Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Rosalyn Rush Date

Excreta Disposal and Hygiene Practices Following Child Defecation among Peri-Urban Households in Western Kenya

By

Rosalyn Rush
MPH

Department of Global Health

_____

Robert Dreibelbis, MPH
Committee Chair

_____

Richard Rheingans, PhD
Committee Member

Excreta Disposal and Hygiene Practices Following Child Defecation among Peri-Urban Households in Western Kenya

By

Rosalyn Rush

Bachelor of Science
The University of Texas at Austin
2008

Thesis Committee Chair: Robert Dreibelbis, MPH

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Health
2011

Abstract

Excreta Disposal and Hygiene Practices Following Child Defecation among Peri-Urban Households in Western Kenya

By Rosalyn Rush

Background: Diarrhea is one of the leading causes of childhood morbidity and mortality in Kenya. The World Health Organization has identified the safe disposal of feces and handwashing as two key behaviors that could result in significant reductions in diarrheal disease. In order to successfully promote these behaviors, it is first essential to understand the local practices and contextual factors that might act as barriers and enablers of change.

Objective: This study examines child excreta disposal practices and associated hygiene practices among peri-urban caretakers of children under the age of two. In addition, this study explores the barriers to and facilitators of safe excreta disposal and hygiene-related practices of caretakers at the household level.

Methods: Semi-structured observations were conducted in 30 compounds to document key hygiene behaviors of caretakers and household latrine conditions. A short hygiene questionnaire was administered to each caretaker under observation. Three focus group discussions were conducted with different caretakers to identify beliefs, motivations, and barriers relevant to stool disposal and associated hygiene practices.

Results: Observation data reveal a wide range of defecation sites, cleaning methods, disposal sites, handwashing practices, and latrine conditions in the peri-urban community. Comparison of observed and reported behaviors shows poor agreement for feces disposal and caretaker handwashing practices. Caretakers tend to over-report "good" hygiene practices such as the disposal of child stools in a latrine and subsequent handwashing with soap. Qualitative data suggest that the decision of where to dispose of child feces may depend on numerous factors, including the child's defecation site, availability of sanitation, and characteristics of latrines. Handwashing behavior may also be influenced by several factors, such as perceived contact with feces and the task in which the caretaker will participate after contact.

Discussion: Promotion of safe excreta disposal and handwashing practices at the individual level may not be successful if larger external factors are not first addressed. Of particular note, households must have continuous access to a clean and well-maintained latrine before they will properly dispose of feces. Findings from this research can be used to inform the development of an intervention to improve feces disposal and handwashing practices.

Excreta Disposal and Hygiene Practices Following Child Defecation among Peri-Urban Households in Western Kenya

By

Rosalyn Rush

Bachelor of Science
The University of Texas at Austin
2008

Thesis Committee Chair: Robert Dreibelbis, MPH

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Health
2011

Acknowledgements

I would like to offer my utmost gratitude to my field supervisor and thesis advisor, Robert Dreibelbis, for his continued support and guidance throughout the past year. I would also like to thank my thesis committee member, Richard Rheingans, and others at the Center for Global Safe Water for making this research possible. I owe many thanks to my field staff, Emily Awino Ogutu and Rosebel Anyango Ouda, for their assistance, enthusiasm, and friendship during my time in Kenya. I would also like to extend my appreciation to Benard Abong'o and Great Lakes University of Kisumu for hosting my research. I am grateful to the Eugene J. Gangarosa Fund for their monetary support that allowed me to travel to Kenya. Finally, I would like to thank my family and friends for their continued encouragement throughout my graduate career.

.

Table of Contents

CHAPTER 1: INTRODUCTION

Diarrhea is one of the leading causes of childhood morbidity and mortality worldwide. Each year, there are approximately 2.5 billion cases of diarrhea and 1.5 million diarrheal-related deaths among children under the age of five (UNICEF & WHO, 2009). In Kenya, diarrheal disease contributes to the high rate of under-five mortality, currently estimated at 74 deaths per 1000 live births (Kenya National Bureau of Statistics & ICF Macro, 2010). From 2000 to 2003, diarrheal disease was the cause of 16% of all deaths among Kenyan children under the age of five (World Health Organization, 2006).

Diarrheal control efforts from previous decades have focused on promoting oral rehydration therapy and upgrading water and sanitation infrastructure (V Curtis et al., 1997; UNICEF & WHO, 2009). Although these efforts are necessary, there are many behavioral factors that also need to be addressed in order to effectively reduce the burden of diarrheal disease. The World Health Organization has identified three critical water, sanitation and hygiene (WASH) behaviors that could have a significant impact on reducing the global burden of diarrheal disease. The WASH behaviors that have been recommended for promotion include the safe disposal of feces, handwashing, and maintaining drinking water free from fecal contamination (World Health Organization, 1992). In order to effectively promote these behaviors, it is first crucial to understand the local practices and cultural factors that might act as barriers and enablers of change (V. Curtis et al., 2001).

This study explores a subset of the WHO recommended WASH behaviors for promotion in the context of child defecation. The two key behaviors of interest are 1) the safe disposal of child feces and 2) handwashing after contact with child feces. Child feces are considered to be safely disposed if they are satisfactorily removed from the human environment, by being thrown in a latrine or buried under the earth.

Aim and objectives

The aim of the research was to both understand current child excreta disposal practices and associated hygiene practices among caretakers of children under the age of two, and to explore barriers to and facilitators of safe excreta disposal and hygiene-related practices of caretakers at the household level. Specifically, the objectives of the research were:

1. To establish the defecation sites of children under the age of two
2. To establish caretaker feces disposal practices following child defecation
3. To identify hygiene practices of caretakers following child defecation
4. To identify beliefs, motivations and barriers relevant to stool disposal and handwashing practices

Significance

This research will provide insight into a small piece of the larger WASH picture in Obunga, an informal settlement of Kisumu, Kenya. Findings from this research will inform government agencies or local organizations in the development of an intervention to improve feces disposal and handwashing practices among caretakers of

young children. Research institutions could also use this study as a foundation for conducting additional in-depth analyses of specific hygiene practices in this community.

CHAPTER 2: LITERATURE REVIEW

Overview of transmission routes and epidemiologic evidence

F-Diagram

The majority of diarrheal diseases result from direct or indirect contact with human feces (V Curtis, Cairncross, & Yonli, 2000). The F-diagram shows the various routes by which pathogens that originate in feces can be transmitted to a new host, and the barriers that can prevent this from occurring (Figure 1). The primary routes of transmission, as denoted by the red arrows, are those by which feces penetrate the human environment through fluids, fields, flies, or fingers. These routes of transmission are perpetuated by inadequate sanitation and hygiene. Primary barriers, including the safe containment and disposal of feces, as well as handwashing after contact with stools, must be in place in order to prevent the spread of fecal pathogens into the environment (V Curtis, et al., 2000). Primary barriers are particularly important when dealing with children's feces, which often carry a higher pathogen load than adult's excreta and thereby are more infectious (UNICEF & WHO, 2009).

