothers were HIV-positive (AOR=5.39; 95% CI: 2.48, 11.68) and HIV-unknown (AOR=4.53, 95% CI:2.47, 8.32).

Given the results of this analysis and those in the literature, the association between maternal mental health symptoms and child health seems to be robust. Similar results

were seen regardless of the following variations: (i) the SRQ variable was used as a continuous variable or a dichotomous variable or other tools were used to measure mental health, (ii) the definition used for the diseases symptoms, and (iii) the other determinants included in the models. The relationship was also noted in research sites with a wide range of prevalence of poor mental health (from Ghana [58%] to Vietnam [31%] with the SRQ and Ghana 10% with the EPDS) as well as the presence of other health conditions such as HIV.

Finally, although maternal mental health was not the main topic in the qualitative phase, there was some evidence that emerged from the discussions about the role of indicators of maternal mental health in child health. Caregivers participating in mother-to-mother support groups of the NL project discussed how they were empowered to improve their health seeking behaviors. This happened by actively participating in groups with other mothers under the supervision of health workers. They mentioned one of the barriers of using the health services was their low authority to take decisions (e.g., sending the child to the hospital when ill). Women mentioned that when they participated in the groups, they were empowered to solve health problems.

Nutrition. Poor quality diet contributes to childhood malnutrition, which increases children's susceptibility to infectious diseases (Rodríguez *et al.,* 2011; World Health Organization, 2019). The dietary indicator used in the present models was maternal dietary diversity, which had a negative association with fever & cough. This variable was correlated to child diet diversity. Other studies have reported on dietary diversity of children and infectious diseases. In a study in Tanzania among children of HIV-exposed women, lower dietary diversity was linked to a higher risk of respiratory

infectious diseases (cough with at least one other symptom [difficulty breathing, chest retraction, or refusal to feed]) (RR=1.41; 95%CI: 1.13, 1.76). (Kamenju *et al.,* 2017).

Results from the present study revealed that better nutritional status (here, a high hemoglobin level) was associated with a lower risk of some RIS (fever, or fever & cough). Fever is a symptom of a variety of diseases and is not a differentiating sign of solely respiratory infections (Abrahamsen *et al.,* 2013). The high prevalence of malaria (31% in children 5 to 59 months of age in the Eastern region of Ghana (Ghana Statistical Service *et al*. 2017), which is linked to both fever and anemia, might confound this present analysis (Menendez *et al.,* 2000). Unfortunately, the number of completed confirmatory tests of malaria was insufficient to be included in analysis. The present results showing a relationship between hemoglobin and RIS are consistent with past studies that identified iron-deficiency anemia as a risk factor for clinically diagnosed respiratory infectious diseases among children (Rashad *et al*. 2015; Sheikh Quyoom Hussain *et al* 2014).

The qualitative phase demonstrated a need for health staff to better understand the facilitators and barriers that community members face in putting their nutrition knowledge to practice for disease prevention. Participants discussed the improvement in their understanding about the role of an appropriate diet to ensure a healthy child (e.g., the importance of diverse diets, clean diets) but were concerned about the barriers to practicing their knowledge. A previous study in Ghana reported a knowledge gap among nurses and their incomplete understanding of the barriers that caregivers faced about young child feeding practices (Davis *et al.,* 2017). Another study from the Volta region in Ghana demonstrated some of the barriers within the household from the caregivers'

perspective that influence their health-care seeking behaviors (Tolhurst *et al.,* 2008). The result from this study consistently showed that caregivers need to bargain for child health within the household with the father of the child or elders and that they did not have enough power for decision making for use of health services.

The influence of interventions. Nutrition-sensitive agricultural interventions may improve child health by addressing the underlying causes of malnutrition, the determinants of which are similar to child illnesses. (Ruel *et al.,* 2013) The bilateral relationship between malnutrition and disease means that improving nutrition would be expected to positively influence health (Black *et al.,* 2013; Rodríguez *et al.,* 2011). The variation in local determinants of illness, the design of the interventions themselves, the ability of participants to act on the intervention and health staff recommendations, and the difficulty in measuring the determinants and the outcomes (including their definition and recall bias) may all contribute to the inconsistent results (Berti *et al.,* 2004; Rodríguez *et al.,* 2011; Girard *et al.,* 2012; Herforth & Ballard., 2016). The NL intervention improved the quality of children's nutrition indicators, including LAZ/HAZ and WAZ (Marquis *et al.,* 2018). However, as shown in the present analysis, there was no association between the NL intervention and childhood symptoms of illnesses. One reason might be the poultry rearing activities promoted by the NL as other researchers have demonstrated the possibility of elevating the risk of diarrhea through exposure to animal feces (Zambrano *et al.,* 2014; Mbuya and Humphrey, 2016).

A similar absence of a relationship between the agriculture-nutrition intervention and childhood diarrhea was noted in a Helen Keller International (HKI) integrated homestead food production in Cambodia; however, caregiver reports of child fever were lower at

endline among the intervention group compared to the control group. (Olney *et al.,* 2009) This study did not demonstrate a treatment group difference in nutrition indicators (diet, hemoglobin, or anthropometric measurements) at endline. In a Helen Keller International intervention with a behavior change communication component in Burkina Faso, there was a reduction in diarrhea prevalence among children who received a home visit (either from a health committee member (community member trained to deliver health messages; p=0.00) or an elderly woman (p=0.05). (Olney *et al.,* 2015). A multivariable analysis of data from three time points of a community-based nutrition intervention with a prospective cohort in Vietnam found a reduction in RIS but no difference in diarrhea between treatment and control groups (Sripaipan *et al.,* 2002). Sensitivity analyses indicate intervention benefits for subgroups of participants even when there is no overall improvement. For example, a community development and livestock promotion study in two geographically and culturally different regions in Nepal did not find any difference in reports of diarrhea, fever, and RIS over the last two weeks (presence or in number of days ill). However, in a sub-analysis of Terai and the hills (the poorer area), the number of reports of days with symptoms was lower in the intervention compared to the control group (Miller *et al.,* 2014).

The qualitative phase provided insight into the beliefs and perceptions of professional health care providers and both intervention and control community members about how the NL intervention influenced nutrition and child health. Health staff discussed how the NL project enhanced the quality of health care delivery by updating their knowledge through capacity building activities. Both the intervention and control arm communities benefitted. In the intervention sites, the relationship with the communities was improved through the staff participation in implementation of various NL activities, such as

community growth promotion and food demonstrations. Community members were in agreement with the health staff and mentioned that NL facilitated their use of health services. In addition, the community members who benefitted from the nutrition education and food demonstration activities where inspired to use their accessible local foods resources to provide their children with appropriate diets for disease prevention.

These qualitative findings show how NL was an effective integrated intervention and followed the recommended approaches on promoting quality of child diet and improving food security status to protect children from preventable diseases such as diarrhea and pneumonia (Black *et al.,* 2013). Notably, both health workers and community members mentioned how community-based clinics were influential in promoting healthcare practices and their engagement with each other, which is consistent with previous evidence on the impact of CHPS centers on providing health services (Atinga *et al.,* 2019: Maly *et al.,* 2019). It should be noted that the qualitative study did not aim to evaluate the NL project and the qualitative data might have been biased as participants could have been influenced by World Vision and NL staff who were present at the time of data collection. This may have led to exaggerated nutrition intervention impacts.

Challenges and Limitations

Conducting a study in a rural area of Ghana had challenges, including language and cultural barriers, and environmental and infrastructural obstacles. Working with a group of motivated researchers, field workers, institutional staff, and community members helped overcome many of the language and cultural barriers. The poor quality of the roads and torrential rains delayed access to communities, made finding their members difficult, and hindered data collection itself. Finding quiet, private sites for qualitative

data collection in rural communities was a challenge during the field work. During the analysis, it was challenging to integrate quantitative and qualitative results and to integrate focus groups and in-depth interviews resulting from the different perspectives of health workers and members from the NL intervention and control communities.

