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Caregiver Perception and the Role of Seasonality in Under-five Childhood Diarrhea Incidence in Svay Rieng Province, Cambodia

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Caregiver Perception and the Role of Seasonality in Under-five Childhood Diarrhea Incidence in Svay Rieng Province, Cambodia

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Diarrheal disease has long been known to be a burden to children worldwide. Although child mortality rates as a result of diarrhea have decreased over the past two decades, overall diarrhea incidence has remained relatively stable. In Cambodia, diarrhea was the third most prevalent outpatient diagnosis for children under five in 2012, with a reported incidence rate of 12 per 100 children, up from 7 per 100 children in 2008 (Ministry of Planning Cambodia, 2012). Cambodia is an agricultural country with 80% of the population living in rural areas (National Institute of Statistics Ministry of Planning, 2013). Many are also poor, with 20.5% of the population living at or below the poverty line (Sobrado et al., 2014). As a result, a large portion of the population is vulnerable to changing climate patterns and seasonal rainfalls. These patterns have been shown to have an effect on the incidence of diarrhea in regions throughout the world.

This research evaluated the relationship between seasonality and the incidence of diarrheal disease in children under five years old in the Rumduol district, Svay Rieng province of Cambodia. Using monthly under-five diarrhea data from a local health center and meteorological data from the Ministry of Water Resources and Meteorology (MoWRAM), Spearman's Correlation was used to find associations between monthly rainfall, heavy rainfall (defined by the 90^{th} percentile), maximum average monthly temperature, and minimum average monthly temperature. Additionally, household surveys, interviews, and observations were used to understand how seasonal behavior, age/gender, household practices, and caregiver perception of the disease affect decisions surrounding diagnosis and treatment of childhood diarrhea throughout the year. Based on the results of the analysis, the number of heavy rainfall days had a weak negative association

with monthly under-five diarrhea incidence in the initial month and following month, referred to as lag 0 and lag 1 ($r_s(96) = -.216$, $p = .035$ and $r_s(95) = -.219$, $p = .033$). Minimum average monthly temperature was also shown to have weak negative association with monthly under-five diarrhea incidence at lag 0 and lag 1 ($r_s(96) = -.208$, $p = .042$ and $r_s(95) = -.212$, $p = .039$). The negative correlation between heavy rainfall and under-five diarrhea indicates that heavy rain can have a washing effect on the environment at lag 0 and lag 1 months. Higher diarrhea incidence in the cooler months suggest a possible link to rotavirus, however more research must be done to make confirm this. Monthly rainfall was seen to have a positive association with diarrhea within the lag 3 and lag 4 months ($r_s(93) = .250$, $p = .015$; $r_s(92) = .222$, $p = .034$). This indicates that increased rainfall could have a delayed effect on diarrhea by three or four months. Maximum temperature did not have statistically significant results. These results show that heavy rainfall and minimum temperature likely play role in under-five child diarrhea in the study area at shorter lags times, while monthly rainfall has a greater effect at longer lag times.

Results of survey and interview data showed participants had sufficient knowledge on personal and food hygiene practices but often practiced improper environmental hygiene behavior, especially as it related to the handling of child and animal feces. Additionally, there were statistically significant results when looking at the relationship between environmental hygiene knowledge and practice and households where mothers migrate for work. Households with migrant mothers was common within the study area, with 51.9% of households having a mother who was currently working away from home or had plans to return to work soon. More data is needed to further investigate this relationship; however, this result suggests that hygiene knowledge and practice could suffer in households where the mother is absent, as added burden is placed on grandmothers to do domestic and childcare work.

CHAPTER 1: INTRODUCTION

1.1 Research Motivation

Diarrhea has long been known to be a severe disease burden to children worldwide with an estimated 2.5 billion annual cases globally affecting children under five years of age (Johansson et al., 2009). It is thus seen as one of the leading causes of morbidity and mortality in this age group (Kosek et al., 2003, Murray et al., 2012, Johansson et al., 2009). As a result, countries and nongovernmental organizations (NGOs) have focused resources to decrease this disease burden over the past several decades. Fortunately, substantial progress has been made in decreasing the burden associated with diarrhea. For example, in 2000 it was estimated that 1.2 million children under the age of five died each year because of diarrheal complications compared to 500,000 deaths in 2015, representing a 57% decrease (Amouzou et al., 2016). However, even as global mortality rates have declined, overall incidence has remained relatively stable (Johansson et al., 2009).

In Cambodia, under-five child mortality, attributed to all factors, has fallen from 108 deaths per 1,000 births in 2000, to 29 deaths per 1,000 births in 2015. This is recognized as a great improvement; however, Cambodia still lags behind neighboring countries in the region. For example, Vietnam and Thailand have under-five child mortality rates of 22 and 12 deaths per 1,000 births (The World Bank, 2016). Furthermore, in 2012, diarrhea was the third most prevalent outpatient diagnosis in Cambodia making up 8% of all new cases and having a reported incidence rate of 12 per 100 children, up from 7 per 100 children in 2008 (Department of Planning and Health Information, 2012).

The youngest children are seen to be the most vulnerable to diarrheal complications, with the period between birth and two years old being optimal for growth and development. Children who do not receive proper nutrients are more susceptible to growth faltering and the contraction of illnesses such as diarrhea (Kosal et al., 2015). The synergistic effects of undernutrition and repeated diarrhea can further exacerbate long term effects of both physical and cognitive development; which include stunting, lower IQ, and environmental enteropathy (Ngure et al., 2014, Mihelcic et al., 2017, Miller-Petrie et al., 2016). It was reported in 2014 that 32% of Cambodian children under the age of five were stunted, with 9% being severely stunted (Kosal et al., 2015). This shows a large portion of children in Cambodia who are at a high risk of diarrhea and the deleterious effects from repeated or chronic occurrence.

Cambodia is an agricultural country with 80% of the population living in rural areas (National Institute of Statistics Ministry of Planning, 2013). Many are also poor, with 20.5% of the population living at or below the poverty line (Sobrado et al., 2014). The rice crop is a main source of income for many of these households, which is oftentimes harvested only once a year during the wet season. As a result, a large portion of the population is vulnerable to changing climate patterns and seasonal rainfalls that have been shown to contribute to loss of crops and increased food insecurity (Ros et al., 2011). Meteorological effects such as rainfall and its relationship with diarrhea have been researched with several studies focused specifically on childhood diarrhea. For example, a 2012 study conducted in fourteen Sub-Saharan countries with children under the age of three found that a shortage of rainfall during the dry season increased the prevalence of diarrhea in the region (Bandyopadhyay et al., 2012). Another study in Bangladesh assessing children under five found that an increase in rainfall, especially heavy rainfall, had a positive association with childhood diarrhea (Mukabutera et al., 2016). Moreover, a study

performed in Cambodia, looking at all age groups, showed varied results depending on the region (McIver et al., 2016b). These studies show that rainfall can have an influence on childhood diarrhea as well as indicate that regional differences can have an effect on results. Additional data gathered in Cambodia could help to further determine the susceptibility of children throughout the year to diarrhea and whether future climate change will have an increased effect on the disease in the region.

Oftentimes other factors such as water, sanitation, and personal hygiene play a dominant role in the incidence of diarrhea in children (Wu et al., 2014) A study by Gunther et al. (2010) that reviewed datasets from seventy countries suggested that improved water and sanitation infrastructure lowered the chance of child contraction by 7-17% (Günther and Fink, 2010). It was estimated that the use of an improved sanitation facility could lower diarrheal morbidity by 28%, the proper promotion and use of hand hygiene with soap could see reductions in diarrhea morbidity of 40%, and the use of a water filter could cause further significant reductions in diarrhea morbidity (Prüss-Üstün et al., 2014). Studies have also revealed unhygienic practices and food preparation to be risk factors for diarrhea in households (Hashizume et al., 2007, Gorter et al., 1998, Scott et al., 2007). Additionally, caregiver perception is an important consideration in its role in childhood diarrhea; as it is shown to be a determinant of treatment and subsequent health outcomes (Baclig and Patrick, 1990). Some research has been conducted in Cambodia which highlight caregivers and their reaction to childhood diarrhea. For example, the Demographic and Health Surveys (DHS) Program submitted the Cambodia National Health Survey in 2014 that found 38.4% and 52.6% of participants gave more or the same amount of water when their child had non-bloody diarrhea, respectively. Their team also reported that ORS was used in 37.4% of non-bloody diarrhea cases and that 77% of rural households had soap and water available for handwashing (Kosal et al.,

2015). An additional 2005 study in Kep, Cambodia assessed recognition of warning signs of severe diarrhea/dehydration and types of treatment (Saunders, 2005). Saunders (2005) found that fever and vomiting were the most recognizable danger signs for treatment of diarrhea at 81.5%, and 37% of participants disclosed private medical establishments to be the most sought-after options for treatment. These studies in Cambodia provide excellent data on how caregivers react to childhood diarrhea, but lack commentary concerning the reasons why they partake in these behaviors.

1.2 Research Questions and Objectives

This research looks to evaluate the relationship between seasonality and incidence of diarrheal disease in children under five years old in the Rumduol district, Svay Rieng province of Cambodia. Under-five refers to children who are less than but not equal to five years old. Historical rainfall and temperature data from the two-distinct wet and dry seasons were obtained from the Ministry of Water Resources and Meteorology and monthly diarrheal data was collected from the local health center. Additionally, household surveys, interviews, and observations were used to understand how seasonal behavior, age/gender, household practices, and caregiver perception of the disease affect decisions surrounding their diagnosis and treatment of childhood diarrhea throughout the year. The research was defined by the following three research questions:

1. What is the association between rainfall, temperature, and incidence of under-five childhood diarrhea?
2. How does seasonality affect who cares for the child and how they perform childcare and household practices?
3. How do caregivers define childhood diarrhea and how does this definition affect decisions surrounding diagnosis and treatment throughout the year?

To answer these questions, the following objectives are presented followed by specific subobjectives:

1. Analyze rainfall, temperature, and local health center data to determine the relationship between seasonality and under-five childhood diarrhea in the area.
    a) Aggregate local historical rainfall, temperature, and under-five childhood diarrhea data.
    b) Perform analysis to determine statistical significance between sets of data.
2. Develop research tools (household survey, interview guide, and observation sheet) for assessing local household behaviors and perceptions of childhood diarrhea
    a) Determine basic family demographic information including age, sex, education, occupation, and other income generating activities.
    b) Determine significant seasonal activities.
    c) Observe differences that age and sex may have on childcare behavior.
    d) Determine who the primary caregivers of the child are and what their normal childcare and household behaviors consist of.
    e) Understand how caregivers define diarrhea in their child.
    f) Identify steps caregivers take in treating their child and why caregivers seek or use certain treatment options.

A better understanding of the relationship between rainfall, temperature, and diarrhea, linked to caregiver perception and the interactions between season-household and caregiver-child relationships should provide a more holistic view of childhood diarrhea in the region; as little research has been conducted in Cambodia that ties these aspects together. A greater wealth of knowledge between these relationships would be helpful in designing more complete regional

education and intervention plans to combat malnutrition and childhood diseases such as diarrhea; with particular use in communities more vulnerable to aspects of climate change. Chapter 2 will provide a brief overview of the Kingdom of Cambodia, Chapter 3 will delve into more detail about previous literature relating to the topics mentioned above. Subsequent chapters will discuss methods (Chapter 4) and results of the data analysis performed as a part of this research (Chapter 5). Chapter 6 provides conclusions to this study and recommendations for future research.

CHAPTER 2: COUNTRY OVERVIEW

Cambodia is steeped in heritage. Many Khmer trace their ancestry back to the Angkor civilization which ruled much of the Indochinese mainland from the 11th to 13th centuries, covering parts of present-day Vietnam, Laos, and Thailand. The ancient king Jayavarma II laid the foundation for the Khmer Empire. Preceding kings such as Suryavarman II and Jayavarma IV continued to expand the state by building roads, hospitals and religious structures (Overton and Chandler, 2017). Over time, the Khmer Empire began to decline, with some pointing to climate variability as main driver (Buckley et al., 2010). With the fall of the empire, the country entered a tumultuous period that was mostly defined by instability and war. In particular was the period between 1975 and 1979 where a communist regime known as the Khmer Rouge took hold of the country. During this time, between 1.5-2 million Cambodians died of disease, malnutrition and execution while millions more fled abroad. As Cambodia emerged from this period, a process began to slowly rebuild the political, healthcare, and educational systems from the ground up. Even today, this horrendous period still echoes through every aspect of the country and remains to linger in the psyche of many of its people.

2.1 Cambodia: Climate, Geography and Country Structure

Cambodia is a small country located in mainland Southeast Asia, also known as the Indochinese Peninsula. Roughly 181,035 square kilometers (The World Factbook, 2018), it is tucked between the countries of Thailand to the northwest, Laos to the north, and Vietnam to the east. A portion of the southwestern flank of the country also brushes the coastal waters of the Gulf of Thailand which extends into the Pacific Ocean. The climate in Cambodia is tropical with yearly

temperatures ranging from 21ºC to 36ºC (Heng An, 2014). From mid-May to early October strong prevailing winds from the southwest cause heavy rains and humidity. From November to mid-March winds from the north bring dryer air and cooler temperatures into the region (Thoeun, 2015). This shifting of the Southwest and Northeast Monsoon systems governs the two distinct wet and dry seasons seen in Cambodia.

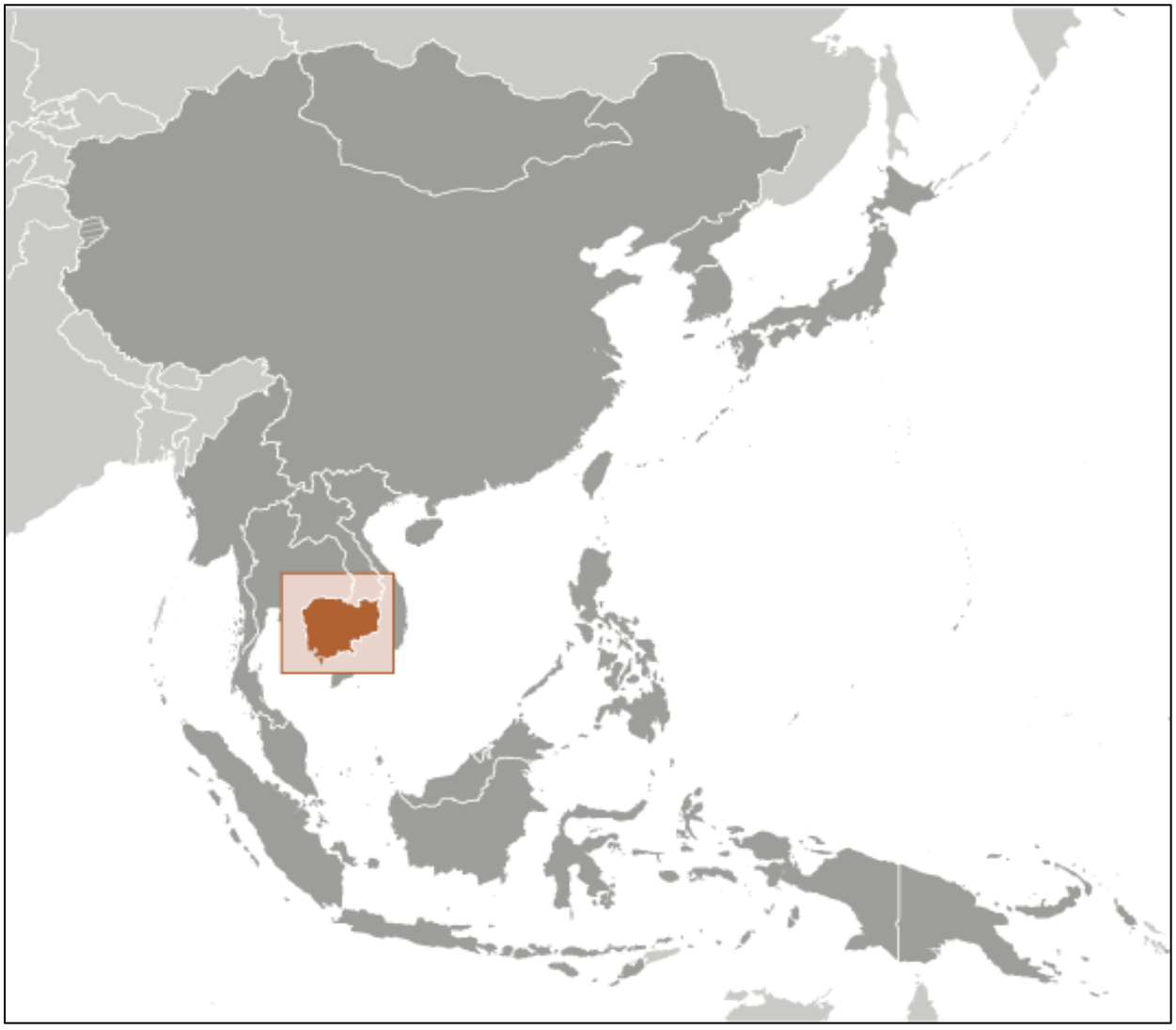

Figure 1: Regional map of Southeast Asia. Reproduced from The World Factbook 2018 Central Intelligence Agency.

The landscape of Cambodia is mostly dominated by alluvial plains (Overton and Chandler, 2017) that cover much of the central region of the country. One of the most notable geographical features in Cambodia is the Mekong River, snaking its way from Laos in the north and exiting into Vietnam in the southeast, which provides a necessary vein of water to the eastern portion of the country. East of the Mekong River the land elevation rises into the eastern highlands, a mountainous and forested region that extends into Vietnam. The low lying Dangrek Mountains make a border with Thailand to the north, and the Cardamom and Domrei Mountains run along the coast in the southwest. A noticeable feature in the center of the country is the Tonle Sap Lake. Known as the largest freshwater lake and wetland ecosystem in the region, this lake is defined by its unique hydrologic activity. During the dry season water flows from the lake via the Tonle Sap River downstream into the Mekong River. However, during the wet season, water from the Mekong and Tonle Sap River enters the Tonle Sap Lake greatly increasing the lakes surface area and flooding the surrounding plains (Fujii et al., 2003, Arias et al., 2012). The annual flood and drought cycle of these important natural resources provide essential water and nutrients for fishing and farming activities throughout the year.

Structurally Cambodia is broken down into 24 provinces; Banteay Meanchey, Battambang, Kampong Cham, Kampong Chhnang, Kampong Speu, Kampong Thom, Kampot, Kandal, Koh Kong, Kratie, Mondulkiri, Oddar Meanchey, Pailin, Preah Sihanouk, Preah Vihear, Pursat, Prey Veng, Ratanakiri, Siem Reap, Stung Treng, Svay Rieng, Takeo, and Tboung Khmum. Additionally, each province is divided into districts, that are further divided into communes and villages. Each province has a provincial town where provincial level government entities reside. Similarly, each district and commune have a designated district and commune town where local government entities can be found. Phnom Penh is the nation’s capital city located in Kandal

province which lies in the center of the country. The estimated population of Cambodia is just over 16 million, with over 1 million people living in Phnom Penh (The World Factbook, 2018). Cambodia is still considered an agricultural country with the proportion of population living in rural areas hovering around 80% (National Institute of Statistics Ministry of Planning, 2013). Retaining the king as its figurehead, Cambodia is a constitutional monarchy; currently presided over by His Majesty King Norodom Sihamoni acting as head of state and His Excellency Prime Minister Hun Sen as head of government. Ethnic Khmer make up 85% of the population followed by several other minority groups which include Chinese 6.4%, Vietnamese 3% and Cham (a Muslim minority group) 2.5% (Overton and Chandler, 2017). The Khmer language is spoken by 97% of the population, while Theravada Buddhism dominates the religious landscape (National Institute of Statistics Ministry of Planning, 2013).

2.2 Peace Corps Service and Study Site

This study took place in the Svay Chek, Sangkae, and Kampong Chork area of Rumduol district, Svay Rieng province shown in Figure 2. Svay Rieng province is approximately 2966 square kilometers (Chinda et al., 2013) and is located in the southeastern corner of the country. Known as the "Parrots Beak", it extends from neighboring Prey Veng province in the west into Vietnam. The topography of Svay Rieng is flat consisting mostly of large floodplains and shares the same wet/dry seasonal climate seen throughout Cambodia.

The main provincial city in Svay Rieng is Svay Rieng town. This town sits on National Highway #1 which is the main artery that connects Phnom Penh and Ho Chi Minh City; the cities are approximately 120 kilometers and 60 kilometers away, respectively. With a population of over 550,000 people, the province is broken down into 8 districts, 80 communes, and 689 villages (Chinda et al., 2013). Agriculture, forestry, and fishing make up the largest part of the workforce

in Svay Rieng with over 230,000 people involved in these activities. The thesis author was a Peace Corps volunteer from 2015 to 2017 as part of the Master's International Program that allowed the thesis author to combine graduate education with service in the Peace Corps (Naughton et al., 2015, McConville and Mihelcic, 2007, Manser, 2015). The Chork district town sits nine kilometers north of Svay Rieng town and has a population close to 2,200 people. As a health extension volunteer the thesis author was stationed at a local health center where he worked alongside community partners to build capacity on hygiene, sanitation, and nutrition issues. The area of this study was restricted to the service area of the health center which lies in Rumduol district. This service area includes parts of three different communes (Svay Chek, Sangkae, and Kampong Chork) containing 23 villages and totaling a population of close to 18,000 people. This area is displayed in the inlay of Figure 2. The 2015 populations of each village are displayed in Table 1.

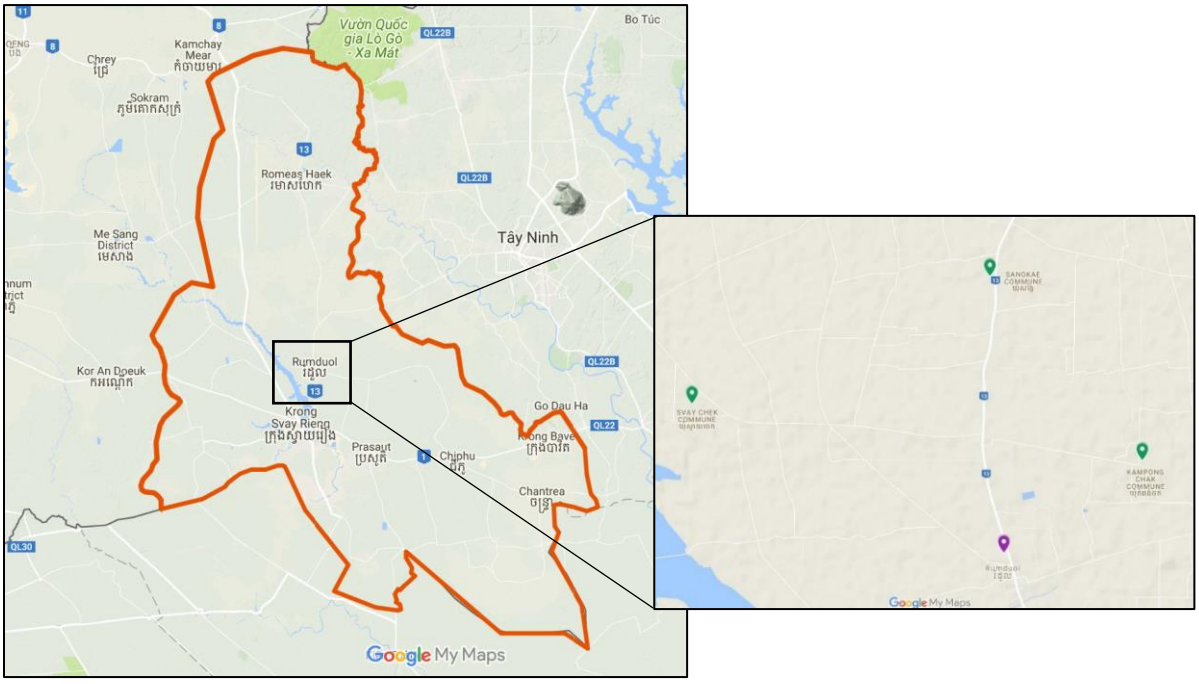

Figure 2: Map of Svay Rieng province with inlay of the study area. Maps are reproduced from Google Maps with Google © 2018 information.

Table 1: Population of study area by village and commune

Village	Commune	Population (2015)
Chork	Kampong Chork	2187
Prey Keav		927
Svay Roung		1058
Chaoeung Pous		474
Leakchear		490
Chambackong		422
Svay Rompear	Sangkae	485
Paun		707
Taccho		684
Tuol Chamback		501
Troping Run		436
Ta Paung		486
Koksramor		785
Taheng		1008
Svay Chek	Svay Chek	1259
Anlong Spearn		701
Chrok Skor		679
Thmei		464
Kandal		859
Popul		505
Bakrong		948
Rong Damrey		1054
Trop Chamback		554
Total		**17673**

Data Source: Ministry of Health, Chork Health Center

CHAPTER 3: LITERATURE REVIEW

3.1 General Classification of Dehydration and Diarrhea

The decrease in diarrhea seen over the past several decades (Amouzou et al., 2016) has been due in large part to countries and nongovernmental organizations (NGOs) working together to increase access to health services and develop efficient methods to diagnose and treat the disease. Therefore, a first step in understanding diarrhea incidence is to know how to properly define and diagnosis the various diarrheal diseases. This section will present a brief overview of diarrheal disease in children under five years of age which includes common types, causes, and recommended treatments of diarrhea in children.

There can often be confusion when identifying diarrhea as the number and consistency of stool passed each day can depend on diet and age. The passing of frequent formed stool, or the soft stool seen from breastfed babies is not considered diarrhea (World Health Organization, 2005). Diarrhea is generally defined as the passage of watery stool more than three times each day, or more frequent passage than is normal for an individual (World Health Organization, 2017). Dehydration is an important factor to consider as well, and oftentimes determines the severity. The World Health Organization (WHO) has developed three main levels of dehydration (Table 2) and diarrhea (Table 3). The main categories of diarrhea are; acute diarrhea, persistent diarrhea, and bloody diarrhea or dysentery. Acute diarrhea is any diarrhea that is watery and lasts less than 14 days (World Health Organization, 2005). This diarrhea is associated with high fluid loss and can be caused by pathogens such as *V. cholerae, E. coli,* and *Rotavirus* (Johansson et al., 2009). Persistent diarrhea is an episode that has a duration longer than 14 days, which oftentimes leads to

nutritional problems in children. Dysentery is characterized by blood in the stool that can also contain mucus (World Health Organization, 2005). This type of diarrhea is associated with intestinal damage and nutrient loss and is often caused by the bacteria *Shigella* (Johansson et al., 2009, World Health Organization, 2005). Most types of diarrhea seen fall within these categories.

Table 2: Levels of dehydration

Signs	Classify As	Identify Treatment
Two of the following signs: • Lethargic or unconscious • Sunken eyes • Not able to drink or drinking poorly • Skin pinch goes back very slowly	Severe dehydration	• If child has no other severe classification, give fluid for severe dehydration (Plan C) • If child also has severe classification, refer urgently to hospital with mother giving frequent sips of ORS on way. Advise mother to continue breastfeeding • If child is 2 years or older and there is cholera in the area, give antibiotic for cholera
Two of the following signs: • Restless, irritable • Sunken eyes • Drinks eagerly, thirsty • Skin pinch goes back slowly	Some dehydration	• Give fluid and foods for some dehydration (Plan B) • If child also has severe classification, refer urgently to hospital with mother giving frequent sips of ORS on way. • Advise mother to continue breastfeeding • Follow-up in 5 days if not improving
Not enough signs to classify as some or severe dehydration	No dehydration	• Give fluid and foods to treat at home (Plan A) • Advise mother when to return immediately • Follow-up in 5 days if not improving

Reprinted from Handbook: IMCI integrated management of childhood illness, World Health Organization Department of Child and Adolescent Health and Development & UNICEF. Chapter 8: Diarrhoea, Example 6: Classification Table for Dehydration, Page 28, Copyright (2005)

Table 3: Classification of diarrhea

Type of Diarrhea	Sign
Acute diarrhea	Diarrhea episode which lasts less than 14 days
Persistent diarrhea	Diarrhea episode which lasts 14 days or more
Dysentery	Diarrhea with blood in stool, with or without mucus

Source: Information obtained from World Health Organization, 2005

3.2 Causes and Treatments of Diarrhea

The majority of diarrhea can be attributed to an infection in the intestinal tract caused by different types of bacterial (*E. coli, Shigella, Campylobacter Salmonella,* and *V. cholerae*), viral (*Rotavirus*), or parasitic organisms (*Cryptosporidium, Giardia*) (World Health Organization, 2017, Johansson et al., 2009). The main route of transmission is fecal-oral, described by the F-diagram in Figure 3. The introduction of fecal matter into the environment can be as a result of poor or inadequate sanitation facilities that contaminate drinking water supplies, or from animal feces used as fertilizer for crops in communities around the world. Flies, insects, and rodents as well as human contact can further spread pathogens throughout the environment. Diarrheal infection is therefore more commonly seen where there is a shortage of sanitation, hygiene, and safe water for drinking, cooking, and cleaning (World Health Organization, 2017).

A handbook on the management of childhood illness published by WHO (World Health Organization, 2005) recommends caregivers continue to provide children with fluid and food to prevent further dehydration. If the children are exclusively breastfed, it is important for mothers to breastfeed more than usual (World Health Organization, 2005). Additionally, caregivers should

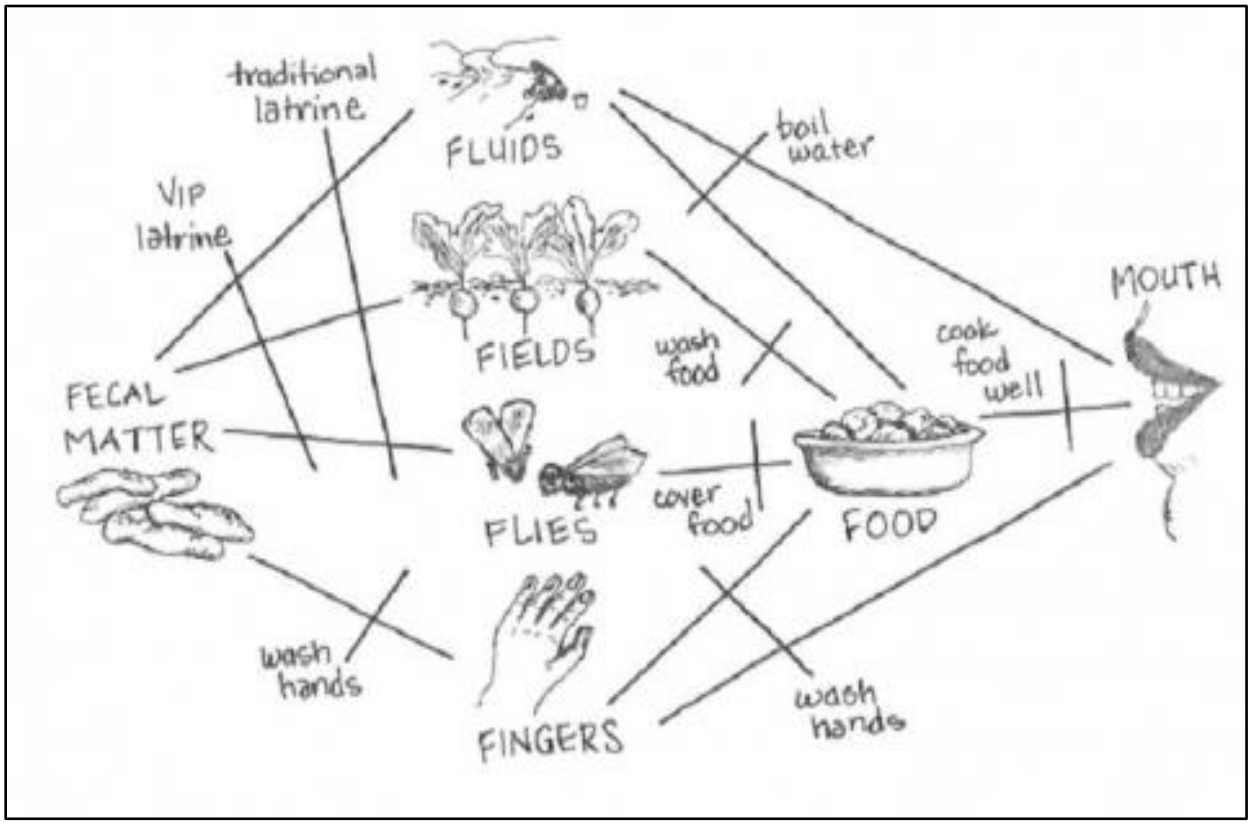

Figure 3: Fecal-oral diagram. Artwork by Linda Phillips. Reproduced from Mihelcic et al. (2009); with permission from ASCE

use oral rehydration salts (ORS) for rehydration. If not available, an alternative can be prepared at home using readily available ingredients which include cereal-based drinks made from thin gruel of rice, maize, or potato (Johansson et al., 2009). For more severe cases such as severe dehydration, persistent diarrhea or dysentery, healthcare providers are needed to provide further intervention. Severe dehydration requires immediate fluid initiation, through intravenous solution (IV) or rehydration therapy, and dysentery involves antibiotic prescription. In cases where fever is a symptom, paracetamol is suggested to lower temperature. For infants and children, the WHO advises to only give antibiotics when necessary and suggests against giving antidiarrheal or antiemetics drugs as they can oftentimes make them more sick (World Health Organization, 2005).

3.3 Weather Factors and Incidence of Diarrhea

As the population in Cambodia grows, agricultural and economic activity has continued to put added stress on the environment. Already forest regions across Cambodia are declining due to logging and economic expansion. Before 1960, forests covered 73% of the total land area however, current forest coverage has dropped to 59% (Ros et al., 2011). Moreover, water resources have been stretched and many coastal areas have been damaged as a result of increased usage and pollution. Looking into the future, the environmental degradation seen today may further exacerbate the effects of climate change on an already environmentally-stressed country.

Cambodia is thought to be among the most vulnerable countries for climate change in Southeast Asia (Davies et al., 2015, Yusuf, 2010). This is due in part to the low improved water and sanitation coverage seen across rural areas, as well as having a large portion of the population dependent on agriculture, fishery, and forestry activities. Those at increased risk include agricultural workers, those in poverty, and households living in drought or flood prone areas (McIver et al., 2016a); with an amplified effect on the elderly and young children (Davies et al., 2015). Future projections predict that the mean annual temperature and rainfall will continue to increase across Cambodia, with expected hotter dry seasons and heavier rainfall during the wet seasons (Davies et al., 2015, Thoeun, 2015).

Exposure to such changes and events will likely increase adverse effects on human health through the transmission of infectious and waterborne disease (McMichael et al., 2003). Examples of such diseases include typhoid fever, leptospirosis, melioidosis, hepatitis E, and diarrhea (McIver et al., 2016b). The following section looks at previous research done assessing the effects of weather factors such are rainfall and temperature on diarrhea incidence. This information follows Objective 1 of the current study.

3.3.1 Rainfall and Diarrheal Disease

The impact of monthly rainfall has been studied extensively in regard to its relationship with diarrhea. Review of this research shows the results vary by region. Many studies have found a positive association between monthly rainfall and diarrheal disease. A study published in 2017 looked at the association between meteorological factors, including rainfall, and all cases of diarrhea from 2003 to 2013 in Bhutan (Wangdi and Clements, 2017). Their results showed clear seasonal patterns in diarrheal incidence, with diarrhea cases increasing with increasing monthly rainfall amount. Another study conducted in Dhaka, Bangladesh from 1996 to 2002 looked at the association of rainfall with all non-cholera cases (Hashizume et al., 2007). This study found a bimodal seasonal relationship of non-cholera cases, with the first peak of cases occurring before the high rainfall period and the second peak at the end of the high rainfall period. The results of this study showed that non-cholera diarrhea increased with high and low rainfall at lag periods extending eight and sixteen weeks after the initial week of interest (Hashizume et al., 2007). Additionally, a study in Ethiopia performed from 2013 to 2015 that looked at diarrheal cases for children under five years old found a positive association with monthly average rainfall (Azage et al., 2017).

Heavy rainfall and diarrhea have also been widely studied showing positive associations in regions across the world. A study conducted in Taiwan analyzing the years 1996 to 2007 found that climatic factors significantly influenced the dynamics of diarrhea with extreme rainfall increasing morbidity of diarrhea (Chou et al., 2010). Additionally, a study in rural Bangladesh looking at children under the age of five concluded that an increase in rainfall is positively associated with the risk of childhood diarrhea. They determined that both intensity and frequency of extreme weather events have a significant effect on incidence (Wu et al., 2014). A comprehensive review by Levy et al. 2016, aggregating research done on the relationship between

diarrheal disease and myriad of meteorological factors, found that there was a significant positive association between heavy rainfall and diarrhea within 71% of studies which they reviewed (Levy et al., 2016).

Rainfall variation can impact diarrheal prevalence through its effects on the growth of bacteria, protozoa, viruses, and helminths that cause infections (Bandyopadhyay et al., 2012). Those using unimproved sources of water and unimproved sanitation are also seen to have a higher risk of diarrheal disease. Inadequate sanitation and open defecation can cause the release of pathogens throughout the community, and these pathogens can be transported to groundwater and surface water sources which increase likelihood of infection (Bhavnani et al., 2014). Heavy rains can also cause flooding that can overwhelm sewer systems causing backflows that lead to the contamination of the food and water supply (Wangdi and Clements, 2017, Levy et al., 2016). Floods also increase risk of exposure to major causes of diarrheal disease such as cholera, cryptosporidium, *E. coli*, giardia, shigella, typhoid, and viruses such as hepatitis A (McMichael et al., 2003, Ingole et al., 2012) and cause population displacement which results in a variety of different health impacts (Levy et al., 2016, Ahern et al., 2005, Alderman et al., 2012).

In contrast to the studies reviewed above, several studies of rainfall and diarrhea have also shown negative correlations. For example, a study conducted in Ho Chi Minh City, Vietnam looking to quantify the impact of environmental conditions on diarrheal risk in different regions of the city found that rainfall had a significantly negative association with the rate of diarrheal hospitalization during their 2005 to 2010 study period (Thompson et al., 2015). A 2012 study conducted in fourteen Sub-Saharan countries with children under the age of three showed that a shortage of rainfall in the dry season increased the prevalence of diarrhea across Sub-Saharan Africa and a high rainfall period in the dry season reduced the prevalence of diarrheal disease by

3% (Bandyopadhyay et al., 2012). This was said be as a result of water scarcity; as it has been shown to increase the prevalence of diarrhea due to increased consumption of unsafe water and the lowering of food hygiene practices (Mukabutera et al., 2016, Fewtrell et al., 2005). Conversely, an increased amount of rainfall could decrease the prevalence of diarrhea as a result of increased water supply and improved water quality.

Studies have also shown mixed associations between rainfall and diarrheal incidence within the study area. One conducted in Fiji found that low rainfall was associated with statistically significant increases in diarrhea in the same month and the following month, while high rainfall was associated with statistically significant increases in diarrhea in the same month but decreased diarrhea in the following month (Singh et al., 2001). A study in Ecuador from 2004 to 2007 found heavy rainfall events were associated with increased diarrhea incidence following relatively dry periods, but decreased diarrhea incidence following relatively wet periods (Carlton et al., 2014).