The secondary routes of transmission, as denoted by the blue arrows, are those by which fecal pathogens that have already reached the environment are transmitted to a new host. These routes could be blocked by other WASH-related behaviors, such as treating drinking water, covering food, and washing hands before preparing a meal. While secondary barriers are important, they would not be as necessary if primary

barriers were adequately in place. Therefore, priority should be given to hygiene and sanitation interventions that promote behaviors which prevent fecal pathogens from entering the human environment (V Curtis, et al., 2000).

Hygiene interventions and health outcomes

A plethora of epidemiological research has provided consistent evidence to support the use of hygiene interventions for the prevention of diarrheal disease. Hygiene interventions take many different forms and address numerous issues ranging from handwashing to food safety. There does not seem to be an agreed upon definition as to what can or cannot be considered a hygiene intervention. Though, the majority of evidence showing the effectiveness of hygiene interventions comes from handwashing promotion programs.

Since the early 1990s, multiple systematic reviews have been published that provide a summary of the quantitative evidence linking hygiene practices to a reduced risk of diarrheal disease. (Aiello, Coulborn, Perez, & Larson, 2008; Cairncross et al., 2010; V Curtis & Cairncross, 2003; Ejemot, Ehiri, Meremikwu, & Critchley, 2008; Esrey, Potash, Roberts, & Shiff, 1991; Fewtrell et al., 2005; Waddington & Snilstveit, 2009). The results from these meta-analyses found hygiene interventions to be associated with a 27-47% reduction in the risk of diarrheal disease. Variation in these numbers is a result of differing eligibility criteria for the reviews, including type of methodology employed, type of hygiene intervention used, definition of diarrheal disease, location of intervention, age of target population, and rigor of study. While many of the reviews included observational studies with inherent limitations, intervention trials with

methodological flaws, or found evidence of publication bias, they all conclude with similar results proving that hygiene interventions are an effective means of reducing the diarrheal burden of populations around the globe.

Hygiene interventions have also been found to improve other health outcomes, such as decreasing the risk of respiratory infections. A 2006 systematic review found that hand cleansing can lower the risk of respiratory infections by 16% (Rabie & Curtis, 2006). However, the few studies eligible for this review had methodological or geographical limitations and used non-severe outcome measures, thereby weakening the evidence for this association. A randomized controlled trial from Pakistan supports this evidence, showing a 50% reduction in pneumonia among children under five in an intervention group that received plan soap and handwashing promotion (Luby et al., 2005).

Sanitation interventions and diarrheal disease

Compared to the number of hygiene studies in the scientific literature, there has been less research on the association between sanitation interventions and health outcomes. Sanitation interventions primarily involve the provision of latrines, but also include the expansion of sewer connections. Multiple systematic reviews have been published since the early '90s that have attempted to establish the relationship between sanitation interventions and diarrheal disease (Cairncross, et al., 2010; Clasen et al., 2010; Esrey, et al., 1991; Fewtrell, et al., 2005; Waddington & Snilstveit, 2009). Three of the reviews pooled the estimates and found sanitation interventions to be associated with a 22-47% reduction in the risk of diarrheal disease (Esrey, et al., 1991; Fewtrell, et

al., 2005; Waddington & Snilstveit, 2009). However, each of these reviews had limitations, such as the use of observational, poor-quality, or too few studies. In the two most recent reviews by Cairncross and Clasen, meta-analyses were not performed due to insufficient cluster sizes in the studies and incomparable types of interventions. The results from the studies in these reviews greatly varied, as sanitation interventions were associated with an 8-80% reduction in risk of diarrheal disease (Cairncross, et al., 2010; Clasen, et al., 2010). Nevertheless, the majority of studies in these two reviews found sanitation interventions to have some protective effect against diarrheal disease.

This epidemiologic evidence confirms the relevance of promoting hygiene and sanitation for the prevention of disease. The following section will provide a detailed discussion of specific hygiene/sanitation behaviors and practices that should be considered when targeting child defecation.

Specific behaviors and practices related to child defecation

Defecation sites

Studies from different parts of the world have found that young children defecate in a variety of locations, with the specific defecation site varying by the age of the child (V Curtis et al., 1995; Gil, Lanata, Kleinau, & Penny, 2004; Huttly et al., 1994; B Yeager, Huttly, Bartolini, Martha, & Lanata, 1999; B Yeager et al., 2002). Reusable diapers or napkins are the most common defecation sites for infants, who usually wear diapers or napkins until they reach six months to one year of age (V Curtis, et al., 1995; Gil, et al., 2004; Huttly, et al., 1994; Huttly et al., 1998; Jinadu, Esmai, & Adegbenro, 2004; Traore et al., 1994; B Yeager, et al., 1999). Mothers from Peru expressed their

eagerness to get their children out of diapers as soon as possible to save the time, energy, and water used in the washing process (Huttly, et al., 1998; B Yeager, et al., 1999).

At the end of infancy and throughout the toddler stage (ages six months to 3 years), children become more mobile and their defecation sites more variable (Huttly, et al., 1998). In Peru, potties are not only considered the most suitable and hygienic option for children of this age, but are also thought to encourage child development (Huttly, et al., 1998; B Yeager, et al., 1999). The use of potties, or pots, among this age group was also documented by other studies in Burkina Faso and Kyrgyzstan (Biran, Tabyshalieva, & Salmorbekova, 2005; V Curtis, et al., 1995). Use of potties for infants is not universal, however, and respondents in some studies have reported forgoing potty training and allowing infants to defecate elsewhere due to difficulties with the potty training process (Huttly, et al., 1998; B Yeager, et al., 1999). The household floor and soil outside of the house are other common defecation sites for children between the ages of six months to three years (Biran, et al., 2005; V Curtis, et al., 1995; Gil, et al., 2004; Huttly, et al., 1994; Huttly, et al., 1998; Jinadu, et al., 2004; Traore, et al., 1994; B Yeager, et al., 1999). Child defecation on the soil is considered acceptable in Peru as long as it is performed outside of the child's house, and not near a neighbor's home (B Yeager, et al., 1999).