While the above challenges were addressed using different approaches, the study had several limitations. Data for some confounders (e.g., malaria) and predictors (e.g., weaning age) were incomplete and could not be included in this analysis. No clinical assessment of symptoms of diseases and diarrhea was available to confirm reports from caregivers. No data on severity of symptoms was available in the quantitative analysis yet the participants talked mainly about what to do when there were severe not mild cases; the action to be done for prevention and treatment would depend on severity. The recall bias for data on diarrhea and RIS was a probable error that should be considered given the primary outcome was collected with self-reported data. In addition, the influence of memory bias may have been important in this study given the high prevalence of maternal mental health distress and the value-based focus on perceptions about child health (Mechera-Ostrovsky and Gluth, 2018). Cultural bias also may have impacted the discussion of the role of the community's beliefs on prevention and treatment of infectious diseases. Data collected in the qualitative phase on the role of the NL project might have been influenced by the presence of World Vision and NL staff during the interviews and focus group discussions (interviewer bias). Finally, the impact of researcher bias was minimized by having a comprehensive method of analysis for the qualitative data and confirmation from other staff and researchers for the interpretation of the results.

To reach the Sustainable Development Goal #3 target by 2030, programs need to address the common influential risk factors for infectious diseases, identifying the socioeconomic, cultural, and environmental dimensions at the individual and institutional levels (United Nations, 2016). Maternal mental health is an example of a determinant that has been neglected and should be addressed. Enhancing capacity to address mental health concerns should be promoted for institutional staff who work in rural communities. Rural interventions are an opportunity to raise awareness within communities about the importance of good maternal mental health status for child health. Integrating community health services with agriculture and other interventions may enhance engagement within communities and between community members and institutional staff for positive outcomes.

Rural interventions have the potential for behavior change to improve children's diets which will, in turn, improve nutritional status and contribute to the reduction in child illnesses. To coordinate effective interventions, collaboration is needed among local communities, health institutions, and organizational authorities. This includes the need for common messages and objectives to promote nutrition, physical and mental health, food security, hygiene practices, and provide better use of health facilities. The unique local and accessible community resources, cultural beliefs, and the level of community readiness should be clarified to enhance knowledge transfer and improve health systems effectiveness. In addition, filling the health staff-community member gap of understanding about the underlying barriers and facilitators for putting knowledge into practice will facilitate communication between these parties. Engaging all members of rural communities and health staff together and empowering them to raise their voice to share their concerns about factors that influence health may contribute to acceptable and

sustainable interventions. Providing a platform to empower, encourage, and motivate care providers from within the household to the service provider institutions could ultimately improve child health in rural Ghana.

References

Abrahamsen, S. K., Haugen, C. N., Rupali, P., Mathai, D., Langeland, N., Eide, G. E., & Mørch, K. (2013). Fever in the tropics: aetiology and case-fatality-a prospective observational study in a tertiary care hospital in South India. BMC Infectious Diseases, 13(1), 355.

Akombi, B. J., Agho, K. E., Hall, J. J., Merom, D., Astell-Burt, T., & Renzaho, A. M. N. (2017). Stunting and severe stunting among children under-5 years in Nigeria: A multilevel analysis. BMC Pediatrics, 17, 15. https://doi.org/10.1186/s12887-016-0770-z.

Anderson, L. C., Tegegn, A., Tessema, F., Galea, S., & Hadley, C. (2012). Food insecurity, childhood illness and maternal emotional distress in Ethiopia. Public Health Nutrition, 15(4), 648-655.

Ashraf, S., Nizame, F. A., Islam, M., Dutta, N. C., Yeasmin, D., Akhter, S., Luby, S. P. (2017). Nonrandomized trial of feasibility and acceptability of strategies for promotion of soapy water as a handwashing agent in rural Bangladesh. American Journal of Tropical Medicine and Hygiene, 96(2), 421–429. https://doi.org/10.4269/ajtmh.16-0304.

Atinga, R. A., Agyepong, I. A., & Esena, R. K. (2019). Willing but unable? Extending theory to investigate community capacity to participate in Ghana's community-based health planning and service implementation. Evaluation and Program Planning, 72, 170–178. https://doi.org/10.1016/j.evalprogplan.2018.10.001.

Baker, K. K., O'Reilly, C. E., Levine, M. M., Kotloff, K. L., Nataro, J. P., Ayers, T. L., Farag, T.H., Nasrin, D., Blackwelder, W.C., Wu, Y., & Alonso, P. L. (2016). Sanitation and hygiene-specific risk factors for moderate-to-severe diarrhea in young children in the global enteric multicenter study, 2007–2011: Case-control study. PLoS Medicine, 13(5), e1002010.

Berti, P. R., Krasevec, J., & FitzGerald, S. (2004). A review of the effectiveness of agriculture interventions in improving nutrition outcomes. Public Health Nutrition, 7(5), 599–609. https://doi.org/10.1079/PHN2003595.

Beusenberg, M., Orley, J. H., & World Health Organization. (1994). A User's Guide to theSself Reporting Questionnaire (SRQ). No. WHO/MNH/PSF/94.8. Unpublished. Geneva: World Health Organization.

Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). Guide to Measuring Household Food Security. Alexandria: Department of Agriculture Food and Nutrition Service.

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., Uauy, R., & Maternal and Child Nutrition Study Group (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet, 382(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X.

Brown, K. H. (2003). Diarrhea and malnutrition. The Journal of Nutrition, 133(1), 328S-332S.

Cha, S., Kang, D., Tuffuor, B., Lee, G., Cho, J., Chung, J., Kim, M., Lee, H., Lee, J. and Oh, C. (2015). The effect of improved water supply on diarrhea prevalence of children under five in the Volta region of Ghana: a cluster-randomized controlled trial. International Journal of Environmental Research and Public Health, 12(10), 12127-12143.

Christian, A. K., Marquis, G. S., Colecraft, E. K., Lartey, A., Sakyi-Dawson, O., Ahunu, B. K., & Butler, L. M. (2016). Caregivers' nutrition knowledge and attitudes are associated with household food diversity and children's animal source food intake across different agro-ecological zones in Ghana. British Journal of Nutrition, 115(2), 351-360.

Curtis, V., Schmidt, W., Luby, S., Florez, R., Touré, O., & Biran, A. (2011). Hygiene: new hopes, new horizons. The Lancet Infectious Diseases, 11(4), 312-321.

Danaei, G., Andrews, K. G., Sudfeld, C. R., Fink, G., McCoy, D. C., Peet, E., Christopher R., Smith A., Ezzati M. & Fawzi, W. W. (2016). Risk factors for childhood stunting in 137 developing countries: a comparative risk assessment analysis at global, regional, and country levels. PLoS Medicine, 13(11), e1002164.

Darapheak, C., Takano, T., Kizuki, M., Nakamura, K., & Seino, K. (2013). Consumption of animal source foods and dietary diversity reduce stunting in children in Cambodia. International Archives of Medicine, 6(1), 29.

Davis, J. N., Brown, H., & Ramsay, S. A. (2017). Gaps in international nutrition and child feeding guidelines: a look at the nutrition and young child feeding education of Ghanaian nurses. Public Health Nutrition, 20(12), 2215-2224.

Ezzati, M., & Baumgartner, J. C. (2017). Household energy and health: where next for research and practice? The Lancet, 389(10065), 130-132.

FAO & FHI 360. 2016. Minimum Dietary Diversity for Women: A Guide for Measurement. Rome: FAO.

Food and Agriculture Organization. (2012). Escala Latinoamericana y Caribeña de seguridad alimentaria (ELCSA): Manual de uso y aplicaciones. Santiago, Chile: FAO Regional Office, Latin America.

Freeman, M. C., Stocks, M. E., Cumming, O., Jeandron, A., Higgins, J., Wolf, J., Prüss-Ustün, A., Bonjour, S., Hunter, P.R., Fewtrell, L. & Curtis, V. (2014). Systematic review: hygiene and health: systematic review of handwashing practices worldwide and update of health effects. Tropical Medicine & International Health, 19(8), 906-916.

Ghana Statistical Service. (2012). 2010 Population and Housing Census Final Results. Accessed April 30, 2020 at https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/2010_PHC_National_Analytical_Report.pdf.