These results have been related to pathogen accumulation in soil and increased pathogen transport to surface and shallow groundwater. Carlton, et al. (2014) discusses that during dry periods, pathogens accumulate in the environment due to improper disposal of human and animal feces. Heavy rainfall events following dry periods can deposit increased concentrations of pathogens into surface water. Rainfall can then flush these pathogens via run-off into drinking water sources, infecting those who ingest it (Carlton et al., 2014). Alternatively, heavy rainfall events following wet periods can dilute pathogen concentrations, decreasing risk of transmission. This effect was illustrated further by Bhavnani, et al. (2014) where after five days of extreme rainfall researchers noticed a protective effect on those with unimproved sanitation facilities, as pathogens were flushed out. However, the risk for those with unimproved water sources increased from pathogen transport into water sources (Bhavnani et al., 2014).

3.3.2 Temperature and Diarrheal Disease

Alongside investigating the relationship between rainfall and diarrhea, researchers have also analyzed the relationship between temperature and diarrhea in many regions of the world. Factors used throughout the studies sometimes vary, with researchers using different designations to represent temperature including maximum temperature, minimum temperature, or average temperature over specified time intervals.

Overall, studies have shown that temperature can play a vital role in diarrhea incidence often showing positive associations. A study in Bangladesh, looking at children under five years old found that an increase in the number of diarrhea cases resulted from an increase in average monthly temperature (Hashizume et al., 2007). Hashizume et al. (2007) concluded that a one degree increase in average temperature would result in a 5.6% increase in cases of diarrhea (Hashizume et al., 2007). Studies in Bhutan and Taiwan looking at maximum monthly temperature found similar positive associations (Chou et al., 2010, Wangdi and Clements, 2017). Other studies using average monthly temperature have shown positive associations as well. In Ethiopia, Azage et al. (2017) found there to be a significant positive association between monthly average temperature and diarrhea for children under the age of five (Azage et al., 2017). A study in Fiji found positive associations between temperature and diarrhea as well (Singh et al., 2001). Moreover, the analysis of literature performed by Levy et al. (2016) found that 65% of studies reviewed showed a significant positive associations between temperature and diarrhea, including 69% of studies on all-cause diarrhea (Levy et al., 2016). Many postulate that this association is as a result of higher temperatures promoting the growth of bacteria and increasing viral exposure (Chou et al., 2010). Studies have shown that infectious diarrheal bacteria can follow seasonal patterns and multiply quickly throughout the warmer months (Azage et al., 2017). Increased growth and exposure can in turn lead to increased incidence of diarrhea.

Interestingly, many studies that specifically looked at rotavirus found negative associations with temperature. A study in the region of Bandung, Indonesia found cases of rotavirus throughout the year, with the highest peak (71% of the cases) occurring when the temperature was at a lower 24.09°C and the lowest peak when the temperature was at a higher 24.59°C (Prasetyo et al., 2015). In an analysis conducted in India, Pakistan, Sri Lanka, Nepal, and Bhutan researchers concluded low temperature to be a significant predictor of increased rotavirus rates as well (Jagai et al., 2012). Jagai et al. (2012) suggests that climate and local weather play a role in the infection; with an increase in infections during cooler, dryer times of the year (Jagai et al., 2012). This climatic difference was also seen in a study in Vietnam that compared differences in rotavirus incidence which occurred in the north and south of the country. Man et al. (2001) found that rotavirus occurred year-round with less seasonal variation in the tropical southern parts of Vietnam, while the subtropical northern areas saw seasonal trends of infection (Man et al., 2001). A study performed from 1991 to 1996 in the United States, before the introduction of a rotavirus vaccine, further supports the seasonal activity of the virus. Török, et al. (1997) found that the incidence of rotavirus began in the Southwest United States from October to December and ended in the Northwest region in April and May. (Török et al., 1997). Although the exact reasonings for seasonal fluctuations in rotavirus are still unknown (Jagai et al., 2012), rotavirus has often shown a negative association with ambient temperature in over 71% of articles reviewed by Levy et al. (2016). All studies referenced in this section are summarized in Table 4.

Table 4: Aggregated studies on weather factors and diarrheal disease

Location / Years	Data inputs	Findings	Source
Bhutan 2003-2013	• Monthly rainfall • Maximum temperature • Age • Gender • All diarrhea	Diarrhea incidence was positively associated with rainfall and maximum temperature, and negatively associated with increasing age and being female	(Wangdi and Clements, 2017)
Dhaka, Bangladesh 1996-2002	• Weekly rainfall • Temperature • Daily river level • Age • Gender • Socio-economic factors • Non-cholera diarrhea	Diarrhea incidence had a positive association with high and low rainfall and high temperature, with particular effect on those with lower socio-economic and sanitation status	(Hashizume et al., 2007)
Ethiopia 2013-2015	• Monthly rainfall • Temperature • Humidity • All diarrhea < 5 years old (morbidity)	Childhood diarrhea incidence had a positive association with rainfall and temperature, and a negative association with humidity	(Azage et al., 2017)
Taiwan 1996-2007	• Extreme rainfall • Temperature • Humidity • All diarrhea (morbidity)	Diarrhea associated morbidity is strongly related to extreme rainfall and maximum.	(Chou et al., 2010)
Bangladesh 2000-2006	• Monthly rainfall • Temperature • High temperature • High rainfall • All diarrhea < 5 years old	High rainfall and high temperature were positively associated with childhood diarrhea	(Wu et al., 2014)
Sub-Sahara African 1992-2001	• Rainfall • Maximum and minimum temperature • Socio-economic, hygiene and sanitation factors • All diarrhea < 3 years old	Shortage of rainfall dry season increases diarrhea. High rainfall in the dry season reduces the prevalence of diarrheal disease. An increase in maximum temperature increases diarrhea while an increase in monthly minimum temperature reduces diarrhea	(Bandyopadhyay et al., 2012)

Table 4 continued

Ho Chi Minh, Vietnam 2005-2010	• Rainfall • Temperature • River level • Weekly average relative humidity • All diarrhea < 16 years old	City-wide river level correlated positively with citywide per capita disease rates whereas humidity, rainfall, temperature was negatively associated with the rate of diarrheal hospitalization. However, associations varied on the district level	(Thompson et al., 2015)
Fiji 1978-1998	• Rainfall • Temperature • All diarrhea	Low rainfall was associated with statistically significant increases in diarrhea in the same month and the following month, high rainfall was associated with statistically significant increases in diarrhea in the same month but decreased diarrhea in the following month. There was a positive association between diarrhea and temperature	(Singh et al., 2001)
Ecuador 2004-2007	• Heavy rainfall • Hygiene and sanitation factors • Social cohesion factors • All diarrhea	Heavy rainfall events were associated with increased diarrhea incidence following dry periods and decreased diarrhea incidence following wet periods. Drinking water treatment reduced impacts of heavy rainfall events following dry periods.	(Carlton et al., 2014)
Badung, Indonesia 2009-2012	• Maximum and minimum temperature • Monthly rainfall • Humidity • Wind speed • Rotavirus < 5 years old	Rotavirus is found year-round however it has a negative correlation with temperature, a moderate correlation with humidity, and no significant correlation with rainfall or wind speed	(Prasetyo et al., 2015)
Cambodia 1997-2012	• Maximum, minimum and average temperature • Monthly average river height • Monthly rainfall • Monthly diarrhea	Temperature is positively associated with monthly cases of diarrheal disease in Battambang, Kampot, Phnom Penh, and Siem Reap and negatively associated in Kampong Thom and Prey Veng. Rainfall is positively associated with diarrheal disease in Svay Rieng, and negatively associated with monthly cases in Banteay Meanchey, Kratie, Phnom Penh and Pursat.	(McIver et al., 2016b)

3.3.3 Rainfall, Temperature and Diarrhea in Cambodia

Studies on meteorological factors and diarrhea have also been performed in Cambodia. These studies followed a pilot climate change, water, and health project titled Developing Research and Innovative Policies Specific to the Water Related Impacts of Climate Change on Health (DRIP-SWICCH). This program looked to increase the resiliency of Cambodian communities to the health risks posed by climate change impacts, as almost no information related to climate change and water-related diseases was available prior (McIver et al., 2016b). This study performed a time series analysis of all monthly diarrheal cases and weather data, including minimum temperature, monthly rainfall, and average river height across eleven qualifying provinces in Cambodia. Regarding monthly rainfall, the analysis results were heterogenous in nature. While rainfall was positively associated with diarrheal disease in Svay Rieng, it was negatively associated with monthly cases in Banteay Meanchey, Kratie, Phnom Penh and Pursat (McIver et al., 2016b).

The results for minimum monthly temperature and diarrhea cases was also found to be heterogenous. McIver et al. (2016) concluded there to be a positive association between monthly cases of diarrhea and temperature in Battambang, Kampot, Phnom Penh, and Siem Reap while Kampong Thom and Prey Veng showed negative associations (McIver et al., 2016a). In another study, a similar time series analysis was performed to understand the association between diarrheal disease and extreme weather events such as drought and flooding. This study concluded that floods are becoming more frequent and intense, while flooding was significantly associated with diarrheal incidence in Kampot and Pursat provinces (Davies et al., 2015).

The research performed for this thesis has a goal to further advance knowledge on this topic in Cambodia. This study will look at temperature, monthly rainfall, and heavy rainfall days and their effect on diarrheal incidence. Children under the age of five will be the focus age group of this study as oftentimes this segment of the population, and especially those who are exposed

to poor environmental conditions, are more susceptible to diarrhea and dehydration (Johansson et al., 2009). The heterogenous results of the study by McIver et al. (2016), warrants a further look into the factors that affect diarrhea incidence in the region. Additionally, while previous studies looked at the impact of rainfall and temperature on diarrhea occurrence in provinces as a whole, this study sought to minimize the confounding effects of regional differences within the province by narrowing the study area to a commune level. The mentioned weather factors are seen as drivers of seasonal change and household and economic activity in the region. Narrowing the scope allowed focus to be placed on how these factors may be affecting behaviors and activities within a smaller commune size with a population of approximately 18,000 people.

3.4 Risk Factors for Diarrhea and Caregiver Perception

Children with poor health and nutrition as well as those who are exposed to poor environmental conditions are more susceptible to diarrheal infection (Johansson et al., 2009). Much work has been done throughout the world and in Cambodia to improve the overall health and nutritional status of children and create cleaner environments that help to lower disease transmission. This has been done by addressing certain risk factors of diarrhea that have been shown to increase the likelihood of infection. These include factors related to lack of improved water supply and sanitation, poor disposal of child feces, poor water storage and treatment methods, poor personal and food hygiene practices, and socioeconomic factors that include education, age, and gender (George et al., 2014). These factors were considered in this study in order to assess drivers within the community which may be contributing to diarrhea incidence. Additionally, caregiver perceptions towards childhood diarrhea can play a critical role in the management of diarrheal disease. Caregivers often control decisions surrounding food and water consumption, personal hygiene, sanitation, diagnosis and care seeking behavior of children.

Oftentimes in countries in the developing world, overall caregiver knowledge of diarrhea is seen to be low (Abdinia, 2014) which exposes children to risk factors that contribute to infection. This in turn leads to increased incidence or delayed and improper treatment (Ene-Obong et al., 2000). In designing proper intervention plans, cultural context is important to make appropriate recommendations (Weiss, 1988). As a result, much research has been done in understanding the behaviors, perceptions and beliefs of caregivers and how these factors relate to diarrheal incidence, especially in children. The following sections discuss in greater detail research done within these areas of study and how these factors relate.

3.4.1 Sanitation, Hygiene and Diarrhea

A large portion of childhood diarrhea deaths are as a result of inadequate sanitation and unsafe water supply (Prüss-Üstün et al., 2018). Inadequate sanitation often refers to unimproved sanitation which can be defined as open pit latrines, pour flush toilets which leak into the environment, or open defecation (United Nations Children's Fund, 2008). These types of sanitation options provide inadequate fecal disposal as pathogens from these systems can more easily be released into the environment through rainfall, flooding, or human contact, leading to the propagation of fecal-oral transmission. Several studies have shown inadequate facilities and open defecation to be a risk factor for diarrhea. For example, a study in Ghana found that children living in a house with a flush toilet or pit latrine had lower incidence of diarrhea compared to children living in a home that lacked a sanitation facility (Boadi and Kuitunen, 2005). Boadi and Kuitunen (2005) concluded that the incidence of diarrhea was also affected by the presence of open defecation with 25% of reported cases in the study coming from homes where mothers reported outdoor defecation was occurring in the neighborhood. A study in Lesotho reported that having a ventilated improved pit latrine (VIP) resulted in a 24% reduction of diarrhea incidence compared

to a household that did not own a latrine (Daniels et al., 1990). Additionally, a study conducted in Indonesia looking at the relationship between improved latrines and under-five childhood diarrhea reported that a household which lacked improved facilities had increased odds of having a child with diarrhea in the previous seven days as well as a history of child mortality in the family (Semba et al., 2011).

Proper disposal of child feces is also a problem observed in many countries, including Cambodia. For example, two studies conducted in Cambodia have shown that between 30-35% of households reported unhygienic disposal of child feces, which include feces being thrown in a ditch or drain, the yard, or left in the open (Kosal et al., 2015, Miller-Petrie et al., 2016). Improper disposal of child feces is seen to increase risk of diarrhea. A study in Sri Lanka showed that children from households where child feces were disposed of in a latrine were less likely to have diarrhea than children whose families improperly disposed of the excreta (Mertens et al., 1992).

Unsafe water supply can be sourced from unprotected wells, surface water, or bottled water (United Nations Children's Fund, 2008). Risk factors from unsafe water can relate to both the quantity of water available and the quality of water that is being used. Oftentimes, rainfall can directly influence the amount of water available for consumption. This was seen in the Mukabutera et al. (2016) study where low rainfall in the dry season contributed to higher diarrhea incidence rates (Mukabutera et al., 2016). Mukabutera et al. (2016) discussed that when water is scarce, the prevalence of diarrhea increases as there is increased consumption of unsafe water and a lowering of food hygiene practices (Mukabutera et al., 2016, Fewtrell et al., 2005, Esrey et al., 1991).

Water from improved sources such as piped water systems, protected wells, protected springs, and rainwater are expected to have better water quality than the unimproved sources. Studies have shown that providing water from an improved source can help to minimize diarrhea

incidence (Cha et al., 2015, Wolf et al., 2014). Although improved systems are designed to protect water from contamination, they do not eliminate the risk of harmful infection (Shaheed et al., 2014a). Improper water storage has been seen to increase the risk of diarrhea (Tambe et al., 2015) through recontamination of previously safe water. This increased risk can result from unhygienic handling of water during transport, improper handling and covering inside the home, or infrequent cleaning of storage devices (United Nations Children's Fund, 2008, Schafer and Mihelcic, 2012). A World Bank review found that household-based water treatment and safe storage was associated with a 35% reduction in diarrheal disease (Fewtrell et al., 2005). Furthermore, a systematic review assessing the impact of inadequate water and sanitation on diarrheal disease concluded that the most effective household-level intervention was point-of-use options such as filters combined with safe water storage practices (Wolf et al., 2014).

Improving domestic practices, such as hand washing and food hygiene, are one of the most effective ways to reduce diarrhea disease in children (Curtis et al., 2000). In regard to handwashing, oftentimes knowledge about the health benefits of handwashing is known, however caregivers are not always seen practicing the behavior (Biran et al., 2014). Research has been done to determine the factors that affect handwashing behavior. Studies have shown that availability of soap and water (Luby et al., 2009) as well as the distance to the handwashing station can affect the handwashing behavior of participants (Naughton et al., 2015). Handwashing in particular plays a large role in the fecal-oral transmission cycle as dirty hands can cause contamination of oneself and others, as well as food and water through direct contact. This was shown by a study in Hanoi, Vietnam which determined that children had increased diarrhea in families where the mother washed her hands less often before feeding (Vu Nguyen et al., 2006). Another study investigating hygiene practices of 172 families in Nicaragua showed washing hands played a role in protecting

children from diarrhea (Gorter et al., 1998). Additionally, a systematic review of articles relating handwashing to the risk of diarrheal disease found that washing hands with soap could reduce diarrhea risk by 42-47% (Curtis and Cairncross, 2003).

Food hygiene is an essential factor when discussing child health. It is estimated that as much as 70% of all cases of diarrhea in children could be attributed to food contamination (Motarjemi et al., 1993); highlighting the importance of proper food handling knowledge and techniques by caregivers. This is especially important in young children under the age of five or those children who are in the process of weaning from breastmilk. Contamination of food and subsequent infection can come from a variety of sources that include not cooking or reheating food properly, not properly washing fruits or vegetables (Motarjemi et al., 1993), using dirty surfaces or utensils (Michanie et al., 1987), and storing foods at high or ambient temperatures for long periods of time (Ehiri et al., 2001). The purchasing of poor quality or contaminated food from vendors outside the house have also been stated as a cause for increased diarrheal disease (Boadi and Kuitunen, 2005, Ehiri et al., 2001). Poor household hygiene can breed flies, another part of the fecal-oral diagram and well-known contaminator of food. Flies often carry bacteria and pathogens and when landing on food, regurgitate and spread infection (Curtis et al., 2000). Several studies have shown the presence of flies to be positively associated with diarrhea morbidity (Parvez et al., 2017, Boadi and Kuitunen, 2005).

3.4.2 Caregiver Perception of Diarrhea and Care-Seeking Behavior

Cultural experiences and traditional beliefs are vital to how people interpret the living world. It is also likely to play a significant role in how caregivers perceive and respond to childhood diarrhea (Kauchali et al., 2004). Therefore, the classical definition of diarrhea outlined by the WHO may not always translate within local populations. Research has shown that causes

and symptoms of diarrhea can be classified and interpreted in many ways throughout the world. In studies conducted in rural Thailand, South Africa, and Ethiopia, researchers determined there to be twelve, eleven and four different locally recognized types of diarrhea within the three communities, respectively (Choprapawon et al., 1991, Taffa and Chepngeno, 2005, Etea, 2014). Oftentimes communities have been shown to classify episodes by cause. For example, in many studies improper sanitation, personal hygiene, and food hygiene were said to be contributors to diarrhea; this included lack of proper latrines or clean drinking water, not washing hands (De Ver Dye et al., 2011), contaminated food and water (Naseem and Swetha, 2016, Khalili et al., 2013, Choprapawon et al., 1991, Rheinlander et al., 2011), flies (Etea, 2014, De Ver Dye et al., 2011), bacteria (Kauchali et al., 2004) or worms (Usfar et al., 2010).

Caregivers in countries such as South Africa, Ethiopia, Iran, Mexico, India, Indonesia, and Thailand are recorded as believing that child developmental stages contributed to diarrhea. These stages included teething (Kauchali et al., 2004, Martinez and Saucedo, 1991, Kaltenthaler and Drasar, 1996), crawling (Khalili et al., 2013, Usfar et al., 2010, Baclig and Patrick, 1990), learning to turn over, learning to make sounds (Pylypa, 2009), or learning to walk (Usfar et al., 2010, Baclig and Patrick, 1990). Supernatural causes were thought to affect diarrhea in South Africa. Kauchali et al. (2004) found that caregivers believed that those who walked over a path left by a sorcerer or inhaled lightning fumes would contract diarrhea (Kauchali et al., 2004).

The type of food eaten by the mother and child was also reported as a believed cause of diarrhea. In Hyderabad, India respondents noted that hot food, which was classified as wheat, eggs, meat, dates, and green mangos, contributed to diarrheal disease (Naseem and Swetha, 2016). Additionally, in a study in Vietnam, caregivers believed fatty foods or sour fruits and vegetables led to diarrhea in their children (Rheinlander et al., 2011). Several studies also mention bad breast

milk described when the mother ate certain types of food (Usfar et al., 2010), hot breastmilk when she would participate in physical activity (Martinez and Saucedo, 1991), or was exposed to the sun (Rheinlander et al., 2011) as believed reasons their young child would contract diarrhea. Several studies also reported caregivers who believed diarrhea to be connected to a cold (Usfar et al., 2010, Khalili et al., 2013), fever (Kaltenthaler and Drasar, 1996), or from exposure to rainy or sudden hot to cold changes in weather (Rheinlander et al., 2011).

These caregiver perceptions of diarrhea have been shown to be closely related to treatment and health seeking behavior. For example, if the caregivers believe a certain diarrheal episode is part of a normal or supernatural event, improper care could be given. Studies in Nigeria and Thailand found that mothers who thought diarrhea in young children to be associated with child development milestones, such as teething or making sounds, would often leave the child without treatment (Pylypa, 2009, Ene-Obong et al., 2000). Caregivers in South Africa who believed diarrhea to come from sorcerers or lightning fumes would seek ritualized traditional medicines that would often cause a substantial delay in treatment (Taffa and Chepngeno, 2005). In indigenous communities in Vietnam, children were brought to spiritual healers to eliminate the effect of ghosts, spells, or discontent ancestors before seeking biomedical options. Additionally, children in Vietnam who were thought to have fever and diarrhea from cold winds used a traditional method of healing where a coin was rubbed on the body (Rheinlander et al., 2011).

Caregivers have also been described to alter food and water intake of children because their perceived effects. In Iran, mothers believed that diluted milk and food was better on the stomach during diarrhea and therefore only fed their children these types of foods (Khalili et al., 2013). Rheinlander et al. (2011) describes a mother in Vietnam who withheld “harmful foods” such as eggs and vegetable soup, from her child for several days because she believed they were

incompatible with the body (Rheinlander et al., 2011). A study in Ethiopia found that although mothers agreed that children with diarrhea needed water, too much water would in fact worsen the effects of the disease (Olango and Aboud, 1990).

These behaviors of caregivers can have an effect on the child's health, but also on the management of diarrhea by community health professionals. A study conducted in Thailand surveyed diarrhea cases of 124 children under three years old for several months, as defined by health professionals. Pradhipasen et al. (1997) determined that over the study period, half of the episodes of diarrhea were unrecognized as diarrhea by the caregiver (Pradhipasen et al., 1997). This result shows that perception can indeed shape behavior, but also its significant effect on under-reporting of the disease. Under reporting can make the problem of diarrhea seem less severe and therefore less important to manage. This could lead to policy makers and administrators reducing budgets for diarrhea prevention (Pradhipasen et al., 1997) which would diminish the health providers ability to combat the drivers of the disease. These studies therefore highlight the importance of understanding cultural perceptions of diarrhea and their relation to healthcare seeking behavior.

3.4.3 Effects of Socioeconomic Factors: Education and Age

General socioeconomic factors such as age and education level affect the caregivers experience and views on the world. As a result, these factors have been thoroughly researched as it relates to caregiving and treatment of diseases such as diarrhea. A study done in Nairobi on care seeking behavior of illness found that maternal age had an impact on treatment sought by the mother. Taffa and Chepngeno (2005) determined that older mothers took children for treatment less than younger mothers, as they more often use their experience which emphasized alternative therapies (Taffa and Chepngeno, 2005). In other studies, younger mothers have been shown to

have less knowledge on diarrhea concepts (Tobin et al., 2014), know less about proper ORS treatment (Kosal et al., 2015), and are less likely to dispose of feces in a hygienic manner (Miller-Petrie et al., 2016). Mothers with less education have been shown to increase risk factors for diarrhea. An assessment in Ghana found that children of uneducated mothers accounted for 60.6% of diarrhea cases as opposed to 25.5% with basic education and 13.8% with higher education (Boadi and Kuitunen, 2005). Many other studies have also shown similar results (McIver et al., 2016b, Vu Nguyen et al., 2006, Tobin et al., 2014). This could be as a result of better knowledge of hygiene behavior. Results from the same study in Ghana show that 75.4% of uneducated mothers did not wash their hands with water or soap before preparing meals, while only 29.2% of mothers with basic education, and 7.7% of those with higher education failed to wash their hands (Boadi and Kuitunen, 2005). Similar results for proper hygiene behavior with increased education has been seen in other studies (Gorter et al., 1998, Scott et al., 2007). Understanding these relationships within a community can allow for more precise targeting of educational initiatives and interventions.

3.4.4 Sanitation, Hygiene and Caregiver Perception in Cambodia

Substantial work has been conducted to improve health coverage, services, and interventions across Cambodia. The WHO/UNICEF Joint Monitoring Program for Water Supply, Sanitation, and Hygiene found that from 2000 to 2015, improved sanitation coverage in Cambodia increased from 13% to 56% and improved water coverage increased to 52% to 75% (Joint Monitoring Programme, 2017) showing a positive national trend. There is still disparity however, that can be seen between rural and urban populations as seen in Table 5. In locations like Svay Rieng for example, the estimated sanitation and improved water coverage lags far behind urban averages at 26% and 61%, respectively (Ministry of Planning Cambodia, 2012). In addition to

Table 5: Urban/rural water and sanitation coverage in Cambodia (2012)

	Urban	Rural	Svay Rieng
Improved Sanitation	88%	37.7%	26%
Improved Water	92%	65.5%	61%

Source: Data obtained from Joint Monitoring Programme, 2017 and Ministry of Planning Cambodia, 2012

work in improving water and sanitation coverage, The Royal Government of Cambodia in partnership with international and non-governmental organizations have performed extensive research into risk factors of diarrhea in Cambodia. Listing all available studies would be impractical, however several assess sanitation marketing, behavior and demand (Program, 2008, Chase et al., 2015, Anand and Jenkins, 2010, Pedi et al., 2014), water treatment adoption, risk and perspective (Brown and Sobsey, 2012, The World Bank, 2007, Brown et al., 2008, Shaheed et al., 2014b), and hygiene behavior (Jenkins et al., 2013).

An assessment on caregiver treatment of diarrhea was conducted by The Demographic and Health Surveys (DHS) Program and published in 2014. The DHS performed a nationwide survey and aggregated data on different topics including feeding practices during episodes of diarrhea. Kosal et al. (2015) found that 38.4% and 52.6% of participants gave more or the same amount of water when their child had non-bloody diarrhea, respectively. Their team also reported that ORS was used in 37.4% of non-bloody diarrhea cases and that 77% of rural households had soap and water available for handwashing (Kosal et al., 2015). A 2005 study in Kep, Cambodia assessed recognition of warning signs of diarrhea/dehydration and types of treatment. Through semi-structured surveys and interviews Saunders (2005) found that fever and vomiting were the most recognizable danger signs for treatment of diarrhea at 81.5%, and 37% of participants disclosed private medical establishments to be the most sought-after options for treatment (Saunders, 2005). Another study conducted in the northeast of Cambodia mentioned traditional beliefs community

members had on diarrhea. The study by Chassagne et al. (2016) on natural remedies used by the indigenous Bunong people stated that diarrhea can be perceived to be due to a lack of wind, which is most often treated by dermabrasive practices such as coining or massage (Chassagne et al., 2016). Little other research has been conducted in Cambodia that assessed the perceptions of caregivers in the greater population. Additionally, how perception and caregiver behavior might be affected by changing seasons and household activity.

CHAPTER 4: RESEARCH METHODS

4.1 Analysis of Weather Factors and Diarrhea Incidence

This study used statistical methods to analyze associations between under-five childhood diarrhea incidence and weather factors as part of Objective #1 outlined in Chapter 1. Under-five diarrhea data were collected from a local health center in Rumdoul district, Svay Rieng province. The Chork health center serves parts of Kampong Chok, Sangkae, and Svay Chek communes which contains 23 villages and approximately 17,674 residents. Currently, the health center has six working staff members; a health center chief, midwife, a vaccination nurse, a tuberculosis nurse, a consultation nurse, and a pharmacist. Together they provide many basic services that include vaccinations, prescriptions, first aid, basic consultation, referrals, ante and post-natal care, HIV testing, childbirth, and abortions.

Each staff member is assigned to their specific duty. As patients are seen, they record information into a log books which are aggregated each month by the health center chief. These reports are then sent to the provincial Ministry of Health offices. The monthly reports contain information about the total monthly patients received, divided into specific illnesses, vaccinations given, childbirths performed etc. grouped by age and sex. Health center data available from 2009 to 2016 was included in this study.

From 2009 to 2016, the Ministry of Health monthly data charts changed several times. For diarrhea classification from 2009 to 2013, diarrhea type illnesses were divided into three categories; diarrhea, suspected cholera, and dysentery. From 2014 onward, the Ministry of Health added more specific categories of diagnosis. These included diarrhea (no dehydration), diarrhea

(minimum dehydration), diarrhea (severe dehydration), cholera, suspected cholera, and dysentery. Additionally, they did not subdivide illness by sex until 2010, and the "0-28 week" and "29 week-11 month" age group categories were not added until 2014.

4.1.1 Data Source and Collection

For this analysis, monthly diarrheal totals for children under the age of five years old were included, using data for males and females under the sub headings of 0-28 weeks, 29 weeks-11 months, 1-4 years. All diarrheal classifications used in the Ministry of Health reports were used, which included diarrhea (no dehydration), diarrhea (minimum dehydration), diarrhea (severe dehydration), cholera, suspected cholera, and dysentery. Only outpatient data was included in this analysis, as the health center refers more serious cases to the provincial level. Oftentimes caregivers from outside the specified villages bring their children to the Chork health center and conversely, caregivers within the area seek other health centers outside the service area for treatment. For this analysis, the assumption was made that this influx/outflux of patients was relatively even, and therefore the diarrhea totals included in the monthly reports could be assumed to be an accurate total of those who visit the Chork health center within the service area.

Monthly historical weather data was also included in this study. This data came from the Cambodian Ministry of Water Resources and Meteorology for the similar time period of 2009-2016. This data was recorded at a weather station located in the provincial town, Svay Rieng, located approximately ten kilometers south of the study location. Data provided by the Ministry were daily rainfall total in millimeters, and daily maximum and minimum temperature in Celsius.

4.1.2 Data Analysis: Weather Factors and Under-five Diarrhea

All diarrheal classifications used in the Ministry of Health reports were added to obtain a total monthly diarrhea incidence for children under the age of five years old. These categories included diarrhea (no dehydration), diarrhea (minimum dehydration), diarrhea (severe dehydration), cholera, suspected cholera, and dysentery. Daily rainfall totals were averaged to obtain an average rainfall amount for each month. Daily maximum and minimum temperatures for each month were averaged to obtain a maximum and minimum average for each month. Heavy rainfall was considered to be days that have a daily rainfall total above the 90^{th} percentile for the years 2009 to 2016. This procedure followed several other studies which looked at heavy rainfall (Bhavnani et al., 2014, Carlton et al., 2014). These days were added for each month to determine a number of heavy rainfall days within each month.

Associations between under-five diarrhea incidence and weather factors (monthly rainfall, maximum temperature, minimum temperature, and heavy rainfall days) were analyzed using a method similar to a study conducted in Bandung, Indonesia that looked at correlations between rotavirus and under-five childhood (Prasetyo et al., 2015). In this study, Prasetyo et al. (2015) used the Pearson product-moment correlation method to find associations between rotavirus and weather variables. This method however, requires assumptions that do not fit several of the datasets within this study; normality, linearity, and homoscedasticity. Therefore, the Spearman rank-correlation method was used for the analysis. This is a non-parametric method which does not have the assumption of normal distribution, where data can be on an interval, ratio, or ordinal scale. Instead of looking at the linear relationship, the Spearman's coefficient assesses how a monotonic function can describe the relationship between two variables (Hauke and Kossowski,

Table 6: Strength of correlation for Spearman's coefficient

$0 < r_s < 0.3$	Very weak
$0.3 < r_s < 0.5$	Weak
$0.5 < r_s < 0.7$	Moderate
$0.7 < r_s < 0.9$	Strong
$r_s > 0.9$	Very strong

Source: Information adapted from Mukaka, 2012

2011). Spearman's coefficient results are displayed on a scale between +1.0 and -1.0. A coefficient close to +1.0 indicate a strong positive correlation, while a coefficient close to -1.0 indicates a strong negative correlation. A coefficient of 0 indicates that no correlation exists. Table 6 shows a grading scale for the strength of coefficient displayed (Mukaka, 2012). Additionally, results were determined to be statistically significant when the p-value < 0.05. Different time periods were analyzed to account for the incubation period of bacteria and a delayed contraction of the disease. These time periods were weather factors and diarrhea analyzed in the initial month (lag 0) as well as diarrhea lagged one (lag 1), two (lag 2), three (lag 3), and 4 months (lag 4). Looking at lag times was also performed in many other studies (Chou et al., 2010, McIver et al., 2016b).

4.2 Research Methods: Surveys, Interviews and Household Observation

A mixed methods study that involved household surveys, interviews, and observations of caregivers was performed to gather data needed to address the Objective #2 and Objective #3 of this study. Interviews were also completed with healthcare providers within the service area to understand health messages being disseminated to the surrounding community. Household surveys were used to access household practice, seasonal behavior and caregiver decisions surrounding diagnosis and treatment of childhood diarrhea. Observations and interviews were used to further explore seasonal behavior and caregiver perceptions as well as to triangulate responses of the

caregivers. This assessment sought to explore risk factors of diarrhea which are present on the household level and understand how caregivers perceive and manage diarrhea in their children. Furthermore, this portion of the study looked to deepen insight into how seasonality may affect the aforementioned factors and therefore the incidence of childhood diarrhea in the region.

This study was approved by the Institutional Review Board (IRB) at the University of South Florida, including activities that present no more than minimal risk to human subjects. The study was also approved by an in-country review process through the National Institute of Public Health (NIPH), National Ethics Committee for Health Research (NCEHR) in Phnom Penh, Cambodia. Furthermore, approval was also given by the Peace Corps Cambodia Country Director and the Chork Health Center Chief. Approval letters can be found in Appendix A. The following sections go into further detail about the procedure of methods used as part of this study.

4.2.1 Inclusion/Exclusion Criteria

The study selected participants who were primary caregivers of a child; those who spend the most time performing childcare activities such as preparing food, feeding, and bathing the child. This was any male or female in good health and over the age of eighteen who took care of a child under the age of five at the specified house. The desired participant also was required to live within the 26 villages and 3 communes described in the study (referred to as the study area going forward). Healthcare providers were selected to be any male or female in good health and over the age of eighteen who provided health care services to community members within the study area. Individuals were excluded if they were in poor health or under the age of eighteen years old. This was determined by asking the participant their age and whether they were physically and mentally fit to take part in the study. Caregivers were excluded if they were not a primary caregiver of a child under the age of five in the household or lived outside of the study area. Healthcare providers were excluded if they did not provide services to patients in the study area.

4.2.2 Counterpart Involvement

It was suggested in Kauchali et al. (2004) that the use of a counterpart of the same ethnic and social background could help facilitate rapport, making participants more comfortable to fully share ideas and beliefs (Kauchali et al., 2004). A counterpart also helps to improve accuracy of the translation process. This research therefore was done with the assistance of an in-country counterpart. The counterpart was a local resident and well-trusted member of the community. He was also an English teacher at the high school with excellent English language skills; having trained at the National Institute of Education in Phnom Penh, Cambodia. He helped to advise the researcher on adhering to proper cultural norms and language use. He also performed primary translation duties for documents from English-Khmer and Khmer-English and was essential in the survey and interview process. Over the course of several months prior to the beginning of data collection, the researcher thoroughly trained the counterpart on proper ethics, data collection techniques, and survey and interview methods. An additional in-country counterpart in Phnom Penh was used to back-translate documents to insure accuracy of translation. This counterpart also had extensive knowledge of the English and Khmer languages, having received a master's degree in the United States.

4.2.3 Sampling Method

A snowball sampling method was chosen to select participants in the study area. This method is used when sampling people who know people that generally have similar characteristics (Palinkas et al., 2015). In this case, caregivers who fit specific inclusion criteria; a male or female in good health and over the age of eighteen who took care of a child under the age of five and lived in within the study area. Time and resources restricted the ability of the researcher to perform data collection throughout the entire community. It was therefore decided to focus on obtaining quality

data from participants. This was done by concentrating surveys and interviews in villages where the thesis author had done previous work as part of the two-year Peace Corps service, as community members within these villages were more familiar with the thesis author.

The villages selected were Chork, Anlong Speun, Thmie, Kandal, and Popul. Chork village is a more urban area than the surrounding villages and is considered the district town of Rumdoul district. As a result, it contains families which could be much wealthier than families in the surrounding areas. In the context of this study, a distinction between more urban and rural needed to be made. Chork village was considered more urban, having a large market and district government buildings. Anlong Speun, Thmie, Kandal, and Popul were considered rural, as they did not contain the same features. The goal of this designation was to capture participants in both rural and urban settings in order to insure a more diverse and representative sample population.

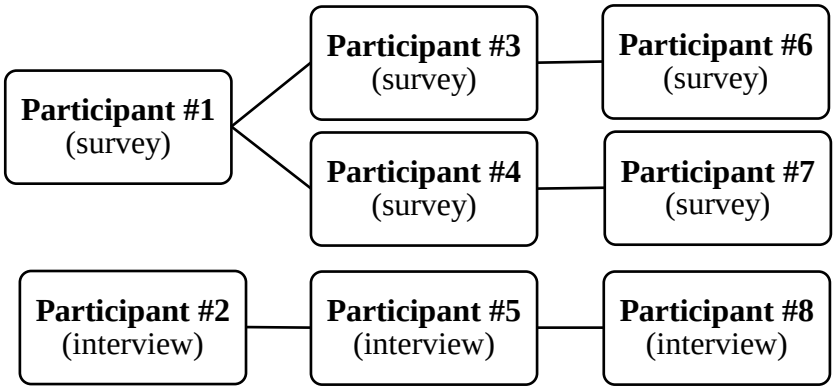

Figure 4: Flow chart of snowball sampling procedure in selected village

In the snowball sampling technique, key informants are used to select other key informants, who are then used to recommend additional informants, being handed from one informant to another until the sampling frame grows (Bernard, 2011). Figure 4 showed the process of sampling during the course of the study. Initially, at least two participants were recruited at the local Chork health center who lived in the selected villages. Once the survey or interview was completed with

the initial participants, the thesis author would ask the participant whether they knew of other caregivers who would be willing to participate. In the example, Participant #1 would seek another participant, Participant #3, either by telephone or traveling to their home. The Participant #3 would then inform the thesis author if they were willing to participate. With completion of the survey or interview the process would be repeated. Oftentimes, the participant would suggest one or multiple caregivers to participate. In every occasion the participants suggested others who lived in the same village. Participants of weekly observations were households which the thesis author had developed a relationship with during the two years living in the community. Healthcare providers were selected as those which the thesis author had previous interactions with during the two years living in the community; representing both the public and private sector. Data collection was performed in October and November 2017. A total of 71 caregivers participated in the study; 54 household surveys, 15 interviews, and two household observations. Additionally, two healthcare providers participated in interviews at their place of work.

4.2.4 Risk and Informed Consent

There was little risk associated with this study. The survey and interview did however, have questions relating to health issues of their children (only pertaining to diarrhea) and their personal caregiving behaviors. Therefore, at every point in the study, participants had the

Table 7: Breakdown of the number of study participants by village

Village	Commune	Survey	Caregiver Interview	Household Observation	Healthcare Provider Interview
Chork	Kampong Chork	16	3	1	2
Anlong Spearn	Svay Chek	11	3	0	0
Thmey		10	3	1	0
Kandal		8	3	0	0
Popul		9	3	0	0
Total		54	15	2	2

opportunity to refuse to answer a question or remove themselves from the study. All research activities were undertaken in a culturally appropriate way, and participants had the opportunity at any time to decline participation, not answer a question or remove themselves from the study. It was noted by the counterpart that oftentimes, signing a document is seen as a formal process in Cambodia, usually reserved for official business. This had the possibility of making participants feel uncomfortable and foster an environment and power dynamic that would not have been conducive to the study. There is also a portion of the population in the provinces that is unable to read or write. Therefore, The IRB approved a waiver of informed consent. Informed consent was given orally to all participants of surveys, interviews and observations. A typed and translated document was also given to each participant to look over and keep that explained information given in the oral consent. Before beginning each survey, interview or observation the researcher and counterpart thoroughly discussed all aspects of the consent form, answered any questions or concerns, and allowed as much time as needed to make a decision on participation.