After age three, it is common to find children defecating in an open field or bush, drainage ditches, and rubbish heaps (V Curtis, et al., 1995; Gil, et al., 2004; Huttly, et al., 1998; B Yeager, et al., 1999). These locations are not considered good sites as

they are often thought to be dirty and unsafe areas where children have a higher risk of disease or injury (Almedom, 1996; Huttly, et al., 1998; B Yeager, et al., 1999). However, some mothers allow their young children to use these locations because they do not consider younger children to be the appropriate age to use the latrine without soiling the floor or falling into the pit (V Curtis, et al., 1995). Mothers also consider latrines to be unhygienic, odiferous, and full of flies, making them an inappropriate option for young children (Huttly, et al., 1998; B Yeager, et al., 1999). Latrine use by children has been documented to start between the ages of three and six (Biran, et al., 2005; Gil, et al., 2004; Huttly, et al., 1994; B Yeager, et al., 1999).

While there have been a number of descriptive studies on the various defecation sites of young children, the association between child defecation site and diarrheal outcomes has not been clearly established in epidemiologic research. Two studies from Myanmar and Bangladesh found the practice of childhood open defecation around the living environment to be associated with an increased incidence of diarrheal disease (Han & Moe, 1990; Stanton & Clemens, 1987). However, two different studies from Burkina Faso and Peru found there to be no such association between defecation site and risk of diarrhea (Huttly, et al., 1994; Traore, et al., 1994). The conflicting results of these studies may be a result of different practices regarding feces disposal, which has been hypothesized to be more important than the defecation site itself (Traore, et al., 1994).

Disposal sites

Feces are considered to be safely disposed if they are satisfactorily removed from the human environment by being thrown in a latrine or buried under the earth. Research has consistently shown that children from households that safely dispose of child feces have a lower risk of diarrheal disease than children from households that dispose of feces elsewhere (Alam, Wojtyniak, Henry, & Rahaman, 1989; Aulia et al., 1994; Baltazar & Solon, 1989; Gorter et al., 1998; Huttly, et al., 1994; Mertens, Jaffar, Fernando, Cousens, & Feachem, 1992; Traore, et al., 1994). A review by the Environmental Health Project found that stool disposal practices vary according to the age of the child. The authors reported the mid-age range for three age groups. Based on ten studies, the estimated frequency of discarding stools in a latrine was 0% for infants aged six months, 70% for children aged 24 months, and 25% for children aged 40 months (Gil, et al., 2004).

One possible explanation for these age-related differences is that feces disposal practices are related to the child's defecation site (Baltazar & Solon, 1989; V Curtis, et al., 1995). As discussed above, children of different ages defecate in a variety of locations. Children with a mid-age of 24 months, the group that most frequently has their feces disposed into a latrine, are the most likely to use a potty or defecate around the house. Since these defecation sites are in the immediate domestic environment, it is hypothesized that caretakers are more likely to know where the stools are left and can thereby dispose of them properly into a latrine (Gil, et al., 2004). This hypothesis is supported by evidence from numerous behavioral studies which have shown that

disposal of stools into a latrine occurs most frequently after a child has defecated in a potty (V Curtis, et al., 1995; Huttly, et al., 1994; Huttly, et al., 1998; Traore, et al., 1994; B Yeager, et al., 1999). A study from Burkina Faso found that children who used a pot for defecation were 26 times more likely to have their feces discarded into a latrine than another location (V Curtis, et al., 1995).

Lack of knowledge of fecal pathogens poses a problem to the safe feces disposal, as many studies have discussed how mothers do not consider the feces of infants to be as dirty, repulsive, or hazardous as stools of older children or adults (Biran, et al., 2005; V Curtis, et al., 1995; Gil, et al., 2004; Gorter, et al., 1998; Huttly, et al., 1998; B Yeager, et al., 1999) . Feces tend to be characterized by their scent and size, which are primarily determined by diet (Huttly, et al., 1998; B Yeager, et al., 1999). Infants are usually breastfed until six months to one year of age, when they begin eating a mixed diet. Only around this older age is when mothers have commented that children's stools become unpleasant and thereby require removal from the defecation site (V Curtis, et al., 1995).

While disposal of feces into a latrine is the desired practice, numerous barriers prevent this from consistently occurring. Reasons cited for not disposing of child feces into a latrine include personal issues of time and laziness, as well as other obstacles such as distance and availability to a latrine (Biran, et al., 2005; B Yeager, et al., 1999). In addition, caretakers from Kyrgyzstan discussed how the transfer of stools from pots into a latrine can be a cumbersome task (Biran, et al., 2005). As a result of these barriers, caretakers often choose to dispose of stools elsewhere.

Other common disposal sites, such as the yard, bush, drainage ditch, rubbish pit, and river, were listed in many studies (Aulia, et al., 1994; Baltazar & Solon, 1989; Biran, et al., 2005; V Curtis, et al., 1995; V Curtis, Sinha, & Singh, 1997; Gil, et al., 2004; Huttly, et al., 1994; Jinadu, et al., 2004; B Yeager, et al., 1999). Outdoor locations near the home were often used to dispose of water from washing soiled diapers, nappies, or clothes (Baltazar & Solon, 1989; Gil, et al., 2004; Huttly, et al., 1994; B Yeager, et al., 1999). While these sites may be convenient, embarrassment has been reported by some caretakers as their neighbors viewed them using outdoor locations to dispose of feces (B Yeager, et al., 1999). Studies also reported feces being left at the original defecation site, possibly to be consumed by animals or to be washed from diapers, nappies or clothes at a later time (Aulia, et al., 1994; Biran, et al., 2005; Gil, et al., 2004; Huttly, et al., 1994; Huttly, et al., 1998; Jinadu, et al., 2004).

Feces near the home

It is important to keep the domestic environment clean and free of feces, since this is the most likely place for young children to come in contact with fecal pathogens (V Curtis, et al., 2000). Many studies have found the presence of human and/or animal feces outside of the home to be associated with an increased risk of diarrheal disease (Ahmed, Zeitlin, Beiser, Super, & Gershoff, 1993; Bukenya & Nwokolo, 1991; Huttly, et al., 1994; Traore, et al., 1994). Soil outside of a household can be contaminated with a child's own feces if he defecates on the ground (and the feces are not properly disposed), or if the water used for washing soiled materials is discarded outside of the home. Other young children can also contaminate a household's soil if they practice

indiscriminate open defecation (Lanata, Huttly, & Yeager, 1998). While a child's feces are rarely a threat to his own health (Lanata, et al., 1998), they can certainly be hazardous to other children. Of the various types of feces that a child could come into direct contact with, the greatest threat to a child's health are feces from other young children, particularly when they have diarrhea (Lanata, et al., 1998).