Ghana Statistical Service. (2014). Ghana Demographic and Health Survey, Accessed April 30, 2020 at http://dhsprogram.com/what-we-do/survey/survey-display-437.cfm.

Ghana Statistical Service (GSS), Ghana Health Service (GHS), and ICF. (2017). Ghana Malaria Indicator Survey 2016. Accra, Ghana, and Rockville, Maryland, USA: GSS, GHS, and ICF.

Girard, A. W., Self, J. L., McAuliffe, C., & Olude, O. (2012). The effects of household food production strategies on the health and nutrition outcomes of women and young children: a systematic review. Paediatric and Perinatal Epidemiology, 26 Suppl 1, 205-222. doi:10.1111/j.1365-3016.2012.01282.x.

Gubert, M. B., Spaniol, A. M., Bortolini, G. A., & Pérez-Escamilla, R. (2016). Household food insecurity, nutritional status and morbidity in Brazilian children. Public Health Nutrition, 19(12), 2240-2245.

Hall, C. B., Douglas Jr, R. G., & Geiman, J. M. (1980). Possible transmission by fomites of respiratory syncytial virus. Journal of Infectious Diseases, 141(1), 98-102.

Harpham, T., Huttly, S., De Silva, M. J., & Abramsky, T. (2005). Maternal mental health and child nutritional status in four developing countries. Journal of Epidemiology & Community Health, 59(12), 1060-1064.

Harpham, T., Reichenheim, M., Oser, R., Thomas, E., Hamid, N., Jaswal, S., Ludermir, A. and Aidoo, M. (2003) Measuring mental health in a cost-effective manner. Health Policy and Planning, 18(3), 344-349.

Hatløy, A., Torheim, L. E., & Oshaug, A. (1998). Food variety—a good indicator of nutritional adequacy of the diet? A case study from an urban area in Mali, West Africa. European Journal of Clinical Nutrition, 52(12), 891.

Hatt, L. E., & Waters, H. R. (2006). Determinants of child morbidity in Latin America: a pooled analysis of interactions between parental education and economic status. Social Science & Medicine, 62(2), 375-386.

Herforth, A., & Ballard, T. J. (2016). Nutrition indicators in agriculture projects: Current measurement, priorities, and gaps. Global Food Security, 10, 1-10.

Horta, B. L., Victora, C. G., & World Health Organization. (2013). Short-term effects of breastfeeding: a systematic review on the benefits of breastfeeding on diarrhoea and pneumonia mortality. Accessed April 30, 2020 at http://apps.who.int/iris/bitstream/10665/95585/1/9789241506120_eng.pdf.

Howie, S. R., Schellenberg, J., Chimah, O., Ideh, R. C., Ebruke, B. E., Oluwalana, C., Mackenzie, G., Jallow, M., Njie, M., Donkor, S. & Dionisio, K. L. (2016). Childhood pneumonia and crowding, bed sharing and nutrition: a case-control study from The Gambia. The International Journal of Tuberculosis and Lung Disease, 20(10), 1405-1415.

Kamenju P., Liu E., Hertzmark E., Spiegelman D., Kisenge R.R., Kupka R., Aboud S., Manji K., Duggan C., & Fawzi W.W. (2017). Complementary Feeding and Diarrhea and Respiratory Infection Among HIV-Exposed Tanzanian Infants. Journal of Acquired

Immune Deficiency Syndromes, 2017;74(3):265-272. doi:10.1097/QAI.0000000000001248.

Kennedy, G., Ballard, T., & Dop, M. C. (2011). Guidelines for Measuring Household and Individual Dietary Diversity. Rome: Food and Agriculture Organization of the United Nations. Retrieved April 30, 2020 from http://www.fao.org/3/a-i1983e.pdf.

Khan, A. M., & Flora, M. S. (2017). Maternal common mental disorders and associated factors: a cross-sectional study in an urban slum area of Dhaka, Bangladesh. International Journal of Mental Health Systems, 11, 23. doi:10.1186/s13033-017-0129-3.

Lamberti, L. M., Walker, C. L. F., Noiman, A., Victora, C., & Black, R. E. (2011). Breastfeeding and the risk for diarrhea morbidity and mortality. BMC Public Health, 11(3), S15.

Maly C, Okyere Boadu R, Rosado C, Lailari A, Vikpeh-Lartey B, Allen C. (2019). Can a standards-based approach improve access to and quality of primary health care? Findings from an end-of-project evaluation in Ghana. PLoS One, 14(5):e0216589. doi:10.1371/journal.pone.0216589.

Marquis, G. S., Colecraft, E. K., Kanlisi, R., Aidam, B. A., Atuobi-Yeboah, A., Pinto, C., & Aryeetey, R. (2018). An agriculture-nutrition intervention improved children's diet and growth in a randomized trial in Ghana. Maternal & Child Nutrition, 14 Suppl 3, e12677. https://doi.org/10.1111/mcn.12677.

Mbuya, M. N., & Humphrey, J. H. (2016). Preventing environmental enteric dysfunction through improved water, sanitation and hygiene: an opportunity for stunting reduction in developing countries. Maternal & Child Nutrition, 12 Suppl 1,106–120. https://doi.org/10.1111/mcn.12220.

McDonald, C. M., Olofin, I., Flaxman, S., Fawzi, W. W., Spiegelman, D., Caulfield, L. E., Black, R.E., Ezzati, M., Danaei, G. & Nutrition Impact Model Study. (2013). The effect of multiple anthropometric deficits on child mortality: meta-analysis of individual data in 10 prospective studies from developing countries. The American Journal of Clinical Nutrition, 97(4), 896-901.

Mechera-Ostrovsky, T., & Gluth, S. (2018). Memory Beliefs Drive the Memory Bias on Value-based Decisions. Scientific Reports, 8(1), 10592. https://doi.org/10.1038/s41598-018-28728-9.

Menendez, C., Fleming, A. F., & Alonso, P. L. (2000). Malaria-related anaemia. Parasitology Today, 16(11), 469-476.

Miller, L. C., Joshi, N., Lohani, M., Rogers, B., Loraditch, M., Houser, R., Singh, P., & Mahato, S. (2014). Community development and livestock promotion in rural Nepal: effects on child growth and health. Food and Nutrition Bulletin, 35(3), 312–326. https://doi.org/10.1177/156482651403500304.

Mondal, D., Haque, R., Sack, R. B., Kirkpatrick, B. D., & Petri Jr, W. A. (2009). Attribution of malnutrition to cause-specific diarrheal illness: evidence from a

prospective study of preschool children in Mirpur, Dhaka, Bangladesh. The American Journal of Tropical Medicine and Hygiene, 80(5), 824-826.

Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification strategies for establishing reliability and validity in qualitative research. International Journal of Qualitative Methods, 1(2), 13-22.

Mortimer, K., Ndamala, C. B., Naunje, A. W., Malava, J., Katundu, C., Weston, W., Havens, D., Pope, D., Bruce, N.G., Nyirenda, M. & Wang, D. (2017). A cleaner burning biomass-fuelled cookstove intervention to prevent pneumonia in children under 5 years old in rural Malawi (the Cooking and Pneumonia Study): a cluster randomised controlled trial. The Lancet, 389(10065), 167-175.

Moschovis, P. P., Addo-Yobo, E. O., Banajeh, S., Chisaka, N., Christiani, D. C., Hayden, D., Jeena, P., MacLeod, W.B., Mino, G., Patel, A. & Qazi, S. (2015). Stunting is associated with poor outcomes in childhood pneumonia. Tropical Medicine & International Health, 20(10), 1320-1328.

Nandy, S., Irving, M., Gordon, D., Subramanian, S. V., & Smith, G. D. (2005). Poverty, child undernutrition and morbidity: new evidence from India. Bulletin of the World Health Organization, 83(3), 210-216.

Nguyen P. H., Saha K. K., Ali D., Menon P., Manohar S., Mai L. T., Rawat R., & Ruel M. T. (2014). Maternal mental health is associated with child undernutrition and illness in Bangladesh, Vietnam and Ethiopia. Public Health Nutrition. 2014;17(6):1318-1327. doi:10.1017/S1368980013001043.