4.2.5 Administration of Research Tools

A household survey was created and can be seen in Appendix D. Several questions were adapted from previous studies done in Cambodia (Kolesar and Willard, 2005, Kosal et al., 2015, Saunders, 2005, Pedi and Touch, 2010). Additional questions were also created to assess objectives of this research. The survey covered basic demographic information (age, sex, education, occupation of family members, etc.), seasonal activities, child feeding practice, household sanitation practice, personal hygiene practice, and perceived knowledge of diarrhea (causes, symptoms and treatment). Most questions were close ended with multiple choice answers which included options such as “Don’t Know” or “Other” if they felt uncertain or the given answers were not applicable. The caregiver also had the option to decline to answer any question.

The thesis author and counterpart tested surveys before beginning data collection, making any necessary changes. Household surveys were performed at the home of the caregiver. Fifty-four surveys were given orally to a primary caregiver of the child. The counterpart administered the questions to insure proper understanding by the participant, while the thesis author recorded the answers. The thesis author also worked with the counterpart to ask any necessary follow up questions to insure accurate understanding and notation. The thesis author recorded all answers on a survey guide and each session was also recorded with the approval of the participate for later data analysis.

Interviews were open ended questions covering similar topics as the survey but framed to obtain richer information on caregiver views. These questions allowed the caregiver to speak about their perceptions of diarrhea, give beliefs on causes, seriousness of symptoms, reasons for using certain treatment options, and daily household, childcare, and seasonal behavior. Two interviews

Table 8: Selected survey questions

- What is your gender/age/education/occupation?
- What are the yearly seasons? What months are they?
- What months does your family plow/plant/harvest rice?
- Who in the family helps with harvesting activities?
- Does your family do any other farming/animal raising activities?
- Does the mother of the youngest child work?
- Who takes care of the child when the mother is away from home?
- Are you giving your child water? Where is the water coming from?
- Are you feeding your child fruits and vegetables? Do you clean them? How are they cleaned?
- From who did you seek advice or treatment?
- What are causes/symptoms/treatments of normal/severe diarrhea?
- Where is the usual place where young children defecate at the home?
- How are the feces disposed of?
- Do you use a cleaning agent to wash your hands?
- When/Why do you wash your hands?
- What is the main source of drinking water during the wet/dry seasons?
- Do you do anything to the water before you treat it?

done with health care providers followed similar topics to understand their perspective on the disease in the area and determine the types of health messages they share with community members. Fifteen caregivers and two healthcare providers were selected for interviews. These interviews took place at the home of caregivers and the office of healthcare providers. The questions were open ended, with an option for the participant to decline answering a question or remove themselves from the interview. The interviews questions were read by the counterpart to insure proper understanding, while the thesis author recorded short-hand notes. The thesis author also worked with the counterpart to ask any necessary follow up questions to insure accurate understanding. The interviews were recorded with the approval of the participate for later data analysis.

Table 9: Selected questions from interview (caregiver)

- What is your age/education/occupation?
- Can you talk about the jobs and activities you and your family members participate in inside and outside the home during the wet season? Dry season?
- How do the activities described in the previous questions affect your childcare behavior?
- Tell me about your experiences in taking care of your child. Could you explain the typical day for you and your child?
- Are you familiar with the term diarrhea? What is it? How would you describe it in your child?
- Can you explain what you do when your child has diarrhea?

Table 10: Selected questions from interview (healthcare provider)

- Can you talk about the types of jobs and activities community members participate in inside and outside the house during the wet season? How about the dry season?
- How do the activities described in the previous question affect childcare behavior?
- Tell me about caregiving behaviors of mothers in this area? What are caregivers typically doing correctly and incorrectly when taking care of their children?
- Could we discuss diarrhea? How would you describe the illness in children?
- What do you suggest caregivers do when their child has diarrhea?
- What do caregivers usually do when their children have diarrhea?
- How long have you been working in the area? How have issues related to child health changed over time? Why do you think it has changed?

Household observations were used to support information given by the survey and interviews. These observations came from three different sources. The first source was general notes and observations made by the thesis author during the Peace Corps Cambodia service. These observations detailed seasonal behaviors witnessed by the thesis author during the two years living and working in the community. The second source was general observation when visiting homes. During this time, the thesis author noted the type of sanitation facility, water source, purification method for drinking water, location for disposing garbage and whether animals were allowed in common and kitchen areas. The third source was planned observations. Two caregivers were selected for these observations. Observations were done at the home of the caregivers between the morning hours of 8a.m. and 11a.m. and the afternoon hours of 2p.m. and 5p.m. Each household was visited by the thesis author for two hours each week for the two-month study period. These observations focused on the interactions between the caregiver and child such as feeding practice, treatment of illness, personal hygiene practice, and household sanitation. Observations on daily household activities were also done to allow the thesis author to view the effects a change in caregiver (i.e. old/young or male/female) or seasonality might have on the care of the child. The thesis author's notes were recorded in an observation book which was later used in data analysis.

Table 11: Factors noted during observation sessions

- What is the water supply? How clean is the surrounding area?
- What is used to clean water?
- What container is used to store water? How clean is it?
- What type of latrine is used? How is water brought to the latrine?
- How clean is the latrine? Is there soap available for washing hands?
- What is the floor of the common area? Is it clean? Are animals allowed in the area?
- What is the floor of the kitchen area? Is it clean? Are animals allowed in the area?
- What are the cleanliness of kitchen utensils and drinking devices? Is food covered?
- What are the activities of the caregivers and other household members?
- How does the caregiver perform caregiving activities (feeding, bathing, treatment if sick)?

4.2.6 Data Analysis: Research Tools

Results of all surveys were analyzed using Microsoft Excel and SPSS statistical analysis software (version 25). Survey data was first input into Microsoft Excel in order to perform a rank procedure adapted from a previous study assessing maternal knowledge and practices (Seksaria and Sheth, 2014). Questions from the survey pertaining to knowledge and practice of food hygiene, personal hygiene and environmental hygiene were used. Answers to these questions were given a score of "2" for a knowledgeable answer and a score of "1" for an insufficient answer. Some questions were also scored on a three-point system with "3" being the best answer, "2" being a passable answer, and "1" being an insufficient answer. Answers were summed, and a percentage score was found for each category. The score was then ranked as "Sufficient" or "Insufficient" based on the percentage. As score of 100%-76% was found to be "Sufficient," while a score of 75%-0% was found to be "Insufficient". These scores were then used to evaluate their relationship with socio-demographic information which included village, urban/rural, age, relation to child, education, participant occupation, occupation of the mother, and whether the mother migrates from the home to find work. This relationship was determined using Cramer's V to test for strength of correlation between variables, and the Chi-squared test for independence to determine significance; at a significance level $p<0.05$. Fisher's exact test was used in place of the Chi-squared test when the cells contained frequencies less than five. Interviews transcripts and observation were coded by the thesis author to determine common themes. These portions where then used to supply relevant information to support quantitative results.

CHAPTER 5: RESULTS AND DISCUSSION

The following section outlines results for Research Questions 1) What is the association between rainfall, temperature, and incidence of under-five childhood diarrhea? 2) How does seasonality affect who cares for the child and how they perform childcare and household practices? 3) How do caregivers define childhood diarrhea and how does this definition affect decisions surrounding diagnosis and treatment throughout the year? The sections of this chapter are organized to discuss results obtained for each research question stated. Section 5.1 and Section 5.2 will discuss results related to Research Question #1, while Sections 5.3, 5.4, and 5.5 will discuss topics related to Research Question #2 and Research Question #3.

5.1 Patterns in Rainfall, Temperature and Diarrhea in the Study Area

Rainfall data collected from the Svay Rieng weather station (SVRWS) by the Ministry of Water Resources and Meteorology (MoWRAM) was continuous throughout the specified study years (i.e. had no gaps or missing data points). Average monthly rainfall for years 2009 to 2016 are shown in Figure 5. Lowest rainfall averages are seen in January (6.625mm) and February (4.5mm) with the highest averages occurring in September (313.4mm) and October (330.6mm). From Figure 5, it can be seen that there was variability in rainfall in months throughout the study period however, driest months were seen to be January and February where almost no rain was recorded. By April, rainfall begins to steadily increase each month until it peaks in September and October. More rain is seen in these two months than the other months of the year. In November, rain begins to decrease again until December, which shows a low average rainfall for the month. National data from The World Bank Group averaged nationally from 1991-2015 show a similar

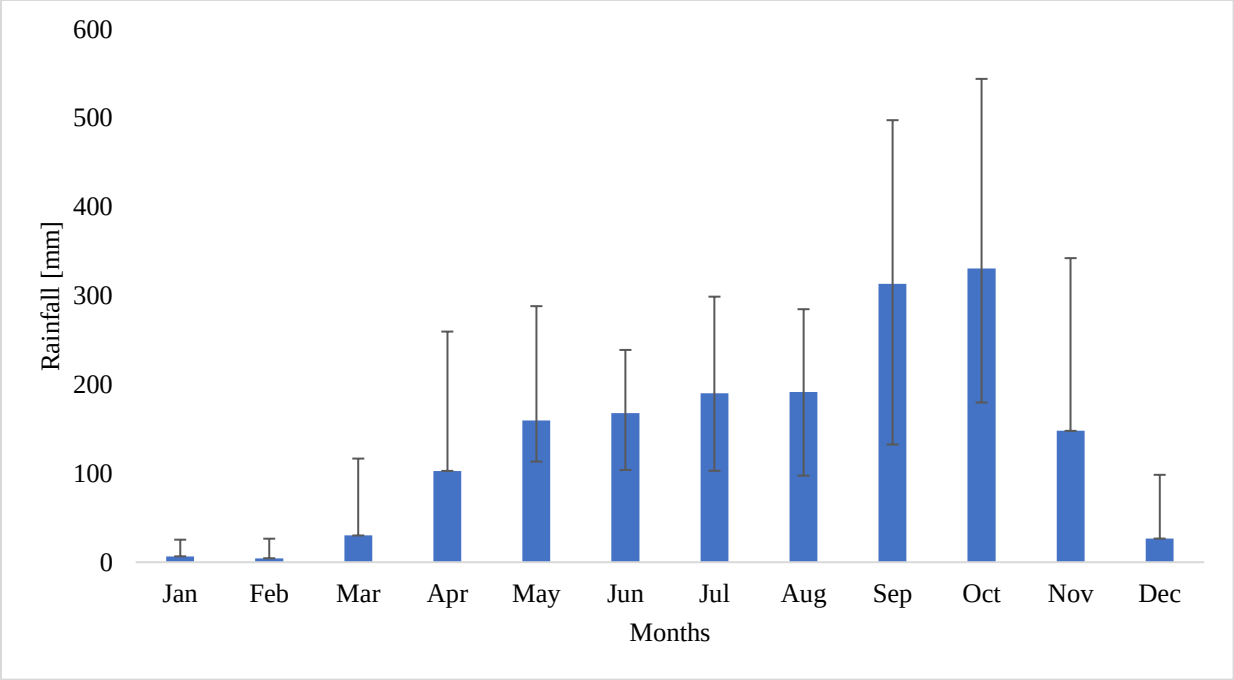

Figure 5: Monthly average rainfall (millimeters) in Svay Rieng (2009-2016)

seasonal pattern in rainfall over a year in Cambodia, with the months of August and September having the highest average monthly rainfall during the year and January and February having the lowest average monthly rainfall. Extreme weather events occur in Cambodia which oftentimes affect the variability of rainfall amounts. The Davies et al. (2015) study aggregated extreme weather events which occurred in Cambodia between the years of 1991 to 2013. It was reported that flood and drought events occur yearly across the country with effects from tropical storms felt every couple years (Davies et al., 2015). Looking at yearly cumulative rainfall data over the study period, the years 2009, 2013, 2014, and 2015 were dryer years, with years 2010, 2011, and 2012 being wetter years. There was substantially more rain measured in 2016, with cumulative rain reaching over 2200 millimeters.

As stated previously, the tropical climate in Cambodia is driven by cyclical monsoon activity. This activity leads to months that have relatively low amounts of rain and months with increased amounts of rain; often referred to as the wet and dry seasons. Ros et al. (2011) states that

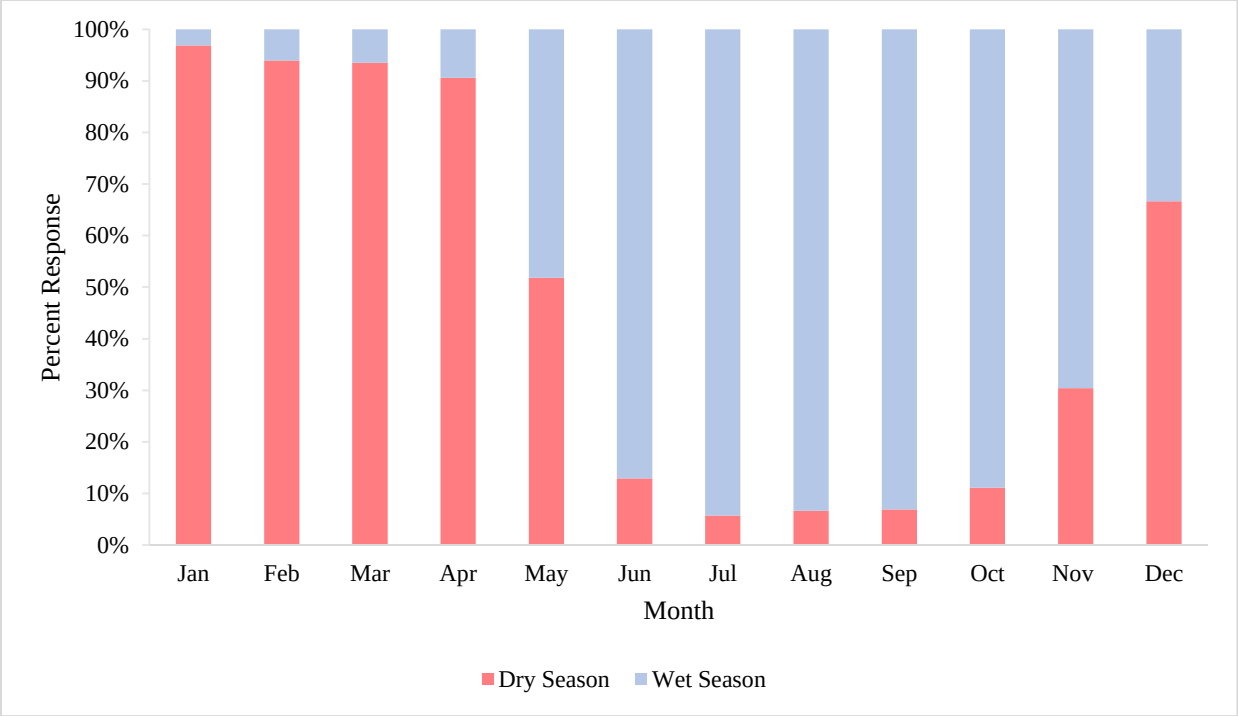

Figure 6: Participants perception of wet/dry seasons in the study area

in Cambodia, the dry season typically extends from November to February, with the wet season being from May to November (Ros et al., 2011).As part of this research, participants were asked to state the seasons they experience within the region and designate which months made up each season. The results of this data are displayed in Figure 6. A high percentage of participants perceived the dry season to be between the months of January through April and the wet season to be between the months of June and October. The months of May, November, and December had less agreement between participants and can therefore be considered transition months. Comparing this participant perception to average monthly rainfall totals from 2009 to 2016 in Figure 5 shows relative agreement. For this study, seasons will be derived from Figure 6 with dry season months being January, February, March, April, and December, and wet season months being May, June, July, August, September, October, and November.

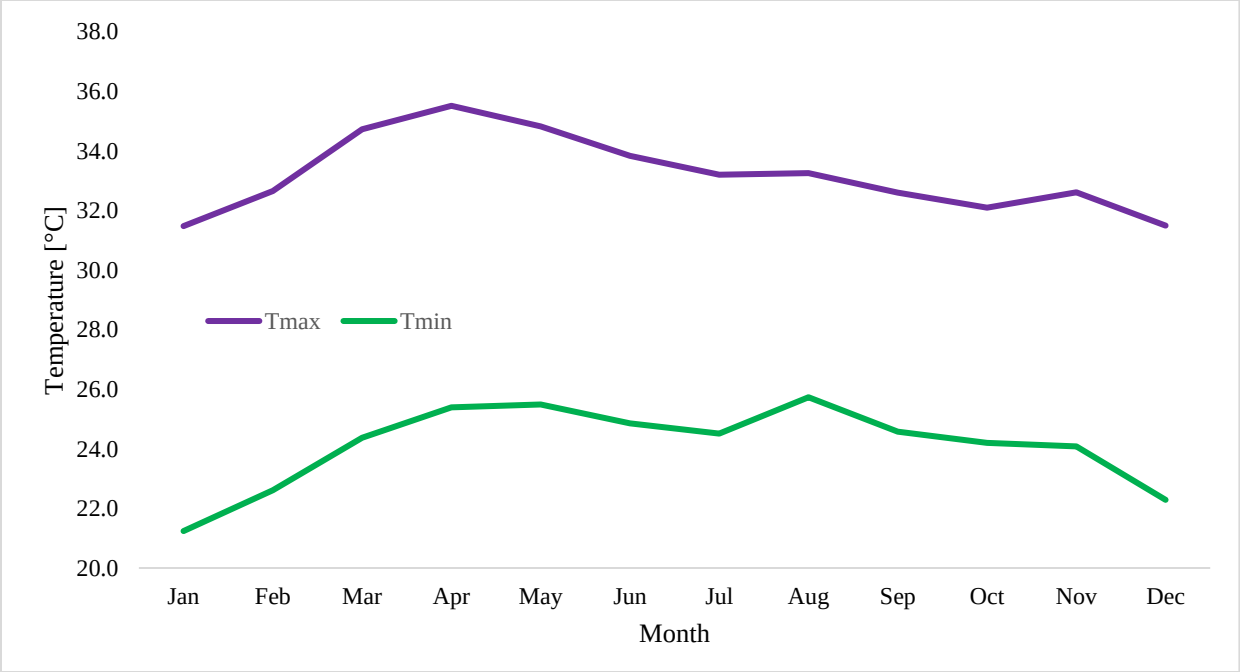

Figure 7: Monthly average maximum and minimum temperature (°C) in Svay Rieng, Cambodia (2009-2016)

Monthly temperature averages for all study years are displayed in Figure 7. Average monthly maximum and minimum temperatures range from 28.8°C- 37 °C and 19.3°C- 37°C, respectively. From Figure 7, both maximum and minimum temperatures follow similar trajectories over the course of the year. This is similar to data provided by Ros et al. (2011), where the average temperature in the wet and dry season were between 27-35°C and 17°C- 27°C, respectively (Ros et al., 2011). It should be noted that the coldest months of the year also correspond to the driest months of the year. The coldest temperatures are seen in the months of January, February, and December (established as dry season months) with temperatures ranging from 19.3°C- 34.3°C. The hottest temperatures are experienced in the months of March, April, and May, which signify the end of the dry season and beginning of the wet season. Temperatures in these months range from 22.9°C - 37°C. Daily maximum and minimum temperature data obtained from the SVRWS by the MoWRAM were mostly complete, only missing two or three days. This however, was not a concern as monthly averages for temperature were used in this study.

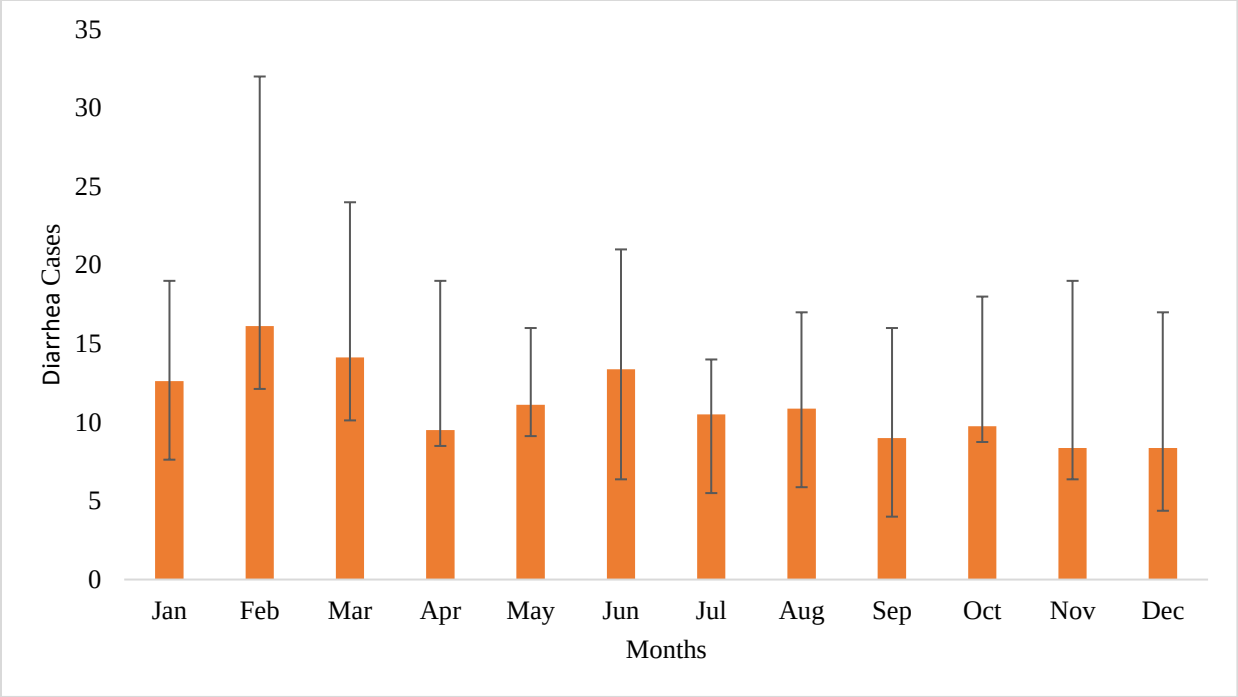

Figure 8: Average monthly under-five diarrhea cases at local health center, Rumdoul district Svay Rieng province, Cambodia (2009-2016)

Under-five diarrhea data obtained from the local health center was continuous, containing values for all months between the years 2009 to 2016. Aggregation of local health center data revealed a total of 44,865 patients having visited the health center between 2009-2016, with 9625 of these patients being children under five years old; totaling 21.9% patients seen. Of all the diagnosed disease over the eight-year study period, 5.5% of reported cases were diarrhea with 2.5% being under-five childhood diarrhea. The majority of cases were classified as diarrhea with different levels of dehydration and dysentery. Cholera represented very few diagnosed cases.

Average monthly under-five diarrhea cases at the health center are reported in Figure 8, showing November and December having the least amount of average cases and February and March having the most. This figure shows diarrhea incidence occurs throughout the year with variability seen within the months during the study years of 2009 to 2016. The highest peak occurs in February, with the months of January, March, and June, showing high average incidence rates.

November and December had the lowest average incidence rates, with September, April, and October showing relatively low results as well. Peak years for diarrhea were in 2010, 2011, and 2012 with totals reaching close to 200 cases during the year. There was a significant drop in under-five cases from 2013 to 2016, with cases totaling close to 100 each year. Studies have shown extreme weather changes such as drought and floods can increase risk of diarrhea (McMichael et al., 2003, Levy et al., 2016). A study conducted in Cambodia looking at extreme weather events and diarrhea found no statistically significant results in Svay Rieng province between the years 2001 and 2012 (Davies et al., 2015). Raw data obtained in this study can be found in Appendix C.

5.2 Associations between Weather Factors and Under-five Childhood Diarrhea

Statistical analysis performed as a part of this study looked at the monthly incidence of under-five diarrhea totals and weather factors which included monthly rainfall total in millimeters, number of heavy rainfall days within the month, average maximum monthly temperature, and average monthly minimum temperature. The results of the Spearman's correlation analysis for the initial month (lag 0) and lagged months (lag 1 to 4) are displayed in Table 12-16. Both the direction and magnitude of the association between the exposure variable (weather factors) and outcome variable (diarrhea cases) are indicated alongside the level of significance.

The results of the Spearman's correlation in Table 12 and Table 13 show significance values for monthly rainfall and maximum temperature to be greater than 0.05 for lag 0 and lag 1 months. This indicates there is no significant association between monthly under-five diarrhea incidence and both monthly rainfall and maximum temperature in the lag 0 and lag 1 months. It can be seen, however that significance values for heavy rainfall days and minimum temperature are below the 0.05 significance value for lag 0 and lag 1 months. This indicates there is a significant association between monthly under-five childhood diarrhea incidence and both heavy rainfall days

Table 12: Results from Spearman's correlation analysis for initial month (lag 0)

		Monthly Rainfall	Heavy Rainfall Days	Maximum Temperature	Minimum Temperature
Monthly under-five diarrhea:	Spearman Correlation	-.162	**-.216***	-.040	**-.208***
	Significance (2-tailed)	.116	.035	.702	.042
	N	96	96	96	96

Table 13: Results from Spearman's correlation analysis for lag 1 month

		Monthly Rainfall	Heavy Rainfall Days	Maximum Temperature	Minimum Temperature
Monthly under-five diarrhea	Spearman Correlation	-.170	**-.219***	-.060	**-.212***
	Significance (2-tailed)	.100	.033	.564	.039
	N	95	95	95	95

Table 14: Results from Spearman's correlation analysis for lag 2 month

		Monthly Rainfall	Heavy Rainfall Days	Maximum Temperature	Minimum Temperature
Monthly under-five diarrhea	Spearman Correlation	.117	0.76	.079	.036
	Significance (2-tailed)	.263	.469	.477	.733
	N	94	94	94	94

Table 15: Results from Spearman's correlation analysis for lag 3 month

		Monthly Rainfall	Heavy Rainfall Days	Maximum Temperature	Minimum Temperature
Monthly under-five diarrhea	Spearman Correlation	**.250***	.167	-.070	-.102
	Significance (2-tailed)	.015	.109	.507	.332
	N	93	93	93	93

Table 16: Results from Spearman's correlation analysis for lag 4 month

		Monthly Rainfall	Heavy Rainfall Days	Maximum Temperature	Minimum Temperature
Monthly under-five diarrhea	Spearman Correlation	**.222***	**.210***	-.160	.016
	Significance (2-tailed)	.034	.045	.127	.877
	N	92	92	92	92

* Correlation is significant at the 0.05 level (2-tailed)

and minimum temperature in the initial and lag 1 month. Table 14 shows that the lag 2 month has no statistically significant results between under-five diarrhea and any of the stated weather factors. Table 15 and Table 16 show monthly rainfall and under-five diarrhea have a significant association at the lag 3 and lag 4 months. This indicates that increased monthly rainfall can result in an increase of under-five diarrhea incidence three or four months following the initial month.

Based on the results of this analysis, the number of heavy rainfall days have a weak negative association with monthly under-five diarrhea incidence ($r_s(96) = -.216$, $p = .035$; $r_s(95) = -.219$, $p = .033$). This indicates that when the number of high rainfall days increases, the number of under-five diarrhea cases decreases. Figure 9 shows a scatter plot of the two variables for the lag 0 month, with the exposure variable (heavy rainfall days) on the x-axis and outcome variable (diarrhea incidence) on the y-axis. From this figure, a negative relationship between the two variables can be seen. Months with zero heavy rainfall days have a variation of diarrhea incidence

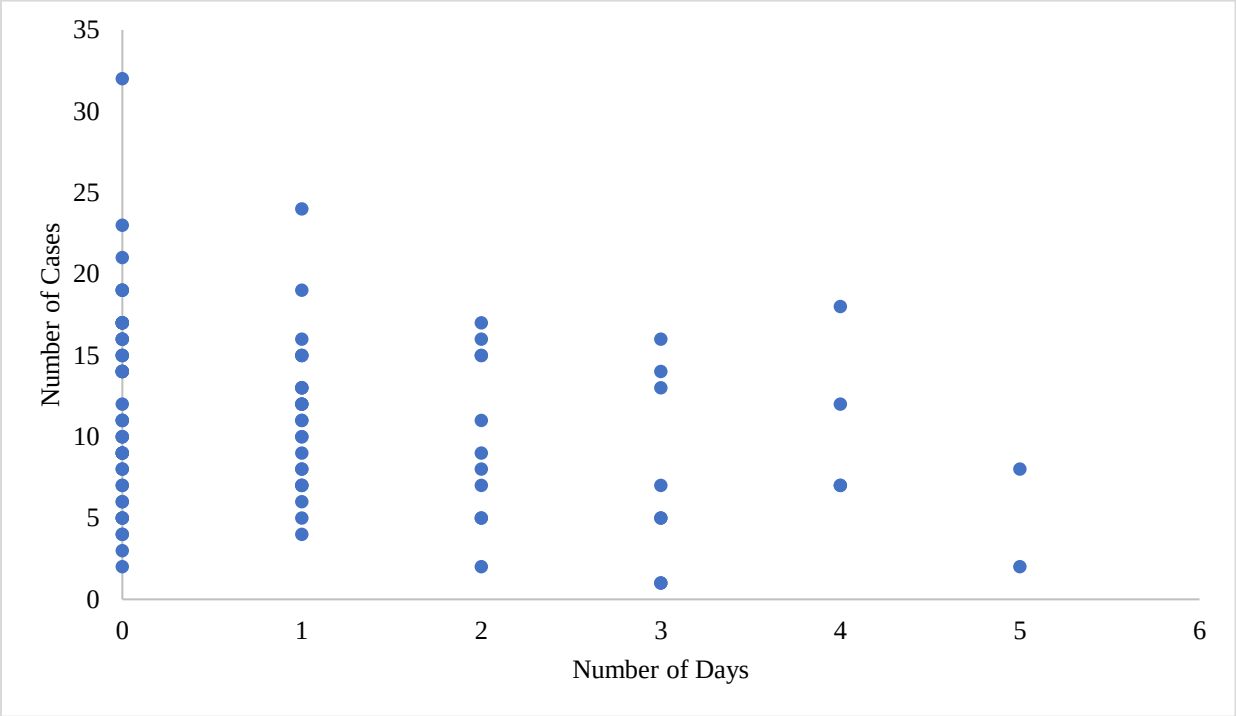

Figure 9: Scatter plot of number of heavy rainfall days and under-five diarrhea (lag 0)

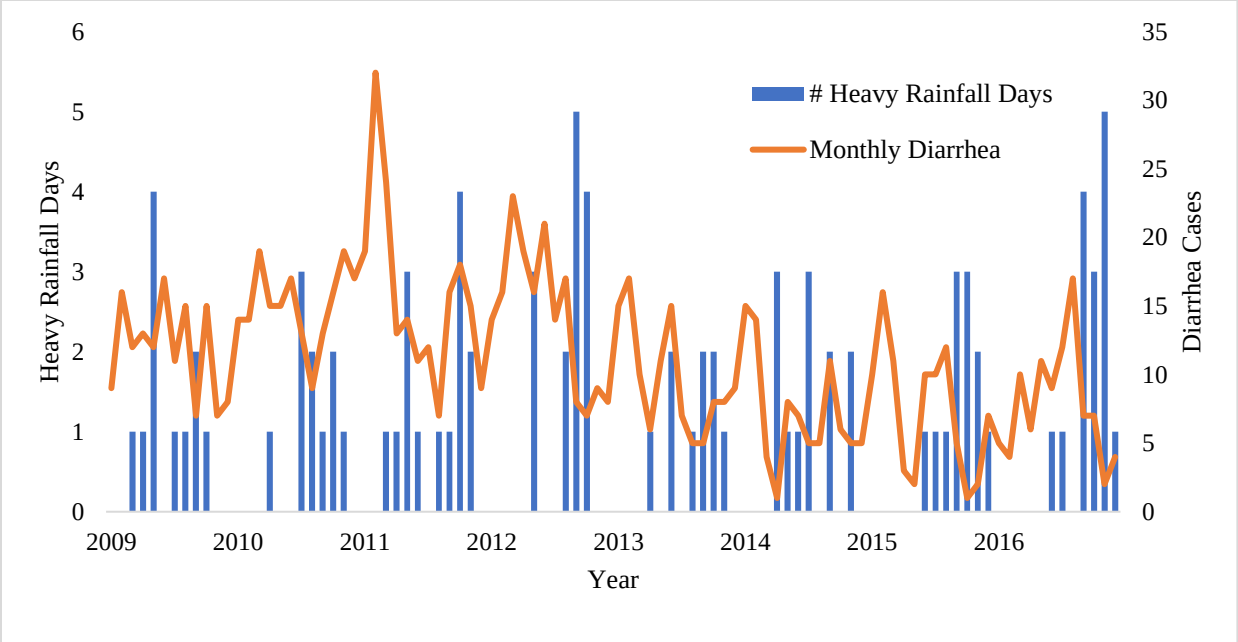

Figure 10: Monthly heavy rainfall days and monthly under-five diarrhea (lag 0)

within the months. This pattern showing a variation in diarrhea incidence is in fact seen for one, two, three, and four heavy rainfall days as well. This result justifies the weaker strength of association seen in Table 12. The number of zero-day heavy rainfall months is larger than the number of five-day heavy rainfall months. A pattern that shows a decreasing number of months with an increasing number of heavy rainfall days within the months is seen. Additionally, as the number of heavy rainfall days increases, the incidence of diarrhea decreases. This relationship can further be illustrated by Figure 10. This figure shows an overlay of the pattern of monthly under-five diarrhea incidence with the months having one or greater heavy rainfall days. From the figure, there are peaks in diarrhea incidence when there are months with zero heavy rainfall days. It can also be seen that with an increase in the number of heavy rainfall days, oftentimes there can be a decrease in the amount of diarrhea cases for that month. A similar relationship exists for under-five diarrhea cases and heavy rainfall days in the lag 1 month.

5.2.1 Heavy Rainfall and Diarrhea from Previous Studies

From literature reviewed in Section 3.3.1, the Levy et al. (2016) comprehensive review found that 70% of the studies found positive associations between heavy rainfall and diarrhea; or an increase in diarrhea with heavy rainfall. This is somewhat different from the results of the current study. This section therefore highlights several selected studies from varying regions of the world to understand possible reasons for disparities.

A study which found a similar negative association between high rainfall and diarrhea was performed in fourteen Sub-Saharan countries between the years of 1992-2001 (Bandyopadhyay et al., 2012). Bandyopadhyay et al. (2012) found high rainfall during the dry season reduced the prevalence or diarrheal disease in the study area. Within this study, 30% of the households did not have latrines, while 70% had access to safe water. With water shortage being a severe problem in many of the study countries, the authors concluded that high rainfall made groundwater more plentiful, as well as helped to improve both the quantity and quality of water from sources. Furthermore, the authors suggested the increased rain provided more water to households which allowed for the adoption of better hygiene practices (Bandyopadhyay et al., 2012). All of these factors therefore helped to reduce diarrhea during high rainfall periods and resulted in a negative association between diarrhea and high rainfall.

A study in Dhaka, Bangladesh looked at the association between non-cholera diarrhea hospitalization and weather factors (temperature and rainfall) from the years 1996 to 2002 (Hashizume et al., 2007). Hashizume et al. (2007) found a significant positive association between high rainfall and hospital visits due to non-cholera diarrhea in lags of 0-8 weeks; where non-cholera cases would increase with high rainfall. The authors concluded that results for the initial lag weeks followed results of previous studies which mentioned high rainfall acting to wash

contaminants into water supplies (Singh et al., 2001). However, unlike previous studies, there was no protective effect seen within the Dhaka study at longer lag times. As most participants in the Dhaka study used tube wells or tap water as a water source, the authors suggested a link between high rainfall and river level. High rains were said to cause flooding and the disruption of water and sanitation systems leading to the contamination of tap water. Previous unpublished studies were also mentioned as showing evidence of floods causing increased diarrhea cases in tube well users (Hashizume et al., 2007)

A study performed within nineteen villages in Ecuador between the years 2004 and 2007 found heavy rainfall to be associated with increased diarrhea following dry periods and decreased diarrhea following wet periods (Carlton et al., 2014). Within this study, households were seen to be dependent of surface water, rainwater, and unprotected wells for drinking water. On average it was also estimated that only 29% reported treating their drinking water and 46% reported access to improved sanitation (Carlton et al., 2014). Similar to many previous studies, heavy rains following dry periods would flush accumulated pathogens into water sources being used as drinking water, resulting in positive associations with diarrhea during the lag 0 period. Continued heavy rain following wet periods would then dilute pathogens in water sources, resulting in negative associations with diarrhea in the lagged period (Carlton et al., 2014, Levy et al., 2016, Singh et al., 2001). Additionally, the authors assessed the relationship between social and environmental factors, such as water treatment behavior, on diarrhea incidence. Their results found that when 71% of households in the community reported treating drinking water, heavy rainfall did not have a significant effect on diarrhea (Carlton et al., 2014). Carlton et al. (2014) therefore concluded that water treatment could decrease the negative health effects of heavy rainfall on diarrhea by reducing human exposure to washed pathogens in the environment.

In reviewing these studies, it should be noted that all three took place within different communities in geographically diverse areas. Each support the idea that the characteristics of the study area can have a significant effect on the results of the study. For example, the majority of households in the Bandyopadhyay et al. (2012) study had access to both improved water and sanitation; however, water shortage was a large constraint which affected both water consumption and hygiene behavior. Additionally, with Dhaka being a large city in Bangladesh, most households had access to both tube wells or tap water. Hashizume et al. (2007) however, suggested that high rains and floods could cause a breakdown of water and sanitation facilities, leading to the contamination of water sources. Finally, households in the Carlton et al. (2014) study in Ecuador were dependent on unimproved water sources, and therefore vulnerable to heavy rains which flushed accumulated pathogens into water environments. Sanitation and water supply can strongly modify the effect of weather variables on diarrheal disease (Singh et al., 2001). For example, in the Carlton et al. (2014) study the use of water treatment helped to decrease the impact of heavy rain on diarrhea. From these studies, it can be seen that regional and community characteristics can play a vital role in the interaction between diarrhea and heavy rainfall. Therefore, results should be placed within the context of the community and regional location.

5.2.2 Household Sanitation Characteristics in the Study Area

This section details the household characteristics for the current study (Table 17). Most households have access to water in both the wet and dry season, with the main water source being a borehole well (motor or hand pump). The majority of households use a water treatment method before drinking, with sand filters being the most popular method (68.5%). Additionally, at least 74% of households store drinking water in a covered container and most also have a functional pour flush latrine at their home. With the absence of local statistics, it is hard to confirm the results

in Table 17. As previously mentioned in Chapter 3, sanitation and improved water coverage in 2012 indicate percentages below what has been reported here. However, it is of the belief of the thesis author that progress has been made to improve coverage. There are many NGOs working in the study area implementing filters and latrines. One local NGO estimated that from 2009 to 2017 they installed over 1000 latrines in the area, with another having supplied 3000 water filters. Overall, local health officials believe coverage has improved:

"Now most people drink clean water. Filtered water. They don't drink well water only. They don't drink that. They use filtered water. Most use foreign filters from NGOs, its good […] Now most people have sanitation. They use a latrine. Probably 80% use, but there are several houses that don't have them now."