In addition to potential health hazards, some cultures consider it disgraceful for feces to be in front of the house, especially if seen by important guests. Caretakers from Kyrgyzstan noted that feces should be removed out of sight and smell so that people do not step on them and carry feces into the house (Biran, et al., 2005). However, observations from a number of studies around the world have found feces of humans and/or animals to be frequently present in outdoor locations surrounding the home (Ahmed, et al., 1993; Biran, et al., 2005; V Curtis, et al., 1995; Huttly, et al., 1994; Huttly, et al., 1998; Traore, et al., 1994).

In order to prevent the risk of fecal contact, it is essential that human stools be adequately contained and removed from the human environment. Research from Burkina Faso found human feces to be less frequently observed in yards when mothers reported their child defecating in a pot, and discarding the feces into a latrine (V Curtis, et al., 1995; Traore, et al., 1994). These hygienic practices have been promoted by several trials and interventions (Biran, et al., 2005; V. Curtis, et al., 2001; V Curtis, Kanki, et al., 1997; V Curtis, Sinha, et al., 1997; B Yeager, et al., 1999; B Yeager, et al., 2002) which will be discussed in a later section.

Anal cleansing

The risk of fecal contact can be minimized if children are properly cleaned following defecation. Anal cleansing has been reported to be a fairly universal practice among caretakers of young children, according to research from Africa and Latin America (Gil, et al., 2004). In Nicaragua, anal cleansing was reported to be performed primarily for aesthetic reasons, rather than due to caretakers' awareness of routes of pathogen transmission (Gorter, et al., 1998).

The method of cleaning may depend on the age of the child, as a few studies described more gentle and careful cleaning for younger children (Cousens, Kanki, Toure, Diallo, & Curtis, 1996; B Yeager, et al., 1999). Anal cleansing is often performed by wiping the child's bottom with bare hands (Cousens, et al., 1996; V Curtis, Sinha, et al., 1997), a clean section of a soiled diaper (Huttly, et al., 1994; Huttly, et al., 1998; B Yeager, et al., 1999) , cloth (Aulia, et al., 1994; Huttly, et al., 1994; Huttly, et al., 1998; Jinadu, et al., 2004; B Yeager, et al., 1999), or paper (Huttly, et al., 1994; Huttly, et al., 1998; Jinadu, et al., 2004). Water is frequently used in the cleaning process (Aulia, et al., 1994; Cousens, et al., 1996; Huttly, et al., 1998; Jinadu, et al., 2004; B Yeager, et al., 1999), but cleansing agents such as soap, mud or ash have been less commonly reported or observed (Aulia, et al., 1994; V Curtis, Sinha, et al., 1997; Huttly, et al., 1998).

Disposal of the cleaning materials has only been documented in one study in Peru. In this setting, diapers were usually left dirty, paper was frequently disposed in a

rubbish bin, potty or latrine, and water was either kept or discarded onto the floor or patio (Huttly, et al., 1998).

Handwashing

After performing anal cleansing, particularly if done with bare hands, it is crucial that handwashing occur to prevent fecal pathogens from spreading into the environment. Handwashing after contact with child feces is a common promotional message that has been used in health campaigns across the globe (V Curtis, et al., 2000). Despite these efforts, numerous studies have found that handwashing at this critical time is not widely practiced in the developing world. Reported or observed documentation for *any* handwashing after cleaning a child or disposing of stools range from 0-72% (Aulia, et al., 1994; Aunger et al., 2010; Biran, et al., 2005; Cousens, et al., 1996; Gilman et al., 1993; Huttly, et al., 1994; Huttly, et al., 1998; Jinadu, et al., 2004; Luby et al., 2010; Oswald et al., 2008; Schmidt et al., 2009). Curtis *et al.* 2009 reviewed formative research studies from 11 countries and found that handwashing with soap (HWWS), the preferred practice, is even less common. Averaging the studies that reported these practices, HWWS was performed by 13% of caretakers after cleaning a child, and 19% of caretakers after cleaning up child feces (V Curtis, Danquah, & Aunger, 2009).

Handwashing after these events is not always considered to be important to mothers, especially if water was already used to clean the child after defecation (Biran, et al., 2005). Lack of handwashing may also be due to the common perception that children's feces are not hazardous, as discussed in a section above. The decision to wash

hands after fecal contact may further depend on what the caretaker plans to do next or the perception of how clean her hands look, as explained by field workers from Burkina Faso (Cousens, et al., 1996).

Child handwashing following defecation also appears to be a fairly rare behavior, as four studies in Peru found this practice to occur between 5-36% of occasions (Gilman, et al., 1993; Huttly, et al., 1994; Huttly, et al., 1998; Oswald, et al., 2008). When handwashing did take place, soap was used infrequently (Gilman, et al., 1993; Huttly, et al., 1994; Oswald, et al., 2008) and both sides of the hands were not always washed effectively (Huttly, et al., 1994).

A 2004 review by Gil *et al.* found child handwashing to significantly vary according to the age of the child. Children with a mid-age of 24 months were less likely to have clean hands following defecation as compared to children with a mid-age of 10 months and 40 months (Gil, et al., 2004). The authors hypothesized that infant handwashing occurs more frequently during the first year of life because mothers are more likely to be present when the child defecates, and are more concerned with child safety. Handwashing declines in the second year of life, when mothers believe children are stronger and can move around more freely. Around the ages of 3 and 4, handwashing increases because children can be taught to wash their own hands following defecation (Gil, et al., 2004). Further research is required on child handwashing, as none of these studies or those in the review were from Africa.

The limited use of soap for maternal or child handwashing is not always due to inaccessibility, since studies from India and Kenya documented nearly all households

having access to soap (Biran et al., 2009; Water and Sanitation Program, 2009). Rather, cost was more often mentioned as a barrier to the use of soap for this purpose (Aunger, et al., 2010; Biran, et al., 2005; Water and Sanitation Program, 2009). Caretakers often place HWWS as a lower priority behind other household activities that require the use of soap, such as bathing, washing dishes and doing laundry (Biran, et al., 2009; Biran, et al., 2005; Gilman, et al., 1993; Oswald, et al., 2008; Water and Sanitation Program, 2009). In Kenya, soap is considered an essential good that should not be wasted. Some Kenyan caretakers even mentioned hiding their soap or placing it in a location where children could not access it easily (Aunger, et al., 2010; Water and Sanitation Program, 2009). As a result, soap is not commonly in sight after child defecation, and thus cannot act as a trigger for handwashing (Water and Sanitation Program, 2009). Availability of water has also been found to be a barrier to frequent handwashing, particularly when the water source is over a kilometer from the household (Biran, et al., 2009; V Curtis, et al., 2000).