Ohemeng, A., Marquis, G. S., & Lartey, A. (2015). Household Food Insecurity is Associated with Respiratory Infections Among 6–11-Month Old Infants in Rural Ghana. The Pediatric Infectious Disease Journal, 34(8), 821-825.

Okronipa, H. E., Marquis, G. S., Lartey, A., Brakohiapa, L., Perez-Escamilla, R., & Mazur, R. E. (2012). Postnatal depression symptoms are associated with increased diarrhea among infants of HIV-positive Ghanaian mothers. AIDS and Behavior, 16(8), 2216-2225.

Olney, D. K., Talukder, A., Iannotti, L. L., Ruel, M. T., & Quinn, V. (2009). Assessing impact and impact pathways of a homestead food production program on household and child nutrition in Cambodia. Food and Nutrition Bulletin, 30(4), 355-369.

Olney, D. K., Pedehombga, A., Ruel, M. T., & Dillon, A. (2015). A 2-Year Integrated Agriculture and Nutrition and Health Behavior Change Communication Program Targeted to Women in Burkina Faso Reduces Anemia, Wasting, and Diarrhea in Children 3–12.9 Months of Age at Baseline: A Cluster-Randomized Controlled Trial–3. The Journal of Nutrition, 145(6), 1317-1324.

Olofin, I., McDonald, C. M., Ezzati, M., Flaxman, S., Black, R. E., Fawzi, W. W., Caulfield, L.E., & Danaei, G. (2013). Associations of suboptimal growth with all-cause and cause-specific mortality in children under five years: a pooled analysis of ten prospective studies. PloS One, 8(5), e64636.

Poblacion, A. P., Cook, J. T., Marín-León, L., Segall-Corrêa, A. M., Silveira, J. A., Konstantyner, T., & Taddei, J. A. A. (2016). Food Insecurity and the Negative Impact on Brazilian Children's Health—Why Does Food Security Matter for Our Future Prosperity? Brazilian National Survey (PNDS 2006/07). Food and Nutrition Bulletin, 37(4), 585-598.

Rabbi, S. E., & Dey, N. C. (2013). Exploring the gap between hand washing knowledge and practices in Bangladesh: a cross-sectional comparative study. BMC Public Health, 13(1), 89. https://doi.org/10.1186/1471-2458-13-89.

Rah, J. H., Akhter, N., Semba, R. D., De Pee, S., Bloem, M. W., Campbell, A. A., Moench-Pfanner, R., Sun, K., Badham, J. & Kraemer, K. (2010). Low dietary diversity is a predictor of child stunting in rural Bangladesh. European Journal of Clinical Nutrition, 64(12), 1393.

Rahman, A. (2005). Maternal depression and child health: the need for holistic health policies in developing countries. Harvard Health Policy Review, 6(2), 70-80.

Rahman, A., Iqbal, Z., Bunn, J., Lovel, H., & Harrington, R. (2004). Impact of maternal depression on infant nutritional status and illness: a cohort study. Archives of General Psychiatry, 61(9), 946-952.

Rahman, A., Patel, V., Maselko, J., & Kirkwood, B. (2008). The neglected 'm'in MCH programmes–why mental health of mothers is important for child nutrition. Tropical Medicine & International Health, 13(4), 579-583.

Rashad, M. M., Fayed, S. M., & El-Hag, A. M. K. (2015). Iron-deficiency anemia as a risk factor for pneumonia in children. Benha Medical Journal, 32(2), 96.

Rodríguez, L., Cervantes, E., & Ortiz, R. (2011). Malnutrition and gastrointestinal and respiratory infections in children: a public health problem. International Journal of Environmental Research and Public Health, 8(4), 1174-1205.

Ruel, Marie T., Harold Alderman, & Maternal and Child Nutrition Study Group. (2014). Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? The Lancet, 382(9891), 536-551.

Sheikh Quyoom Hussain, M. A., Wani, J. G., & Ahmed, J. (2014). Low hemoglobin level a risk factor for acute lower respiratory tract infections (ALRTI) in children. Journal of Clinical and DiagnosticRresearch, 8(4), PC01-PC03.

Smith, K. R., McCracken, J. P., Weber, M. W., Hubbard, A., Jenny, A., Thompson, L. M., Balmes, J., Diaz, A., Arana, B. & Bruce, N. (2011). Effect of reduction in household air pollution on childhood pneumonia in Guatemala (RESPIRE): a randomised controlled trial. The Lancet, 378(9804), 1717-1726.

Sripaipan, T., Schroeder, D. G., Marsh, D. R., Pachón, H., Dearden, K. A., Ha, T. T., & Lang, T. T. (2002). Effect of an integrated nutrition program on child morbidity due to respiratory infection and diarrhea in northern Viet Nam. Food and Nutrition Bulletin, 23(4 Suppl), 70–77.

Surkan, P. J., Kennedy, C. E., Hurley, K. M., & Black, M. M. (2011). Maternal depression and early childhood growth in developing countries: systematic review and meta-analysis. Bulletin of the World Health Organization, 89(8), 608–615. https://doi.org/10.2471/BLT.11.088187.

Tolhurst, R., Amekudzi, Y. P., Nyonator, F. K., Squire, S. B., & Theobald, S. (2008). "He will ask why the child gets sick so often": The gendered dynamics of intra-household bargaining over healthcare for children with fever in the Volta Region of Ghana. Social Science & Medicine, 66(5), 1106-1117.

United Nations & Ghana. Ghana Millennium Development Goals. (2015). Retrieved January 2018, from https://ghana.un.org/en/19078-ghana-mdgs-report-2015.

United Nations. (2015). United Nations Millennium Development Goals. Accessed on April 30, 2020 at https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf.

United Nations. Sustainable development goal 3. (2016). Sustainabledevelopment.un.org. Retrieved April 30, 2020 from https://sustainabledevelopment.un.org/sdg3.

United Nations Inter-agency Group for Child Mortality Estimation (UNIGME). (2019) Levels & Trends in Child Mortality: Report 2019, United Nations Children's Fund. Accessed April 30, 2020 at https://www.unicef.org/media/60561/file/UN-IGME-child-mortality-report-2019.pdf.

van der Westhuizen, C., Wyatt, G., Williams, J. K., Stein, D. J., & Sorsdahl, K. (2016). Validation of the self reporting questionnaire 20-item (SRQ-20) for use in a low-and middle-income country emergency centre setting. International Journal of Mental Health and Addiction, 14(1), 37-48.

WHO/UNICEF. (2013). Ending Preventable Child Deaths from Pneumonia and Diarrhoea by 2025. The Integrated Global Action Plan for Pneumonia and Diarrhea (GAPPD).Retrieved April 30, 2020 from https://www.unicef.org/media/files/Final_GAPPD_main_Report-_EN-8_April_2013.pdf.

Wolf, J., Prüss-Ustün, A., Cumming, O., Bartram, J., Bonjour, S., Cairncross, S., Clasen, T., Colford Jr, J.M., Curtis, V., De France, J. and Fewtrell, L (2014). Systematic review: assessing the impact of drinking water and sanitation on diarrhoeal disease in low-and middle-income settings: systematic review and meta-regression. Tropical Medicine & International Health, 19(8), 928-942.

Working Group on Infant and Young Child Feeding Indicators. Developing and Validating Simple Indicators of Dietary Quality and Energy Intake of Infants and Young Children in Developing Countries: Summary of findings from analysis of 10 data sets. Food and Nutrition Technical Assistance Project (FANTA). Washington, D.C., August 2006.

World Health Organization. (2006). WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age:

methods and development. Accessed April 30, 2020 at https://apps.who.int/iris/handle/10665/43413.

World Health Organization (WHO). (2008). Indicators for assessing infant and young child feeding practices: conclusions of a consensus meeting held 6-8 November 2007 in Washington DC, USA. World Health Organization (WHO). Accessed April 30, 2020 at https://www.who.int/nutrition/publications/iycf_indicators_for_peer_review.pdf.