Therefore, it should be noted that percentages detailed in Table 17 represent information gathered when surveying participants during the study process. These numbers do not give exact percentages of the study area, however generally reflect the sanitation trends in the community.

5.2.3 Heavy Rainfall and Diarrhea Incidence in the Study Area

Unlike the Bandyopadhyay et al. (2012) study, the current study area does not have a water scarcity problem. All households were said to use an improved water source (either a borehole well or piped to their home) and had water available during both the wet and dry seasons. The Dhaka, Bangladesh study similarly had piped water or wells as water sources. Hashizume et al. (2007) however, mentioned high rains as making water sources susceptible to contamination by flooding, resulting in an increase in diarrhea incidence. This was not seen as a large problem in the study area, with only 16.7% (n=9) of surveyed households mentioning some sort of flooding at their homes during the wet season. Contamination of wells therefore is possible, however unlikely.

Table 17: Household water/sanitation demographics by village

	Chork	Anlong Speun	Thmie	Kandal	Popul	Villages Total
Water Always Available:						
Yes	100%	100%	100%	100%	100%	100%
No	0%	0%	0%	0%	0%	0%
Water Source:						
Piped into home	6.3%	0%	0%	0%	0%	0%
Borehole well	93.8%	100%	100%	100%	100%	100%
Water Treatment Method:						
Boil	25%	9.1%	0%	12.5%	11.1%	13%
Filter (Ceramic)	18.8%	18.2%	0%	12.5%	0%	11.1%
Filter (Sand)	50%	54.5%	90%	75%	88.9%	68.5%
Don't Know	6.3%	18.2%	10%	0%	0%%	7.5%
Water Storage:						
Covered	50%	81.8%	80%	100%	77.8%	74.1%
Not covered	12.5%	9.1%	20%	0%	0%	9.3%
N/A	37.5%	9.1%	0%	0%	22.2%	16.7%
Type of Latrine:						
Pour flush	100%	100%	100%	100%	100%	100%
Kitchen Floor:						
Dirt	43.8%	63.6%	60%	62.5%	88.9%	61.1%
Concrete	25%	27.3%	40%	37.5%	11.1%	27.8%
Tile	18.8%	9.1%	0%	0%	0%	7.4%
Other	12.5%	0%	0%	0%	0%	3.7%
Animals in Kitchen:						
Yes	37.5%	54.4%	40%	62.5%	66.7%	50%
No	50%	45.5%	40%	37.5%	33.3%	42.6%
Don't Know	12.5%	0%	20%	0%	0%	7.4%
Common Area Floor:						
Dirt	43.8%	63.6%	60%	62.5%	88.9%	55.6%
Concrete	37.5%	27.3%	40%	37.5%	11.1%	38.9%
Tile	18.8%	9.1%	0%	0%	0%	5.6%
Other	12.5%	0%	0%	0%	0%	0%
Animals in Common Area:						
Yes	68.8%	54.5%	40%	62.5%	66.7%	88.9%
No	31.3%	45.5%	40%	37.5%	33.3%	11.1%
Don't Know	0%	0%	20%	0%	0%	0%

Households in the Carlton et al. (2014) study had unimproved water sources, unimproved sanitation, or had low usage of point-of-use treatment options. A large reasoning for increased diarrhea incidence in the lag 0 month was stated as a result of accumulated pathogens being flushed into water bodies which would then be used by community members as water sources (Carlton et al., 2014, Bhavnani et al., 2014, Levy et al., 2016, Singh et al., 2001). Carlton et al. (2014) further stated that heavy rain following wet periods washes the environment and making water more diluted of pathogens. Additionally it was suggested that treated drinking water could decrease the negative impacts of heavy rain during dry periods and improve health outcomes (Carlton et al., 2014). Moreover, the Bhavnani et al. (2014) study in Ecuador found unimproved sanitation was only a risk factor during dry periods and unimproved water sources were only a risk factor after heavy rains.

Within the current study area, most households have access to improved water source and sanitation as well as use a point-of-use treatment method. Following the Carlton et al. (2014) study, the negative associations found for heavy rainfall and diarrhea in the initial month (lag 0) and following month (lag 1) are reasonable. As shown in Table 17, a large portion of the study population allows animals (dogs, chickens, ducks, cows, water buffalo, etc.) into the common and kitchen areas of their homes. As the thesis author observed, this oftentimes leads to animals and feces being in close contact with members of the family and foodstuffs. A study in Zimbabwe has shown that children can be exposed to fecal bacteria from crawling on kitchen floors and bare soil (Ngure et al., 2013). Furthermore, contamination levels were shown to increase in kitchens areas, and on dirt floors (Exum et al., 2016). Heavy rain therefore could clean the environment and flush accumulated pathogens away from living spaces. More heavy rain days results in more rain which would remove more accumulated pathogens, thus helping to decrease likelihood of diarrhea. Water

treatment, as well as the use of improved water sources help to protect households from ingesting harmful pathogens that run off into surface waters. Therefore, the heavy rain can be seen to have an immediate cleansing effect that results in the negative association at lag 0.

As studies have been shown to vary by community, careful interpretation needs to be taken when comparing studies over different regions. In drawing conclusions about the washing effect of accumulated pathogens from living spaces, it should be noted that Fiji and Ecuador have far different terrain than Cambodia. Many parts of Ecuador and Fiji have steeper sloping lands which help to move stormwater more easily. The landscape in this study's location in Cambodia is much flatter and therefore the washing effect may not be as significant as in other regions. Washing, however can still occur and collect in rice fields or drainage ditches around homes. These ditches were shown to fill during the wet seasons, oftentimes causing a stagnation of water for long periods of time. Several participants mentioned avoiding this water because it was dirty and caused itching. Additionally, the ditches were said to breed mosquitos and other insects, which could lead to the contraction of other disease such as dengue fever or malaria.

5.2.4 Minimum Temperature and Diarrhea Incidence in the Study Area

Based on the results of the analysis in Table 12 and Table 13, the average minimum monthly temperature at lag 0 and lag 1 have a weak negative association with monthly under-five diarrhea incidence ($r_s(96) = -.208$, $p = .042$ and $r_s(95) = -.212$, $p = .039$). This result indicates that when the minimum temperature decreases, the number of under-five diarrhea cases increases. This relationship is seen in Figure 11, which shows monthly under-five diarrhea totals inlayed with average monthly minimum temperature for the study period. As seen in the figure, significant dips in minimum temperature can be seen in the dry cooler months of December to February. Oftentimes this dip is met with a rise in under-five diarrhea cases for those months.

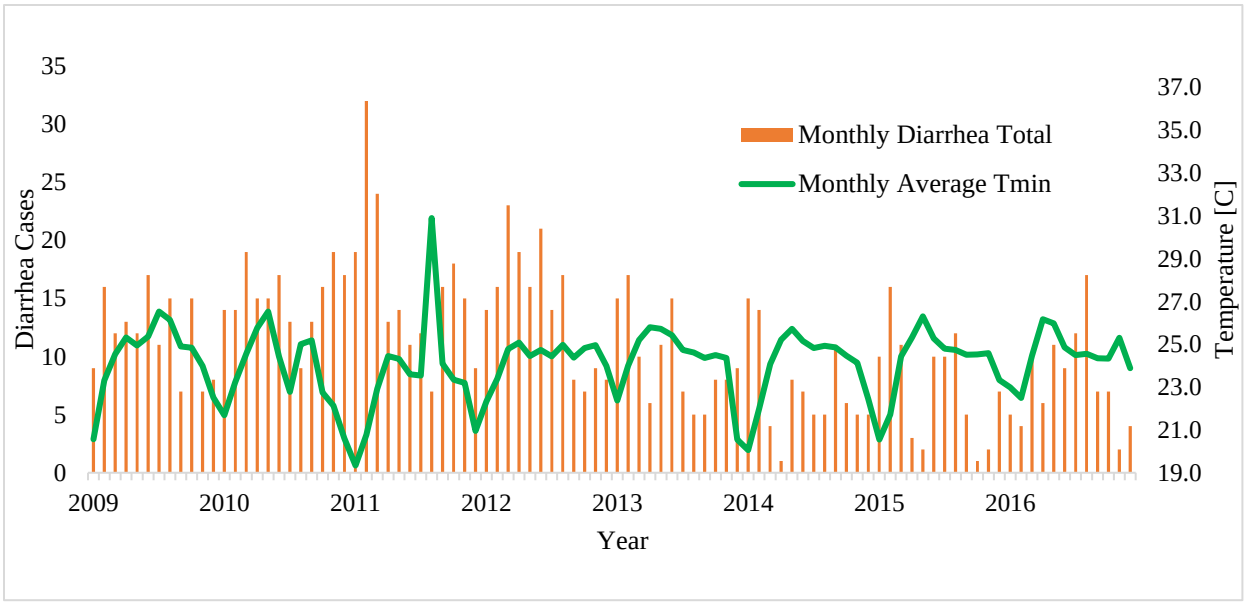

Figure 11: Monthly average minimum temperature and monthly under-five diarrhea cases 2009-2016 for the study area

The McIver et al. (2016) study in Cambodia looked at the association of weather factors and diarrhea morbidity throughout the country. When looking at the association between minimum temperature and diarrhea in Svay Rieng there were inconclusive results, with minimum temperature causing both negative and positive percent changes in diarrheal disease from lag 0 to lag 4 months. The study did however, find that minimum temperature had a negative association with diarrhea in Kampong Thom and Prey Veng provinces. (McIver et al., 2016b); Prey Veng being the closest province to Svay Rieng.

Most studies that found negative associations between temperature and diarrhea incidence were those reporting the relationship between rotavirus and seasonality. In many of these studies, rotavirus was found to increase during cooler months of the year (Levy et al., 2016, Jagai et al., 2012, Prasetyo et al., 2015). There is a possibility that this relationship could also be seen within the study area, as rotavirus is prevalent within the country. A study conducted at a Phnom Penh hospital in 2011 found rotavirus to be in 30% of children tested with diarrhea, with all but three

rotavirus cases being found in children under the age of two years old (Silapong et al., 2017). Tests specifying pathogenic causes of diarrhea are not available at the health center and are not currently recorded in health records. Therefore, this assumption could not be further confirmed without more testing. Additionally, as mentioned previously, the lowest minimum temperatures and the lack of heavy rainfall events occur within the same time period each year (December, January, February). Therefore, there is likely an interaction between these two factors. A more robust model would be needed which included multiple weather factors such as rainfall and temperature as well as other possible factors (wind speed, and humidity). This multivariable model would help understand the interaction between weather factors and their association with under-five childhood diarrhea.

5.2.5 Monthly Rainfall/Maximum Temperature and Diarrhea Incidence

From Table 12 to 16 average maximum monthly temperature did not have statistically significant associations with under-five diarrhea incidence during any of the time periods analyzed. This suggests that average maximum monthly temperature does not contribute significantly to diarrheal disease within the study area. Similarly, monthly rainfall did not have statistically significant results for lag 0, lag 1, and lag 2 months. From Table 12 and Table 13, although not significant, the correlation coefficients show a weak negative relationship between monthly rainfall and under-five diarrhea incidence. This may suggest that monthly rainfall could have a small washing effect on the environment as well. Variability of diarrhea totals in wet season months further indicate, however that this is not a main driver of under-five diarrhea incidence.

These results for lag 0 to lag 2 months differ from McIver et al. (2016) study in Svay Rieng province which showed small positive associations during lag 0 to lag 4 months Differences between studies could be as a result of differences in study years. The McIver et al. (2016) study looked at data from the years 1997 to 2012. During this time, local data was available on water

and sanitation coverage in Svay Rieng, displayed in Table 5 in Chapter 3. Coverage during this time was much lower than what has seen surveyed in Table 17. With increased coverage, it is realistic to believe there could be a lessening effect of rainfall on diarrheal incidence and morbidity.

From Table 15 and Table 16, monthly rainfall begins to have positive associations with diarrhea within the lag 3 and lag 4 months ($r_s(93) = .250$, $p = .015$; $r_s(92) = .222$, $p = .034$). This indicates that increased rainfall could have a delayed effect on diarrhea by three or four months. As mentioned previously, the terrain within the study area often results in the accumulation of stormwater for long periods of time in rice fields and ditches. The more rainfall, the more stormwater accumulates, and the longer the stagnation time. Stagnation of water can breed harmful pathogens which could have an effect on child health, as longer periods of stagnation increase the likelihood for human exposure. The McIver et al. (216) study in Cambodia also found positive associations between rainfall and diarrhea morbidity in Svay Rieng province for lag 3 and lag 4 months.

From this study, heavy rainfall had a greater effect on under-five diarrhea, especially in the wet season, with minimum temperature likely having an effect during cooler periods. The associations between heavy rainfall and minimum temperatures displayed in Table 12 and Table 13 represent weak correlations with under-five diarrhea incidence. The weak positive correlations between monthly rainfall and under-five diarrhea seen at lag 3 and lag 4 show a possible delayed effect of rainfall on under-five diarrhea incidence. Weak correlations seen between under-five diarrhea and weather factors suggest there may be other factors within the study area contributing to diarrhea incidence in children under five years old. The following sections discuss other possible factors.

5.3 Effect of Seasonality on Caregiving and Household Practice

This section will discuss seasonality in Cambodia and how it can affect the everyday life of community members in the study area. As mentioned previously, in most rural areas of Cambodia the rice crop accounts for a large portion of the household income (Ros et al., 2011). Within the study area, rice farming was an activity that 94.4% (n=51) of survey participants took part in. Those who did not take part in rice farming hired an outside party to perform all required activities. Most households grow one annual crop. Some families also participate in dry season farming; however, lack of water and irrigation is a significant constraint that deters most households from growing during the dry season (Ros et al., 2011). As a result, the majority of rice is grown during the wet season and is dependent on seasonal rain.

5.3.1 Activities in the Wet and Dry Seasons

Rice farming is an involved process, taking many months of proper care for a successful harvest. Most households have their own field which can range from one to several hectares. Each household has the responsibility of growing and harvesting this plot of land in order to sustain the livelihood of their family; rice is used as both the main staple in the Khmer diet, but can also be sold for income. From observation by the thesis author over two years in the community, the general rice farming process in the study area follows several main steps;1) preparing the field for plowing 2) plowing the field 3) sowing of rice, and 4) harvesting. Preparing the field means spreading cow manure over the land, which is usually done in the months leading up to the first rain of the season. The field is then plowed one time in order to mix in the manure. After the first rains of the season in May or June, more manure can be added to the field before it is plowed again. Once plowed, rice seeds can then be thrown/broadcasted over the land. This process usually takes place in June or July depending on the rain. Harvesting takes place at the end of the wet

season in November or December. Participants who took part in surveys were asked to detail which months these rice farming activities took place in, which is displayed in Figure 12. This figure follows closely to what was observed by the thesis author, with responses for plowing, planting, and harvesting peaking in the months of June, July, and November, respectively. Similar outlines for the rice farming process were reported in other studies (Ros et al., 2011, Dang et al., 2016).

During the wet season, besides plowing the field, planting, and harvesting in the months displayed in Figure 12, farmers are also busy with other daily farm activities. One of the main activities is raising animals. Most households in Cambodia raise animals as a source of livelihood or savings (Ros et al., 2011). Within this study, 55.6% (n=30) of participants were involved in raising animals for money, shown in Table 18. This included cows, water buffalos, pigs, chickens, and ducks. Those who did not raise animals for money, still raised them for family consumption. In addition to raising animals, farmers are involved in activities to maintain the rice fields as well.

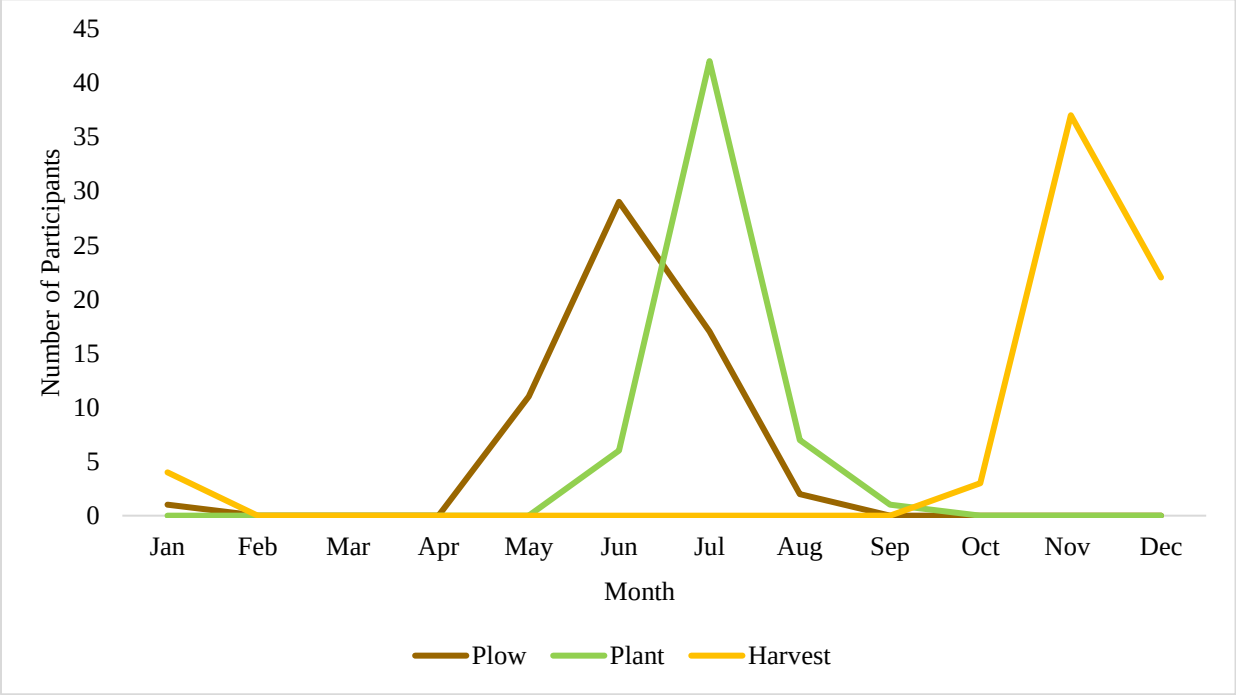

Figure 12: Responses for participation in selected rice farming activities (plowing, planting seeds, and harvesting)

These activities include bundling grass from the fields to feed animals, walking the animals to the surrounding fields to feed on grass, maintaining dikes, and fishing in the paddies. In the dry season activities are much less involved, as most do not plant a second rice crop. During the dry season, many families grow small cash crops in the area surrounding their homes. In this study, 20.4% (n=11) of participants were involved in growing and selling small crops for cash, shown in Table 18. These crops included beans, cucumber, morning glory, squash, spices, and herbs. Just as with animals raising, most households only grow vegetables and fruits for their family to eat. In addition to growing crops in the dry season, many households continue to raise animals during this time. During the dry season period, many members of the family also ventured to find additional seasonal work as construction or garment workers.

Table 18: Percentage of participants involved in raising crops/animals for income

	Yes	No
Animal raising activities to sell	55.6% (n=30)	44.4% (n=24)
Grow other crops to sell	20.4% (n=11)	79.6% (n=43)

5.3.2 Division of Labor within the Household

Many households in rural Cambodia are multigenerational. This includes homes where children, parents, and grandparents live in the same home. In Cambodia, about 25% of the children under the age of five live in a home with at least one grandparent (Hong, 2013). This was noted in the study survey where 63% (n=34) of homes had greater than four adults over the age of eighteen living in the household; with members being parents grandparents, children, grandchildren, aunts, or uncles. With many members living in close proximity, division of labor is an important issue as it relates to household and income generating activities.

Division of labor within the household is oftentimes seen as gendered. From interviews and observations throughout the study period, there were distinct activities which were seen to be performed by men and women in the household. Regarding agricultural activities, women were responsible for throwing seeds, pulling grass, or hand-harvesting the rice crop. Conversely, men were seen using machines to plow the land, or harvest and thresh the rice crop. Women took charge of raising smaller animals such as pigs, chickens, and ducks, while men would take care of cows and water buffalo. During non-agriculture periods women often participated in other income generating activities such as creating small stores or restaurants or going to work at garment factories, while men would look for employment in construction or as moto-drivers. When men are absent from the house, some of their responsibility fell onto the women as well. Similar division in roles have been reported in other studies (Hong, 2013, Asian Development Bank, 2015).

Additionally, household activities were also seen to have a distinct division of labor with women being responsible for household work (Asian Development Bank, 2013) including cooking, cleaning, and taking care of children and the elderly. When the mother of the children stays home, oftentimes the burden of the work falls on her. As one grandmother explained:

"My daughter is busy watching cows, finding grass, going to the field, watching pigs and buffalos. She has the most energy. My daughter does most of the work. But we all help clean and organize the house, cooking rice, washing dishes. If something isn't clean it's her responsibility."

Cambodian women are expected to be the homemaker, work on the family farm, and manage finances. Balancing all of these responsibilities can constrain her ability to provide care for her children. The presence of healthy and capable grandparents can help to alleviate some of the burden, with grandmothers taking more of a responsibility performing domestic and childcare tasks (Hong, 2013). One mother states the following of the grandmother:

"When I am not available to take care of [the child], then grandmother does. We share caregiving. Grandmother probably watches [her] 50% of the time."

Results from the study survey confirm that mothers and grandmothers often share caregiving responsibilities. Of the 26 mothers who participated in the study (mothers who worked at home, were on leave, or did not have employment), 3.5% (n=1) and 65.4% (n=17) of the responses indicated that the grandfather and grandmother were the secondary caregiver in the household, respectively. This is a reasonable result as women are expected to be responsible for domestic activities. They continue to assist in these activities as they age, providing the mother with a secondary support for childcare (Hong, 2013).

Women are often responsible for a large portion of domestic and childcare work. These activities require a large amount of their time and energy. Oftentimes hygiene and sanitation activities are seen as an additional activity done if there is sufficient time and energy left (UNICEF, 2012). This message was echoed by one grandmother in the study area who stated:

"*We don't really wash hands often because we are so busy."*

Insufficient time for hygiene practices has been seen in several other studies. A study in handwashing in Cambodia found being "too busy to help children" as a barrier which sometimes made it difficult to wash hands (Jenkins et al., 2013). A systematic review by Curtis et al. (2009) found that mothers often complained that they were too busy to wash hands properly, as other duties were more urgent (Curtis et al., 2009). Moreover, a study in Malawi reported that 20% of participants suggested being too busy as a barrier to providing the household with clean drinking water (Bennett et al., 2018). For participants in this study, the work burden increases during the wet season as there is a demand for agricultural work as well (refer to Figure 12). This could explain to some degree the fact that diarrhea totals are seen throughout the year with some months

often having spikes in incidence, even in the wet season. It could also explain the jump in diarrhea incidence shown in Figure 8 for the month of June. As shown in Figure 12, June is a month where much of the family is busy with plowing the field, planting the seeds, and transplanting rice. These activities would require extra time spent in the field and therefore less time performing household and childcare activities.

5.4 Caregiver Hygiene Practices

This section discusses caregiver behavior as it relates to sanitation and hygiene practices. The first part of this section goes into detail about the knowledge and behavior score of participants obtained for three separate categories; food knowledge and practice, personal hygiene knowledge and practice, and environmental hygiene knowledge and practice. The second section discusses the results of these scores when compared to socio-demographic variables.

Table 19 shows some of the basic demographic information for the study villages; Chork, Anlong Speun, Thmie, Kandal, and Popul. From the table, there was an equal distribution for participant age throughout the study. The youngest and oldest participants were 21 and 78 years old with the average age being 43 years old. Mothers and grandmothers were the primary caregivers and dominated as the most frequent survey participants at 48.1% and 44.4%. Fathers and grandfathers only made up 7.5% of participants. The majority of participants (53.7%) had a primary school education, while 5.6% received education or training beyond secondary school. Rice farming was the primary occupation making up 70.4% or surveyed participants followed by hired work, which included work in a garment factory, school, or hotel/casino. The distribution of sex for the youngest child in the surveyed home was 44.4% male and 55.6% female. The distribution in age of these children was not as well distributed; with the age group of 0-7 months and 1-3 years comprising the largest percentage. This could have been as a result of the sampling method, where participates would suggest children that were similar in age to their own children.

5.4.1 Scoring of Caregiver Knowledge and Practice

Answers for survey questions were scored for three different categories of hygiene knowledge. These categories were food hygiene, personal hygiene, and environmental hygiene. Each participant was scored as discussed in Section 4.2.6. Table 20 shows the percentages of these scores for each category. From this table, it is seen that knowledge and practice for food and personal hygiene in relatively high with 83.3% and 75.9% of participants surveyed receiving a score of "Sufficient. Conversely, only 44.4% of participants scored "Sufficient" for environmental hygiene knowledge and practice. Average total scores for the entire surveyed population are shown in Table 20. The score for environmental hygiene knowledge and practice is again the lowest of the three scores (74%). Low scores in environmental hygiene knowledge and practice indicate that it is an area of knowledge and practice where caregivers need the most improvement.

Environmental hygiene knowledge and practice was the lowest of the three categories. Several questions within this category dealt with the presence of animals within the kitchen and common areas. Feces from animals have been shown to encourage fly proliferation and to increase contact with fecal matter (Curtis et al., 2000, Exum et al., 2016). In this study, 50% and 88.9% of households allowed animals within the kitchen and commons areas. Although all houses had a pour flush latrine, only 18.5% (n=10) of children were using the latrine as a primary location to defecate. Diapers were also being used frequently in the evenings by caregivers (59.3%). Dirty diapers were often seen scattered on the ground around homes as caregivers tried to dispose of them. If thrown in a ditch, buried, or burned caregivers would complain that wet season rain would bring them to the surface or dogs would get at them. Many children were said to defecate in the yard (20.4%). There were many methods for disposing of the feces. The most common was to flush them down the latrine (24.1%), however other options were to bury (20.4%), leave in the open (18.5%), put in a drain or ditch (16.7%) or burn them (13%). One father explains:

Table 19: Demographic information for survey participants by village

	Chork	Anlong Speun	Thmie	Kandal	Popul	Villages Total
Age of Participant:						
< 30	25%	18.2%	40%	12.5%	22.2%	24.1%
30 – 40	50%	18.2%	20%	25%	11.1%	27.8%
41 – 60	12.5%	27.3%	30%	25%	55.6%	27.8%
60+	12.5%	36.4%	10%	37.5%	11.1%	20.4%
Relation to Child:						
Mother	68.8%	36.4%	50%	37.5%	33.3%	48.1%
Grandmother	18.8%	63.6%	50%	37.5%	66.7%	44.4%
Father	6.3%	0%	0%	25%	0%	1.9%
Grandfather	6.3%	0%	0%	0%	0%	5.6%
Education:						
No education	6.3%	9.1%	10%	37.5%	22.2%	14.8%
Primary	50%	54.5%	70%	25%	66.7%	53.7%
Secondary	25%	36.4%	20%	37.5%	11.1%	25.9%
Higher education	18.8%	0%	0%	0%	0%	5.6%
Occupation: *						
No work	12.5%	0%	0%	12.5%	0%	5.6%
Rice farmer	62.5%	72.7%	70%	62.5%	88.9%	70.4%
Hired work	25%	18.2%	30%	25%	11.1%	20.4%
Seller	0%	9.1%	0%	0%	0%	3.7%
Mother Migrate for Work: **						
Yes	31.3%	63.6%	50%	87.5%	44.4%	51.9%
No	68.6%	36.4%	50%	12.5%	55.6%	48.1
# of 18+ Members in Home:						
1	0%	0%	0%	0%	0%	0%
2	37.5%	9.1%	10%	12.5%	22.2%	20.4%
3	12.5%	18.2%	10%	0%	44.4%	16.7%
4+	50%	72.7%	80%	87.5%	33.3%	62.9%
Age of Youngest Child:						
0-7 months	37.5%	45.4%	10%	25%	11.1%	27.8%
8-11 months	6.3%	0%	10%	12.5%	11.1%	7.4%
1-3 years	50%	54.5%	80%	62.5%	33.3%	55.6%
4-5 years	6.3%	0%	0%	0%	44.4%	9.3%
Sex of Youngest Child:						
Male	37.5%	54.5%	70%	37.5%	22.2%	44.4%
Female	62.5%	45.5%	30%	62.5%	77.8%	55.6%

*Hired worker are occupations outside the home where they receive income; i.e. garment work, school worker, or hotel/casino work **Mothers who are currently working as migrant workers, or mothers who were leaving soon to return to work away from home

"When [my daughter] was younger, she would go to the bathroom wherever. We would use diapers sometimes. But now we have stopped because she is older now and can tell us now. Sometimes she uses a chamber pot, sometimes she will go in a place with rocks to poop. She likes to poop in cleaner places. So she poops on the rocks. When she poops on the rocks I put some sand on top and after several minutes I use a spoon to pick it up and throw it in the back [of the house]."

The results found in this study are similar to those reported by Miller-Petrie et al. (2016), where they found that 31% of children used the latrine and 20% would defecate in the yard. Similarly, in the mentioned study, the main disposal site for feces was the latrine (37%) followed by caregivers burying the feces (20%). Overall these results show a need for further interventions in the area of environmental hygiene and child feces disposal.

Food hygiene knowledge and practice had the highest overall participants with a sufficient score. These questions dealt with how and what they gave their children to eat and drink. As it related to water, almost all participants stated they provided some sort of treated water to their children to drink (Table 17). Of the 54 total participants surveyed, only 7.4% (n=4) said they gave their children untreated water. Methods for cleaning utensils (cups, spoons, or bottles) and fruits and vegetables varied by household, however almost all participants stated they did some sort of washing. The most popular methods for cleaning child utensils was untreated water and soap

Table 20: Practice and knowledge scores for hygiene categories

	Food Hygiene Knowledge and Practice	Personal Hygiene Knowledge and Practice	Environmental Hygiene Knowledge and Practice
% of Total with "Sufficient" score	83.3%	75.9%	44.4%
% of Total with "Insufficient" score	16.7%	24.1%	55.6%
Average Score	80%	80%	74%

(25.9%). For baby bottles, it was common to see caregivers rinsing/soaking the bottles in just-boiled water before letting their child use it. For cleaning fruits and vegetables, the most common method was rinsing in untreated well water (37%), while adding salt to the water during rinsing was also popular (18.5%).

Often participants would not practice good utensil and food storage behavior within the household. Of the homes where the thesis author was able to make observations, only 14.8% (n=8) of the households had silverware covered, as most were often in a bowl or plastic holder exposed to the elements. Cups were also left uncovered in 81% (n=30) of homes observed. It is quite common in Cambodia (at homes, school, and restaurants) for one or two cups to be shared by a group of people for the day. These cups are often left uncovered near the place where water is available and used by many people. Additionally, baby bottles were only seen by the thesis author to be covered in 5 of the 11 houses where bottles were observed. Bottle feeding has been shown to be a major-risk factor for diarrhea, with children not receiving proper antibodies from mothers, and from possible increased exposure to contaminated water and bottles (Curtis et al., 2000). This is especially important within the study area where 24% (n=13) of the children were stated to be drinking formula milk.

Personal knowledge and practice had a high number of participants with sufficient scores (75.9%) as well. These questions mostly dealt with hand washing and cleaning the child after defecating. Of the 54 participants surveyed, 53 said they helped to clean their child after defecation. Almost all did this by using their hand and water (18.5%) or a combination of soap and water (77.8%). When asked if they cleaned their hands after washing their children, 100% of participants said they cleaned their hands. Most said they used soap while cleaning their hands (94.4%), while only three said they just used water. As this was a self-reported question, the number is most likely

unreliable. A study in Cambodia also found 100% of participants as using soap when handwashing however, only 85% used soap when doing a demonstration (Jenkins et al., 2013). Additionally, studies that have used observations to gauge handwashing behavior have reported much lower percentages of participants using soap to wash their hands (Biran et al., 2014, Curtis et al., 2009). For example, a study which observed 527 households in Bangladesh found that only 18% of people who had observed contact with feces washed their hands with soap (Luby et al., 2009).

During this study, the thesis author was restricted in making substantial observations on handwashing behavior, especially after defecation. This was as a result of most participants doing their washing inside the latrine after defecation. However, it was seen that 23% did not have soap available inside the latrine for washing. The presence of soap has been reported as being associated with increased handwashing behavior after fecal contact (Luby et al., 2009). Although, the score for personal hygiene may be inflated as a result of self-reporting, it still indicates that participates have good knowledge of handwashing technique. As mentioned previously, time could be a barrier in washing hands as caregivers feel too busy doing other activities to help their children. Having proper materials available for washing, such as soap, has also been shown to be a barrier, which was reported by Jenkins et al. (2013).

5.4.2 Caregiver Hygiene Score and Demographics

This section looks at the participants scores in each of the three categories (food hygiene, personal hygiene, and environmental hygiene) and compares them with demographic factors within the community (village, urban/rural, age, relation to child, education, participant occupation, occupation of the mother, and whether the mother migrants from the home to find work). These variables were compared using the Chi-squared test for independence, and the results are displayed in Table 21. Bar charts showing statistically significant results are shown in

Appendix E. The village of a participant had a statistically significant results with environmental hygiene knowledge and practice. The bar charts relating frequency of scores to villages (Appendix E) show most villages having increased counts of participants with sufficient knowledge compared to insufficient knowledge. Anlong Speun and Kandal however, have higher percentages of insufficient scores compared to sufficient scores. This could be as a result of these villages having a larger number of participants over the age of sixty. Of the eleven participants interviewed in Anlong Speun, four were over sixty years old. In Kandal, 37.5% (n=3) were over the age of sixty. This is relevant because, this was the only age group which had more insufficient scores than sufficient scores in environmental hygiene. Looking at the demographics, these two villages also had the highest percentages of mothers who migrate to work.

Table 21: Results of Chi-squared test: Participant scores and demographic information

Socio-Demographic Factors		Food Hygiene Knowledge and Practice	Personal Hygiene Knowledge and Practice	Environmental Hygiene Knowledge and Practice
Village	Correlation:	.235	.164	**.439***
	Significance:	.609	.844	.034
Urban/Rural	Correlation:	.038	.037	.151
	Significance:	.781	.788	.267
Age	Correlation:	.141	.273	.274
	Significance:	.857	.312	.256
Relation to Child	Correlation:	.131	.277	.272
	Significance:	1	.244	.212
Education	Correlation:	.119	.182	.193
	Significance:	.813	.714	.620
Participants Occupation	Correlation:	**.559***	.215	.254
	Significance:	.004	.727	.374
Mothers Occupation	Correlation:	**.463***	.282	.344
	Significance:	.016	.286	.088
Mother Migrate for Work	Correlation:	.265	.196	**.331***
	Significance:	.072	.207	.015

*Chi-squared is significant at the 0.05 level

A household who had a mother who migrates for work had a statistically significant result with environmental hygiene knowledge and practice. This category relates to mothers who venture outside the house to find income for their families. This also includes mothers who have come back home for a short period of time but will be returning to their places of work soon. Oftentimes this means living far away from home or abroad and only returning several times a year. This result fits into the growing trend in Cambodia where parents leave their families to find work and live away from home.

In the past decade, the Cambodian economy has seen a boom in the construction and industrial sectors. This boom not only changed the landscape of business in Cambodia but the workforce as well. In 1996, 77% of people were involved in agriculture, fishery, and forestry activities (Ministry of Planning Cambodia, 1996). By 2004, the agricultural workforce had decreased to 55%, while the population in manufacturing increased to 9% (Ministry of Planning Cambodia, 2004). These growing industries have played an increasingly important role in providing an alternative source of income for workers migrating from rural households (World Bank Group, 2017) to seek jobs domestically or abroad. It was seen that in 2015, migration from rural villages to find work doubled compared to 2014 estimates, increasing from 241,375 to 450,845 people (Creamer et al., 2017).

A report by Serey and Nguyen (2014) reported significant shifts from agriculture work towards jobs in the service and manufacturing industry within Svay Rieng. This effect could be seen within the study area. Oftentimes households within the study area would mention having many members of the family migrating to work in Bavet, Phnom Penh, or Thailand. One grandmother explained:

"My grandchild's father drives a tuk-tuk in Phnom Penh. The mother sews. […] All of my children work in Phnom Penh."

The location of work could often determine frequency in which family members could be able to return to visit home. Those working in Thailand were said to visit once or twice a year during the main holidays. Family members working in Phnom Penh (a three-hour drive away) were said to be able to visit several times a year, while those in Bavet (a one-hour drive) could return home to visit more frequently. Leaving homes to find work elsewhere was as a result of seeking a higher and more stable pay. One participant mentioned that in Cambodia a worker would make $150 each month, while in Thailand monthly income could be $300. Many families have been reported to be dependent on this money as the only source of income in the household (Creamer et al., 2017), as most migrant workers would send money to support family expenses; food, education, and renting equipment for rice farming.

As family members leave their homes to seek employment opportunities, this could lead to a further division of labor within the household. The survey results from this study found that 51.9% of households had a mother who was currently working away from home or had plans to return to work soon. The mother leaving the house could put an even greater burden on the grandmother for domestic and childcare activities. Creamer et al. (2017) reported that 82.4% of migrant workers left their children behind for grandparents to provide care for. This was similarly seen within the study area as 80% of grandmothers were the primary caregiver in the households where the mother was working outside the home. As a result of this burden, grandmothers often feel physically and mentally exhausted caring for their grandchildren or feel they are not able to take care of them properly (Creamer et al., 2017). One grandmother stated the following:

"Doing all of those activities affect [the grandchildren] a lot. It has a lot of effect because I am older, and I get tired quicker. I do everything myself. When grandfather is here he helps, but when he isn't I do things by myself. Its tiring. When the grandchild is sick, or I have to do a lot of work. I'm very tired because I can't sleep and I'm dizzy. My blood raised to 190 but now it has lowered. Days that my blood pressure is high, I can't sleep, my eyes hurt. It affects my energy. I do everything for them, and I am at the house by myself, there aren't any other members. I need to wash clothes and do the work around the house."

This added responsibility on grandmothers could have an effect on childcare activities as many grandmothers are tasked with performing an even larger portion of household work. Additionally, this could have an amplified effect in the wet season as more work is required to perform rice farming activities. This can lead to a further negligence of hygiene and sanitation behavior outlined previously in Section 5.3.2. Within this study, a busy caregiver was also noted by a healthcare provider to negatively affect caretaking behavior:

"In taking care of their children sometimes grandparents make mistakes. The mistake isn't that big. It's sometimes because they are busy. They do not give proper care to the child because they are busy with their work. When the time comes to feed the children, the feeding isn't always regular. They don't have time to make food for the children sometimes. The child loses weight. When the child loses weight then they get sick. These are the effects [that the mother not being around has] on the grandparents and grandchildren. They don't receive proper care, they don't have time."

The overburden on grandmothers as a result of mothers migrating for work could cause a decrease in caretaking level. Whether it be feeding or hygiene behaviors, decreased levels of care could contribute to greater risk in diarrhea incidence. Oftentimes that burden increases during the

wet season as there is a demand for agricultural work as well. This could explain to some degree the fact that diarrhea totals, seen in Figure 8, occur throughout the year with some months often having spikes in incidence in wet season. The largest wet season diarrhea incidence total occurs in June, which also coincides with peaks in farming activities (Figure 12). Additionally, it was found that there is a possible connection with older caregivers and their hygiene knowledge and practice, mostly regarding the improper disposal of feces. Knowing these factors can help further target interventions to these more vulnerable populations.