Interventions for behavior change

A few hygiene interventions have been implemented, following extensive formative research, to try to change the hygiene practices of caretakers following child defecation. While small-scale behavioral trials have shown promising results for the adoption of hygienic behaviors related to the containment and disposal of child feces (Biran, et al., 2005; V Curtis, Kanki, et al., 1997; V Curtis, Sinha, et al., 1997; B Yeager, et al., 1999) , larger interventions that have promoted potty use and disposal of feces into latrines have not proven to be as successful. One intervention in Peru promoted these

practices through video, pamphlets, and interpersonal communication at health clinics. Over the course of the program, they encountered substantial problems with coverage and in the end were not able to show an impact on the target behaviors (B Yeager, et al., 2002). In Burkina Faso, potty use and the safe disposal of feces were already common practices at baseline, which was the likely reason why an intervention trial failed to show significant changes in these behaviors at endline (V. Curtis, et al., 2001). Additional information is required to determine if potties and the disposal of feces into a latrine can be effectively promoted and adopted through an intervention setting.

Handwashing following contact with child feces has been one of the more commonly promoted practices in hygiene interventions, some of which have resulted in positive behavior change. Programme Saniya, a hygiene intervention in Burkina Faso, found promising results after three years of implementation. Statistically significant changes were seen for handwashing practices, with and without soap, after handling child feces. From baseline to endline, HWWS increased from 13% to 31%, and handwashing with water-only increased from 35% to 74%. However, Programme Saniya was unable to use the traditional intervention and control groups to measure the effectiveness of the program, since the intervention partially relied on radio campaigns that were meant to reach all households in the area (V. Curtis, et al., 2001).

Other handwashing programs have supported the evidence that handwashing with soap after contact with child feces can be promoted through an intervention setting. For example, a short-term handwashing promotion program in Bangladesh that provided free soap to participating households showed a 61% increase in HWWS after

cleaning a child's anus (Luby, et al., 2010). However, another study documented a significant decline in HWWS in the time after intensive promotion, and the long-term sustainability of these improvements is unknown (Luby et al., 2009). Further research is necessary to examine the issue of sustaining handwashing practices following interventions.

Methodological issues in hygiene research

Once an intervention is in place, it is often difficult to determine the most appropriate way to measure hygiene behaviors. Numerous methods for measuring hygiene behavior have been utilized and compared through research, but there still does not appear to be a 'gold-standard' for measuring practices such as the disposal of feces or handwashing. The two methods that have received the most attention in the academic literature are questionnaires and structured observations. While questionnaires may be a cost-effective way to measure hygiene behavior across a large population, they have consistently been shown to have low validity (Gil, et al., 2004). Studies from Bangladesh, Burkina Faso, Zaire and India have all found that respondents tend to report 'desired' behaviors, such as disposing stools into a latrine and handwashing after contact with feces, more frequently than seen during observations (Biran et al., 2008; V Curtis et al., 1993; Manun'Ebo et al., 1997; Stanton, Clemens, Aziz, & Rahman, 1987). Therefore, the results from questionnaires may not accurately reflect the actual behaviors under investigation.

Structured observations are usually considered to be more valid that questionnaires, but other issues, such as variability of behavior and reactivity to the

observer, arise with their use (Gil, et al., 2004). Studies that rely on obtaining results from a single observation period may not be accurate if the behaviors of interest are not always practiced in the same manner. Cousens *et al.* 1996 found the method of stool disposal to be the most repeatable hygiene behavior over a course of three household observations. Other behaviors, such as the use of a potty, cleaning the child, and handwashing, were found to have greater variability (Cousens, et al., 1996). A different study from Burkina Faso found similar results, showing some inconsistency of hygiene behaviors over time (V Curtis, et al., 1993).

Reactivity, the effect of the observer on the participant's behavior, is another potential limitation to the use of observations. Cousens *et al.* 1996 found that many participants admitted to altering their appearance or tidiness of the house, but the key behaviors (defecation site, method of stool disposal and cleaning the child) did not appear to change during observations (Cousens, et al., 1996). However, a recent study from Bangladesh compared structured observation to soap movements that contained sensors and found handwashing behavior to be reactive to the presence of an observer (Ram et al., 2010). Additional studies using soap sensors, or similar technologies, need to be performed in order to verify their effectiveness.

Despite these limitations, observations are generally considered to be a better measure of hygiene-related behaviors than questionnaires. Further research is still needed to determine if alternative methods could be used as the "gold standard" in conducting hygiene research.

Conclusion

There is substantial epidemiological evidence to support the use of hygiene and/or sanitation interventions to improve health outcomes. In order to have a lasting impact, these interventions should focus on primary barriers to disease transmission, such as the safe disposal of stools and handwashing after contact with feces. Several studies have provided a descriptive account of specific hygiene behaviors, and associated practices, that would prevent primary transmission from occurring. However, the majority of these studies were conducted in Peru and Burkina Faso, so the understanding of these practices is limited to a few countries. In addition, very little qualitative research has been performed to obtain the perspectives and opinions of the target populations. There is also limited evidence to suggest that hygiene behaviors, such as potty use, disposal of stools in a latrine, and handwashing after contact with feces, can be adequately adopted in an intervention setting and sustained. Finally, there are numerous methodological challenges to hygiene research and a "gold standard" measurement of these practices has not yet been established.

This study will build upon the existing descriptive research on hygiene practices surrounding child defecation. It will provide insight into the behaviors of caretakers in a geographical region, peri-urban Kenya, which has not been adequately explored in the literature. This study will also contribute to the limited pool of qualitative research on feces disposal and handwashing practices. Furthermore, it will offer additional evidence to support the use of a particular method to measure hygiene practices.

CHAPTER 3: PROJECT CONTENT

Study site

This study was conducted in Obunga, an informal settlement of Kisumu, Kenya (Figure 2). Obunga is one of Kisumu's poorest slum areas in terms of physical infrastructure and basic social services (UN-HABITAT, 2005). Access to safe water and adequate sanitation is limited. As a result of this poor living environment, outbreaks of disease often occur and cause high rates of infant morbidity (UN-HABITAT, 2005).

Obunga consists of three distinct areas - Obunga, Kamakowa, and Sega Sega, each of which is divided into a lower and upper section. Obunga is situated at the bottom of a hill with a major road and the Kisat River as boundaries. Kamakowa is situated uphill from Obunga on the opposite side of the main road. Sega Sega is a small estate that borders a major regional highway. The research team separated the six community sections into three groups according to the observed homogeneity in socioeconomic status (SES). The lowest SES area includes only Lower Obunga. The middle SES area encompasses Upper Obunga, Lower Kamakowa, and Lower Sega Sega. The highest SES area covers Upper Kamakowa and Upper Sega Sega.