World Health Organization. (2019). children-reducing-mortality. https://www.who.int/en/news-room/fact-sheets/detail. Retrieved 27 April 2020, from https://www.who.int/en/news-room/fact-sheets/detail/children-reducing-mortality.

Zambrano, L. D., Levy, K., Menezes, N. P., & Freeman, M. C. (2014). Human diarrhea infections associated with domestic animal husbandry: a systematic review and meta-analysis. Transactions of the Royal Society of Tropical Medicine and Hygiene, 108(6), 313–325. https://doi.org/10.1093/trstmh/tru056.

Appendix

Ethical Approval

McGill University

ETHICS REVIEW
AMENDMENT REQUEST FORM

This form can be used to submit any changes/updates to be made to a currently approved research project. Changes must be reviewed and approved by the REB before they can be implemented.

Significant or numerous changes to study methods, participant populations, location of research or the research question or where the amendment will change the overall purpose or objective of the originally approved study will require the submission of a complete new application.

REB File #: 806-1113
Project Title: Part 2. Capacity building/training activities
Principal Investigator: Grace S Marquis
Email: grace.marquis@mcgill.ca
Faculty Supervisor (for student PI):

1) Explain what these changes are, why they are needed, and if the risks or benefits to participants will change.

The original application covered the capacity building and training activities with evaluation of knowledge and skills learned for staff of governmental, non-governmental, and private sector institutions in the Upper Manya Krobo District (UMKD) in the Eastern Region of Ghana. The training was directed towards health personnel (including health volunteers), extension workers, microcredit loan officers, teachers, or other individuals involved in working in the rural communities.

We would like to evaluate more broadly the importance of the training for the staff and their institutions as well as for the district residents who have interacted with the staff over the years of the project and better understand how we can improve and make sustainable training in this poor district. Thus, we are requesting the following modifications.

(i) Expand the number of contacts of trained participants and the participant list to include other staff of the institutions, local leaders, and community residents.
This data collection is based on qualitative methods and therefore the final number of participants will depend on the point at which we research information saturation. I have listed our expected maximum number.

(i-a) We anticipate including staff and trained volunteers who were part of the project workshops – this would be an additional data collection beyond that originally planned. We also would like to include some administrators who have seen the effect of the training on their staff. We estimate

30 staff of local institutions and up to 240 community health volunteers for focus groups (each group with 8-10/group)

24 staff for individual interviews

The staff will be identified based on their (and their institution's) participation in training activities with the project. Approval will be obtained from different administrative units of the institutions who referred staff for participation in the workshops. After obtaining administrative approval, the project staff in coordination with the institutional staff will select participants based on the communities they serve so as to have coverage of the project's communities and activities.

(i-b) We plan to interview about 12 traditional leaders (Chiefs, Queens Mothers, Elders) who are knowledgeable about the community and the institutional activities in their community. If possible, we will bring leaders together for three focus group discussions (30 total, 8-10/group), although we recognize that this may be challenging. These key informants will be identified by the project and institution staff who are working in the district and will be selected from the three sub-districts where the project has been most active.

(i-c) Finally, we plan to carry out focus group discussions with community residents who have participated in health-related as well as agriculture-related group activities. This will include up to 24 focus group discussions (approximately 240 individuals; 8-10/group) across the three sub-districts. The project has worked in these communities with the residents; participants will be selected purposefully to reflect the variation in experiences over the last 4 y. Discussions will continue until information saturation is reached.

2. Expand the methodology to include focus groups and in-depth interviews

The project has carried out surveys to document knowledge change. This modification will allow us to use two qualitative methods, in-depth interviews and focus group discussions, to evaluate the extent and value of the training. Individual and group interviews with staff will be held in English and those for key informants and residents will take place in Krobo (or the preferred language of the participant). With permission, the discussions will be audio recorded. Audiotapes will be destroyed after all transcription (with translation as needed) and analysis is completed.

The interviews and focus groups of the staff will take place in private at work places or the Nutrition Research and Training Center (project centre); the leaders and residents' data collection will be carried out in the communities. Whereas interviews can be done privately, this is most likely not possible for the group discussions in the communities where group discussions occur in the open air. Participants will be reminded of this at the time of enrollment. The in-depth interview is expected to take up to 60 minutes; the focus group discussion is expected to last up no longer than 120 minutes.

All dissemination of results will protect the identify of the participant – assuring that their responses cannot be attributed to them unless they provide written approval.

3. Expand the questions

We aim to learn about staff experiences in implementing the knowledge and skills gained, opinions regarding the lessons and the materials used, suggestions for improvement and sustainability of the training, perceptions regarding participants' receptivity to and adoption of promoted activities, recommendations for improving service delivery in the district, and overall satisfaction with the capacity built and the effect it had in their own livelihoods.

Key informants/opinion leaders and participants of the *Nutrition Links* communities will be asked about facilitators and barriers to accessing, receiving and adopting services provided by the trained staff. Additionally, they will be asked to give their opinions on the add-on interventions, as well as their perceptions about the effect of the intervention on livelihoods of their respective communities.

The *Nutrition Links* project focus is on infant/young child and adolescent health. Therefore, some questions will be asked also about perceptions of health and pedagogical approaches that can be

used in the communities to improve their health. These series of questions will help us address the challenge of sustainability of the project's training activities.

4. Expand the collaborators

Three new collaborators who will be working with us on this part of the project: Mona Ghadirian (McGill PhD student), Elahe Karimi Shahrbabak (McGill MSc student), and Stephen Matey (World Vision program manager). Their Tri-Council ethics certificates are attached.

2) Attach relevant additional or revised documents such as questionnaires, consent forms, recruitment ads.

See attached draft interview/focus group guides and consent forms.

Principal Investigator Signature: Grace S Marquis Digitally signed by com.apple.idms.appleid.prd.576c5572536c456951667858594b6e586f52564c54773d3d DN: cn=com.apple.idms.appleid.prd.576c5572536c456951667858594b6e586f52564c54773d3d Date: 2017.06.21 11:07:19 -05'00' Date: June 21, 2017

Faculty Supervisor Signature: _____ Date: _____
(for student PI)

For Administrative Use **REB:** ___REB-I ___REB-II ___~~REB-III~~ ✓ FAES

X Delegated Review ___ Full Review

✓ This amendment request has been approved.

Signature of REB Chair/ delegate: J McNeil Date: July 18, 2017

Project Approval Expires: Oct. 12, 2017

Submit by email to lynda.mcneil@mcgill.ca. REB Office: James Administration Building, 845 Sherbrooke Street West suite 429, fax: 398-4644 tel: 398-6831/6193; www.mcgill.ca/research/researchers/compliance/human
(August 2014)

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

Established 1979 A Constituent of the College of Health Sciences

University of Ghana

Phone: +233-302-916438 (Direct)

+233-289-522574

Fax: +233-302-502182/513202

E-mail: nirb@noguchi.ug.edu.gh

NMIMR-IRB

P. O. Box LG 581

Legon, Accra

Ghana

My Reference: DF 22

August 19, 2020

Grace .S.Marquis,PhD

University of McGill, School of Dietetics and Human Nutrition,CINE Buldg

111

RE: Our Study # 072/13-14 **At:** NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH-IRB

Dear Grace .S.Marquis,PhD:

Meeting Date: 7/5/2017 **At:** NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH-IRB

Protocol Title:

Strengthening Local District Capacity for delivering improved Nutrition, Agriculture and Health Services

"Understanding facilitators and barriers for the implementation of an integrated agriculture and nutrition education intervention project in the Upper Manya Krobo District in Ghana"

This is to advise you that the above referenced Study has been presented to the

Institutional Review Board, and the following action taken subject to the conditions and explanation

provided below.