5.4.3 Caregiver Perception on Causes of Childhood Diarrhea

Caregivers in the study area named a range of causes for their children contracting diarrhea. These causes are listed in Table 22. In this section, ideas only relating to the overall theme of this research are discussed; which include caregiver perception that diarrhea is caused by contaminated food/water, weather, and fever/high temperature. Further sections will go into more detail about other caregiver beliefs mentioned.

As seen in Table 22, the most common participant perceptions for the cause of both normal and severe diarrhea was contaminated food (81.5% and 43.4%). Answers for contaminated food ranged from food that was spoiled, food or milk that was kept out too long, food contaminated with chemicals, or fruits and vegetables that were not washed properly. Similarly, contaminated water was mentioned as being water that was not treated properly (not boiled or filtered), water that had germs/bacteria/dirt in it, or water that came from a dirty container. Similar findings were reported in many previous studies as causes of diarrhea (Naseem and Swetha, 2016, Khalili et al., 2013, Choprapawon et al., 1991, Rheinlander et al., 2011, Kauchali et al., 2004). One mother explains:

"I heard [diarrhea] comes from bad food. Food that's not cooked properly, raw vegetables. Raw water can cause diarrhea. Food we don't clean. We eat it and then there will be problems in the stomach. And water that isn't clean. Water that you don't boil or filter, when the pot is dirty."

Diarrhea which originates from contaminated food and water likely follows the fecal-oral transmission route described in Chapter 3. Avoiding the causes of diarrhea from these sources require following proper hygiene and sanitation behavior. The fact most participants scored relatively high in personal and food hygiene knowledge and practice (with average scores of 80%) as well as the fact that the largest portion of participants believe diarrhea to come from contaminated food is a positive sign that many are listening to the health messages disseminated by healthcare providers.

From the survey, 35.2% and 9.4% of participants believed fever or high temperature to cause diarrhea. It should be noted that in the current study, participants referred to fever as an increase in body temperature alongside symptoms of a cold, while they used a separate word to mean only an increase in body temperature (denoted as high temperature). The way in which an increase in body temperature caused diarrhea varied among participants, with many of the participants not being able to explain the link. Several participants, however believed that the increase in body temperature had an effect on the intestines, which would cause diarrhea; saying that high temperature would cause bloating and then diarrhea. Several other participants said that bad food or milk would cause the body to be hot, and lead to diarrhea. One grandmother explained:

"W*hen [the children] eat food [the stomach] starts to bloat. When it bloats, it also gets hot. When it's hot then they have diarrhea."*

There are several studies that report an increase in body temperature as a perceived cause of diarrhea (Kaltenthaler and Drasar, 1996, Rheinlander et al., 2011). The Kaltenthaler and Drasar (1996) study conducted in Botswana found mothers believed fever to be a cause diarrhea. Weather factors were identified as a cause of normal and severe diarrhea by 25.9% and 17% of participants surveyed, respectively. An increase in ambient temperature, or "hot" weather, was one of the factors attributed to diarrhea by several participants. One mother simply stated:

"*You get diarrhea when the weather is too hot."*

Similar results were reported in a study in northern India where 66% of participants believed hot weather was a cause of diarrhea (Bentley, 1988). Looking at Figure 7 in Section 5.1, it can be seen that the hottest months of the year are March, April, and May. Comparing this to the Figure 8 shows March to have a high number of average cases, while April and May show decreased case averages. This does not support the belief that high temperature causes diarrhea. Additionally, correlations between maximum temperature and diarrhea cases show no significant associations. It is unclear the reasoning for this thinking. It could be as a result of traditional beliefs or an association with a fever or high temperature a mentioned previously. Further research would be needed to obtain additional information.

Wind was also a common theme among participants. A change in wind was reported by some respondents to signify a change in season, which would lead to illness and diarrhea. One mother explained this relationship:

"It comes from weather, from hot weather. When the wind blows hard, it makes you have a cold for 2 days and then you'll get diarrhea. When the weather is hot and there is no wind, it gives you a fever for 2-3 days and then you get diarrhea."

Table 22: Caregiver perception on causes, symptoms and care-seeking behavior for normal and severe diarrhea

	Symptom		Cause		Care Seeking Behavior	
Normal Diarrhea	Bowel movement 3+ times / day	63%	Contaminated food	81.5%	Give medicine	60.4%
	"Muddy" stool	44.4%	Fever/High temperature	35.2%	Take to doctor	58.5%
	Stomach Pain	42.6%	Weather	25.9%	Give hot water/foods	22.6%
	Fever/High temperature	33.3%	Sour food	25.9%	Home remedy	9.4%
			Passed from mother	16.7%	Do nothing	7.5%
			Contaminated water	16.7%		
			Child development	11.1%		
Severe Diarrhea	"Watery" stool	48.1%	Contaminated food	43.4%	Take to doctor	98.1%
	Blood or mucus in stool	46.3%	Don't know	30.2%	Give medicine	33.3%
	Bowel movement 3+ times / day	31.5%	Weather	17%	Give extra fluids	14.8%
	Severe stomach pain	31.5%	Contaminated water	15.1%	Give hot water/foods	9.3%
	Fever/High temperature	24.1%	Untreated normal diarrhea	15.1%		
	Vomiting	20.4%	Fever/High temperature	9.4%		

Table 23: Place of treatment of children with diarrhea in previous month

Place of Treatment	Percent Participants Who Visited
Health Center	50%
Private Clinic / Pharmacy	40%
Hospital	3.3%
Did not seek treatment	6.7%

A study by Rheinladner et al. (2011) looking at child diarrhea management in minority groups in Vietnam reported similar results on the perceived influence of changes in wind and weather. There was a belief that diarrhea was caused by the exposure to changes in weather, from hot to cold or rainy weather, which caused the child to be unbalanced, causing illness. In the Rheinladner et al. (2011) study, a mother was also described as providing a treatment for fever that was caused by "cold winds hitting the child" (Rheinlander et al., 2011). Finding associations between wind and diarrhea was not a part of the scope of this study. A report, however by Janjai et al. (2013) estimates that the highest wind speed in Svay Rieng can be seen from November to February (Janjai et al., 2013). Additionally, from Figure 6, changes in seasons occur during the months of November and December, and April and May. Looking at Figure 8, showing monthly diarrhea averages, it is difficult to discern any clear relationship; with months mostly transitioning from higher diarrhea months to lower diarrhea months. A more likely reason for this result could be explained by a study conducted in northwest Cambodia. This study connects diarrhea and wind as a traditional belief amongst the Bunong people of Cambodia. They see wind as a vital force which allows movement of liquids (including blood, feces, and urine) throughout the body, with an excess of wind leading to an excess of diarrhea (Chassagne et al., 2016).

5.4.4 Care-Seeking Behavior of Childhood Diarrhea

This section seeks to understand whether the perception of childhood diarrhea can affect the way caregivers seek treatment. Through surveys and interviews, caregivers were found to seek treatment in three general places; at a public health provider, a private health provider, and at home. No caregiver mentioned seeking a traditional healer for treatment purposes.

Table 22 shows the care seeking behavior for both normal and severe types of diarrhea. It can be seen from this table that seeking medicine was the most common behavior at 60.4%. This

was done by either visiting a private or public clinic, or at a small pharmacy in the village which sells medicine. This was similar to results seen in the study in Kep, Cambodia (Saunders, 2005). Many of the participants also knew to give more fluids to their children during diarrhea. Of those children surveyed who had diarrhea in the previous month, 67% said they would give them fluids more than usual, while 25% would give them fluids the same as usual. The foods and fluids given during diarrhea were often said to be hot, such as rice porridge or boiled water. Many caregivers would also wipe a hot towel over the child's body, saying it would help to lower the temperature. Home remedies often included applying an ointment which heated up the skin, while several mentioned making a medicinal tea with different leaves and tree bark. Severe diarrhea was almost exclusively dealt with by taking the child to the see a healthcare provider and getting them proper medicine. Unlike normal diarrhea, when caregivers noticed severe diarrhea they would take them to the public hospital or a private clinic in the provincial town. They believed healthcare providers in the provincial town where "higher" or "more experienced" doctors.

A common theme among caregivers in their care seeking behavior was trust. This relationship was found in another study on care-seeking behavior in Cambodia (Ozawa and Walker, 2011). This was both seen as trust in the healthcare workers but also in the treatment which they provided. There were several instances where caregivers refused to go to a certain location because the healthcare providers there were mean, nasty, or rude. Caregivers would also go to healthcare providers who they thought provided the best treatment to their child or had a reputation for providing good medicine. Most looked at the speed and cost of treatment, cleanliness of the establishment, and effectiveness of the intervention as ways to gauge providers. Caregivers had differing opinions on locations, doctors, and types of practices. As one healthcare provider explains:

"If they feel they get healthy at the health center, then they go to the health center. When they believe in someone then they go to that person. […] They care about the doctor being able to take care and cure the illness. Even if the doctor is skilled if they don't believe in you then they won't come. "when the water is cold, the fish stay" […] They listen to each other. Someone comes to the health center and says that its good then they bring each other to come, but if they say that the health doesn't cure then even if they have a rash they do not come. They have the belief and they listen to each other, that's humans "one raven becomes 10 ravens."

Of the participants whose children had diarrhea, 50% responded as taking their child to the health center, while 40% took their child to a private clinic. Other studies in Cambodia have reported the percentage of caregiver seeking treatment at private clinics to be as high as 48% or 70% (Saunders, 2005, World Health Organization, 2012). These numbers could show a variability in preference by region. The percentage for the current survey could be lower than expected as a result of participants knowing the thesis author worked at the health center. Such a large number of caregivers seeking treatment at private clinic leads to the belief that the number of cases of diarrhea reported by the health center are much lower than the actual incidence of diarrhea happening in the community. Although self-reported, the current survey found that 37% (n=20) of the youngest children in the household had diarrhea within the previous month.

This trust in healthcare providers could be a reason why such a high percentage of participates seek treatment outside the home, combined with many caregivers not feeling knowledgeable on proper treatment methods. Several participates stated that they did not know what medicine was appropriate to give, with many saying they would give whatever medicine the doctor gave them even if they did not know its function. Many also said they did not know how to properly treat the diarrhea at home and trusted the doctors, as they know the disease and what their

children need. This has led to the problem of healthcare providers supplying inappropriate prescriptions and dosages to patients (Chareokul et al., 2002); a problem also mentioned to happen within the study area by one of the healthcare providers interviewed.

Although the quality of treatment could often differ depending on provider or location, it can be seen that the majority of caregivers within this study trust seeking treatment or medicine for diarrhea from providers in the area. Not enough information was gathered in this study to determine whether caregiver perception on diarrhea caused by heat or weather change would affect their care-seeking behavior. Only one participant specified how she treated this type of diarrhea:

"Before I saw [diarrhea] come from the wind, after coining it went away. It got better. After coining and swallowing medicine, it goes away."

This method was similar to the method described in the Rheinlander et al. (2011), where participants were seen using dermabrasive practice of rubbing the skin (referred to as coining). More information would need to be gathered to understand whether this procedure was done with or without an additional biomedical treatment.

5.5 Additional Caregiver Perceptions of Diarrhea in the Study Area

Several additional perceptions of note were discovered when speaking with caregivers about diarrhea. These include normal diarrhea being caused by sour food (25.9%), being passed from the mother (16.7%), and as a result of child development phases (11.1%).

Sour food as the cause of diarrhea was a prevalent belief among participants in the study area. Similar results have also been found in several other studies (Rheinlander et al., 2011, Maarij, 2005). Sour foods were mentioned as papayas, mangos, tamarind, certain traditional Khmer soups, or raw vegetables. Many parents said they would try to protect their children from eating these foods and would avoid feeding these types of foods to them when they had diarrhea. Participants

said eating too much of this food would affect the intestines, which could then lead to diarrhea in their children. Many breastfeeding mothers also believed that they could pass diarrhea to their children through their breastmilk. This has been described in several studies as a belief many caregivers have (Maarij, 2005, Usfar et al., 2010, Martinez and Saucedo, 1991). This diarrhea was said to be passed from the mother eating bad, wrong, or sour foods. As one grandmother explains:

"This type of diarrhea is when the mother's milk is warm, this diarrhea is foamy and can have blood. It's not normal, its watery and when the mother has high temperature, the child that breastfeeds can have high temperature too, and then diarrhea. When the mother eats food that is not good. For example, when she eats raw vegetables and then breastfeeds there's diarrhea. When she eats sour food, then diarrhea"

Not all diarrhea described being passed from breastmilk was accompanied with blood and high temperature, some was mentioned as being a more normal "muddy" diarrhea that occurred two or three times a day, and then went away. Most caregivers said they treated this diarrhea by having the mother stop eating or avoid the mentioned foods, and by taking medicine for diarrhea or high temperature.

Lastly, certain child development stages were stated to be a perceived cause of diarrhea in a small number of participants within this study. This has also been reported as a prevalent belief among caregivers by several other studies in different regions in the world (Pylypa, 2009, Baclig and Patrick, 1990). Development stages which were mentioned included learning to laugh, talk, turn over, or sit. Participants who mentioned this as a cause made clear distinctions between a normal type of diarrhea, which resulted in the child being sick, and one caused by these stages. As one father explains ("Somraw" refers to the name he gives the diarrhea caused by development stages):

"With Somraw diarrhea the child has a change or a growth in the body. There is foam and mucus. That's Somraw diarrhea. The child isn't sick. Sometimes it lasts for a half a month. She has it often. After that there is one without foam. That is the real diarrhea. That one can be a problem. You have to look at it also and use medicine. Use diarrhea medicine. And it can have high temperature as a symptom as well. If its normal diarrhea we give medicine, if its Somraw diarrhea than we don't. It's normal and it goes away by itself."

Not providing treatment for this type of diarrhea was common in all of those who mentioned child development stages as a cause.

Most of the participants had a clear knowledge that contaminated food caused diarrhea, but many still had alternative beliefs on other possible causes of diarrhea in their children. Although most caregivers take their children to see a healthcare provider during diarrhea episodes, withholding certain foods as a result of their beliefs could affect the nutritional health of both the mother and their child. The belief that diarrhea is caused by child development stages is of a particular concern. This was the only cause in this study where non-treatment was the consensus. This information underlines the fact that there is still confusion in community members on the path of transmission of diarrhea in children, and continued education is therefore highly suggested.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Major Findings

The objectives of this study were to understand the associations between under-five childhood diarrhea and weather factors; which included total monthly rainfall, heavy rainfall days within the month, average maximum monthly temperature, and average minimum monthly temperature. Surveys, interviews, and observation of participants were used to determine whether seasonality had an effect on caregiver behaviors and their perception of diarrhea. Five Cambodian communities were selected to conduct surveys, interviews, and observations, where a total of 54 surveys and 17 interviews were conducted (two being with local healthcare providers).

Spearman's correlation was used to determine if there were associations between under-five childhood diarrhea cases within the study area and selected weather factors. Correlations were found for the initial month (lag 0) and the following month (lag 1). Results show there to be statistically significant correlations at the 0.05 level between under-five childhood diarrhea and both heavy rainfall days and average minimum monthly temperature at lag 0 and lag 1 months. Correlation coefficients for both heavy rainfall and average minimum monthly temperature were approximately -0.2, which indicate weak negative correlations.

The results for the negative correlation between heavy rainfall and under-five diarrhea show that as the number of heavy rainfall days within the month increases, the incidence of diarrhea within that month decreases. Other research has shown similar results between heavy rainfall and diarrhea at lag 1, with heavy rain acting to wash away accumulated contaminants from the environment while diluting surface water sources (Singh et al., 2001). Results of this study for

lag 0 contradict several studies that state in the initial month, diarrhea increases as a result of water increasing pathogens levels in surface water sources used for drinking (Levy et al., 2016, Singh et al., 2001). Using improved water and sanitation has been suggested to be protective against weather related diarrhea (Carlton et al., 2014, Bhavnani et al., 2014). In the current study area, it was found that the majority of households have a proper functioning pour flush latrine, a protected water source, and use some type of point-of-use treatment method before drinking. The use of improved facilities therefore helps to protect households of the initial increased pulse of pathogens into water sources. This study suggests that the heavy rains act as a mechanism for washing pathogens away from living spaces in both the lag 0 and lag 1 months. As a result, the study area may see decreased under-five diarrhea cases during these periods.

The weak negative associations seen between under-five diarrhea cases and average minimum monthly temperature can be described by data collected by the Ministry of Health and MoWRAM. In Cambodia, the coolest months of the year are December, January, and February. Monthly totals for under-five diarrhea cases over the study period showed the highest number of cases to be in January, February, and March. This data shows a pattern that indicates spikes in under-five diarrhea cases when monthly temperatures are at its lowest.

Similar negative associations between diarrhea and minimum temperature were previously found in two provinces in Cambodia (McIver et al., 2016b). Most studies which show negative associations between temperature and diarrhea looked specifically at rotavirus. These studies have shown that rotavirus cases see increase incidence in the cooler months of the season (Levy et al., 2016, Prasetyo et al., 2015). Cases of rotavirus have been reported and studied in Phnom Penh (Silapong et al., 2017), and therefore it could be reasonable that rural areas such as Rumdoul district in Svay Rieng province could have increased cases during cooler months as well. Tests

specifying viral or bacterial causes of diarrhea are not available at the health center and are not currently recorded in health records kept by the Ministry of Health. Therefore, this assumption could not be further confirmed without more testing.

Monthly rainfall had a positive association with diarrhea within the lag 3 and lag 4 months. This indicates that increased rainfall could have a delayed effect on diarrhea by three or four months. This could be as a result of increased rainfall causing water accumulation in rice paddies and ditches. As water stagnates for long periods of time, it can breed harmful pathogens. Longer stagnation times could lead to an increased likelihood of exposure, which could a negative effect on child health. These results suggest that monthly rainfall can have an increased effect on under-five diarrhea for longer lag times.

Remaining results looked at caregiver behavior and household practice and how each could be affected by the seasonal climate patterns which are seen in Cambodia. As the climate in Cambodia is broken into two main seasons (wet and dry), much activity of primary and secondary caregivers is driven by this dynamic. The activity most dependent on the season is rice farming; which is performed by 94.4% of the participants surveyed in this study. Rice farming in the study location usually spans the entire wet season with plowing, planting, and harvesting happening in specific months of the season. Peak labor is usually seen in May, June, July where both plowing, and planting is taking place. Diarrhea totals for the wet season were generally seen to be lower than in the dry season, except for a spike in June. This suggests that rice farming activities could have an effect on caregiver practice as oftentimes division of labor roles in the household are divided. This time of year could put added burden on the females of the household who are often responsible for caregiving, domestic activities, and a portion of rice farming activities.

A more detailed look into caregiving behavior was done by scoring caregivers knowledge and practice in three different categories; personal hygiene, food hygiene, and environmental hygiene. For each category, participants were found to take part in both desirable and undesirable behavior; properly treating water and washing fruits and vegetables, while not properly covering utensils and food. The lowest average score for all participants was in environmental hygiene knowledge and practice. This was supported by interviews in which many younger children would defecate openly in the yard. Caregivers would also not practice hygienic disposal of child or animal feces; leaving them in the open or transferring them to a drain or ditch. Improvement is needed in all aspects of hygiene behavior. This study suggests, however that hygiene in the household environment could have the largest knowledge gap, especially relating to child and animal feces.

An analysis of hygiene and knowledge scores showed statistically significant results between environmental hygiene knowledge and practice and the villages which were surveyed. Of the five villages surveyed, three had a higher number of participants with “Sufficient” scores than participants with “Insufficient” scores. The two villages with a higher number of “Insufficient” scores, were also villages with the highest number of participants over the age of sixty years old. Furthermore, the sixty and over age group was the only age group that also had more “Insufficient” scores than “Sufficient” scores. This suggest that caregivers over the age of sixty may participate in more high-risk environmental hygiene behavior than other age groups.

Statistically significant results were also found between environmental hygiene knowledge and practice and households where mothers migrate for work. This follows results which were stated previously. The responsibility of managing childcare, domestic, and farm activities may place a strain on mothers and grandmothers, especially during peak farming months. Households with migrant mothers was common within the study area, with 51.9% of households having a

mother who was currently working away from home or had plans to return to work soon. A mother leaving home and migrating to find work can place an even greater responsibility on grandmothers. It is recommended that more data be collected to investigate this relationship; however, this result suggests that hygiene knowledge and practice could suffer in households where the mother is absent, as added burden is placed on grandmothers to do domestic, childcare, and rice farming activities.

The majority of participants had a relatively clear understanding of the link between poor food hygiene and under-five diarrhea, with 81.5% of participants stating contaminated food to be a cause. Despite this however, many still had misconceptions about the causes of diarrhea, with many believing diarrhea to be caused by fever, heat, sour food, bad breastmilk, or child development stages. In most cases, perception does not seem to drive care-seeking behavior as most caregivers gave their child medicine or brought them to a healthcare provider during an episode of diarrhea. The exception to this was diarrhea caused by child development stages, which was considered a normal disease and therefore not treated. Although most can recognize the signs of diarrhea, these results suggest that there is still confusion on the causes of diarrhea. More emphasis should be placed on dispelling myths and disseminating the causes and paths which pathogens take to infect children.

6.2 Study Limitations

Several limitations were identified in this study. Research within this study was completed in the Khmer language. This required the thesis author to be able to speak the language and interact in the culture. Although the thesis author was in country for over two years, it took a substantial time to develop proficient skills and integrate into the community. Additionally, finding a counterpart, training a counterpart, translating and testing documents, and conducting survey and

interview methods is an involved process which took an extended amount of time to accomplish. Although the thesis author was limited by time, 54 surveys and 17 interviews (two with healthcare providers) were performed in the study area.

The thesis author was a new member of the community who had advance, but limited Khmer language abilities. It was therefore important for this study to include a local counterpart to assist with language and cultural immersion. In rural Cambodia, there are a limited number of English speakers. There was also a limited number of people with additional time to assist with activities outside their home, as the majority work several jobs to support their family. Women often had less time, as they were also responsible for domestic and childcare activities. Finding a counterpart was a difficult process. Finding a female counterpart was a priority but was not possible for this study. Therefore, a male counterpart was used. The particular male counterpart was selected because of his excellent language abilities in both English and Khmer. He was also a well-known and respected member of the community and had previous experience doing outreach work on the commune level. The selection of a male counterpart however, likely had a small effect in this study. This study relied mostly on interviews and surveys with mothers and grandmothers. During the interview and survey process, it may have been difficult for some of the women caregivers to talk openly about certain behaviors or difficulties within the household, which may have led to more incomplete or short answers. This however, was not likely for the majority of participants, as most talked openly with the thesis author and counterpart.

In the same respect, home observations were done by the thesis of this study. As a foreign male living in a rural community it was difficult to experience a “normal” setting in any environment. Households were selected which the thesis author had previous relationships as an effort to combat this, however oftentimes when visiting the homes for observations participants

alter would their behaviors to accommodate the thesis author. In future research, it would be suggested to have a woman counterpart to talk to caregivers about caregiving behaviors, and an in-country counterpart to conduct field observations.

The sampling method was also dictated by time restraints. Although the method provided access to caregivers of children under five, it also confined surveys and interviews to specific regions of the study area. It was therefore difficult to get a representative sample of the entire study area. This decreased the ability to make assumptions on segments of the population, or the population as a whole. For example, a survey could be completed for one seller who has a small shop inside her home. She suggests another seller several houses away who has a similar job. This second seller then suggests a similar type of participant. Answers from these three participants would likely be similar, and would exclude sellers who work in other villages, or sellers who leave their homes to sell goods in the market. Making an assumption on all sellers based on those surveys would therefore be misguided. As a result, careful consideration was needed when making these assumptions.

The timing of the study period was also a limitation. Surveys and interviews took place at the end of the wet season in October and November. As a result, participants were more focused on the current work of the season, mainly rice farming. Therefore, conversations about the dry season were usually short and lacked detail. All formal observation took place during this time as well, and limited detail could be gathered on how a seasonal change could affect household and childcare activity. Observations during the dry season were confined to the thesis author's previous experiences in the community during this time. This study would have benefited from a longer study period that included wet and dry season observation.

6.3 Recommendations for Future Research

In Cambodia, there is a large variation in care-seeking behavior as it relates to finding treatment with public or private healthcare providers. Both the current study and the McIver et al. (2016) study used diarrhea aggregated by the Ministry of Health as the main source of diarrhea data. This data excludes a large portion of cases which are treated at home or are seen by private healthcare providers. This could lead to diarrhea totals at the health center which are not representative of actual totals seen within the community. For future research related to this topic, it would be useful to obtain diarrhea information from both the private and public health sectors of the community. This could be accomplished by organizing diarrhea surveillance within a certain study area over a period of time as seen in several other studies (Carlton et al., 2014, Wu et al., 2014). This could help capture diarrhea incidence that would be treated in a public, private, or home setting.

The current study used Spearman's correlation to understand the associations between two variables. Assessing diarrhea data and weather factors with a more developed statistical model could help to understand more clearly how diarrhea and weather factors in the area might interact with each other. For example, in this study diarrhea increased in months which had no heavy rainfall days and where minimum temperature was at its lowest. It is difficult from the Spearman's correlations to discern how much each factor contributed to under-five diarrhea in the study area. Additionally, it is difficult to discern the interactions the weather factors have with each other. Therefore, a more robust multivariable model which is capable of incorporating a variety of weather factors (rainfall, temperature, wind speed, and humidity) could describe more accurately the interactions and contributions each factor has with each other and the overall diarrhea incidence in the study area.

Several previous studies have assessed hygiene and sanitation behavior in Cambodia looking at handwashing, sanitation behavior, disposal of child feces, etc. (Miller-Petrie et al., 2016, Jenkins et al., 2013).This study conducted a broad assessment on caregiver behavior looking at hygiene and sanitation practice, however focused on the role seasonality may play in these behaviors. A further look into the role of seasonality is warranted, with more complete observations being conducted, especially during the dry season. This would be helpful in capturing more information on perceptions and care-seeking behavior of caregivers whose children have diarrhea from perceived weather factors such as hot weather and wind. These weather factors were seen to occur in the dry season and the months which transition to the wet season.

More specific research could also be done to understand in greater detail the effect which mothers who migrate for work have on caregiving behavior and child health. This is an increasingly common theme in many households in rural Cambodia which has the possibility of affecting many children. Better understanding of the dynamics within these households could help to identify and provide more specific interventions to at risk children. Healthcare providers and local government officials within the area could play a large role in assisting many of these vulnerable households. Recommendations for local public and private healthcare providers include identifying poor and vulnerable households within the service area. Once identified, local organizations such as health center staff, local village chiefs, NGOs, and designated village health volunteers could perform home visits or check-ups on children to provide any necessary support and education. Additionally, it is important to ensure vulnerable households have access to health and social services through the use of health equity funds or the enrollment in the government IDPoor program. This could help alleviate dependency on migrant wages and reduce barriers in seeking assistance.

Within this study, it was suggested that peak seasonal farming months overburden caregivers which could have a negative effect on caregiver behavior. Additionally, it was suggested that this could be increased in households which had mothers who migrate for work; as added responsibility is put on grandmothers. This study further recommends that public and private healthcare workers provide outreach and education throughout the community which highlight the effect that seasonal farming and migrant work can have on caretaking behaviors, especially during peak rice farming seasons. Messages could be built around previous education done on topics such as hygiene, sanitation, and nutrition with an emphasis on migrant households and peak farming months as contributing to more high-risk childcare behaviors. Sessions could also focus on ways in which families can share caretaking and household responsibilities among family members or within the surrounding community.

Additionally, with Rotavirus being a suggested cause of increased diarrhea, more research into understanding the viral and bacterial pathogens could give a more complete picture on the causes and pathways of infection for under-five diarrhea cases in the study area. This information could then be used to provide more proper education and intervention methods.

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APPENDIX A: RESEARCH APPROVALS

UNIVERSITY OF SOUTH FLORIDA

RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-7091

June 6, 2017

Brian Wells
Civil and Environmental Engineering
Tampa, FL 33612

RE: **Expedited Approval for Initial Review**
IRB#: Pro00029159
Title: Caregiver Perception and the Role of Seasonality in Under-five Childhood Diarrhea Incidence in Svay Rieng Province, Cambodia

Study Approval Period: 6/6/2017 to 6/6/2018

Dear Mr. Wells:

On 6/6/2017, the Institutional Review Board (IRB) reviewed and **APPROVED** the above application and all documents contained within, including those outlined below.

Approved Item(s):
Protocol Document(s):
Wells IRB Protocol Version 1.0 5.19.17

Consent/Assent Document(s)*:
Wells Verbal Caregiver Informed Consent Version 1 05.19.17
Wells Verbal Healthcare Provider Informed Consent Version 1 5/19/2017

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent documents are valid until the consent document is amended and approved. The Verbal Consent forms are not stamped forms.

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110. The research proposed in this study is categorized under the following expedited review category:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Your study qualifies for a waiver of the requirements for the documentation of informed consent as outlined in the federal regulations at 45CFR46.117(c) which states that an IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either: (1) That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or (2) That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context. (2 Verbal consents).

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval via an amendment. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) calendar days.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

USF Institutional Review Board

ក្រសួងសុខាភិបាល
MINISTRY OF HEALTH
គណៈកម្មាធិការជាតិក្រមសីលធម៌
សំរាប់ការស្រាវជ្រាវសុខភាពដែលទាក់ទងនឹងមនុស្ស
National Ethics Committee for Health Research

លេខ.....169NECHR.....

ព្រះរាជាណាចក្រកម្ពុជា
KINGDOM OF CAMBODIA
ជាតិ សាសនា ព្រះមហាក្សត្រ
NATION RELIGION KING

រាជធានីភ្នំពេញ, ថ្ងៃទី 14 ខែ 07 ឆ្នាំ 2017

Mr. Brian Wells

Project: Caregiver Perception and the Role of Seasonality in Under-five Childhood Diarrhea Incidence in Svay Rieng Province, Cambodia. Version N° 1, dated 6th June 2017.

Reference: - Your letter on 23rd June 2017
- Report of NECHR's secretaries on 10th July 2017

Dear Mr. Brian Wells,

I am pleased to notify you that your study protocol entitled "Caregiver Perception and the Role of Seasonality in Under-five Childhood Diarrhea Incidence in Svay Rieng Province, Cambodia. Version N° 1, dated 6th June 2017"has been approved by National Ethics Committee for Health Research (NCEHR).This approval is valid for twelve months after the approval date.

The Principal Investigator of the project shall submit following document to the committee's secretariat at the National Institute of Public Health at #80, Samdach Penn Nouth Blvd (289), Sangkat Boeungkok2,Khan Tuol Kork, Phnom Penh. (Tel: 855-23-880345, Fax: 855-23-881949):

- Annual progress report
- Final scientific report
- Patient/participant feedback (if any)
- Analyzing serious adverse events report (if applicable)

The Principal Investigator should be aware that there might be site monitoring visits at any time from NECHR team during the project implementation and should provide full cooperation to the team.

Regards,

Chairman

ឡូតិ៍លេខ៨០.វិថីសម្តេច ប៉ែន នុត (២៨៩) សង្កាត់បឹងកក់២ ខណ្ឌ ទួលគោក រាជធានីភ្នំពេញ. ទូរស័ព្ទ (៨៥៥-២៣) ៨៨០ ៣៤៥. ទូរស័ព្ទដៃ (៨៥៥-១២) ២៨០ ៧៩០. (៨៥៥-១២) ៨៤២ ៤៤២
Lot #80, Samdach Penn Nouth Blvd (289), Sangkat Boeungkok2, Khan Tuol Kork, Phnom Penh, Cambodia. Tel: (855-23) 880 345, Mobile Phone : (855-12) 280 790, (855-12) 842 442

KINGDOM OF CAMBODIA
NATION RELIGION KING

PEACE CORPS CAMBODIA

THE UNIVERSITY OF SOUTH FLORIDA

LETTER OF APPROVAL

To Whom It May Concern:

This letter is concerning the research which will be performed by **Mr. Brian Wells**, a volunteer at Peace Corps Cambodia and a student at the University of South Florida in the United States of America. This study will take place in Rumdoul District, Svay Rieng Province. Using rainfall and local diarrhea data, the researcher will look at the relationship between rainfall and under-five childhood diarrhea. The researcher will also use surveys, observations, and interviews to understand how seasonal behavior, age/gender, household practices, and caregiver perception of the illness affect decisions surrounding diagnosis and treatment. There will be approximately 130 participants of which informed consent will be asked.

I am [redacted], a Chork Health Center Chief, have discussed this plan with the researcher and approve this study to **Mr. Brian Wells** to conduct in Rumdoul District, Svay Rieng Province

Kampong Chork……/……/2017
Health Center Chief

ព្រះរាជាណាចក្រកម្ពុជា
ជាតិ សាសនា ព្រះមហាក្សត្រ

តីសខ័រ ប្រចាំកម្ពុជា
សាកលវិទ្យាល័យ សោសថ្លរីដា

លិខិតអនុញ្ញាត

សូមគោរពចូលមកលោក លោកស្រី

លិខិតនេះអនុញ្ញាតអោយ **Mr. Brian Wells** អ្នកស្ម័គ្រចិត្តអង្គការតីសខ័រប្រចាំកម្ពុជា និងជានិស្សិតនៃសាកលវិទ្យាល័យសោសថ្លរីដា នៅក្នុងសហរដ្ឋអាមេរិច ធ្វើកិច្ចការស្រាវជ្រាវ។

ការសិក្សានេះ នឹងធ្វើឡើងនៅក្នុងស្រុករំដួល ខេត្តស្វាយរៀង។ ដោយសារទទួលបានទិន្នន័យភ្លៀងធ្លាក់ និងជំងឺរាកក្នុងស្រុក អ្នកសិក្សាស្រាវជ្រាវ នឹងតាមដានពីទំនាក់ទំនងរវាងទឹកភ្លៀងធ្លាក់ និងទារកក្រោមអាយុ ៥ឆ្នាំមានជំងឺរាក។ អ្នកសិក្សា នឹងប្រើប្រាស់ការវាយតម្លៃ ការសង្កេត និងការសម្ភាសន៍ ដើម្បីស្វែងយល់ ថាតើស្ថានភាពអាកាសធាតុ អាយុ/ភេទ ការអនុវត្តន៍ពីស្ត្រីមេផ្ទះ និងអ្នកមើលថែរក្សាកូនមានជំងឺ ជះឥទ្ធិពលទៅលើការសំចិត្តពួកគេយ៉ាងណា ជុំវិញទៅលើ ការធ្វើរោគវិនិច្ឆ័យ និងការព្យាបាលទៅលើកុមារមានជំងឺរាគ។ អ្នកសិក្សាត្រូវការអ្នកចូលរួម ប្រហែ១៣០ នាក់ដើម្បីត្រៀមឆ្លើយសំណួរដែលអ្នកសិក្សាស្រាវជ្រាវសម្ភាសន៍។

ខ្ញុំបាទឈ្មោះ **សុខ ចន្ថារី** ជាប្រធានមណ្ឌលសុខភាពចក បានពិភាក្សាគំរោងការនេះជាមួយអ្នកសិក្សាស្រាវជ្រាវហើយខ្ញុំបានឯកភាព និងយល់ព្រមអនុញ្ញាតអោយលោក **Mr. Brian Wells** សិក្សាស្រាវជ្រាវនៅក្នុងស្រុករំដួល ខេត្តស្វាយរៀង។

ធ្វើនៅកំពង់ចក ថ្ងៃទី..20.....ខែ.....6.....ឆ្នាំ២០១៧

ប្រធានមណ្ឌលសុខភាពចក

Peace Corps

ភ្នាក់ងារ គីសខំ សហរដ្ឋអាមេរិកនៅកម្ពុជា
UNITED STATES PEACE CORPS CAMBODIA

TO: University of South Florida, Master of Science in Environmental Engineering Program

RE: Brian Well's study of the relationship between seasonality and the incident of diarrheal illness in children under five years old in Rumduol District, Svay Rieng Province, Cambodia.

DATE: April 3, 2017

FROM: S[redacted]r

Brian Wells has Peace Corps Cambodia's approval to conduct his study in Rumduol District under the following conditions:

- He has approval of his Health Center Director.
- He has the consent of those participating in the study.
- He has the approval of an Institutional Review Board at South Florida University.

[redacted]

Country Director
Peace Corps Cambodia

N° 7A, Street 256, Sangkat Chak Tomouk, Khan Daun Penh, Phnom Penh, Cambodia. P.O. Box: 2453.
Tel: (855) 23 222 901. Fax: (855) 23222903. http://www.peacecorps.gov/cambodia

APPENDIX B: APPROVAL TO REPRODUCE

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permissions@who.int <permissions@who.int> Mon, May 14, 2018 at 11:56 AM
To: bswells22@gmail.com
Cc: permissions@who.int

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APPENDIX C: RAW DATA

Table C1: Monthly under-five diarrhea totals 2009-2016 Chork health center

Month	2009	2010	2011	2012	2013	2014	2015	2016	Total
Jan	9	14	19	14	15	15	10	5	101
Feb	16	14	32	16	17	14	16	4	129
Mar	12	19	24	23	10	4	11	10	113
Apr	13	15	13	19	6	1	3	6	76
May	12	15	14	16	11	8	2	11	89
Jun	17	17	11	21	15	7	10	9	107
Jul	11	13	12	14	7	5	10	12	84
Aug	15	9	7	17	5	5	12	17	87
Sep	7	13	16	8	5	11	5	7	72
Oct	15	16	18	7	8	6	1	7	78
Nov	7	19	15	9	8	5	2	2	67
Dec	8	17	9	8	9	5	7	4	67
Total	142	181	190	172	116	86	89	94	1070

Table C2: Monthly cumulative rainfall 2009-2016 (measured at SVRWS)

Month	2009	2010	2011	2012	2013	2014	2015	2016	Total
Jan	0.0	23.7	3.9	25.4	0.0	0.0	0.0	0.0	53.0
Feb	26.5	0.0	1.8	5.3	0.0	2.0	0.0	0.0	35.6
Mar	116.7	11.5	93.5	18.4	0.0	0.8	0.0	0.0	240.9
Apr	147.8	98.4	99.8	82.0	101.0	259.7	33.9	0.0	822.6
May	288.3	126.6	258.7	220.0	100.1	110.5	46.2	125.7	1276.1
Jun	63.9	239.0	160.5	125.9	200.9	168.7	150.5	233.1	1342.5
Jul	159.4	299.0	106.0	87.4	116.5	296.9	204.0	253.6	1522.8
Aug	185.5	284.9	248.2	147.7	254.4	94.0	172.0	145.2	1531.9
Sep	285.7	209.1	251.2	497.7	287.8	180.8	311.4	483.1	2506.8
Oct	178.0	449.7	378.6	400.5	272.6	150.8	270.5	544.2	2644.9
Nov	0.0	112.7	151.9	120.3	142.5	156.5	156.8	342.4	1183.1
Dec	0.0	0.0	0.0	0.0	4.5	49.8	60.2	98.4	212.9
Total	1451.8	1854.6	1754.1	1730.6	1480.3	1470.5	1405.5	2225.7	13373.1

Table C3: Monthly average maximum temperature 2009-2016 (measured at SVRWS)

Month	2009	2010	2011	2012	2013	2014	2015	2016
Jan	29.8	30.3	32.0	30.9	32.3	31.0	31.7	33.8
Feb	32.3	33.3	33.1	28.8	34.1	32.5	32.9	34.3
Mar	33.2	35.4	33.8	35.0	35.3	34.3	35.3	35.6
Apr	34.3	36.1	34.6	35.1	35.7	35.3	36.0	37.0
May	32.8	35.7	34.4	32.7	35.8	35.2	36.3	35.8
Jun	33.4	34.6	33.3	33.6	33.8	33.9	34.7	33.5
Jul	32.8	32.9	33.5	33.4	32.2	33.1	33.6	34.1
Aug	33.5	32.7	33.2	34.2	33.0	33.8	34.2	31.4
Sep	31.6	33.4	32.2	31.3	32.1	33.3	33.4	33.5
Oct	32.0	30.9	32.4	31.5	32.1	33.1	33.1	31.6
Nov	31.5	32.0	33.0	32.5	32.6	33.3	33.8	32.2
Dec	30.2	32.1	31.1	31.3	30.8	32.2	33.2	31.1

Table C4: Monthly average minimum temperature 2009-2016 (measured at SVRWS)

Month	2009	2010	2011	2012	2013	2014	2015	2016
Jan	20.6	21.7	19.3	22.3	22.4	20.1	20.6	23.0
Feb	23.3	23.2	20.8	23.4	24.0	22.0	21.7	22.5
Mar	24.5	24.6	22.9	24.8	25.2	24.1	24.4	24.5
Apr	25.3	25.8	24.5	25.1	25.8	25.2	25.3	26.2
May	24.9	26.5	24.3	24.4	25.7	25.7	26.3	26.0
Jun	25.4	24.4	23.6	24.7	25.4	25.2	25.3	24.9
July	26.5	22.8	23.5	24.4	24.7	24.8	24.8	24.5
Aug	26.1	25.0	30.9	25.0	24.6	24.9	24.7	24.6
Sep	24.9	25.2	24.1	24.4	24.4	24.9	24.5	24.4
Oct	24.8	22.7	23.3	24.8	24.5	24.5	24.5	24.3
Nov	24.0	22.1	23.2	25.0	24.4	24.1	24.6	25.3
Dec	22.5	20.6	21.0	24.0	20.6	22.5	23.3	23.9

APPENDIX D: SURVEY, INTERVIEW, AND OBSERVATION GUIDES

HOUSEHOLD QUESTIONNAIRE for Primary Caregivers of Under-five Children
University of South Florida / Peace Corps Cambodia

Household ID:
Village:
Commune:
Participant ID:

Total number of people living at residence: .....
Number of < 5 children living at residence: .....