Methods

Data collection

A mixed-methods triangulation design was used to investigate caretaker excreta disposal practices and associated hygiene behaviors in Obunga (Creswell & Plano Clark, 2007). Quantitative and qualitative data were collected in a single phase between June and July 2010. Specific data collection methods included semi-structured observations, questionnaires, and focus group discussions. Two trained female staff from Great Lakes

University of Kisumu (GLUK) conducted the field work. Criterion-based purposive sampling techniques were used during household selection to identify caretakers of children under the age of two. Field staff recruited participants from all areas of the Obunga community to ensure maximum variation of the sample. Potential participants were told that the purpose of the study was to understand domestic practices related to child health. Field staff obtained oral consent from all participants prior to data collection. This study was granted ethical approval from Emory University and GLUK.

Observations and questionnaires

Semi-structured observations were conducted in 30 compounds, ten in each of the three areas of the target community. Field staff recruited caretakers the morning of the observation and began documenting their behaviors shortly after receiving consent. Three of the selected compounds had more than one caretaker who met the criteria for the study, so field staff recruited all eligible caretakers in the compound on these occasions. Each observation period lasted three hours, usually between 8 a.m. and 12 p.m.

One field worker was assigned to each compound under observation. The field worker usually situated herself in an outdoor location where she could observe most of the household activities, while remaining as unobtrusive as possible. The field worker had little to no interaction with family members until after the observation period had ended. Participants were asked to proceed with their normal daily activities and to disregard the observer's presence.

Field workers used pre-coded observation tools to document key hygiene practices of caretakers and household latrine conditions. The observation tools were piloted to check for clarity and consistency between observers. Behaviors of interest that were recorded with time of occurrence included: the defecation site of the child, cleaning of the child after defecation, excreta disposal practices of the caretaker, and handwashing of the caretaker and the child following these events. Multiple coded responses and additional written explanation were permitted for each behavior. Factors included in the latrine observations were distance from household, number of persons sharing the latrine, and variables related to cleanliness and structure of the latrine. Field workers also sketched a map of the compound, took photographs of the latrines, and recorded jottings during each observation period to provide context for the behaviors of interest. They later combined these jottings with the observation results and synthesized the information into detailed field notes.

Immediately after the observation period, the field worker administered an eight question survey to each caretaker that asked about the same key hygiene practices which were under observation. The questions were worded to reveal the *usual* defecation and disposal sites, and the *last time* that anal cleaning and handwashing occurred (i.e. the observed events). The purpose of this questionnaire was two-fold. First, it generated data for behaviors that may not have been seen during the observation period. Second, it provided a reported account of caretaker practices to be compared with the observed practices documented by field staff.

Field staff collected the observation and survey data on paper documents. The lead researcher entered the numeric data into an electronic spreadsheet using Microsoft Excel 2007 (Redmond, WA) and typed the field notes into electronic documents using Microsoft Word 2007 (Redmond, WA). The compound maps and photographs were scanned and uploaded, respectively, and stored in an electronic folder. All textual and visual data from the observations were imported into MAXQDA 10 (Marburg, Germany) for analysis.

Focus group discussions

Three focus group discussions (FGD) were conducted to further explore the hygiene behaviors that were documented in the compound observations. One FGD was held for each SES level defined by the research team. Field staff recruited six to ten participants from the designated SES areas of Obunga the morning of the FGD. All participants were caretakers of children under the age of two that were new to the study and had not been involved in the previous observations.

The two field staff alternated between the roles of the moderator and note-taker in each FGD. The moderator followed a detailed guide with specific questions about hygiene behavior and possible probes to direct the discussion. The note-taker documented the words of the participants and helped to facilitate a group freelisting activity. Each FGD lasted approximately 90 minutes and was recorded on an audio tape with permission from all participants. The FGDs were conducted in Dholuo, and later translated and transcribed into English. The lead researcher typed the English

transcripts into electronic documents using Microsoft Word 2007, de-identified them, and imported the documents into MAXQDA 10 for analysis.

Data analysis

The goals of the quantitative data analysis were to provide descriptive statistics on the five key hygiene behaviors, to compare observed and reported behaviors, and to assess crude associations between variables of interest. For each hygiene behavior, the lead researcher confirmed the response documented on the observation tool with the field notes written for that particular observation period. Any discrepancies were clarified with the field staff. The specific categories presented in the descriptive statistics were informed by the field notes and focus group discussions. Simple frequencies for the descriptive statistics were calculated using Microsoft Excel 2007.

Two nonparametric methods were used to compare the observed and reported behaviors. First, the Kappa statistic was used to determine the degree of agreement between observation and questionnaire data. This statistic, which accounts for chance agreement, is evaluated from the magnitude of a score which ranges from 0 to 1. A score of 0 indicates no agreement, while a score of 1 represents perfect agreement. The scores that fall between these values have been classified as the following: < 0.40 indicates poor agreement, $0.40 – 0.75$ fair to good agreement, and > 0.75 excellent agreement (Fleiss, 1981). Second, McNemar's test was used to statistically assess the differences between observation and questionnaire data (Siegel & Castellan, 1988). An online calculator from VassarStats was used to calculate the Kappa statistic and McNemar's test (http://faculty.vassar.edu/lowry/VassarStats.html).

The Fisher's Exact test, another nonparametric method, was used to determine crude associations between latrine characteristics and the disposal site. OpenEpi 2.3.1 (Atlanta, Ga) was used to calculate the Fisher's Exact tests (www.openepi.com).

Qualitative data were analyzed using MAXQDA 10 with the purpose of providing a descriptive account of the hygiene behaviors that were documented during compound observations. The lead researcher analytically read the three transcripts and created memos to facilitate code development. Major themes for coding were identified through the memos, the interview guide, preliminary findings from the observations, and discussion amongst the research team. The lead researcher developed a detailed codebook with definitions of each code and applied the codes to the transcripts. The coded data were compared between and within FGDs, and summaries were written for each of the major themes.

Consistent with the triangulation design, the quantitative and qualitative data were analyzed concurrently and equal weight was given to both methods. The data are presented separately in the results, but are synthesized in the discussion section (Creswell & Plano Clark, 2007).