Internal #: 1711

Expiration Date: 3/7/2018

On Agenda For: Procedure

Reason 1: Amendment **Reason 2:**

Description: The PI is seeking the following amendments ;

1. Revision of protocol to include in-depth interviews, focus group discussions and number of contacts of trained participants

2.Inclusion of "Stephen Tetteh Matey" as Co-PI and "Mona Ghadirian" and "Elahe Shahrbabak" as student investigators

3. Revision of consent form to include new investigators and description of procedures for focus group discussions with community members and leaders and new interview guidees developed for in-depth interviews for institutional staff and opinion leaders.

IRB ACTION: Approved

Condition 1:

Action

Explanation: The amendments were approved. However considering the time to spend on both Focus group discussions (2 hours) & interviews (1hour). It is suggested that snacks should be given as compensation to participants.

Yours Sincerely,

NMIMR-IRB

IRB Administrator

cc: Anna Lartey PhD , Nutrition and Food Science Department, University of Ghana, Bridge Aidam, PhD , World Vision Inernational, Nutrition Research and Evaluation Advisor, Carolyn MacDonald, PhD , World Vision Internati, Nutrition Director and Nutrition cen of expertise, Esi Colecraft, PhD , University of Ghana, Department of Nutrition and Food Science, Raymond K Owusu , World Vision Ghana, Health,Nutrition and HIV/AIDS, Richmond Aryeetey, PhD, MPH, University of Ghana, Dept. of Population, Family and Reproductive Health, PhD Cand. Ms Diana Dallmann

Qualitative Interviews Guide
In-Depth Interviews for Institutional Staff

Introduction:

Thank you for taking the time to meet with us.

My name is _____ and this is _____. We are _____ and we are working with World Vision to conduct a survey on health issues in your community. We would particularly like to get your feedback about the different trainings you attended that were hosted by WV & Nutrition Links.

Make sure if it is a training or community-based activity

Demographic Questions

Demographic Information that we already know going in:

Name of Institution

Name

Sex

Job Title

Demographic questions:

What is your current job title?

How long have you been working in this profession?

May I ask, how old are you?

What year were you born?

How long have you been living in Upper Manya Krobo?

How long have you been working in your present position in Upper Manya Krobo?

What is your ethnic group?

options

What is the highest degree or level of school you have completed? (If currently enrolled, highest degree received).

None

Preschool

Middle/JSS/JHS

Secondary/SSS/SHS

Technical/Vocational

Higher

TOPIC I: Generic Questions for Institutional Staff; Capacity Building in Health, Nutrition, Agriculture, Evidenced-based Decision Making and its Utilization

*Interviewer is provided with a **coversheet** that includes a list of all possible Nutrition Links/World Vision facilitated trainings.*

I would like to first ask you a few questions about the trainings you attended with Nutrition Links.

According to our records we see that you have participated in *Nutrition Links*/World Vision-facilitated (Health/Nutrition/ Agriculture/Data collection/Analysis) trainings. Can you confirm which trainings you have participated in during the past four years.

(*For each **training**, go through questions 2 to 5)*

For the _____ training, when were you trained? How long did it last? Was it held multiple times?

a) What were the **main topics** covered?

b) What **skills** did you acquire?
c) What would you say were the **key or take away messages** from this training?

a) How have you **applied the learning(s)** gained from the trainings you mentioned earlier (for each training mention above)? *(Probe for examples)*

b) What **helped you apply** (the aspects of the training you implemented)*? Probe: What do you think made it* ***easier*** *for you? Can you give me an example?*

a) Which aspects of the _____ training have you not been able to fully-implement if any? *(Probe for examples*).

b) What **factors prevented you** from fully-applying the learning gained from the training?

Is there health information that is given in the training that was different than what the participants believed? Do you have an example?

(Skip next two questions if they did not participate in LQAS)

On a scale of 1 – 5, how confident are you of your ability to conduct statistical analyses of your district data? **(1 being "not at all confident", 5 being "very confident")**

(This question is only for program administrators.) On a scale of 1 – 5, what is your (program administrators) level of satisfaction with cross-sector or integrated programs? **(1 being "not at all satisfied", 5 being "very satisfied")**

Cross-Sector Integration and LQAS questions ***(For Institutional Staff only)***

I would like to talk about your collaboration with different institutions that also received WV/Nutrition Links trainings.
For example trainings in Health/Nutrition/Agriculture/Data collection/Analysis.

What have you **learned about integration (linking and working together)** with different institutions from the *Nutrition Links* project?

Has it resulted in any collaboration with other institutions to work together towards a common goal or objective? Can you have an example?

What do you think **made it easier** for you? Can you give me an example?

In this light, have you **met any obstacles when trying to collaborate** with other institutions?

Probe: What **made it harder** for you to fully-integrate? Can you give me an example?

TOPIC II: Changes in Access, Service Provision, Health and Nutrition Attributable to Capacity Building

Introduction

Thank you. We're hoping to learn more about changes in access to health and nutrition services since the trainings have taken place.

What **changes have you seen in access** to Health/Nutrition/Agriculture services for children? families? or communities? as a result of the Nutrition Links project? (By access I mean, how it may be easier for someone that is looking for health services are able to find it.) What can you attribute this change in access to?

Probing question: Have you had a personal experience where mother or patient mentioned experiencing changes in health access? What can be attributed to this change in access?

Can you describe any **services or programs** that have been put in place by you? or your organization? to improve access to Health/Nutrition/Agriculture for children? families? or as a result of *Nutrition Links* project?
(For example: Community Based Growth Promotion Centers, Mother to Mother Support Groups etc. We expect those trained in that aspect to help establish these programs so we're asking if they did)

I'd like to ask you about the support you receive to do your work.
a) Who supervises (For KI advice) and supports you in your role?

b) How often have you received monitoring and supervision visits in the last **6 months?**
c) What was done during those visits? *(Note: This is supervision that is supposed to be done. these questions are **for health staff only**. We're not assessing their performance, we just want to get an idea of what was done)*

d) What did you find helpful during these supervisory visits?

Additional Questions for Health Institutional Staff Only
(*Skip questions 6-9 for non-health staff).*

Thank you. As a (say Job Title) you're in a unique position to know about general health trends.

Have you witnessed any changes in:

the general health, feeding and growth of the children in this community that you can attribute to the project or trainings provided? *(What changes? Give me examples of what you've noticed.)*

(What changes? Give me examples of what you've noticed.)

Are there **changes in how often children were getting sick** or the **severity of diseases** children encounter?

For health workers/nurses/volunteers:. What are challenges with making those referrals? Do you have more challenges with writing referrals for certain diseases? What makes it harder for families to act on your referral for different types of diseases?

How has the *Nutrition Links*/WV training **affected the ability for caregivers to access health care and monitor their children's growth in this community**?

Probing questions:

*Are there any **changes in the places where caregivers can go** to have their **children weighed**? Are there **more available** places for CBGP?*

*Has there been a difference the **distance** caregivers travel to have their children weighed?*

*How about the **growth promoters and community health workers or volunteers?**(Numbers trained)*

Numbers of children at CBGP centers, services provided in the community?

Where do caregivers in this community usually seek care for their sick children?

a) Over the past 4 years, have you seen changes in the **way you interact with caregivers** because of the training? //What changes? // Can you give me an example?

b) What/who can you say contributed to the changes you described above? Can you give me an example?

a) When you advise or teach someone about their health, what are the different teaching aides you use? Can you give me an example? What are the strengths and challenges of using this tool?

What other teaching tools are available to you?

How often do you _____ to teach someone about their health?
Probe: What topics do you use it for? Why is it helpful? What are some challenges?

use written teaching aides like posters and pamphlets

just talk *(probe: how about storytelling?)*

use models *(like food models, anatomy models etc.)*

use demonstrations *(like food demonstrations)*

Some teaching tools work better for some groups of people? In your communities, what teaching tools work better for mothers? For adolescents?

For what health topics did you wish to had teaching tools? What kinds of teaching tools you wish to have?

How would you compare the quality of services here compared to similar services in Accra, can you give me some examples? What do you think should be improved within your means?

Introduction :

Now we want to talk about the future outlook and sustainability of the programs like (e.g. Community-Based Growth Promotion centers, mother-to-mother support groups, vegetable gardens, etc.) to improve access to Health/Nutrition/Agriculture services to children, families or communities

TOPIC III: Sustainability and Future Outlook

(mention the answers they gave in the section about access above) **How can the programs you mentioned be sustained after the *Nutrition Links* project ends**?