Interview Information:

Date	
Start and End Time	
Team Present	

Eligibility:

ID#	AGE 18+	LIVE AT HOUSE	GOOD HEALTH	PRIMARY CAREGIVER FOR CHILD < 5	SEX	RELATION TO YOUNGEST CHILD	RELATION TO HEAD OF HOUSEHOLD	HEAD OF HOUSEHOLD
	..... ☐	☐	☐	☐				☐
	..... ☐	☐	☐	☐				☐
	..... ☐	☐	☐	☐				☐

NOTES:

1 - Adult (+18) Household Roster **តារាងបញ្ជីមេគ្រួសារមានអាយុ ១៨ឆ្នាំឡើងទៅ:**

ជាដំបូង យើងខ្ញុំសុំស្គាល់អាយុ កេទ ការអប់រំ មុខរបរ ក្នុងសមាជិកក្នុងផ្ទះនេះដែលមានអាយុលើស១៨ឆ្នាំ។

សូមនិយាយឲ្យបានច្បាស់ ហើយយឺតៗដើម្បីឲ្យប្រាកដថាយើងអាចយល់ពីអ្វីគ្រប់យ៉ាងនូវអ្វីអ្នកកំពុងនិយាយ។ អ្នកអាចសួរខ្ញុំជួយពន្យល់សំណួរបន្ថែម នៅពេលណាក៏បានដែរ។ សូមជម្រាបប្រាប់ខ្ញុំផងប្រសិនបើមានចំណុចណាមួយអ្នកចង់បញ្ចប់ការស្ទាបស្ទង់។ (សរសេរជួរទី១ ចំពោះអ្នកដែលយើងកំពុងនិយាយទៅកាន)

We first would like the age, sex, education, occupation of all the members of this house who are older than 18 years old. Please speak clear and slow to make sure we can understand everything you are saying. You can ask me to explain a question at any time. Also let us know if at any point you would like to end the survey.

(First line is for the responder of this survey)

ID # **លេខ**	AGE **អាយុ**	SEX **កេទ**	RELATION TO HEAD OF HOUSEHOLD **ត្រូវជាមេគ្រួសារ**	PRIMARY CAREGIVER OF CHILD UNDER 5? **អ្នកមើលថែកុមារញឹកញាប់**	EDUCATION **ការអប់រំ** [0] NO SCHOOL [1] SOME PRIMARY [2] FINISHED PRIMARY [3] SOME SECONDARY [4] FINISHED SECONDARY [5] HIGHER EDUCATION	OCCUPATION **មុខរបរ** [0] NEVER [1] THROUGHOUT THE YEAR [2] ONCE IN A WHILE [3] SEASONAL / PART OF YEAR [4] ON LEAVE
				YES NO DN		
				YES NO DN		
				YES NO DN		
				YES NO DN		
				YES NO DN		

- *For **"Occupation"**, state what they do to earn income and if **SEASONAL** or **ONCE IN A WHILE** specify when*
- ***Primary School:*** grades 1-6 ***Secondary School:*** grades 7-12 ***Higher Education:*** school or training after high school
- ***Primary Caregiver:*** People/Person who spends the most time cleaning, feeding, watching, caring for child

2 - Seasons រដូវ:

សំណួរបន្ទាប់គឺទាក់ទងទៅនឹងរដូវក្នុងប្រទេសកម្ពុជា នឹងសកម្មភាពដែលបានធ្វើនៅពេលនោះ។

The next questions relate to the seasons in Cambodia and activities done during them

<table>
<tr><td>2.1
(1)</td><td colspan="2">តើមានរដូវប៉ុន្មាននៅប្រទេសកម្ពុជា?
How many seasons does Svay Rieng have?</td><td>1. 1
2. 2
3. 3
4. 4
5. OTHER:</td></tr>
<tr><td>2.2
(2)</td><td colspan="3">តើមានអ្វីខ្លះ? ហើយខែណាខ្លះ?
What and when are they?</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>1. JANUARY មករា
2. FEBRUARY កុម្ភៈ
3. MARCH មីនា
4. APRIL មេសា
5. MAY ឧសភា
6. JUNE មិថុនា
7. JULY កក្កដា
8. AUGUST សីហា
9. SEPTEMBER កញ្ញា
10. OCTOBER តុលា
11. NOVEMBER វិច្ឆិកា
12. DECEMBER ធ្នូ
13. DON'T KNOW អត់ដឹង</td><td>1. JANUARY មករា
2. FEBRUARY កុម្ភ
3. MARCH មីនា
4. APRIL មេសា
5. MAY ឧសភា
6. JUNE មិថុនា
7. JULY កក្កដ
8. AUGUST សីហា
9. SEPTEMBER កញ្ញា
10. OCTOBER តុលា
11. NOVEMBER វិច្ឆិក
12. DECEMBER ធ្នូ
13. DON'T KNOW អត់ដឹង</td><td>1. JANUARY មករា
2. FEBRUARY កុម្ភ
3. MARCH មីនា
4. APRIL មេសា
5. MAY ឧសភា
6. JUNE មិថុនា
7. JULY កក្កដ
8. AUGUST សីហា
9. SEPTEMBER កញ្ញា
10. OCTOBER តុលា
11. NOVEMBER វិច្ឆិក
12. DECEMBER ធ្នូ
13. DON'T KNOW អត់ដឹង</td><td>1. JANUARY មករា
2. FEBRUARY កុម្ភ
3. MARCH មីនា
4. APRIL មេសា
5. MAY ឧសភា
6. JUNE មិថុនា
7. JULY កក្កដ
8. AUGUST សីហា
9. SEPTEMBER កញ្ញា
10. OCTOBER តុលា
11. NOVEMBER វិច្ឆិក
12. DECEMBER ធ្នូ
13. DON'T KNOW អត់ដឹង</td></tr>
<tr><td>2.3
(3)

[3.4]</td><td colspan="2">តើគ្រួសារអ្នកធ្វើស្រែទេ?
Does your family grow rice?</td><td>1. YES បាទ/ចា ***[go to #4]***
2. NO ទេ ***[go to #10]***
3. DON'T KNOW អត់ដឹង</td></tr>
<tr><td>2.4
(4)

[3.4]</td><td colspan="2">តើអ្នកភ្ជួរដី នៅខែណាខ្លះ?
What months do you plow the rice fields?

(សូមជ្រើសរើសចំណុចទាំងនោះ)
(Select those that apply)</td><td>1. JANUARY មករា
2. FEBRUARY កុម្ភៈ
3. MARCH មីនា
4. APRIL មេសា
5. MAY ឧសភា
6. JUNE មិថុនា
7. JULY កក្កដា
8. AUGUST សីហា
9. SEPTEMBER កញ្ញា
10. OCTOBER តុលា
11. NOVEMBER វិច្ឆិកា
12. DECEMBER ធ្នូ
13. DON'T KNOW អត់ដឹង</td></tr>
</table>

2.5 (5) *[3.4]*	តើអ្នកព្រោះ/ស្លងស្រូវ នៅខែណាខ្លះ? What months do you plant rice? **(សូមរុជើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. JANUARY មករា 2. FEBRUARY កុម្ភៈ 3. MARCH មីនា 4. APRIL មេសា 5. MAY ឧសភា 6. JUNE មិថុនា 7. JULY កក្កដា 8. AUGUST សីហា 9. SEPTEMBER កញ្ញា 10. OCTOBER តុលា 11. NOVEMBER វិច្ឆិកា 12. DECEMBER ធ្នូ 13. DON'T KNOW អត់ដឹង
2.6 (6) *[3.4]*	តើអ្នកច្រូតស្រូវ នៅខែណាខ្លះ? What months do you harvest rice? **(សូមរុជើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. JANUARY មករា 2. FEBRUARY កុម្ភៈ 3. MARCH មីនា 4. APRIL មេសា 5. MAY ឧសភា 6. JUNE មិថុនា 7. JULY កក្កដា 8. AUGUST សីហា 9. SEPTEMBER កញ្ញា 10. OCTOBER តុលា 11. NOVEMBER វិច្ឆិកា 12. DECEMBER ធ្នូ 13. DON'T KNOW អត់ដឹង
2.7 (7) *[3.4]*	តើអ្នកដែលរស់ក្នុងផ្ទះនេះនរណាខ្លះ ដែលជួយស្លង/ព្រោះស្រូវ និងច្រូតស្រូវ? Who in this household helps with the planting/harvesting of the rice? *If family members, List ID # of those who help*	1. FAMILY MEMBERS សមាជិកគ្រួសារ ***[go to #8]*** 2. HIRED WORKERS ជួលកម្មករ ***[go to #10]*** 3. OTHER ផ្សេងៗ:
2.8 (8) *[3.4]*	តើអ្នកធ្វើការនៅវាលស្រែប៉ុន្មានម៉ោងក្នុងមួយថ្ងៃ? How many hours a day do you work in the fields?	1. 0 2. 1-3 3. 4-6 4. 7+

2.9 (9) ***[3.4]***	តើអ្នកប្រើម៉ាស៊ីនសម្រាប់ជួយកិច្ចការទាំងនេះទេ? Do you use a machine which helps you do these tasks? ប្រសិនបើមាន តើម៉ាស៊ីនប្រើសម្រាប់ធ្វើអ្វី? តើអ្នកប្រើម៉ាស៊ីនរយៈពេលប៉ុន្មានឆ្នាំហើយ? *If yes, the machine helps with what task? How many years have you been using this machine?*	1. YES ជាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង
	1. PLOUGHING ភ្ជួរ	2. PLANTING ស្ទូង/ព្រោះ 1. LESS THAN 1 YEAR 2. 1 - 3 3. 4 – 6 4. 7 – 9 5. 10+ 6. DON'T KNOW អត់ដឹង
	3. HARVESTING ច្រូត 1. LESS THAN 1 YEAR 2. 1 - 3 3. 4 – 6 4. 7 – 9 5. 10+ 6. DON'T KNOW អត់ដឹង	
2.10 (10) ***[3.4]***	តើក្រុសារអ្នកមានដាំដំណាំផ្សេងៗ /សកម្មភាពចិញ្ចឹមសត្វ សម្រាប់លក់ដែរឬទេ? Does your family do any other farming/animal raising activities for selling? *ប្រសិនបើមាន តើដំណាំអ្វីខ្លះ/ប្រភេទសត្វអ្វី ហើយនៅពេលណា តើនរណាជួយកិច្ចការទាំងនេះ?* *If yes, what crops/animals, when, and who helps with the activities?* **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. YES ជាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង 1. PIGS ជ្រូក 2. CHICKENS មាន់ 3. DUCKS ទា 4. COWS គោ 5. BUFFALO ក្របី 6. FISH ត្រី 7. CROPS : ដំណាំ 8. OTHER: ផ្សេងៗ
2.11 (11) ***[2.1]***	តើផ្ទះអ្នកលិចទឹកទេ? Does your house flood? ប្រសិនបើមាន តើរដូវណា ហើយហេតុអ្វី? *If yes, what season and why?*	1. YES ជាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង
2.12 (12) ***[2.1]***	តើអ្នកតែងតែមានទឹកសម្រាប់ផឹក និងប្រើប្រាស់នៅក្នុងផ្ទះអ្នកដែរឬទេ? Is water available at your home to drink and use?	1. ALWAYS តែងតែ 2. SOMETIMES ពេលខ្លះ 3. NEVER មិនដែរ 4. DON'T KNOW អត់ដឹង

	(អានជម្រើសទាំងអស់, ជ្រើសរើសយកតែមួយ) **(Read all options, check only one)** ប្រសិនបើ " មានខ្លះ " ឬ " មិនមាន " តើរដូវអ្វី? ហេតុអ្វីបានជាមិនមាន ហើយអ្នកធ្វើដូចម្តេច? *If "SOMETIMES" or "NEVER" what season? Why it is not available and what do you do?*	
2.13 (13) ***[1.1]***	នៅក្នុងរដូវប្រាំង តើជំងឺធម្មតាបំផុត ដែលកុមារកើតគឺជំងឺអ្វីខ្លះ? In the dry season what are the most common illnesses that children get? **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. FEVER ក្រុនក្តៅ 2. DIARRHEA រាក 3. DEHYDRATION ខ្វះជាតិទឹក 4. COLD ផ្តាសាយ 5. SKIN PROBLEMS បញ្ហាស្បែក 6. EYE SICKNESS ឈឺភ្នែក 7. TIRED/WEAKNESS ហត់/អស់កម្លាំង 8. TYPHOID ក្រុនពោះវៀន 9. DENGUE ក្រុនឈាម 10. OTHER RESPIRATORY ILLNESS ជំងឺរលាកផ្លូវដង្ហើម 11. OTHER: ផ្សេងៗ
2.14 (14) ***[1.1]***	នៅក្នុងរដូវវស្សា តើជំងឺធម្មតាបំផុត ដែលកុមារកើតគឺជំងឺអ្វីខ្លះ? In the wet season what are the most common illness that children get? **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. FEVER ក្រុនក្តៅ 2. DIARRHEA រាក 3. DEHYDRATION ខ្វះជាតិទឹក 4. COLD ផ្តាសាយ 5. SKIN PROBLEMS បញ្ហាស្បែក 6. EYE SICKNESS ឈឺភ្នែក 7. TIRED/WEAKNESS ហត់/អស់កម្លាំង 8. TYPHOID ក្រុនពោះវៀន 9. DENGUE ក្រុនឈាម 10. OTHER RESPIRATORY ILLNESS ជំងឺរលាកផ្លូវដង្ហើម 11. OTHER: ផ្សេងៗ

3 - Household Roster (children under 5) **តារាងបញ្ជីមេក្រសារ (កូនក្រោមអាយុ៥ឆ្នាំ):**
ឥឡូវនេះយើងសូមសួរអ្នក អំពីកូនអាយុក្រោម៥ឆ្នាំ ដែលកំពុងរស់នៅក្នុងផ្ទះនេះ។
Now we would like to ask you questions about the children under five who are living at this house

ID# ល	SEX ភេទ	AGE អាយុ	WEIGHT [KG] ទម្ងន់	HEIGHT [CM] កម្ពស់	LIVE AT HOUSE? រស់នៅផ្ទះ	DIARRHEA 1 MONTH? រាគក្នុង១ខែមុន	RELATION TO HEAD OF HOUSEHOLD ទំនាក់ទំនងទៅនឹងមេក្រសារ
	M F				YES NO	YES NO DN	
	M F				YES NO	YES NO DN	
	M F				YES NO	YES NO DN	
	M F				YES NO	YES NO DN	
	M F				YES NO	YES NO DN	
	M F				YES NO	YES NO DN	

4 - Youngest Child កុមារតូច:
សំណួរខាងក្រោមសម្រាប់កុមាររស់នៅក្នុងផ្ទះ
*The following questions refer to the **youngest child** living at the home*

4.1 (15)	តើម្តាយទារក មានកូនប៉ុន្មាន? How many children does this mother have?	1. 1 2. 2 3. 3 4. 4+ 5. DON'T KNOW អត់ដឹង
4.2 (16) ***[3.4]***	តើម្តាយទារកទៅធ្វើការដែរ ឬទេ? Does the mother of the youngest child work? *ប្រសិនបើធ្វើការ តើគាត់ធ្វើការនៅកន្លែងណា ហើយនៅពេលណា?* **If YES**, *what does she do, where does she work and when?* *ប្រសិនបើមាតុភាព តើនាងធ្វើការនៅទីណា ហើយនាងត្រឡប់មកពីធ្វើការវិញនៅពេលណា? តើនរណាមើលថែទាំកុមារ ពេលម្តាយទៅធ្វើការវិញ?* **If ON LEAVE**, *where does she work and when will she go back? Who will take care of the child when she returns?* *ប្រសិនបើមិនដែរ ហេតុអ្វីមិនធ្វើការ?* **If NEVER,** *why does she not work?*	1. YES បាទ/ចា 2. NO, ON LEAVE ទេ មាតុភាព 3. NO, NEVER WORKED ទេមិនដែរធ្វើការទេ 4. DON'T KNOW អត់ដឹង 5. OTHER ផ្សេងៗ:
4.3 (17) ***[3.1]***	តើនរណាមើលថែទាំកូនពេលម្តាយទារកមិននៅ? Who takes care of the child when the mother is away from home? ប្រសិនបើកុមារ កំណត់អាយុ និងភេទ: *If child, specify age, sex:*	1. MOTHER TAKES CHILD ម្តាយកុមារ 2. HUSBAND ប្តី 3. CHILD កុមារ 4. GRANDMOTHER យាយ 5. GRANDFATHER តា 6. AUNT មីង 7. UNCLE ពូ 8. NEIGHBOR/FRIEND សាច់ញាតិ/ មិត្តភក្តិ 9. OTHER ផ្សេងៗ:
4.4 (18) ***[3.3]***	តើកុមារឥឡូវកំពុងបៅដោះមែនទេ? Is the child currently breastfeeding?	1. YES បាទ/ ចា **[go to #19]** 2. NO ទេ **[go to #20]** 3. DON'T KNOW អត់ដឹង

4.5 (19) ***[3.3]***	តើគ្រួសារអ្នកធ្វើដូចម្តេច ពេលម្តាយមិននៅ ហើយកុមារត្រូវការជៅដោះ? What does the family do when the mother is gone and the child is hungry? *តើមានការពន់ពាក់ទេចំពោះរឿងនេះ?* *Is there difficulties with this?*	1. MOTHER TAKES CHILD ម្តាយយកកូនតាម 2. GIVE CHILD FORMULA MILK ដោះគោកំប៉ុង 3. GIVE CHILD OTHER MILK ទឹកដោះគោផ្សេងៗ 4. GIVE CHILD SOLID FOOD អាហាររឹង 5. GIVE CHILD SEMISOLID FOOD អាហាររឹងកិចៗ 6. GIVE CHILD WATER ផ្តល់ទឹក 7. GIVE CHILD FOOD FROM OUTSIDE HOUSE អោយអាហារក្រៅផ្ទះ 8. DON'T KNOW អត់ដឹង 9. OTHER ផ្សេងៗ:

5 – Feeding ការជៅដោះ:

ខាងក្រោមនេះជាទម្លាប់នៃការជៅដោះ ដែលទាក់ទងទៅនឹងកុមារ

*The following are feeding habits related to the **youngest child***

5.1 (20) ***[3.3]***	តើអ្នកជាអ្នកយកទឹកឲ្យទារក/ក្មេងឬ? Are you giving your baby/child water?	1. YES ចាទ/ ចា ***[go to #21]*** 2. NO ទេ ***[go to #22]*** 3. DON'T KNOW អត់ដឹង
5.2 (21) ***[2.1]***	តើជានទឹកមកពីណា? Where is the water coming from? *កំណត់ឲ្យច្បាស់ពី ទឹស្អាតឬទឹកមិនស្អាត* ***Make sure to specify treated or untreated!*** *ប្រសិនបើទឹកមិនស្អាត តើប្រភពទឹកមកពីណា?* *If UNTREATED, specify source*	1. UNTREATED អត់សម្អាត 2. TREATED (FILTETRED) សម្អាត (ចម្រោះ) 3. TREATED (BOILED) សម្អាត (ច្រកដប) 4. BOTTLED WATER ទឹកសុទ្ធ 5. OTHER ផ្សេងៗ:
5.3 (22) ***[3.3]***	តើអ្នកជាអ្នកឲ្យទឹកដោះគោកំប៉ុង ឬម្សៅទៅទារក/កុមារឬ? Are you giving your baby/child formula milk? *ប្រសិនបើមែន តើប៉ុន្មានដងក្នុងមួយថ្ងៃ?* *If yes, how many times per day?*	1. YES ចាទ/ ចា **[go to #23]** 2. NO ទេ **[go to #24]** 3. DON'T KNOW អត់ដឹង 1. 1 - 2 2. 3 - 4 3. 5 +
5.4 (23) ***[2.1]***	តើទឹកលាយជាមួយទឹកដោះគោកំប៉ុង ជានមកពីណា? Where is the water used to make the formula coming from? *កំណត់ឲ្យច្បាស់ពី ទឹស្អាតឬទឹកមិនស្អាត*	1. UNTREATED អត់សម្អាត 2. TREATED (FILTETRED) សម្អាត (ចម្រោះ) 3. TREATED (BOILED) សម្អាត (ច្រកដប) 4. BOTTLED WATER ទឹកសុទ្ធ 5. OTHER ផ្សេងៗ:

	Make sure to specify treated or untreated! *ប្រសិនបើទឹកមិនស្អាត តើប្រភពទឹកមកពីណា?* *If UNTREATED, specify source:* ……	
5.5 (24) ***[3.3]***	តើអ្នកជាអ្នកឲ្យទឹកផ្សេងៗទៅដល់ទារក/កុមារមែនឬ? Are you giving your baby/child any other fluids? ប្រសិនបើមាន តើទឹកប្រភេទអ្វី *If yes, what fluids?* ……	1. YES ចាទ/ ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង
5.6 (25) ***[3.3]***	តើអ្នកឲ្យកុមារផឹកទឹកដោយរបៀបណា? How are you feeding the child these fluids? **(សូមរុជើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. BABY BOTTLE ដបកូនក្មេង 2. BOTTLE ដោយដប 3. SPOON ដោយស្លាបព្រា 4. BOWL ដោយចានគោម 5. CUP ពែង 6. DON'T KNOW អត់ដឹង 7. OTHER ផ្សេងៗ:
5.7 (26) ***[2.1]*** ***[3.3]***	តើអ្នកលាងសម្អាត **[ចម្លើយលេខ២៥]** ឬអត់? Do you clean **[ANSWER FROM #25]**?	1. YES ចាទ/ ចា ***[go to #27]*** 2. NO ទេ ***[go to #28]*** 3. NO, DISPOSABLE ទេ ប្រើរួចចោល ***[go to #28]*** 4. DON'T KNOW អត់ដឹង
5.8 (27) ***[2.1]*** ***[3.3]***	តើអ្នកសម្អាត **[ចម្លើយលេខ២៥]** ដោយរបៀបណាវិញ? How do you clean **[ANSWER FROM #25]**? *កំណត់ឲ្យច្បាស់ពី ទឹស្អាតឬទឹកមិនស្អាត* ***Make sure to specify treated or untreated!*** **(សូមរុជើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. RINSE WITH UNTREATED WATER លាងទឹកមិនបានសម្អាត 2. RINSE WITH UNTREATED WATER AND SOAP លាងទឹកមិនបានសម្អាត និងសាប៊ូ 3. RINSE WITH TREATED WATER (OTHER THAN BOILED) លាងជាមួយទឹកស្អាត (ក្រៅពីទឹកដាំ) 4. RINSE WITH TREATED WATER (OTHER THAN BOILED) AND SOAP លាងជាមួយទឹកស្អាត (ក្រៅពីទឹកដាំ) ប្រើសាប៊ូ 5. RINSE WITH TREATED WATER (JUST BOILED) លាងជាមួយនឹងទឹកស្អាត (ក្រាន់តែដាំ)

		6. RINSE WITH TREATED WATER (JUST BOILED) AND SOAP លាងជាមួយនឹងទឹកស្អាត (គ្រាន់តែដាំ) និងសាប៊ូ 7. DON'T KNOW អត់ដឹង 8. OTHER ផ្សេងៗ:
5.9 (28) *[3.3]*	តើអ្នកអោយផ្លែឈើ ឬបន្លែដល់ទារក/កុមារឬ? Are you giving your baby/child fruits or vegetables? តើផ្សារដែលអ្នកទិញបន្លែ និងសាច់នៅជិតផ្ទះអ្នកបំផុត មានចម្ងាយប៉ុន្មាន? How far is the nearest market where you can buy vegetables and meat?	1. YES ចាទ/ ចា ***[go to #29]*** 2. NO ទេ ***[go to #31]*** 3. DON'T KNOW អត់ដឹង 4. LESS THAN 1 km 5. 1 -2 km 6. 3 -4 km 7. 5 + km
5.10 (29)	តើអ្នកលាងបន្លែ និងផ្លែឈើឬទេ? Do you clean the fruits and vegetables?	1. YES ចាទ/ ចា ***[go to #30]*** 2. NO ទេ ***[go to #31]*** 3. DON'T KNOW អត់ដឹង
5.11 (30) *[2.1]* *[3.3]*	តើអ្នកសម្អាតដូចម្តេច? How are they cleaned? *កំណត់ឲ្យច្បាស់ពី ទឹស្អាតឬទឹកមិនស្អាត* ***Make sure to specify treated or untreated!*** **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. RINSE WITH UNTREATED WATER លាងទឹកមិនបានសម្អាត 2. RINSE WITH UNTREATED WATER AND SOAP លាងទឹកមិនបានសម្អាត ប្រើសាប៊ូ 3. RINSE WITH TREATED WATER លាងជាមួយទឹកស្អាត 4. RINSE WITH TREATED WATER AND SOAP លាងជាមួយទឹកស្អាត និងសាប៊ូ 5. SALT WATER ទឹកអំបិល 6. DON'T KNOW អត់ដឹង 7. OTHER ផ្សេងៗ:
5.12 (31) *[2.1]* *[3.3]*	តើអ្នកផ្តល់អាហារដល់ទារកដែលបានចំអិននៅក្រៅផ្ទះឬ? Are you giving your baby/child food that is prepared outside the house? *ប្រសិនបើមែន តើអ្វីទៅ នៅកន្លែងណា ហើយញឹកញាប់ប៉ុនណា ហើយតើពួកគេគិតថាអាហារទាំងនោះមានអនាម័យដែរទេ?* *If yes, what, from where, how often, and do they think the food is sanitary?*	1. YES ចាទ/ ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង 1. 2-3 PER DAY ២- ៣/ថ្ងៃ 2. 1 PER DAY ១ដង/១ថ្ងៃ 3. 4-5 PER WEEK ៤- ៥/សប្តាហ៍ 4. 1-3 PER WEEK ១- ៣/សប្តាហ៍ 5. DON'T KNOW អត់ដឹង

6 - Most Recent Diarrheal Episode ពេលដែលរាកថ្មីៗបំផុត:

ខាងក្រោមនេះជាសំណួរសំដៅទៅលើពេលដែលកុមារទើបតែមានជំងឺរាក

The following questions refer to the child's most recent diarrheal episode

6.1 (32)	តើប៉ុន្មានដងដែលទារកធម្មតាបន្ទោបង់ ក្នុងមួយថ្ងៃ? How many bowel movements does your youngest child normally have each day?	1. 0 2. 1 3. 2 4. 3 5. 4+
6.2 (33) ***[4.1]***	តើអ្នកធ្លាប់លឺជំងឺរាកទេ? ដូចម្តេចដែលហៅថាជំងឺរាក? (ទុកឲ្យពួកគេពន្យល់) Have you heard of diarrhea? What do you mean by diarrhea? *(allow them to explain)*	1. YES បាទ/ចា 2. NO ទេ
6.3 (34)	តើកូនអ្នករាកទេ កាលពីខែមុន? Has your child had diarrhea in the last month? *ប្រសិនបើមាន តើមានប៉ុន្មានថ្ងៃ ក្នុងរយៈខែ?* *If yes, how many days within the month?* *តើប៉ុន្មានដងក្នុងរយៈថ្ងៃ អំឡុងពេលរាក?* *How many times each day during the episode*	1. YES បាទ/ចា ***[go to #35]*** 2. NO ទេ ***[go to #47]*** 3. DON'T KNOW អត់ដឹង 1. 1 - 3 2. 4 - 6 3. 7 + 4. DON'T KNOW អត់ដឹង 1. 1 - 2 2. 3 - 4 3. 5+ 4. DON'T KNOW អត់ដឹង
6.4 (35) ***[2.1]***	តើមានឈាម ឬស្លេសនៅក្នុងលាមកទេ? Was there any blood or mucus in the stools? *ប្រសិនបើមាន តើឈាម ឬស្លេស?* If YES, which one?	1. YES បាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង
6.5 (36) ***[2.5]*** ***[3.3]***	អំឡុងពេលកុមាររាក តើកុមារជៅដោះទេ? During your child's diarrhea did you breastfeed?	1. YES បាទ/ចា ***[go to #37]*** 2. NO ទេ ***[go to #38]*** 3. DON'T KNOW អត់ដឹង
6.6 (37) ***[2.5]***	តើអ្នកជៅដោះកូន: Did you breastfeed your child: **(អានជម្រើស ទាំងអស់ ហើយជ្រើសរើសតែមួយ)** **(Read all options, check only one)**	1. MORE THAN USUAL ច្រើនជាងជម្ហរ 2. SAME AS USUAL ដូចជម្ហរ 3. LESS THAN USUAL តិចជាងជម្ហរ 4. DON'T KNOW អត់ដឹង

6.7 (38) ***[2.5]*** ***[3.3]***	អំឡុងពេលកុមាររាក តើអ្នកផ្តល់ទឹកផ្សេងៗ ក្រៅពីទឹកដោះឬ? During your child's diarrhea, did you provide him/her with fluids other than breastmilk? *តើប្រភេទទឹកអ្វីខ្លះ?* *What were those fluids?*	1. YES ចាទ/ ចា ***[go to #39]*** 2. NO ទេ ***[go to #40]*** 3. DON'T KNOW អត់ដឹង
6.8 (39) ***[2.5]***	តើអ្នកផ្តល់ទឹកផ្សេងៗ ដល់កុមារ: Did you provide fluids to your child: **(អានជម្រើស ទាំងអស់ ហើយជ្រើសរើសតែមួយ)** **(Read all options, check only one)**	1. MORE THAN USUAL ច្រើនជាងធម្មតា 2. SAME AS USUAL ដូចធម្មតា 3. LESS THAN USUAL តិចជាងធម្មតា 4. DON'T KNOW អត់ដឹង
6.9 (40) ***[2.5]***	អំឡុងពេលកុមាររាក តើអ្នកបន្តផ្តល់កុមារនូវអាហារឬង /រឹងតិចៗឬ? During your child's diarrhea, did you continue to provide him/her with solid/semisolid foods? *តើអាហារទាំងនោះមានអ្វីខ្លះ?* *What were those foods?*	1. YES ចាទ/ ចា ***[go to #41]*** 2. NO ទេ ***[go to #42]*** 3. DON'T KNOW អត់ដឹង
6.10 (41) ***[2.5]*** ***[3.3]***	តើអ្នកផ្តល់កុមារនូវ អាហារឬង /រឹងតិចៗឬ? Did you provide solid/semisolid foods to your child: **(អានជម្រើសទាំងអស់, ជ្រើសរើសយកតែមួយ)** **(Read all options, check only one)**	1. MORE THAN USUAL ច្រើនជាងធម្មតា 2. SAME AS USUAL ដូចធម្មតា 3. LESS THAN USUAL តិចជាងធម្មតា 4. DON'T KNOW អត់ដឹង
6.11 (42) ***[2.3]***	ពេលកុមាររាករូស តើអ្នកស្វែករកការឱ្យដំបូលទ្ធាន ឬកំការព្យាបាលដែរ ឬទេ? When your child had diarrhea did you seek advice or treatment? ប្រសិនបើមិនមាន តើហេតុអ្វី? If no, why not?	1. YES ចាទ/ ចា ***[go to #43]*** 2. NO ទេ ***[go to #45]*** 3. DON'T KNOW អត់ដឹង

6.12 (43) *[2.3]*	តើអ្នកស្វែងរកការឲ្យដំបូលឆ្ពាន ឬការព្យាបាលជំងឺរាគពីនរណា? From who did you seek advice or treatment from? តើមានចម្ងាយប៉ុន្មានដែរ ពីផ្ទះទៅកន្លែងព្យាបាល? *What is the distance to this provider?* 1. LESS THAN 1 km 2. 1 -2 km 3. 3 -4 km 4. 5 + km	1. HOSPITAL មន្ទីពេទ្យ 2. HEALTH CENTER មណ្ឌលសុខភាព 3. PRIVATE CLINIC/DOCTOR គ្លីនិច/ពេទ្យឯកជន 4. PHARMACY ឱសថស្ថាន 5. VILLAGE HEALTH VOLUNTEER ពេទ្យស្ម័គ្រចិត្តភូមិ 6. TRADITIONAL HEALER ឱសថបុរាណ 7. TRADITIONAL BIRTH ATTENDANT ការព្យាបាលឆ្មបបុរាណ 8. FRIENDS/RELATIVES មិត្តភក្តិ 9. OTHER: ផ្សេងៗ
6.13 (44) *[2.3]*	ហេតុអ្វីបានអ្នកសម្រេចចិត្តយកកុមារនោះ ទៅឲ្យអ្នកផ្តល់សេវាសុខភាពនេះ ជាជាងយកទៅមើលអ្នកផ្តល់សេវាសុខភាពដទៃទៀត? Why did you decide to take the child to this provider instead of other providers? **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. COST LESS MONEY ចំណាយលុយតិច 2. CAN PAY ON TIME អាចចំណាយទានពេល 3. PRACTITIONER KNOWN ស្គាល់គ្នា 4. PRACTITIONER TRUSTED ទុកចិត្តលើ 5. CLOSEST DISTANCE ជិតផ្ទះ 6. DON'T KNOW អត់ដឹង 7. OTHER ផ្សេងៗ:
6.14 (45) *[2.5]*	តើកុមារត្រូវបានព្យាបាលជំងឺរាគតាមវិធីមួយចំនួនមែនឬ? Was anything given to treat the diarrhea?	1. YES បាទ/ចា ***[go to #46]*** 2. NO ទេ ***[go to #47]*** 3. DON'T KNOW អត់ដឹង ***[go to #47]***
6.15 (46) *[2.5]*	តើកុមារត្រូវបានព្យាបាលជំងឺរាគតាមវិធីណាខ្លះ? What was given to treat the diarrhea? **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)** *ប្រសិន " បើមានឱសថបុរាណ" ឬ "ផ្សេងៗទៀត" សូមកំណត់ :* *If "home remedy" or "other" please specify:* ..... *ហេតុអ្វីបានជាគេធ្វើការព្យាបាលកុមារតាមរបៀបនេះ តើការព្យាបាលតាមរបៀបនេះមានអ្វីខ្លះ?* *Why were they given this treatment and what does that treatment do?*	1. ORALYTE ទឹកអូរីលីត្រ 2. ORS TABLET ថ្នាំអូរីលីត្រ 3. ANTIBIOTIC ថ្នាំសម្លាប់បាក់តេរី 4. ANTI-MOBILITY ថ្នាំបញ្ឈប់កុំឲ្យរាក 5. OTHER PILL OR SYRUP ក្រាប់ថ្នាំផ្សេងៗ ឬទឹកសេរ៉ូ: 6. UNKNOWN PILL OF SYRUP ក្រាប់ថ្នាំសេរ៉ូអត់ស្គាល់ 7. ANTIBIOTIC INJECTION ការចាក់ថ្នាំប្រឆាំងបាក់តេរី 8. NON-ANTIBIOTIC INJECTION ការចាក់ថ្នាំមិនប្រឆាំងបាក់តេរី 9. UNKNOWN INJECTION ការចាក់ថ្នាំមិនស្គាល់ 10. INTRAVENOUS (IV) ការចាក់សេរ៉ូម 11. HOME REMEDY ឱសថបុរាណ 12. NO TREATMENT មិនធ្វើការព្យាបាល 13. OTHER ផ្សេង:

7 - Diarrhea General ការរាករូស:

ខាងក្រោមនេះជាសំណួរទូទៅអំពីជំងឺរាក The following are general questions about diarrhea

7.1 (47) ***[2.1]*** ***[4.1]***	តើជំងឺរាកមានប្រភេទផ្សេងទៀតដែរឬទេ? Are there different types of normal childhood diarrhea? *ប្រសិនបើមាន បំពេញឈ្មោះទាំងអស់។ ប្រសិនបើគ្មានទេ បំពេញតែពាក្យ " រាក "* *If yes complete with all names. If no, complete with just "រាក"*		1. YES បាទ/ ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង
	1 :	2 :	3 :
7.2 (48) ***[2.1]*** ***[4.1]***	តើអ្វីទៅដែលបណ្តាលឲ្យកុមាររាក/ ប្រភេទជំងឺរាកនីមួយៗ? What are the causes of this/these diarrhea in children? **(សូមជ្រើសរើសចំណុចទាំងនោះ:) (Select those that apply)**		
	1	**2**	**3**
	1. CONTAMINATED FOOD អាហារផ្ទុកដោយមេរោគ 2. CONTAMINATED WATER ទឹកផ្ទុកមេរោគ 3. SPICY FOOD អាហារហិល 4. HEAT ក្តៅ 5. COLD ត្រជាក់ 6. BACTERIA/VIRUSES មេរោគ/វីរុស 7. CHILD DEVELOPMENT STAGES ដំណាក់កាលលូតលាស់របស់កុមារ 8. NOT WASHING HANDS មិនលាងដៃ 9. DON'T KNOW អត់ដឹង 10. OTHER ផ្សេងៗ:	1. CONTAMINATED FOOD អាហារផ្ទុកដោយមេរោគ 2. CONTAMINATED WATER ទឹកផ្ទុកមេរោគ 3. SPICY FOOD អាហារហិល 4. HEAT ក្តៅ 5. COLD ត្រជាក់ 6. BACTERIA/VIRUSES មេរោគ/វីរុស 7. CHILD DEVELOPMENT STAGES ដំណាក់កាលលូតលាស់របស់កុមារ 8. NOT WASHING HANDS មិនលាងដៃ 9. DON'T KNOW អត់ដឹង 10. OTHER ផ្សេងៗ:	1. CONTAMINATED FOOD អាហារផ្ទុកដោយមេរោគ 2. CONTAMINATED WATER ទឹកផ្ទុកមេរោគ 3. SPICY FOOD អាហារហិល 4. HEAT ក្តៅ 5. COLD ត្រជាក់ 6. BACTERIA/VIRUSES មេរោគ/វីរុស 7. CHILD DEVELOPMENT STAGES ដំណាក់កាលលូតលាស់របស់កុមារ 8. NOT WASHING HANDS មិនលាងដៃ 9. DON'T KNOW អត់ដឹង 10. OTHER ផ្សេងៗ:
	កំណត់ចម្លើយឲ្យលម្អិត (ដូចជា អាហារអ្វី ដំណាក់កាលលូតលាស់ ។ល។) *Elaborate details of the answers (i.e. what foods, development stages, etc):*		