Results

Quantitative results

Field staff visited 30 compounds over the course of the observation period. They observed the behaviors of and administered questionnaires to 34 caretakers and documented information on 26 events surrounding child defecation. Field staff also evaluated the conditions of 29 latrines: one compound did not have a latrine, one

compound latrine was locked and not accessible, and one compound had two types of latrines. Of these latrines, 22 were associated with households where a defecation event was observed. Two households included in the observations shared the same latrine, and no latrine was accessible for the other two. Figure 3 displays a summary of the compound observations.

The following observation and questionnaire results are specific to the 26 caretakers that were recorded to be involved in events surrounding child defecation. The first section will discuss the observed and reported results of the key hygiene behaviors of interest. The second section will discuss the findings from the latrine observations.

Household observations

Table 1 shows descriptive statistics for the five key hygiene behaviors that were documented during household observations. The three most frequently observed defecation sites among the participant's children were clothes (n=6), soil outside of the household (n=5), and potties (n=5). Other defecation sites (n=8) included diapers, the household floor, newspaper on the ground, the garbage pile, and nappies. Two of the events were recorded to have two defecation sites each. On both occasions, the child started defecating in his clothes, and then the mother removed the pants and the child finished defecating on the soil outside of the house. On the remaining four occasions, the child's defecation site was unknown, but events following defecation were observed.

Among the households where potties were the observed defecation site, almost all of the potties (4/5) were located outside of the house and were clean before use. Three of the used potties were taken to the latrine to dispose of feces. All potties were washed after the stools were discarded, but only three caretakers used soap. Children who used potties were old enough to walk, and most let their caretakers know (either verbally or physically) that they needed to defecate. The majority of potty-users were in Sega Sega (n=3), a middle-to-upper SES area.

Rags and paper (n=7) were the most commonly used materials for cleaning a child following defecation. These materials were often pieces of cloth, newspaper, or magazine that could be easily accessed in or around the compound. Child's clothes (n=4) were also frequently used for cleaning, particularly when the child had already soiled his pants. The caretaker would usually remove the soiled pant, and then wipe the child using the same piece of clothing. Tissue paper was another common cleaning material used (n=4), though this practice was only observed in more economically prosperous areas. Other materials, such as water, soap, and other linens, were used for child cleaning on five occasions. For the remaining nine events, child cleaning following defecation was not seen during the observation time period.

Half of the caretakers (n=13) safely disposed of their child's stools into a latrine. However, 11 others discarded the feces in unsafe locations including the bush, drainage ditch, or outdoor garbage pile. Two of these caretakers disposed of their child's feces both in the latrine and another site. On both occasions, this occurred when the child defecated in his clothes or a nappy that required washing. The solid stools were

discarded into a latrine, but the water used for washing the soiled materials was disposed in a drainage ditch. For the four remaining events, the final disposal of child feces was not documented during the observation period.

After last contact with child feces, caretakers washed their hands with water and soap on three occasions, and water only or water for washing on 16 occasions. Of these observed handwashing events, only two caretakers appeared to have deliberately washed her hands. More commonly, caretakers began or resumed washing activities where their hands were immersed in water, but they did not appear to have purposively washed their hands (n=17). The presence or absence of soap in the washing water was not documented during data collection. On the remaining seven occasions, handwashing after contact with child feces was not observed.

Child handwashing after defecation was even less common, with only five events recorded during the observations. Soap and water was used on four of these occasions, and water for washing was used for the other event. For the majority of the occasions where soap was used, the child had either come into contact with his feces or the child was being bathed after defecation. Child handwashing after defecation was not observed for the remaining 21 events.

Questionnaire data revealed marked differences from the observed behaviors. When the same caretakers were asked where they *usually* dispose of child feces, an overwhelming majority (n=22) reported the latrine (two of which also gave a second location – bush and drainage ditch). The remaining four caretakers said that they usually dispose child stools in the bush or in an outdoor garbage pit. When caretakers were

asked how they washed their hands the *last time* (i.e. the observed event) they were in contact with child feces, 22 reported that they washed with water and soap. Among the others, three stated that they used water only, and one reported that she did not wash her hands. When caretakers were asked how they washed their child's hands the *last time* the child defecated (i.e. the observed event), 10 caretakers reported that the child's hands were washed with water and soap.

Table 2 compares the observed and reported behaviors for feces disposal and handwashing practices. The Kappa statistic shows poor agreement for disposing feces into a latrine (k=0.36) and any caretaker handwashing after last contact with feces (k=0.20). Good agreement was found for any child handwashing after last defecation event (k=0.55). At an alpha level of 0.05, McNemar's test provided evidence of over-reporting of safe feces disposal into a latrine (p=0.0156) and any caretaker handwashing after last contact with child feces (p=0.0313). Significant differences were also found for any child handwashing after defecation, but only when the alpha level was raised to 0.10.

Latrine observations

The first two columns of Table 3 display the characteristics of the latrines that were associated with 24 of the 26 households where defecation events were observed. Nine households used a latrine block, and 21 shared a latrine with an average of seven other households. Eight households used a latrine that was located at least 10 meters away. The majority of households had access to either a traditional pit latrine (n=12) or

a ventilated improved pit latrine (n=9). Among the other three, one household used each of the following: a flush toilet, an above-ground vault, and a mobilet.

Eight households used a latrine with a door that did not close completely and four household latrines had a lock. A strong smell was detected inside and outside of latrines that eight households used. Less than half of the households used a latrine that had very visible feces (n=9), puddles of urine (n=6), or flies inside and outside (n=3). Seven households used a latrine that had a dilapidated roof or no roof at all. Two households used a latrine with dilapidated walls, and four households used a latrine that had an unstable slab.

When latrine characteristics were compared to the corresponding stool disposal sites (columns 3 & 4 of Table 3), presence of visible feces had a significant association with unsafe stool disposal. Of the nine households that used a latrine with very visible feces on the slab, only two disposed of the child's feces into the latrine (p=0.0427) compared to the seven others who disposed of the feces in another location. None of the other factors were found to be significantly associated with the stool disposal site. The two households that did not have access to a latrine disposed of their child's feces in the bush.

Qualitative results

A total of 24 caretakers of children under the age of two participated in the three FDGs. The results from these discussions help to elucidate the behaviors documented in the household observations. The following sections are presented in order of the key behaviors of interest: defecation site, cleaning methods, disposal site, and handwashing.

Defecation site

Caretakers listed more than ten defecation sites for children under the age of two in their community. All of the observed and reported defecation sites were included in their lists. The participants' opinions of four common defecation sites (potty, magazine/newspaper, household floor/soil beside the house, field/bush) are discussed below.