What positives changes do you see as a result of the training in your community?

If there are **positive changes** associated with the *Nutrition Links*/WV Project capacity building, what needs to be done to ensure that these positive changes are sustained? Can you give me an example?

What can you or your organization do to ensure **that there continues to be positive change and that** the Health/Nutrition/Agriculture services are **sustained** after *Nutrition Links* project ends?

Do you have any suggestions on how to reduce prevalence of infectious diseases?

What are your priorities and future plans and interventions to promote health in these communities?

TOPIC IV: Beliefs about diarrheal diseases, malaria and respiratory tract infections in children under 5 years of age.

Introduction: Now I want to discuss the concerns of children under five years old.

In-depth interview with health staff

What are the primary concerns for the health of children in your district?
(*Ask for examples and if the answer was something rather than disease like traffic accident, ask them beside that is there any cause of death.*)

What do you believe are the primary causes of death in young children in your district?

Introduction: Now I would like to know your opinion about communities' beliefs about illness

What does the communities you work with, think are the causes of infectious diseases?

What are their biggest concerns about preventing infectious diseases in children?

a
b) Can you give me some example where you struggled to get the community to participate?
c) Some communities are better than others at promoting child health, what are the different characteristic that make some communities better than others?

a) What does the community consider to be clean safe water? How do they obtain it?

b) What is the most challenging issue for them in terms of making sure their children are consuming clean water?
c) What does the community think of the importance of hand washing? What is the most challenging issue for them in terms of handwashing?

Introduction : Their understanding of how beliefs affect behavior in the prevention or treatment of illnesses

a) What do you think residents think are the cause of **diarrheal disease**?

b) In your communities what are the practices and beliefs to prevent diarrhea?

d) In your community is there any special remedies or foods that are believed to help prevent diarrhea in children? Is there any foods or remedies that should be avoided to prevent diarrhea?

e) Are there any beliefs about the consumption of animal source food (like dairy, eggs and meat) with regards to diarrhea prevention?

f) What about the diarrhea treatment?

a) What do you think residents think are the cause of **respiratory infectious disease**?

b) In your communities what are the practices and beliefs to prevent respiratory infectious?

d) In your community is there any special remedies or foods that are believed to help children to not get respiratory infectious? Or is there any foods or remedies that should be avoided to prevent respiratory infectious?

e) Are there any beliefs about the consumption of animal source food (like dairy, eggs and meat) with regards to preventing respiratory infections?

f) What about the RI treatment?

a) What do you think residents think are the cause of **Malaria**?

b) What do you think residents think are steps they can take to prevent malaria?

c) What about the malaria treatment?

What are the perceptions of the community towards illness for boys and girls?

What are their perceptions of these same diseases when children are in different ages?

Interview Guides for Focus Group Discussions

TOPIC I: Gender Roles and Dynamics Knowledge Gained and Use by Community Members

a) How many of you participated in any community meetings organized by World Vision where you talked about the roles of men and women in the community? How many of you have participated 3 times? 2 times? 1 time? *(max possible times is 3)*
b) When was the last time you participated?

a) What did you learn from these discussions about the role of men and women in the household?

b) What did you learn about equality of women and men in the household, family or community?

c) How has this influenced the way you think?

Probing questions: Has your view on whether men and women are equal changed? Are there certain tasks that were initially accepted as a norm for a man or men only which you as a woman/women are doing? Or something accepted as a norm for a woman/women that you as a man or men are doing?

What changes have you made in your household or family as a result of what you learned?

How has this training changed your community's perceptions, norms and/or actions in general?

a) In this community, what is the role of adolescent boys in the household?

b) In this community, what is the role of adolescent girls in the household?

c) Is there an important difference between the two?

d) What are the general health problems (nutritional issues) for adolescents in your district?

e) Is there a difference (in the food requirements/nutritional needs) for boys and girls during adolescence? If so, what is the difference?

f) Assuming their nutritional needs are not met, who is more at risk? *(in adolescents)*

TOPIC II: Key Nutrition Knowledge and Skills Gained from Food Demonstrations, and how it is Applied (*Participants of Food Demonstrations Only)*

What have you learnt from the food demonstrations?

What influences your decisions about what to feed to your child in any given day?

In your community how do people determine that their children have appropriate food intake? *(quality and/or quantity)*

a) How do you define a balanced diet?

b) Do you consider a balanced diet when making decisions on what to feed your family?

c) Does your household get a balanced diet? What may be lacking?

d) In your community how do people see the benefits of a balanced diet for their body?

e) How has your household's diet changed since the food demonstration? Example?

a) At the food demonstration, they mentioned different categories of food. What do you remember about these different categories? *For each category given, you want to probe about what they see as its benefit for the body.*
b) *(GO)* What are examples of **energy giving** foods in your community? In the food demonstration what kind of foods were used? What new foods are you using?
c) *(GLOW)* What are examples of **protective foods** in your community? In the food demonstration what kind of foods were used? What new foods are you using?
d) *(GROW)* What are examples of **body building** foods in this community? In the food demonstration what kind of foods were used? What new foods are you using?

a) What causes anemia in children?
b) How can we prevent anemia in children?

What are good sources of food to prevent anemia? Give examples from your local context.

a) With respect to the risk of anemia, do the food requirements change from childhood to adolescence? How so?

Are there different risks for adolescent girls versus boys? If so, what changes?

How would adolescents hear about information to prevent anemia?

Have there been any changes in the **selection of foods** given to children that can be attributed to the *Nutrition Links*/ WV food demonstration sessions held in your community? If so what are the changes?

Have you changed the **way you prepare** your food because of something you learned at the food demonstration? If so what are the changes? Do you have an example?

How have these changes affected children's health, nutrition and growth in your family?

a) Which aspects of the food demonstration have you been able to put into practice in your home, for your children, or family? (*example growing food*)

b) How have you applied those learnings? Can you give me an example?

c) What helped you apply (the aspects of the training you implemented)*?* What do you think made it easier for you? Can you give me an example?

a) Which aspects of the food demonstration have you not been able to fully-implement? *(Probe for examples. e.g. access to the fruits and vegetables).*
b) What made it harder for you to fully-implement the learning gained from the food demonstration?

How do you think communities' beliefs can affect nutrition of children?

a)What foods do you choose not to eat in this community? Why?

b) Are there special foods that you eat at special occasions? Why?

a) What needs to be done to help families sustain the knowledge and skills gained (if any)?

What needs to be done to help the community sustain good nutrition and health in children?

TOPIC III: Mobilization of community leaders, Perceptions of Changes, Community actions, Sustainability and Future Outlook. (*For Chiefs, Queen Mothers, Elders and other Opinion leaders Only*)

To first assess level of participation (what trainings did they have access to: food demonstrations, gender training, the community-based growth promotion sessions. Then want to assess its influence on knowledge and behaviour).

a) Can you confirm which community-based trainings you have participated in during the past four years.

b) In general, how many times do you recall participating in these meetings and discussions over the last 4 years?

c) How about in the last year?

a) What were the topics discussed in these meetings or discussions?

b) What skills did you develop?

c)What key messages can you recall from these meetings/discussions?

a) What changes have you personally made (if any) as a result of what you learned?

b) How have you applied your learning in the community?

a) How do people get health information in your community?

b) How do community members share information they find important with each other? *Probing question: If I was a member of your community, and I had not attended a Nutrition Links training or community activity, how would I find out what was shared?*

c) How has the information gained been transferred to other community members? *(want to know the spillover effect)*

a) Could you describe recent examples of collective positive actions *(defined as a group coming together to conduct an activity)* that have taken place in the community as a result of the *Nutrition Links*/WV project capacity building efforts? *(Stop here – by "collective positive actions" have they come together to do something as a result)*

b) What was the outcome of these activities?

c) Who initiated the activities?

d) How were people mobilized?

e) What motivated this collective action?