	តើអ្វីទៅដែលបណ្ដាលឲ្យកុមាររាក/ ប្រភេទជំងឺរាកទីមួយៗ? What are symptoms of this/these diarrhea in children? **(សូមជ្រើសរើសចំណុចទាំងនោះ)** (Select those that apply)		
	1	**2**	**3**
7.3 (49) ***[2.1]*** ***[4.1]***	1. DON'T KNOW អត់ដឹង 2. BOWELS MOVEMENT 3+ TIMES IN ONE DAY មានលាមក បីដងឡើងទៅក្នុង១ថ្ងៃ 3. VOMITIING ចុះក្អួត 4. FEVER គ្រុនក្ដៅ 5. WATERY STOOL លាមកដូចទឹក 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេស ជាប់លាមក 7. LOSS OF APPETITE អត់ស្រេកឃ្លាន 8. WEAKNESS ខ្សត់ខ្សោយ 9. STOMACH PAIN ចុកពោះ 10. OTHER ផ្សេងៗ:	1. DON'T KNOW អត់ដឹង 2. BOWELS MOVEMENT 3+ TIMES IN ONE DAY មានលាមក បីដងឡើងទៅក្នុង១ថ្ងៃ 3. VOMITIING ចុះក្អួត 4. FEVER គ្រុនក្ដៅ 5. WATERY STOOL លាមកដូចទឹក 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេស ជាប់លាមក 7. LOSS OF APPETITE អត់ស្រេកឃ្លាន 8. WEAKNESS ខ្សត់ខ្សោយ 9. STOMACH PAIN ចុកពោះ 10. OTHER ផ្សេងៗ:	1. DON'T KNOW អត់ដឹង 2. BOWELS MOVEMENT 3+ TIMES IN ONE DAY មានលាមក បីដងឡើងទៅក្នុង១ថ្ងៃ 3. VOMITIING ចុះក្អួត 4. FEVER គ្រុនក្ដៅ 5. WATERY STOOL លាមកដូចទឹក 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេស ជាប់លាមក 7. LOSS OF APPETITE អត់ស្រេកឃ្លាន 8. WEAKNESS ខ្សត់ខ្សោយ 9. STOMACH PAIN ចុកពោះ 10. OTHER ផ្សេងៗ:
	តើសកម្មភាពអ្វីខ្លះ ដែលអ្នកគួរធ្វើ ប្រសិនបើកុមាររាក? What actions do you take if a child has this/these diarrhea? **(សូមជ្រើសរើសចំណុចទាំងនោះ)** (Select those that apply)		
	1	**2**	**3**
7.4 (50) ***[2.1]*** ***[4.1]***	1. DON'T KNOW អត់ដឹង 2. INITIATE FLUIDS RAPIDLY សារធាតុរាវជាញឹកញាប់ 3. GIVE CHILD MORE TO DRINK THAN USUAL អោយក្មេងផឹងអោយបានច្រើនជាងធម្មតា 4. BEDREST ដេក 5. GIVE CHILD SMALLER MORE FREQUENT MEALS អោយក្មេងញុំាអាហារតិចជាងធម្មតា តែញឹកញាប់ 6. GIVE ORS អោយទឹកអូរ៉ាលីត 7. TAKE CHILD TO DOCTOR យកកុមារទៅពេទ្យ 8. FEED MORE AFTER DIARRHEA EPISODE SO CHILD CAN REGAIN WEIGHT អោយអាហារកាន់តែច្រើន បន្ទាប់ពីរាក ដូចនេះកុមារអាចឡើងគីឡូឡើងវិញ 9. WITHHOLD FLUIDS មិនផ្ដល់អាហាររាវ	1. DON'T KNOW អត់ដឹង 2. INITIATE FLUIDS RAPIDLY សារធាតុរាវជាញឹកញាប់ 3. GIVE CHILD MORE TO DRINK THAN USUAL អោយក្មេងផឹងអោយបានច្រើនជាងធម្មតា 4. BEDREST ដេក 5. GIVE CHILD SMALLER MORE FREQUENT MEALS អោយក្មេងញុំាអាហារតិចជាងធម្មតា 6. GIVE ORS អោយទឹកអូរ៉ាលីត 7. TAKE CHILD TO DOCTOR យកកុមារទៅពេទ្យ 8. FEED MORE AFTER DIARRHEA EPISODE SO CHILD CAN REGAIN WEIGHT អោយអាហារកាន់តែច្រើន បន្ទាប់ពីរាក ដូចនេះកុមារអាចឡើងគីឡូឡើងវិញ 9. WITHHOLD FLUIDS មិនផ្ដល់អាហាររាវ	1. DON'T KNOW អត់ដឹង 2. INITIATE FLUIDS RAPIDLY សារធាតុរាវជាញឹកញាប់ 3. GIVE CHILD MORE TO DRINK THAN USUAL អោយក្មេងផឹងអោយបានច្រើនជាងធម្មតា 4. BEDREST ដេក 5. GIVE CHILD SMALLER MORE FREQUENT MEALS 6. អោយក្មេងញុំាអាហារតិចជាងធម្មតា 7. GIVE ORS អោយទឹកអូរ៉ាលីត 8. TAKE CHILD TO DOCTOR យកកុមារទៅពេទ្យ 9. FEED MORE AFTER DIARRHEA EPISODE SO CHILD CAN REGAIN WEIGHT អោយអាហារកាន់តែច្រើន បន្ទាប់ពីរាក ដូចនេះកុមារអាចឡើងគីឡូឡើងវិញ 10. WITHHOLD FLUID មិនផ្ដល់អាហាររាវ

	10. WITHHOLD FOOD មិនផ្តល់អោយអាហារ 11. GIVE MEDICINE អោយថ្នាំលេប 12. GIVE HOT FOODS/FLUIDS អោយអាហារក្តៅ/ទឹក 13. GIVE COLD FOODS/FLUIDS អោយអាហារត្រជាក់/ទឹក 14. OTHER ផ្សេងៗ:	10. WITHHOLD FOOD មិនផ្តល់អោយអាហារ 11. GIVE MEDICINE អោយថ្នាំលេប 12. GIVE HOT FOODS/FLUIDS អោយអាហារក្តៅ/ទឹក 13. GIVE COLD FOODS/FLUIDS អោយអាហារត្រជាក់/ទឹក 14. OTHER ផ្សេងៗ:	11. WITHHOLD FOOD មិនផ្តល់អោយអាហារ 12. GIVE MEDICINE អោយថ្នាំលេប 13. GIVE HOT FOODS/FLUIDS អោយអាហារក្តៅ/ទឹក 14. GIVE COLD FOODS/FLUIDS អោយអាហារត្រជាក់/ទឹក 15. OTHER ផ្សេងៗ:
	កំណត់ចម្លើយឲ្យលម្អិត (ដូចជា អាហារអ្វី ទឹក ថ្នាំពេទ្យ។ល។) *Elaborate details of the answers (i.e. what foods, fluids, medicine, etc.):*		
7.5 (51) ***[2.1]*** ***[4.1]***	តើមានប្រភេទជំងឺរាកធ្ងន់ធ្ងរ ដែរឬទេ? Are there more serious types of diarrhea? ប្រសិនបើមាន តើមានឈ្មោះអ្វីខ្លះ? *If yes, what are the names?*		1. YES បាទ/ ចា ***[go to #52]*** 2. NO ទេ ***[go to #55]*** 3. DON'T KNOW អត់ដឹង
	1 :	2 :	3 :
7.6 (52) ***[2.1]*** ***[4.1]***	តើអ្វីទៅដែលបណ្តាលឲ្យកុមាររាក/ ប្រភេទជំងឺរាកនីមួយៗ? What are the causes of this/these diarrhea? **(សូមជ្រើសរើសចំណុចទាំងនោះ) (Select those that apply)**		
	1	**2**	**3**
	1. CONTAMINATED FOOD អាហារផ្ទុកដោយមេរោគ 2. CONTAMINATED WATER ទឹកផ្ទុកមេរោគ 3. SPICY FOOD អាហារហិល 4. HEAT ក្តៅ 5. COLD ត្រជាក់ 6. BACTERIA/VIRUSES មេរោគ/វីរុស 7. CHILD DEVELOPMENT STAGES ដំណាក់កាលលូតលាស់របស់កុមារ 8. NOT WASHING HANDS អត់លាងដៃ 9. DON'T KNOW អត់ដឹង 10. OTHER ផ្សេងៗ:	1. CONTAMINATED FOOD អាហារផ្ទុកដោយមេរោគ 2. CONTAMINATED WATER ទឹកផ្ទុកមេរោគ 3. SPICY FOOD អាហារហិល 4. HEAT ក្តៅ 5. COLD ត្រជាក់ 6. BACTERIA/VIRUSES មេរោគ/វីរុស 7. CHILD DEVELOPMENT STAGES ដំណាក់កាលលូតលាស់របស់កុមារ 8. NOT WASHING HANDS អត់លាងដៃ 9. DON'T KNOW អត់ដឹង 10. OTHER ផ្សេងៗ:	1. CONTAMINATED FOOD អាហារផ្ទុកដោយមេរោគ 2. CONTAMINATED WATER ទឹកផ្ទុកមេរោគ 3. SPICY FOOD អាហារហិល 4. HEAT ក្តៅ 5. COLD ត្រជាក់ 6. BACTERIA/VIRUSES មេរោគ/វីរុស 7. CHILD DEVELOPMENT STAGES ដំណាក់កាលលូតលាស់របស់កុមារ 8. NOT WASHING HANDS អត់លាងដៃ 9. DON'T KNOW អត់ដឹង 10. OTHER ផ្សេងៗ:

	កំណត់ចម្លើយឲ្យលម្អិត (ដូចជា អាហារអ្វី ដំណាក់កាលលូតលាស់ ។ល។) *Elaborate details of the answers (i.e. what foods, development stages, etc.):*		
7.7 (53) ***[2.1]*** ***[4.1]***	តើអ្វីទៅដែលបណ្តាលឲ្យកុមាររាក/ ប្រភេទជំងឺរាកនីមួយៗ? What are symptoms of this/these diarrhea in children? **(សូមជ្រើសរើសចំណុចទាំងនោះ) (Select those that apply)**		
	1	**2**	**3**
	1. DON'T KNOW អត់ដឹង 2. BOWELS MOVEMENT 3+ TIMES IN ONE DAY មានលាមក បីដងឡើង ទៅក្នុង១ថ្ងៃ 3. VOMITIING ចុះក្អួត 4. FEVER គ្រុនក្តៅ 5. WATERY STOOL លាមកដូចទឹក 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេស ជាប់លាមក 7. LOSS OF APPETITE អត់ស្រេកឃ្លាន 8. WEAKNESS ខ្សត់ខ្សោយ 9. STOMACH PAIN ចុកពោះ 10. OTHER ផ្សេងៗ:	1. DON'T KNOW អត់ដឹង 2. BOWELS MOVEMENT 3+ TIMES IN ONE DAY មានលាមក បីដងឡើង ទៅក្នុង១ថ្ងៃ 3. VOMITIING ចុះក្អួត 4. FEVER គ្រុនក្តៅ 5. WATERY STOOL លាមកដូចទឹក 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេស ជាប់លាមក 7. LOSS OF APPETITE អត់ស្រេកឃ្លាន 8. WEAKNESS ខ្សត់ខ្សោយ 9. STOMACH PAIN ចុកពោះ 10. OTHER ផ្សេងៗ:	1. DON'T KNOW អត់ដឹង 2. BOWELS MOVEMENT 3+ TIMES IN ONE DAY មានលាមក បីដងឡើង ទៅក្នុង១ថ្ងៃ 3. VOMITIING ចុះក្អួត 4. FEVER គ្រុនក្តៅ 5. WATERY STOOL លាមកដូចទឹក 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេស ជាប់លាមក 7. LOSS OF APPETITE អត់ស្រេកឃ្លាន 8. WEAKNESS ខ្សត់ខ្សោយ 9. STOMACH PAIN ចុកពោះ 10. OTHER ផ្សេងៗ:
7.8 (54) ***[2.1]*** ***[4.1]***	តើសកម្មភាពអ្វីខ្លះ ដែលអ្នកគួរធ្វើ ប្រសិនបើកុមាររាក? What actions do you take if a child has this/these diarrhea? **(សូមជ្រើសរើសចំណុចទាំងនោះ) (Select those that apply)**		
	1	**2**	**3**
	1. DON'T KNOW អត់ដឹង 2. INITIATE FLUIDS RAPIDLY សារធាតុរាវជាញឹកញាប់ 3. GIVE CHILD MORE TO DRINK THAN USUAL អោយក្មេងផឹងអោយបាន ច្រើនជាងធម្មតា 4. BEDREST ដេក 5. GIVE CHILD SMALLER MORE FREQUENT MEALS អោយក្មេងញាំអាហារតិច ជាងធម្មតា 6. GIVE ORS អោយទឹកអូរ៉ាលីត 7. TAKE CHILD TO DOCTOR យកកុមារទៅពេទ្យ 8. FEED MORE AFTER DIARRHEA EPISODE SO CHILD CAN REGAIN	1. DON'T KNOW អត់ដឹង 2. INITIATE FLUIDS RAPIDLY សារធាតុរាវជាញឹកញាប់ 3. GIVE CHILD MORE TO DRINK THAN USUAL អោយក្មេងផឹងអោយ បានច្រើនជាងធម្មតា 4. BEDREST ដេក 5. GIVE CHILD SMALLER MORE FREQUENT MEALS អោយក្មេងញាំអាហារតិច ជាងធម្មតា 6. GIVE ORS អោយទឹកអូរ៉ាលីត 7. TAKE CHILD TO DOCTOR យកកុមារទៅពេទ្យ 8. FEED MORE AFTER DIARRHEA EPISODE SO	1. DON'T KNOW អត់ដឹង 2. INITIATE FLUIDS RAPIDLY សារធាតុរាវជាញឹកញាប់ 3. GIVE CHILD MORE TO DRINK THAN USUAL អោយក្មេងផឹងអោយបាន ច្រើនជាងធម្មតា 4. BEDREST ដេក 5. GIVE CHILD SMALLER MORE FREQUENT MEALS អោយក្មេងញាំអាហារតិច ជាងធម្មតា 6. GIVE ORS អោយទឹកអូរ៉ាលីត 7. TAKE CHILD TO DOCTOR យកកុមារទៅពេទ្យ 8. FEED MORE AFTER DIARRHEA EPISODE SO

	WEIGHT អោយអាហារកាន់តែច្រើន បន្ទាប់ពីរាគ ដូចនេះកុមារអាចឡើងគីឡូឡើងវិញ 9. WITHHOLD FLUIDS មិនផ្តល់អាហារវត្ថុរាវ 10. WITHHOLD FOOD មិនផ្តល់អោយអាហារ 11. GIVE MEDICINE អោយថ្នាំលេប 12. GIVE HOT FOODS/FLUIDS អោយអាហារក្តៅ/ទឹក 13. GIVE COLD FOODS/FLUIDS អោយអាហារត្រជាក់/ទឹក 14. OTHER ផ្សេងៗ:	CHILD CAN REGAIN WEIGHT អោយអាហារកាន់តែច្រើន បន្ទាប់ពីរាគ ដូចនេះកុមារអាចឡើងគីឡូឡើងវ 9. WITHHOLD FLUIDS មិនផ្តល់អាហារវត្ថុរាវ 10. WITHHOLD FOOD មិនផ្តល់អោយអាហារ 11. GIVE MEDICINE អោយថ្នាំលេប 12. GIVE HOT FOODS/FLUIDS អោយអាហារក្តៅ/ទឹក 13. GIVE COLD FOODS/FLUIDS អោយអាហារត្រជាក់/ទឹក 14. OTHER ផ្សេងៗ:	CHILD CAN REGAIN WEIGHT អោយអាហារកាន់តែច្រើន បន្ទាប់ពីរាគ ដូចនេះកុមារអាចឡើងគីឡូឡើងវិញ 9. WITHHOLD FLUIDS មិនផ្តល់អាហារវត្ថុរាវ 10. WITHHOLD FOOD មិនផ្តល់អោយអាហារ 11. GIVE MEDICINEអោយថ្នាំលេប 12. GIVE HOT FOODS/FLUIDS អោយអាហារក្តៅ/ទឹក 13. GIVE COLD FOODS/FLUIDS អោយអាហារត្រជាក់/ទឹក 14. OTHER ផ្សេងៗ:
	កំណត់ចម្លើយឲ្យលម្អិត (ដូចជា អាហារអ្វី ទឹក ថ្នាំពេទ្យ។ល។) *Elaborate details of the answers (i.e. what foods, fluids, medicine, etc.):*		
7.9 (55) ***[2.1]*** ***[4.1]***	តើអ្វីទៅជាសញ្ញា/រោគសញ្ញា ដែលធ្វើអោយអ្នកស្វែងរកការអោយដំបូលថ្នាន ឬការព្យាបាលចំពោះកុមារដែលមានជំងឺរាក? What are signs/symptoms that would cause you to seek advice or treatment for a child's diarrhea? **(សូមជ្រើរើសចំណុចទាំងនោះ:)** **(Select those that apply)**		1. DON'T KNOW អត់ដឹង 2. VOMITIING ក្អួត 3. FEVER ក្រុន 4. DEHYDRATION (DRY MOUTH. THIRSTY, SUNKEN EYES, DECREASE URINE) ខ្សោះជាតិទឹក (មាត់ស្ងួត ស្រេកទឹក ឡើងខ្មៅសងខាងភ្នែក នោមតិចក្លួច) 5. PROLONGED DIARRHEA (14+ DAYS) រាកច្រើនជាងពីរសប្តាហ៍ (១៤ថ្ងៃ) 6. BLOOD/MUCUS IN STOOL ឈាម/ស្លេសជាប់លាមក 7. LOSS OF APPETITE ជាតិបង់ការឃ្លានបាយ 8. WEAKNESS ខ្សោយ 9. OTHER ផ្សេងៗ:

7.10 (56) *[2.1]* *[4.1]*	តើអ្នកធ្វើដូចម្តេចនៅក្នុងក្រុសារអ្នកដើម្បីទប់ស្កាត់កុំអោយកុមាររាក? What can you do in your household to prevent children from getting diarrhea? **(ស្មមធ្ជើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. PRAY TO SPIRITS/ANCESTORS ប្តងសូងដល់ព្រលឹង/ដូនតា 2. COOK FOOD PROPERLY ចំអិនយ៉ាងត្រឹមត្រូវ 3. EAT SOON AFTER COOKING ហូបអាហារបន្ទាប់ពីចំអិនរួច 4. BE CAREFUL WITH FOOD EATEN ប្រុងប្រយ័ត្នក្នុងការហូបអាហារ 5. BOIL DRINKING WATER ទឹកឆ្អិន 6. FILTER DRINKING WATER ទឹកចម្រោះ 7. WASH FRUITS/VEGETABLES WITH CLEAN WATER លាងផ្លែឈើ/បន្លែជាមួយទឹកស្អាត 8. WASH HANDS WITH SOAP AFTER DEFECATION លាងដៃជាមួយនឹងសាប៊ូបន្ទាប់ពីបន្ទោបង់រួច 9. WASH HANDS WITH SOAP AFTER CLEANING CHILD លាងដៃជាមួយសាប៊ូបន្ទាប់ពីដួតទឹកឲ្យក្មួន 10. WATCH HANDS WITH SOAP BEFORE PREPARING FOOD លាងសម្អាតដៃជាមួយនឹងសាប៊ូបន្ទាប់រៀបចំអាហារ 11. CLEAN COOKING UTENSILS សម្អាតថាងម្ងាំងស្អាបព្រា 12. COVER FOOD ក្របម្ហូបអាហារ 13. NOTHING ក្មាន 14. DON'T KNOW អត់ដឹង 15. OTHER ផ្សេងៗ:
7.11 (57) *[4.1]*	តើកូនរបស់អ្នកមានជំងឺរាកកម្រិតណាដែរ? How serious is diarrhea to the health of your child? **(អានជរុម្ងើសទាំងអស់, ធ្ជើសរើសយកតែមួយ)** **(Read all options, check only one)**	1. VERY SERIOUS ធ្ងន់ធ្ងរខ្លាំង 2. QUITE SERIOUS ធ្ងន់ធ្ងរគិចតួច 3. NOT SO SERIOUS មិនជាធ្ងន់ធ្ងរទេ 4. NOT SERIOUS AT ALL មិនធ្ងន់ធ្ងរទាល់តែសោះ 5. DON'T KNOW អត់ដឹង

8 - Child Defecation ការបន្ទោបង់របស់ទារក:

8.1 (58) *[3.1]* *[3.3]*	តើមាននរណាម្នាក់ជួយសម្អាតកុមារបន្ទាប់ពីគេបន្ទោបង់ដែរឬទេ? Does somebody help your child clean after they defecate?	1. YES ជាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង
8.2 (59) *[3.3]*	តើអ្នកប្រើប្រាស់អ្វីក្នុងការសម្អាតកុមារ បន្ទាប់ពីកុមារបន្ទោបង់រួច? What is used to wash your child after they defecate? **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. ONLY HAND ប្រើដៃ ***[go to #61]*** 2. DON'T WASH អត់សម្អាត ***[go to #61]*** 3. DON'T KNOW អត់ដឹង ***[go to #61]*** 4. WATER ទឹក ***[go to #60]*** 5. SOAP AND WATER សាប៊ូនិងទឹក ***[go to #60]*** 6. WIPES/PAPER ក្រដាស់ជូតកូនក្មេង/ក្រដាស់ ***[go to #60]*** 7. DIRT ដី ***[go to #60]*** 8. HAY/LEAVES/GRASS ចំបើង/ស្លឹកឈើ/ស្មៅ ***[go to #60]*** 9. OTHER: ផ្សេងៗ
8.3 (60) *[3.3]*	តើអ្នកបោះចោលវានៅឯណា **[ចម្លើយ #59]**? Where do you dispose **[ANSWER #59]?** **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. THROW IN YARD ចោលនៅទីធ្លាផ្ទះ 2. WASH DOWN LATRINE ចាក់ចូលក្នុងបង្គន់ 3. BURY កប់ 4. BURN ដុតចោល 5. DON'T KNOW អត់ដឹង 6. OTHER ផ្សេងៗ:
8.4 (61)	តើកុមារប្រើខោទឹកនោមដែរឬទេ? Do any of the children use a diaper/cloth?	1. YES ជាទ/ចា ***[go to #63]*** 2. NO ទេ ***[go to #62]*** 3. DON'T KNOW អត់ដឹង
8.5 (62) *[3.3]*	ជាធម្មតា តើក្មេងៗបត់ជើងធំនៅទីណា ពេលនៅផ្ទះ? What is the usual place where young children defecate at home?	1. LATRINE បង្គន់ ***[go to #64]*** 2. POTTY បង្គន់ឆ្នៃ 3. YARD តាមរបង 4. RICE FIELD តាមវាលស្រែ 5. OTHER ក្មេង:

8.6 (63) *[3.3]*	តើ **[ចម្លើយ #61 ឬ #62]** ជោះចោលយ៉ាងដូចម្តេច? How are **[ANSWER FROM #61 or #62]** disposed?	1. PUT INTO LATRINE ដាក់ចូលទៅក្នុងបង្គន់ 2. PUT INTO DRAIN/DITCH ដាក់ចូលក្នុងអន្លង 3. THROWN INTO GARBAGE ចោលក្នុងធុងសំរាម 4. BURIED កប់ 5. LEFT IN OPEN ទុកចោល 6. BURNED ដុតចោល 7. DON'T KNOW អត់ដឹង 8. OTHER ផ្សេងៗ:
8.7 (64) *[2.1]* *[3.3]*	តើអ្នកលាងដៃរបស់អ្នកបន្ទាប់ពីសម្អាតទារកមែនឬ? Do you wash your hands during this process?	1. YES បាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង

9 - Hygiene & Sanitation អនាម័យ & ការធ្វើអនាម័យ:

ឥឡូវនេះយើងមានសំណួរទាក់ទងទៅលើទឹក និង អនាម័យ នៅផ្ទះរបស់អ្នក
Now, we have questions regarding water and sanitation at your home.

9.1 (65) *[2.1]* *[3.3]*	តើអ្នកប្រើសម្ភារៈដែរទេក្នុងការលាងដៃ? Do you use a cleaning agent to wash your hands?	*1.* YES បាទ/ចា ***[go to #66]*** *2.* NO ទេ ***[go to #67]*** 3. DON'T KNOW អត់ដឹង
9.2 (66) *[2.1]* *[3.3]*	តើអ្នកប្រើសម្ភារៈអ្វីខ្លះក្នុងការលាងដៃ? What cleaning agent do you use?	1. SOAP/DETERGENT សាប៊ូដុំ/សាប៊ូដុសខោអាវ 2. ASH/MUD/SAND ផេះ/ភក់/ដីខ្សាច់ 3. NONE ក្មាន 4. OTHER ផ្សេងៗ:
9.3 (67) [3.3] *[4.1]*	តើអ្នកជារឿយៗលាងដៃនៅពេលណា? When do you usually wash your hands? **(សូមរុជើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. WHEN THEY ARE DIRTY នៅពេលវាកខ្វក់ 2. WHEN RETURNING HOME ពេលក្រឡប់ទៅផ្ទះ 3. BEFORE EATING មុនហូបអាហារ 4. AFTER EATING បន្ទាប់ហូបអាហារ 5. AFTER DEFECATION បន្ទាប់បត់ជើងរួច 6. BEFORE GOING TO SLEEP មុនចូលគេង 7. AFTER WAKING UP

		បន្ទាប់ភ្ញាក់ពីដេក 8. AFTER WASHING BABY បន្ទាប់ពីងូតទឹកទារក 9. BEFORE PREPARING FOOD មុនរៀបចំអាហារ 10. OTHER ផ្សេងៗ:
9.4 (68) *[4.1]*	ហេតុអ្វីបានជាអ្នកលាងដៃ? Why should you wash your hands? **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. TO REMOVE DIRT/MAKE CLEAN ដើម្បីជម្រះកខ្វក់/ធ្វើឲ្យស្អាត 2. TO LOOK GOOD មើលទៅស្អាត 3. TO MAKE SMELL GOOD ដើម្បីញញឹមទៅស្អាត 4. TO PREVENT DISEASE ដើម្បីការពារជំងឺ 5. TO REMOVE BACTERIA សម្អាតមេរោគ OTHER ផ្សេងៗ:
9.5 (69) *[3.3]*	តើអ្នកលាងចាន ស្លាបព្រា ពែង ដូចម្តេចដែរ? How do you wash your plates, cups, and silverware? *បញ្ជាក់ឲ្ច្បាស់រឿ ទឹកស្អាត ឬទឹកមិនស្អាត* ***Make sure to specify treated or untreated!*** **(សូមជ្រើរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. RINSE WITH UNTREATED WATER លាងទឹកមិនបានសំអាត 2. RINSE WITH UNTREATED WATER AND SOAP លាងទឹកមិនបានសំអាតនឹងសាប៊ូ 3. RINSE WITH TREATED WATER លាងទឹកដែលបានសំអាត 4. RINSE WITH TREATED WATER WITH SOAP លាងទឹកដែលបានសំអាត ជាមួយសាប៊ូ 5. NOTHING គ្មាន 6. DON'T KNOW អត់ដឹង 7. OTHER ផ្សេងៗ: 8.
9.6 (70) *[2.1]*	តើអ្នកមានបង្គន់ផ្ទាល់ខ្លួនទេ? Do you own a latrine? ប្រសិនបើមាន តើអ្នកមានបង្គន់ប៉ុន្មានឆ្នាំហើយ? *If yes, how many years have you had it?* ប្រសិនបើមិនមាន តើពួកគេបត់ជើងធំនៅទីណា? *If no, where do you defecate?*	1. YES ចាទ/ចា ***[go to #71]*** 2. NO ទេ ***[go to #74]*** 1. LESS THAN 1 2. 1 - 3 3. 4 – 6 4. 7 – 9 5. 10+ 6. DON'T KNOW អត់ដឹង

9.7 (71) **[2.1]** **[3.4]**	តើក្មេងជំទង់ក្នុងក្រសារអ្នក ប្រើបង្គន់សម្រាប់បត់ជើងជំដែរ ឬទេ ក្នុងរដូវវស្សា? Do the adults in your household use the latrine for defecation in the **WET** season: **(អានជម្រើសទាំងអស់, ជ្រើសរើសយកតែមួយ)** **(Read all options, check only one)**	1. ALWAYS ជានិច្ចកាល 2. SOMETIMES ពេលខ្លះ 3. NEVER មិនដែល 4. DON'T KNOW អត់ដឹង
9.8 (72) **[2.1]** **[3.4]**	តើក្មេងជំទង់ក្នុងក្រសារអ្នក ប្រើបង្គន់សម្រាប់បត់ជើងជំដែរ ឬទេ ក្នុងរដូវប្រាំង? Do the adults in your household use the latrine for defecation in the **DRY** season? **(អានជម្រើសទាំងអស់, ជ្រើសរើសយកតែមួយ)** **(Read all options, check only one)**	1. ALWAYS ជានិច្ចកាល 2. SOMETIMES ពេលខ្លះ 3. NEVER មិនដែល 4. DON'T KNOW អត់ដឹង
9.9 (73) ***[2.1]***	តើបង្គន់តឡូវដំណើរការដែរ ឬទេ? Is the latrine functioning now? *ប្រសិនបើមិនដំណើរការ ហេតុអ្វី?* *If no, why not?*	1. YES ចាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង

10 - Water Supply ការផ្គត់ផ្គង់ទឹក:

10.1 (74) ***[2.1]*** ***[3.4]***	តើក្រសារអ្នកយកទឹកសម្រាប់ពិសា មានប្រភពមកពីណា អំឡុងពេលរដូវវស្សា? What is the main source of drinking water during the **WET** season for members of your household?	1. PIPED INTO DWELLING ទឹកម៉ាស៊ីនក្នុងផ្ទះ 2. PIPED INTO PLOT ទឹកម៉ាស៊ីននៅក្រៅផ្ទះ 3. PUBLIC TAP ទឹកម៉ាស៊ីនសាធារណៈ 4. TUBE WELL ទឹកអណ្តូងស្នប់ 5. DUG WELL (PROTECTED) ទឹកអណ្តូងកាឡ (មានម្នាក់ថែរក្សា) 6. DUG WELL (UNPROTECTED) ទឹកអណ្តូងកាឡ (ក្មានម្នាក់ថែរក្សា) 7. WATER FROM SPRING (PROTECTED) ទឹកផុស (មានម្នាថែរក្សា)

	ប្រសិនប្រើអណ្តូងស្នប់ តើសប់ដៃ ឬក៏បូមនឹងម៉ូទ័រ? តើអ្នកមានអណ្តូងនេះរយៈពេលប៉ុន្មានហើយ? If tube well, is it hand or motor pumped? How long have you had this well? ..... 1. LESS THAN 1 YEAR 2. 1 - 3 3. 4 – 6 4. 7 – 9 5. 10+ 6. DON'T KNOW អត់ដឹង	8. WATER FROM SPRING (UNPROTECTED) ទឹកធុស (ក្តានម្តុំថែរក្សា) 9. RAINWATER ទឹកភ្លៀង 10. TANKER TRUCK ឡានដឹកទឹក 11. SURFACE WATER ទឹកស្រះ 12. BOTTLED WATER ទឹកសុទ្ធ 13. OTHER ផ្សេងៗ:
10.2 (75) ***[2.1]*** ***[3.4]***	តើក្រួសារអ្នកយកទឹកសម្រាប់ពិសា មកពីណា អំឡុងពេលរដូវប្រាំង? What is the main source of drinking water during the **DRY** season for members of your household? ប្រសិនប្រើអណ្តូងស្នប់ តើសប់ដៃ ឬក៏បូមនឹងម៉ូទ័រ? តើអ្នកមានអណ្តូងនេះរយៈពេលប៉ុន្មានហើយ? If tube well, is it hand or motor pumped? How long have you had this well? ..... 1. LESS THAN 1 YEAR 2. 1 - 3 3. 4 – 6 4. 7 – 9 5. 10+ 6. DON'T KNOW អត់ដឹង	1. PIPED INTO DWELLING ទឹកម៉ាស៊ីនក្នុងផ្ទះ 2. PIPED INTO PLOT ទឹកម៉ាស៊ីននៅក្រៅផ្ទះ 3. PUBLIC TAP ទឹកម៉ាស៊ីនសាធារណៈ 4. TUBE WELL ទឹកបូមដាក់ធុង 5. DUG WELL (PROTECTED) អណ្តូងកាឡ (មានម្តុំថែរក្សា) 6. DUG WELL (UNPROTECTED) អណ្តូងកាឡ (ក្តានម្តុំថែរក្សា) 7. WATER FROM SPRING (PROTECTED) ទឹកធុស (មានម្តុំថែរក្សា) 8. WATER FROM SPRING (UNPROTECTED) ទឹកធុស (ក្តានម្តុំថែរក្សា) 9. RAINWATER ទឹកភ្លៀង 10. TANKER TRUCK ឡានដឹកទឹក 11. SURFACE WATER ទឹកស្រះ 12. BOTTLED WATER ទឹកសុទ្ធ 13. OTHER ផ្សេងៗ:
10.3 (76) ***[2.1]***	តើអ្នកប្រើវិធីដើម្បីសម្អាតទឹកមុនអ្នកផឹក ដែរឬទេ? Do you do anything to the water before you drink it?	1. YES បាទ/ចា ***[go #77]*** 2. NO ទេ ***[go #79]*** 3. DON'T KNOW អត់ដឹង

10.4 (77) *[2.1]*	*តើអ្នកជាធម្មតាធ្វើដូចម្តេចទៅលើទឹកមុនអ្នកផឹកវា?* What do you usually do to the water before you drink it? **(សូមរង្វិលរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. BOIL ដាំ 2. BLEACH/CHLORINE ទឹកសាវ៉ែល 3. STRAIN THROUGH CLOTH ទឹកចំរោះតើក្រណាត់ 4. USE FILTER (CERAMIC) ធុងចំរោះដីរ 5. USE FILTER (BIOSAND) ធុងចំរោះដី 6. SOLAR ហាលទឹកក្រោមកំដៅថ្ងៃ 7. DON'T KNOW អត់ដឹង 8. OTHER ផ្សេងៗ:
10.5 (78) *[4.1]*	ហេតុអ្វីបានជាអ្នកចំអិនមុនអ្នកផឹកវា? Why do you treat your water before drinking it? **(សូមរង្វិលរើសចំណុចទាំងនោះ)** **(Select those that apply)**	1. CONTAMINATED WITH DIRT ប្ពុកដោយកខ្វក់ 2. CONTAMINATED WITH FECES ប្ពុកដោយលាមក 3. CONTAMINATED WITH BACTERIA ប្ពុកដោយមេរោគ 4. GOOD FOR HEALTH/APPEARANCE ល្អសម្រាប់សុខភាព/រាងកាយ 5. ANIMALS USE WATER ទឹកសត្វលុកលុយ 6. SMELLS BAD ស្អុយ 7. LOOKS BAD មើលទៅកខ្វក់ 8. DON'T KNOW អត់ដឹង 9. INSECTS IN IT សត្វល្អិតក្នុងទឹក 10. SO DON'T GET SICK មិនអោយឈឺ 11. OTHER ផ្សេងៗ:

11 - Possessions and Finance ទ្រព្យសម្បត្តិ និងហិរញ្ញវត្ថុ:

11.1 (79)	តើជាមធ្យមទទួលបានប្រាក់ចំណូលប៉ុន្មានក្នុងមួយខែ? How much is the average monthly household income?	
11.2 (80)	តើគ្រួសារអ្នកមានដីស្រែ ឬទេ? Does your household own agricultural land? *ប្រសិនបើមាន តើគ្រួសារអ្នកមានដីប៉ុន្មានហិកា?* *If yes, how many hectares of agricultural land do members of this household own?*	1. YES បាទ/ចា 2. NO ទេ 3. DON'T KNOW អត់ដឹង AREA ផ្ទៃដី:

11.3 (81)	តើគ្រួសារអ្នក ត្រូវកំណត់ជាគ្រួសារក្រីក្រ ដោយទទួលបាន ប័ណ្ណមនុស្សធ៌ម (EC) ឬ ប័ណ្ណអទិភាពពិសេស (PAC) ឬទេ? Has this household been identified as poor through the identification of poor households process conducted by village representatives and been placed on the List of Poor Households or received an Equity Card (EC) or Priority Access Card (PAC)?	1. YES EC បាទ/ចា ប័ណ្ណមនុស្សធ៌ម 2. YES PAC បាទ/ចា ប័ណ្ណអទិភាពពិសេស 3. NO ទេ 4. DON'T KNOW អត់ដឹង

12 - Health Contacts ទាក់ទងសុខភាព:

12.1 (82)	តើអ្នកជារឿយៗទទួលបានព័ត៌មាន ឬការទូន្មានអំពីសុខភាព នៅទីណា? Where do you usually get information or advice about health? **(សូមជ្រើរើសចំណុចទាំងនោះ:)** **(Select those that apply)**	1. NO ONE គ្មាននរណាទេ 2. DOCTOR (PUBLIC HOSPITAL) គ្រូពេទ្យ (ពេទ្យបង្អែក) 3. DOCTOR (HEALTH CENTER) គ្រូពេទ្យ (មណ្ឌលសុខភាព) 4. MEDICAL ASSISTANT (PUBLIC) ជំនួយការពេទ្យ (រដ្ឋ) 5. NURSE (PUBLIC) គិលានុបដ្ឋាក គិលានុបដ្ឋាយិកា (រដ្ឋ) 6. MIDWIFE (PUBLIC) ពេទ្យឆ្មប (រដ្ឋ) 7. TRADITIONAL BIRTH ATTENDANT ឆ្មបបុរាណ 8. VILLAGE HEALTH VOLUNTEER ពេទ្យអ្នកស្ម័គ្រចិត្តភូមិ 9. VILLAGE COMMITTEE MEMBER ក្រុមប្រឹក្សាឃុំ 10. PRIVATE DOCTOR/CLINIC ពេទ្យ/ឃ្លីនិចឯកជន 11. PRIVATE PHARMACIST អ្នកលក់ថ្នាំជាម៉ាស៊ី 12. HUSBAND ប្តី 13. MOTHER/MOTHER IN-LAW ម្តាយ/ម្តាយក្មេក 14. SISTER បងប្អូនស្រី 15. BROTHER បងប្អូនប្រុស 16. GRANDPARENT យាយតា 17. AUNT មីង 18. UNCLE ពូ 19. FRIEND/NEIGHBOR មិត្តភក្តិ/អ្នកជិតខាង 20. TRADITIONAL HEALER គ្រូខ្មែរ 21. VILLAGE ELDER មនុស្សចាស់ប្រចាំភូមិ 22. RADIO វិទ្យុ 23. NEWSPAPER ការសែក 24. TELEVISION ទូរទស្សន៍ 25. INTERNET អ៊ិនធឺណិត

END OF SURVEY

INTERVIEW for Under-five Primary Caregivers
University of South Florida / Peace Corps Cambodia

Household ID:
Village:
Commune:
Participant ID:

|

Total number of people living at residence: ……
Number of < 5 children living at residence: ……

Interview Information:

Interview Date	
Interview Time	
Length of Interview	
Team Present	

Eligibility:

ID#	AGE 18+	LIVE AT HOUSE	GOOD HEALTH	PRIMARY CAREGIVER FOR CHILD < 5	SEX	RELATION TO YOUNGEST CHILD	RELATION TO HEAD OF HOUSEHOLD	HEAD OF HOUSEHOLD
	..... ☐	☐	☐	☐				☐
	..... ☐	☐	☐	☐				☐

NOTES:

Interview Guide for CAREGIVER សេចក្តីណែនាំ សម្រាប់អ្នកមើលថែទាំកុមារ:
ជាទ អនុញ្ញាតសុំចាប់ផ្តើមសួរសំណួរងាយៗ ខ្លះៗអំពីខ្លួនអ្នក។ សូមនិយាយឲ្យច្បាស់ៗ ហើយយឺតៗ ដើម្បីប្រាកដថា យើងអាចស្តាប់បានផ្ទុរអ្វីគ្រប់យ៉ាងដែលអ្នកនិយាយ។
Okay, let's start by asking a few short questions about yourself. Please speak clear and slow to make sure we can understand everything you are saying.