What do you think motivated community members to participate in these educational and skill-building sessions? *(referring to the overall sessions in the community that is a result of Nutrition Links)*

How do you think people in your community feel about the educational and skill-building sessions?

Were the other interventions for vegetable gardens and poultry production well-integrated? *(Well-integrated in how it was presented to them as a part of Nutrition Links)*

a) Do you see any changes in the health and nutrition of children, women that you could attribute to the project? What changes are those? Any positive/negative changes?

b) What about water sanitation and hygiene?

c) How about households' access to foods - particularly vegetables and eggs?

If there are positive changes associated with the *Nutrition Links*/WV Project capacity building and training, what needs to be done to ensure that these positive changes are sustained?

What is the long-term effect on health and nutrition for children and households in this community? *(example, how poultry improved their income)*

If no positive changes are associated with *Nutrition Links*/WV Project capacity building/training, what needs to be done in the future to improve livelihood, health, agriculture, nutrition, water and sanitation for pregnant women and women with infants and young children in the community as a whole? *(Limiting the answers more to what is within nutrition links capabilities and Window of opportunity – first 100day for pregnant women until child age 2 years of age)*

Over the years, *Nutrition Links* has been working to improve maternal and child health. In this light, what do you think *Nutrition Links*/WV should do differently if they were to implement a similar project in the future?

Interview Guide for IDIs (Control)

Demographic questions

In-depth interviews with family members (mothers, fathers, other relatives)

What do you consider as serious diseases existing in your district that affect children under 5 years old?

Do you think these diseases can be prevented? How can these diseases be prevented?

Do you think diarrhea is a serious disease?

some children get more episode of diarrhea and more severe than the others? What do you think are the difference between them?

When do you recognize that diarrhea is serious or not in your child? When do you think (or what are the signs that indicate) your child needs treatment for diarrhea?

Do you think respiratory infections are serious in children? When do you recognize that respiratory tract infections are serious or not in your child? When do you think (or what are the signs that indicate) your child need treatment for respiratory infections?

Do you think malaria is a serious disease? When do you recognize that malaria is serious or not in your child? When do you think (or what are the signs that indicate) your child needs treatment for malaria?

How does breastfeeding affect diseases in children?

Do you think it may have any benefits in preventing disease? Why/Why not?
How do you see the effect of breastfeeding in diarrhea?

How do you see the effect of breastfeeding in respiratory infectious?

Diarrhea (give definition)

What do you think are the causes of diarrhea in children?

Do you think it is possible to prevent diarrhea? What do you do to make sure your children not get diarrhea?

Have you ever taken a child with diarrhea to health services?

What were the symptoms/reasons that lead you to go to get health services?

Children who have good nutrition are tall and have good weight, whereas children that are poorly nourished are shorter and more thin compared to other children their own age) (How does the child's nutritional status affect diarrhea in children?

Do you think children should have a different diet when they have diarrhea? What about the amount of food?

In your community what do people give to their children to prevent diarrhea? What about your household? How do you see the effect of different food groups in children nutrition? For example egg? Dairy? Meat?

In your communities what are the practices and beliefs to prevent diarrhea? In your community is there any special remedies or foods that are believed to help children to not get diarrhea? Or is there any foods or remedies that should be avoided to prevent diarrhea?

Are there any beliefs about dairy?

Are there any beliefs about eggs?

Are there any beliefs meat towards prevention of diarrhea? What about in your household?

What matters the most for you when you want to decide what food to give your children to prevent diarrhea? What makes it hard for you to provide (the foods that you think are beneficial for your children to not get diarrhea?

Respiratory Infection (give definition. Cough, rapid breathing (with or without fever))

Do you think it is possible to prevent RI? What do you think are the causes of respiratory infection in children?

Some children get cold and some get pneumonia, what do you think are the difference between them?

What do you do to make sure your children not get respiratory infections?

Have you ever taken a child with RI to health services?

What were the symptoms/reasons that lead you to go to get health services?

Children who have good nutrition are tall and have good weight, whereas children that are poorly nourished are shorter and thinner compared to other children their own age. How does nutrition of children affect respiratory infection in children?

Do you think children should have a different diet when they have RI? In your community what do people give to their children to prevent RI? What about your household? How do you see the

effect of different food groups in prevention of RI? For example egg? Dairy? Meat? What about the amount of food?

In your communities what are the practices and beliefs to prevent respiratory infectious? In your community is there any special remedies or foods that are believed to help children to not get respiratory infectious? Or is there any foods or remedies that should be avoided to prevent respiratory infectious?

Is there any beliefs about consumption of animal source food like dairy? What are the challenges in providing dairy for your children consumption in your community towards prevention of respiratory infectious disease? What about in your household?

Is there any belief about consumption of egg? What are the challenges in providing egg for your children? What about in your household?

Is there any belief about consumption of meat? What are the challenges in providing meat for your children consumption in your community? What about in your household?

Do you think breastfeeding may have any benefits in preventing respiratory infection? Why? Why not?

What matters for you when you want to decide what food to give your children to prevent RI? What makes it hard for you to provide (the foods that you think is beneficial for your children to not get RI?

What are the main concerns in the health and nutrition of children, women

What about water sanitation and hygiene?

Interview Guide for Focus Group Discussions (Control)

TOPIC I: Gender Roles and Dynamics Knowledge Gained and Use by Community Members

a) How do you see the role of men and women in the household?
b) What do you think about equality of women and men in the household, family or community?
Probe: Are there certain tasks that are accepted as a norm for a man or men only which woman/women that you as a man or men are doing?

a) In this community, what is the role of adolescent boys and girls in the household?

b) Is there an important difference between the two?

d) What are the general health and nutritional problems for adolescents in your district?

e) Is there any difference in the amount of food adolescent boys and girls need to grow well? If so, what is the difference?

f) Are there any particular nutrients that adolescent girls need?

g) Assuming their nutritional needs are not met, who is more at risk? *(in adolescents)*

In your community who needs more care to not get sick in children under the age of 5 - boys or girls? What is the difference?

At what age do children need more care to not get sick? What is the reason?

TOPIC II: Key Nutrition Knowledge and Skills

What influences your decisions about what to feed your child in any given day?

In your community how do people determine that their children have appropriate food intake? *(quality and/or quantity)*

a) What does an appropriate diet look like?

b) Do you consider an appropriate diet when making decisions on what to feed your family?

c) Does your household get an appropriate diet? What may be lacking? What do you think is the reason for this lack?

d) In your community how do people see the benefits of appropriate diet for their body?

a) Children who have good nutrition are tall and have good weight, whereas children that are poorly nourished are shorter and thinner compared to other children their own age.How do you think communities' beliefs can affect nutrition of children?

What foods do you choose not to eat in this community? Why?

Are there particular foods you give to children to prevent disease? Why?

What causes ill health for children under five years of age?

How can we ensure good health for children in this age group?

How can we ensure good hygiene in the home?

Do you think it is possible to prevent diarrhea? some children get more episode of diarrhea and more severe than the others? What do you think are the difference between them?
a) In your community what do you give your children to prevent **diarrhea**? What about your household? (probe for hygiene and food0

b) What matters the most for you when you want to decide what food to give your children to prevent diarrhea?
c)What makes it hard for you to provide the foods that you think are beneficial for your children to not get diarrhea?

a) How does **breastfeeding** affect diseases in children?

b) Do you think it may have any benefits in preventing diarrhea? Why? Why not?

a) Do you think it is possible to prevent respiratory infection?

In your community what do people give to your children to prevent **respiratory infection**? What about your household?

Some children get cold and some get pneumonia, what do you think are the difference between them?

b) What matters the most for you when you want to decide what food to give your children to prevent respiratory infection?
c)What makes it hard for you to provide the foods that you think are beneficial for your children to not get respiratory infection?

d) Do you think breast feeding may have any benefits in preventing respiratory infection? Why? Why not?

b) How do you see the effect of different food groups in child nutrition? For example, egg? Dairy? Meat?

What needs to be done in the future to improve the health and nutrition of pregnant women? women with infants and young children in the community as a whole?