Basic Background ជីវប្រវត្តិ:

1. តើអ្នកមានអាយុប៉ុន្មាន? កត់សម្គាល់ពីភេទអ្នកចូលរួម
   How old are you? *Note the sex of the participant*
2. តើអ្នកមានមុខរបរអ្វី?
   What is your occupation?
3. តើអ្នករៀនដល់ណាដែរ?
   What is your education?
4. តើកុមារពៅគេបង្អស់នៅក្នុងផ្ទះនេះអាយុប៉ុន្មាន? កត់សម្គាល់ភេទ?
   How old is the youngest child at this house? *Note the sex of the child*
5. តើអ្នកត្រូវជាអ្វីនឹងកុមារនេះ?
   What is your relation to the youngest child?

Open Ended Questions សំណួរបើក:
ឥឡូវនេះខ្ញុំសូមសួរអ្នក ពីរ បីសំណួរ។ សូមគាំងអារម្មណ៍ធម្មតា តាមតែអាចធ្វើបាន និងសួរបញ្ជាក់ប្រសិនបើសំណួរមិនច្បាស់។ ប្រសិនបើមានសំណួរណាដែលអ្នកមិនចង់ឆ្លើយ សូមប្រាប់ខ្ញុំ យើងអាចបញ្ចប់ការផ្ញើសំភាសន៍ នៅពេលណាមួយដែលអ្នកចង់បញ្ចប់។

Now I have a few questions to ask you. Please feel free to elaborate as much as you can and ask for clarification if needed. If there is a question you do not want to answer, please let me know.

6. ខ្ញុំចាប់អារម្មណ៍ទៅលើសកម្មភាព អ្នកនិងក្រុសារអ្នកធ្វើអ្វីជារៀងរាល់ថ្ងៃ។ តើអ្នកអាចប្រាប់ពីមុខរបរ និងសកម្មភាពក្នុងផ្ទះនិងក្រៅផ្ទះ ដែលអ្នក និងក្រុសារអ្នកធ្វើក្នុងអំឡុងពេលរដូវវស្សាបានទេ? ចុះចំណែករដូវប្រាំងវិញ ដូចម្តេចដែរ?
   I am interested in what you and your family do every day. Can you talk about the jobs and activities you and your family members participate in inside and outside the home during the wet season? How about the dry season?

   ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned guide to:
   - ការងារ : ការងារអ្វី នរណារធ្វើ ពេលណា ខែណា? (សមាជិកក្រុសា ការងារ)
     Jobs: Who is doing what job and what time of the day and year
   - សកម្មភាពប្រចាំថ្ងៃ : ការងារអ្វី នរណារធ្វើ ពេលណា ខែណា?
     (ការថែទាំកុមារ ការចំអិន ការសម្អាត ។ល។)
     Daily activities: Who does what activities and when (childcare, cooking, cleaning, etc.)
   - ការងារកសិកម្ម : សកម្មភាពអ្វីខ្លះ នរណាជាអ្នកធ្វើ នៅពេលណា?
     ឧ. (ការដាំស្រូវ ដំណាំផ្សេងៗ ការចិញ្ចឹមសត្វ ។ល។)
     Agriculture work: Who does what activities and when. Examples (rice growing, other crops, raising animals, etc.)

- ភាពលំបាក : ភាពលំបាកក្នុងរដូវប្រាំង និង រដូវវស្សា?
  ឧ. (ជំងឺ ការធ្វើដំណើរ ភាពរាំងស្ងួត ទឹកជំនន់ ។ល។)
  Challenges/Difficulties: In wet and dry season. Examples (illnesses, travel, drought, flooding etc.)

7. តើសកម្មភាពដែលពណ៌នានៅចំណុចខាងលើ ប៉ះពាល់ដល់ការមើលថែទាំកុមារដូចម្តេចដែរ?
   How do the activities described in the previous question affect your childcare behavior?

   ប្រសិនបើមិន ជួលទៅការណែនាំ If not mentioned guide to:
   - អ្នកថែទាំ : តើនរណាជាអ្នកជួយមើលថែទាំកុមារ ហើយនៅពេលណា? តើមានការប៉ះពាល់ ដល់ការចិញ្ចឹម ការបៅដោះ ការលាងសម្អាតខ្លួន ។ល។
     Caregiver: Who helps take care of children and when. How does this effect feeding, breastfeeding, hygiene, etc.
8. សូមប្រាប់ខ្ញុំអំពីបទពិសោធន៍របស់អ្នកក្នុងការមើលថែទាំកុមារ។ តើអ្នកអាចពន្យល់អំពីខ្លួនអ្នក និងកូនរបស់អ្នក នៅថ្ងៃជាធម្មតាបានទេ?
   Tell me about your experiences in taking care of your child. Could you explain the typical day for you and your child?

   ប្រសិនបើមិន ជួលទៅការណែនាំ If not mentioned guide to:
   - សកម្មភាពចិញ្ចឹម : តើអាហារអ្វី និងទឹកប្រភេទដូចម្តេច ចំអិន/ធ្វើយ៉ាងដូចម្តេច?
     ការរក្សាទុកអាហារក្នុងផ្ទះ/ ក្រៅផ្ទះ?
     Feeding practices: What foods and fluids and how are they prepared. Keep in mind food from outside the house
   - ការរបន្ទោរបង់ : កុមាររបន្ទោរបង់នៅទីណា? ជោះចោលយ៉ាងម៉េច? លាងយ៉ាងដូចម្តេច?
     Defecation: Where is the child defecating and how is it cleaned and disposed
   - ការអនុវត្តន៍លាងសម្អាតខ្លួន : តើលាងដៃទេ? លាងនៅពេលណា? ហេតុអ្វី?
     Hygiene practices: Are they washing their hands, when, and why
   - ចំណុចប្រឈម : ការថែរក្សាកុមារ ប្រចាំថ្ងៃ?
     Challenges: In caring for child on a daily basis

9. តើអ្នកស្គាល់ពីជំងឺរាកទេ? តើវាជាអ្វី? តើអ្នកអាចកំណត់ជំងឺរាកបានយ៉ាងដូចម្តេច?
Are you familiar with the term diarrhea? What is it? And how would you describe it in your child?

ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned:

- **ប្រភេទ:** តើអ្នកស្គាល់ប្រភេទឌុសគ្នាទេ ហើយដឹងពីកម្រិតធ្ងន់ធ្ងរដែរឬទេ?
  Types: Different names, types, or known levels of severity
- **បណ្តាលមកពី** : អ្វីបណ្តាលឱ្យកុមាររាក? ហេតុអ្វី?
  Causes: What causes the diarrhea and why
- **រោគសញ្ញា** : តើមានរោគសញ្ញាដូចម្តេច?
  Symptoms: What are the symptoms
- **ភាពតានតឹងនៃរោគសញ្ញា** : តើករណីធ្ងន់ធ្ងរ មានរោគសញ្ញាអ្វីខ្លះ? ហេតុអ្វីបានជាវាធ្ងន់ធ្ងរជាង? តើអ្នកដឹងបានដោយរបៀបណា?
  Severity: What about more severe symptoms, why they are more severe and how do they know
- រដូវ : តើមានទំនាក់ទំនងរវាងជំងឺ និងរដូវទេ?
  Seasons: Is there a relationship with diarrhea and the seasons

10. តើអ្នកអាចប្រាប់ អ្នកធ្វើដូចម្តេច នៅពេលកូនអ្នកមានជំងឺរាក?
Can you explain what you do when your child has diarrhea?

ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned:

- តើអាហារ និងទឹក : ផ្តល់អាហារអ្វីខ្លះ? ហើយនៅពេលណា?
- *Foods and fluids: What and when they give them*
- ការព្យាបាល : ព្យាបាលយ៉ាងដូចម្តេច? ហេតុអ្វី? ការព្យាបាលនេះជួយបានកម្រិតណាដែរ?
  Treatments: What and why. How does the treatment help.
- ការស្វែងរកដំបូលន្ទាន : ជានមកពីណា ? ហេតុអ្វីចូលចិត្តកន្លែងនោះ ឬ អ្នកព្យាបាលនោះ?
  Seek advice: From where and why is this place/person preferred
- ការការពារ : របៀបការការពារជំងឺរាកលើកុមារ?
  Prevention: Ways to prevent diarrhea in children
- ភាពលំបាក : តើមានភាពលំបាកខ្លះក្នុងការព្យាបាលកុមាររាក? ហេតុអ្វី?
  Difficulties: what are difficulties in treating childhood diarrhea. Why?

11. តើអ្វីជាការព្រួយបារម្ភណ៍ខ្លាំងបំផុត ទាក់ទងទៅលើសុខភាពកុមារ?
What are you most concerned about as it relates to your child's health?

INTERVIEW for Health Providers Located in Study Area
University of South Florida / Peace Corps Cambodia

Village:
Commune:
Participant ID:

Total number of people living at residence: ……..
Number of < 5 children living at residence: ……..

Interview Information:

Interview Date	
Interview Time	
Length of Interview	
Team Present	

Eligibility:

ID#	AGE 18+	GOOD HEALTH	HEALTH CARE PROVDER	SEX	OCCUPATION	HOUSE LOCATION	OFFICE LOCATION
	…… ☐	☐	☐				
	…… ☐	☐	☐				

NOTES:

Interview Guide for HEALTH PROVIDER សេចក្តីណែនាំ សម្រាប់អ្នកផ្តល់សេវាសុខភាព:
បាទ អនុញ្ញាតសុំចាប់ផ្តើមសួរសំណួរងាយៗ ខ្លះៗអំពីខ្លួនអ្នក។ សូមនិយាយឱ្យច្បាស់ៗ ហើយយឺតៗ ដើម្បីយើងអាចស្តាប់បានន្ទូវអ្វីគ្រប់យ៉ាងដែលអ្នកនិយាយ។ សូមម្តងទៀត សូមប្រាប់ខ្ញុំ ប្រសិនបើចំណុចណាមួយដែលអ្នកចង់បញ្ចប់ការស្ទាបស្ទង់នេះ។
Okay, let's start by asking a few short questions about yourself. Please speak clear and slow to make sure we can understand everything you are saying. Again, let us know if at any point you would like to end the interview.

Basic Background ជីវប្រវត្តិ:

1. តើអ្នកមានអាយុប៉ុន្មាន? កត់សម្គាល់ពីភេទអ្នកចូលរួម
   How old are you? *Note the sex of the participant*
2. តើអ្នកមានមុខរបរអ្វី?
   What is your occupation?
3. តើអ្នកទទួលការបណ្តុះបណ្តាល មុខរបរនេះនៅឯណា ?
   Where did you train for this occupation?
4. តើផ្ទះ និងកន្លែងធ្វើអ្នកនៅទីណា?
   What village is your home and office located?
5. តើអ្នកជារឿយៗជួបអ្នកជំងឺប៉ុន្មាននាក់ ជារៀងរាល់ថ្ងៃ?
   How many patients do you usually see each day?
6. តើជំងឺធម្មតាអ្វីខ្លះ ដែលកុមាររអាយុក្រោម៥ឆ្នាំកើត?
   What are the most common illnesses you treat in children under 5?

Open Ended Questions សំណួរបើក:
ឥឡូវនេះខ្ញុំសូមសួរអ្នក ពីរ បីសំណួរ។ សូមធ្វើអារម្មណ៍តាមធម្មតា និងសួរបញ្ជាក់ប្រសិនបើសំណួរណាមួយមិនច្បាស់។ ប្រសិនបើមានសំណួរដែលអ្នកមិនចង់ឆ្លើយ សូមប្រាប់ខ្ញុំ។
Now I have a few questions to ask you. Please feel free to elaborate as much as you can and ask for clarification if needed. If there is a question you do not want to answer, please let me know.

7. តើអ្នកអាចប្រាប់ពីមុខរបរ និងសកម្មភាព ដែលប្រជាពលរដ្ឋក្នុងសហគមន៍ ធ្វើនៅផ្ទះ និងនៅក្រៅផ្ទះ ក្នុងអឡុងពេលរដូវវស្សាបានទេ? ចុះចំណែកក្នុងរដូវប្រាំងវិញយ៉ាងម៉េចដែរ?
   Can you talk about the types of jobs and activities community members participate in inside and outside the home during the wet season? How about the dry season?

   ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned guide to:
   - មុខរបរ : មុខរបរធម្មតាដែលប្រជាពលរដ្ឋតែងតែធ្វើ?
     Jobs: Most common jobs that people have
   - សកម្មភាពប្រចាំថ្ងៃ : តើប្រភេទសកម្មភាពអ្វីខ្លះ ហើយនរណាធ្វើវា?
     (ការថែរក្សាកុមារ ការចំអិន ការសម្អាត ។ល។)
     Daily activities: What typical activities and who does them (childcare, cooking, cleaning, etc.)
   - ការងារកសិកម្ម : សកម្មភាពអ្វីខ្លះ នរណារធ្វើ ហើយនៅពេលណា?
     (ដាំដុះស្រូវ ដំណាំផ្សេងៗ ការចិញ្ចឹមសត្វ ។ល។)

Agriculture work: Who does what activities and when. Examples (rice growing, other crops, raising animals, etc.)

- ចំណុចប្រឈម/ភាពលំបាក : នៅក្នុងរដូវវស្សា និងរដូវប្រាំង (ជំងឺ ការធ្វើដំណើរ ភាពរាំងស្ងួត ទឹកជំនន់ ។ល។)
  Challenges/Difficulties: In wet and dry season. Examples (illnesses, travel, drought, flooding etc.)

8. តើសកម្មភាពដែលបានរៀបរាប់ដូចខាងលើ អាចប៉ះពាល់ដល់ការមើលថែទាំកុមារដូចម្តេចដែរ?
   How do the activities described in the previous question affect childcare behavior?

   ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned guide to:

   - អ្នកមើលថែទាំកុមារ : តើនរណាជាអ្នកជួយមើលថែទាំកុមារ ហើយនៅពេលណា?
     តើទាំងនេះអាចប៉ះពាល់ទៅលើការចិញ្ចឹម ការបៅដោះ និងការថែទាំយ៉ាងដូចម្តេចដែរ?
     Caregiver: Who helps take care of children and when. How does this effect feeding, breastfeeding, hygiene, etc.

9. សូមប្រាប់ខ្ញុំអំពីសកម្មភាពថែទាំរបស់ម្តាយ នៅក្នុងតំបន់នេះ? តើអ្វីដែលអ្នកថែកុមារកំពុងប្រព្រឹត្តខុស/ប្រព្រឹត្តត្រូវ ពេលដែលពួកគេកំពុងមើលថែទាំកុមារ?
   Tell me about caregiving behaviors of mothers in this area? What are caregivers typically doing correctly and incorrectly when taking care of their young children?

   ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned guide to:

   - សកម្មភាពថែទាំ : តើអាហារអ្វី និងទឹកប្រភេទដូចម្តេច ហើយពួកគេចំអិនដូចម្តេចដូចម្តេចដែរ? អាហារក្រៅផ្ទះ?
     Feeding practices: What foods and fluids and how are they prepared. Keep in mind food from outside the house
   - ការបន្ទោរបង់ : តើកុមារបន្ទោរបង់នៅកន្លែងណា ហើយលាងសម្អាត/ជោះចោលដូចម្តេចដែរ?
     Defecation: Where are children defecating and how is it cleaned and disposed
   - ការអនុវត្តន៍លាងសម្អាតខ្លួន : តើកុមារលាងសម្អាតដៃឬទេ នៅពេលណា ហើយមូលហេតុអ្វី?
     Hygiene practices: Are they washing their hands, when, and why
   - ចំណុចប្រឈម : ចុះការមើលថែទាំកុមារ ប្រចាំថ្ងៃ?
     Challenges: In caring for child on a daily basis

10. តើយើងអាចនិយាយពីជំងឺរាកបានទេ? តើអ្នកអាចកំណត់ពីជំងឺរាកលើកុមារបានយ៉ាងដូចម្តេច?
Could we discuss diarrhea? How would you describe the illness in children?

ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned:

- **ប្រភេទ:** តើអ្នកស្គាល់ប្រភេទឌុសគ្នាទេ ហើយដឹងពីកម្រិតធ្ងន់ធ្ងរដែរឬទេ?
  Types: Different names, types, or known levels of severity
- **បណ្តាលមកពី :** តើអ្វីដែលបណ្តាលឱ្យរាក ហើយមូលហេតុអ្វី?
  Causes: What causes the diarrhea and why
- **រោគសញ្ញា :** តើអ្វីទៅជារោគសញ្ញាធម្មតានៃជំងឺនេះ?
  Symptoms: Common symptoms of the illness
- **ភាពតានតឹងនៃរោគសញ្ញា** : តើពួកគេដឹងថា វាជាករណីធ្ងន់ធ្ងរដោយរបៀបណាទៅ? ហេតុអ្វីបានជាធ្ងន់ធ្ងរ? ហើយអ្នកដឹងដោយរបៀបណា?
  Severity: What about more severe symptoms, why they are more severe and how do they know
- តើសហគមន៍គិតថា អ្វីទៅជាការភាន់ច្រឡំ បណ្តាលឱ្យកុមាររាក?
  What are common misconceptions community members have about childhood diarrhea
- រដូវ : តើមានទំនាក់ទំនងរវាងជំងឺរាក និងរដូវទេ?
  Seasons: Is there a relationship with diarrhea and the seasons

11. តើអ្នកសុំឱ្យអ្នកថែទាំកុមារធ្វើអ្វីខ្លះ នៅពេលកូនរបស់ពួកគាត់មានជំងឺរាក?
What do you suggest caregivers do when their child has diarrhea?

ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned:

- អាហារ និងទឹក : អាហារអ្វី ប្រភេទទឹកដូចម្តេច? នៅពេលណា?
  Foods & fluids: What and when
- ការព្យាបាល : តើរោគសញ្ញាប្រភេទណា ហើយប្រើវិធីព្យាបាលដូចម្តេច?
  Treatments: which treatments and for what symptoms
- ហេតុអ្វីបានជាគេប្រើ ឬចូលចិត្តប្រើការព្យាបាលទាំងនេះ?
  Why are these treatments used or preferred
- ការការពារ : របៀបការពារកុំឱ្យកុមាររាក
  Prevention: Ways to prevent diarrhea in children

12. តើអ្នកមើលថែទាំកុមារជារឿយៗធ្វើអ្វីខ្លះពេលកូនពួកគាត់រាក?
What do caregivers usually do when their child has diarrhea?

ប្រសិនបើមិន ចូលទៅការណែនាំ If not mentioned:

- អាហារ និងទឹក : អាហារ ទឹកអ្វី ? ហើយនៅពេលណា?
  Foods & fluids: What and when
- ការព្យាបាល : រោគសញ្ញាប្រភេទណា ហើយប្រើវិធីព្យាបាលដូចម្តេច?
  Treatments: which treatments and for what symptoms. Where do they go
- ហេតុអ្វីបានជាគេប្រើ ឬចូលចិត្តប្រើការព្យាបាលទាំងនេះ?
  Why are these treatments used or preferred

- ភាពលំបាក : ប្រជាពលរដ្ឋក្នុងសហគមន៍ មានការព្យាបាល ឬការការពារដែរ ឬទេ? ហេតុអ្វី?
  Difficulties: Community member have in treating or preventing it? Why?

13. តើអ្នកបានធ្វើការនៅទីនេះរយៈពេលប៉ុន្មានហើយ? តើបញ្ហាដែលទាក់ទងទៅនឹងសុខភាពកុមារបានផ្លាស់ប្តូរយ៉ាងដូចម្តេចដែរ? ហេតុអ្វីបានជាអ្នកគិតថាវាមានការផ្លាស់ប្តូរ?
How long have you been working in this area? How have issues related to child health changed over that time? Why do you think it has changed?

ប្រសិនបើមិន ជួលទៅការណែនាំ If not mentioned:
- ចុះចំណែកកុមាររាក និងកង្វះអាហាររូបត្ថម ដូចម្តេចដែរ?
  What about child diarrhea and malnutrition

14. តើអ្វីជាការព្រួយបារម្ភណ៍ខ្លាំងបំផុត ទាក់ទងទៅលើសុខភាពកុមារនៅក្នុងតំបន់នេះ?
What are you most concerned about relating to children's health in this area?

HOUSEHOLD OBSERVATION for Under-five Primary Caregivers during Survey/Interview
University of South Florida / Peace Corps Cambodia

Household ID:
Village:
Commune:
Participant ID:

Total number of people living at residence: ……
Number of < 5 children living at residence: ……

Interview Information:

Date	
Start and End Time	
Team Present	

Eligibility:

ID#	AGE 18+	LIVE AT HOUSE	GOOD HEALTH	PRIMARY CAREGIVER FOR CHILD < 5	SEX	RELATION TO YOUNGEST CHILD	RELATION TO HEAD OF HOUSEHOLD	HEAD OF HOUSEHOLD
	..... ☐	☐	☐	☐				☐
	..... ☐	☐	☐	☐				☐
	..... ☐	☐	☐	☐				☐

NOTES:

Observations when interview is taking place:

11.4	What kind of shelter walls does the house have on the main living floor?	1. CONCRETE/BRICK 2. GALVANIZED STEEL 3. WOOD 4. PALM/BAMBOO/THATCH 5. STONE WITH MUD/CEMENT 6. SALVAGED MATERIALS 7. NO WALLS 8. OTHER:
11.5	What kind of roof does the house have?	1. CONCRETE/BRICK 2. GALVANIZED STEEL 3. WOOD 4. PALM/BAMBOO/THATCH 5. STONE WITH MUD/CEMENT 6. SALVAGED MATERIALS 7. TILES 8. PLASTIC SHEET 9. OTHER:
11.6	What type of electricity does the house have?	1. GRID POWER 2. GENERATOR 3. SOLAR 4. BIOGAS 5. NONE 6. OTHER:
11.7	Which of the following does the home own?	1. MOTORBIKE 2. CAR 3. TELEVISION 4. FLAT SCREEN TELEVISION 5. RADIO 6. COMPUTER 7. SMART PHONE 8. TABLET 9. TRACTOR
11.8	The floor in the main living area is made of:	1. DIRT 2. GRAVEL 3. CONCRETE 4. TILE 5. OTHER
11.9 ***[3.4]***	What type of livestock do they own?	1. COW 2. PIG 3. BUFFALO 4. CHICKENS 5. DUCKS 6. NONE 7. OTHER:

9.10 ***[2.1]***	Are livestock animals allowed in this main living area/eating area? *If yes, which animals?*	1. YES 2. NO 3. DON'T KNOW

- ***Common area:*** *(Note cleanliness, animals, how areas are cleaned)*

- ***Family Member Activities:*** *(locations and activities of other family members during visit, food eaten)*

Latrine Area:

11.10	What type of latrine do they have?	1. POUR FLUSH 2. PIT 3. VIP PIT 4. COMPOSTING 5. DON'T KNOW 6. OTHER:
11.11	Where is the latrine located? *If outside, approximately how far?*	1. INSIDE THE HOUSE 2. OUTSIDE THE HOUSE
11.12	What is the superstructure of the latrine made from?	1. CONCRETE/BRICK 2. GALVANIZED STEEL 3. WOOD 4. PALM/BAMBOO/THATCH 5. STONE WITH MUD/CEMENT 6. SALVAGED MATERIALS 7. NO WALLS 8. OTHER:
10.6 ***[2.1]***	តើអ្នកយកទឹកទៅបន្ទប់ទឹក ដោយរបៀបណា? How do they get water to the latrine?	1. CARRIED ដូចដៃ 2. PUMPED ម៉ូម 3. DON'T HAVE CISTERN អត់មានអាងទឹក 4. DON'T KNOW អត់ដឹង 5. OTHER ផ្សេងៗ
9.11 ***[2.1]***	Is there a cleaning agent in the latrine for washing hands?	1. YES, SOAP/DETERGENT 2. YES, ASH/MUD/SAND 3. NONE

- ***Latrine/place where family defecates and showers**: (Note cleanliness, how area is cleaned, whether there is water)*

Kitchen Area:

11.14	Where is the kitchen located? If outside, approximately how far?	1. INSIDE THE HOUSE 2. OUTSIDE THE HOUSE
11.15	The floor in the kitchen is made of:	1. DIRT 2. GRAVEL 3. CONCRETE 4. TILE 5. OTHER
9.12 ***[2.1]***	Are livestock animals allowed in the kitchen area? *If yes, which animals?*	1. YES 2. NO 3. DON'T KNOW
9.13 ***[2.1]***	Where do they store plates?	1. IN A CUPBOARD 2. UNCOVERED 3. COVERED 4. OTHER
9.14 ***[2.1]***	Where do they store silverware?	1. IN A CUPBOARD 2. UNCOVERED 3. COVERED 4. OTHER
9.15 ***[2.1]***	Where do they store cups?	1. IN A CUPBOARD 2. UNCOVERED 3. COVERED 4. OTHER
9.16 ***[2.1]*** ***[3.3]***	Where do they store baby bottles?	1. IN A CUPBOARD 2. UNCOVERED 3. COVERED 4. DON'T HAVE 5. OTHER
9.17 ***[2.1]***	តើអ្នកគ្រួសារក្បាទុកអាហារដែលសល់នៅទីណា? How do they store leftover food?	1. IN A CUPBOARD 2. UNCOVERED 3. COVERED 4. OTHER

9.18 ***[2.1]***	Is there a cleaning agent in the kitchen for washing?	1. YES, SOAP/DETERGENT 2. YES, ASH/MUD/SAND 3. NONE

- ***Kitchen area****: (Note cleanliness, soap, silverware, plate and glass storage, food storage, animals, cutting board, how areas are cleaned, type of stove used*

Water treatment:

10.7	Where is the water source located?	1. IN DWELLING ក្នុងផ្ទះ 2. IN YARD ក្នុងបរិវេនផ្ទះ 3. OTHER ផ្សេងៗ:
9.19 ***[2.1]***	How is the water stored after it is treated? *What type of container and how often is it cleaned?*	1. CONTAINER (COVERED) 2. CONTAINER (NOT COVERED) 3. NOT STORED 4. DON'T KNOW 5. OTHER

- ***Drinking water treatment****: (Note cleanliness, whether functioning properly, storage)*

Solid Waste Disposal Area:

8.8 ***[2.1]*** ***[3.3]***	Are baby diapers seen on the ground?	1. YES 2. NO
8.8 ***[2.1]*** ***[3.3]***	What do they do with their diapers?	1. OPEN PIT ទុកចូលក្នុងរណ្តៅ 2. CLOSED PIT កប់ក្នុងរណ្តៅ 3. ANYWHERE ចោះចោលពាសកាល 4. PILE IN ONE PLACE ទុកមួយកន្លែង 5. BURN ដុត 6. DON'T HAVE 7. OTHER ផ្សេងៗ:
9.20 ***[2.1]***	តើអ្នកធ្វើដូចម្តេចចំពោះ សំរាម? What do they do with their garbage?	1. OPEN PIT ទុកចូលក្នុងរណ្តៅ 2. CLOSED PIT កប់ក្នុងរណ្តៅ 3. ANYWHERE ចោះចោលពាសកាល 4. PILE IN ONE PLACE ទុកមួយកន្លែង 5. BURN ដុត 6. OTHER ផ្សេងៗ:

- ***Solid waste disposal method*** *(method used, where is area located)*

APPENDIX E: BAR CHARTS OF STATISTICALLY SIGNIFICANT RESULTS

Bar charts present the response rates to the participants scores for personal hygiene knowledge and practice, food hygiene knowledge and practice, and environmental hygiene knowledge and practice. Displayed below are the charts which represent the statistical significant results from Table 21. Charts were produced in SPSS statistical analysis software (version 25)

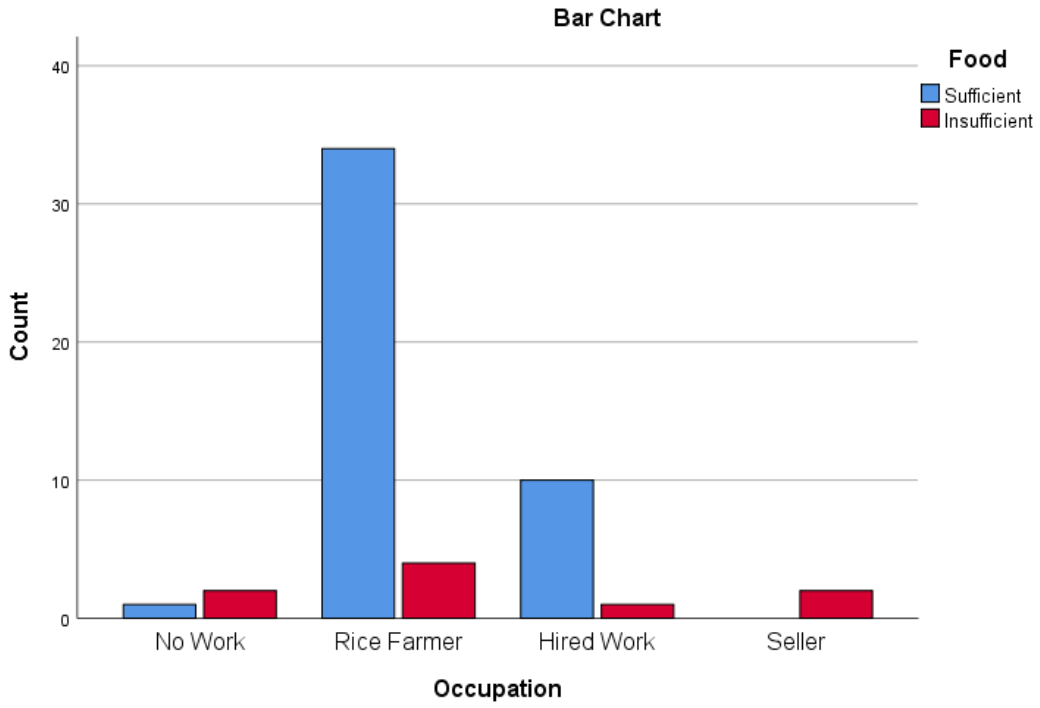

Figure E1: Results from Chi-squared test for independence, village and environmental hygiene knowledge and practice

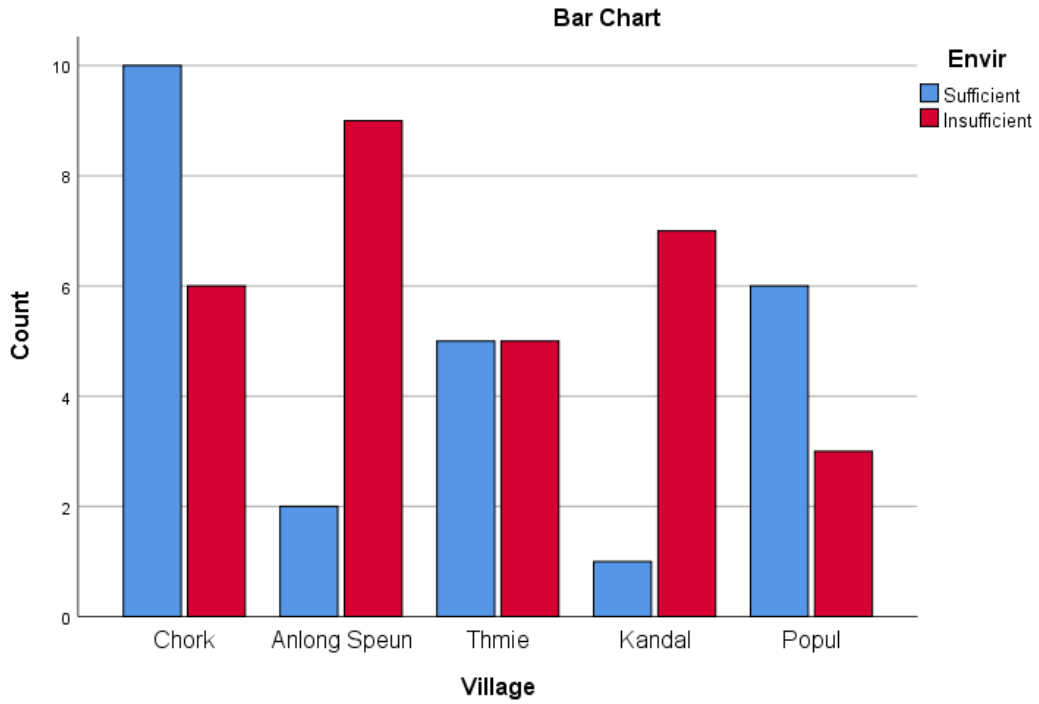

Figure E2: Results from Chi-squared test for independence, occupation and food hygiene knowledge and practice

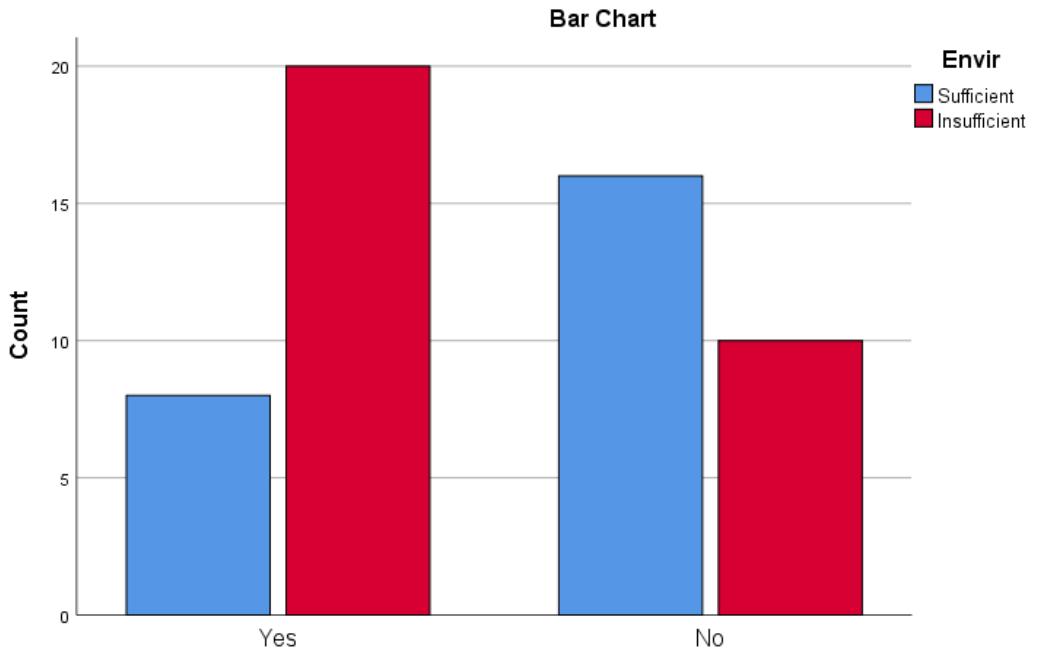

Figure E3: Results from Chi-squared test for independence, mother migrating to work and environmental hygiene knowledge and practice

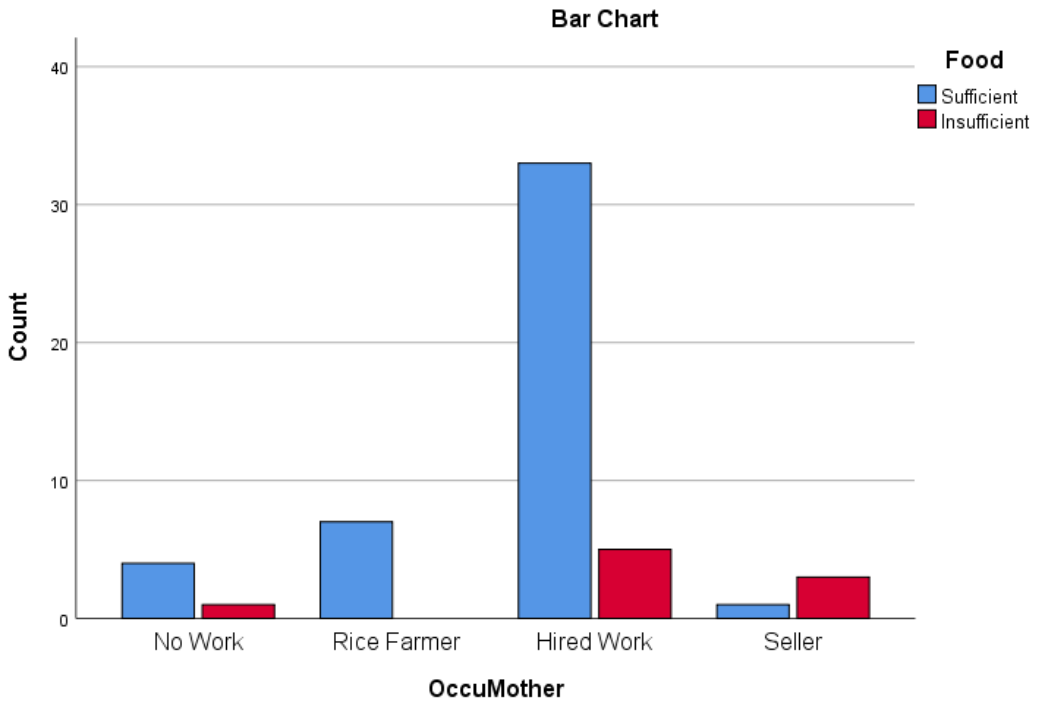

Figure E4: Results from Chi-squared test for independence, mother's occupation and food hygiene knowledge and practice