Across all three focus groups, the potty was considered the best defecation site for children under two. From the caretakers' perspective, the potty was good because it allowed for easy removal of stools and cleaning of the defecation site. As one mother described, *"when the child wants to defecate, you put a little water inside the potty so that the feces don't stick on the potty. After the child has defecated you pour more water and then you dispose in the latrine. Then you come back and wash your potty"* (FGD 2). In addition to being less work for the caretaker, the potty was considered to be a safe and comfortable place for a young child to defecate. Mothers thought it was a particularly good option for children who do not know how to squat (as needed for most defecation sites) because the potty has a seat that provides support for the child. The barrier between the seat and the collection basin helps to prevent children from touching their feces following defecation. Caretakers also discussed that they use potties to teach their children not to defecate in the open at a young age.

Despite the many benefits of the potty, a few participants described how mothers whose children use potties often become lazy. Instead of disposing the stools immediately after the child defecates, many caretakers simply cover the potty with the

lid and carry on with their daily activities. If this process continues and the caretaker forgets to the dispose the stools, the potty will eventually fill and the child will end up sitting on a pile of feces during defecation.

The participants expressed mixed opinions about the use of a magazine or newspaper for a child's defecation site. Some mothers liked using these materials because they thought they were easy to clean. After the child finished defecating, the mother would simply fold the paper with the feces inside and dispose. Other caretakers mentioned how these materials are sometimes very weak and the feces end up falling through, thereby making it difficult to properly dispose. This is particularly a problem when the child has loose stools or diarrhea.

Child defecation on the household floor or beside the house was looked down upon. Several participants expressed feelings of shame in the presence of a guest when there was sight or smell of their child's feces in or around the household. A caretaker explained that *"…once the child is used to defecating inside the house, the child can come in the house when you have a visitor and start defecating. That is embarrassing. The child will not feel anything because you are the one who trained him to defecate in the house …"* (FGD 1). In addition, mothers discussed how children often mess with their feces and subsequently touch other things in the house, making cleaning a more strenuous task. Lastly, the participants thought feces on the household floor would attract flies that would transfer the feces to food and cause disease.

Most caretakers agreed that the open field or bush was the worst defecation site for children under the age of five. They discussed how this site is potentially dangerous

for a child due to the thorny vegetation and poisonous animals that populate the environment. Since numerous people openly defecate in the field, mothers also feared their child contracting diseases after being exposed to, or even smelling, feces from other people. Caretakers also expressed their concern of flies bringing in feces from the field and landing on food, thus making the child ill.

In addition, when the child defecates in the bush it is difficult for the caretaker to properly dispose of the feces. As one participant described, "*many children go to the bush so you cannot clean one and leave the others and you cannot know which one was your child's. You know you cannot wipe somebody's child's feces"* (FGD 2). While most considered this a problem, one caretaker discussed how she liked her child to use the bush because it was less work for her in the cleaning process.

Cleaning methods

Participants thought the easiest and safest methods for cleaning a child following defecation were water (without and without soap) and tissue paper. These materials are primarily used when the child has diarrhea, has touched feces, or has dried feces on his bottom. However, tissue paper is considered very expensive by some mothers and is used sparingly as a result. To save money, caretakers often obtain newspapers, magazines, or rags from around the compound to clean the child. When these items are not available, mothers might use leaves or simply tell the child to wipe his bottom on the grass or soil. The latter option was considered the most common practice among respondents from lower socioeconomic areas.

The materials used for cleaning children after defecation are disposed in a variety of places. The latrine was mentioned to be the most common disposal site for most materials, including water, tissue paper, newspaper and leaves. However, some caretakers noted that this is not always the case. Dirty water is sometimes disposed in the drainage ditch. Newspapers and magazines were said to just lie around the compound and are not discarded in any location. Rags are known to fill the latrine very fast, so they are usually thrown in bushes or in the dust bin after use.

Disposal site

In Obunga where living conditions are very crowded, "…*when the baby defecates no one owns up it's her baby so you find there is a lot of feces in the compound"* (FGD 3). Many mothers discussed their aversion to touching other children's feces, but others said they would pick up the feces and dispose of them so they would be out their child's reach. Caretakers expressed their concern that children would eat the feces thinking it was soil, since eating soil is a common practice among children in the area. Other mothers said they would dispose of feces so flies do not land on them and spread the feces to food in the household. Caretakers also explained that they would dispose of other children's feces to rid the smell from the ground.

Almost all participants agreed that the safest place to dispose of child feces was into a latrine. Mothers felt good about using a latrine because they knew it was meant for collecting feces. They described the process of disposal into a latrine as being quick and easy. Once the stools are thrown into the pit, caretakers liked how you could no

longer see or smell the feces. They also appreciated that the feces were no longer accessible to children, who often play with their stools and make a mess.

Mothers generally disapproved of disposing feces in drainage ditches, but one liked using this site because she said the feces are carried away with the water. However, other participants discussed how this was a bad site because many children play in drainage ditches and sometimes even drink the water, which can make them sick. One caretaker also expressed her concern that "w*hen the drainage ditches are full during rainy season, the water may get flooded and the feces may flow into people's houses"* (FGD 2).

Caretakers discussed other "bad" disposal sites that are commonly used in their community. The bush and garbage pit were disliked because the feces made those locations smell bad when the sun heated them. "Flying toilets" were mentioned as an alternative method to discarding child feces. With this method, the feces are placed in a plastic bag and then *"you swing it in your hand and throw it with force"* (FGD 2). This was mentioned to be a common disposal method in places where there were no latrines. Flying toilets were looked down upon by most mothers because they said the bag could land anywhere, on the road or on someone's roof. Participants disapproved of the foul odor that came from the flying toilets. This method of stool disposal was also considered unacceptable since children often take the bags to play with, and thereby get exposed to feces.

Although mothers knew that the latrine was the proper location to dispose of child feces, they often used other sites for a variety of reasons. Many caretakers

discussed how there are too few latrines in the community and many households do not have access to adequate sanitation. Mothers in these households sometimes choose to dispose of feces elsewhere to save the embarrassment of asking a neighbor to borrow their latrine. Caretakers without a latrine also prefer to use their money to purchase water, rather than paying to dispose of feces in a community latrine.

Even when a latrine was available, caretakers offered several explanations for not using it to dispose of feces. When the pits are full of feces and maggots or the latrine is not very clean, mothers tend to dispose of stools elsewhere. One participant described how "*sometimes the latrine is so messed up. People defecate on floor so when you go to the latrine you can even feel nauseated"* (FGD 3). Access to a latrine was another commonly mentioned concern, though not due to distance. Some caretakers cited structural problems of the latrine as a barrier to access and fear of falling in the pit. Others noted how many latrines are kept locked. In some cases, only one person would have the key and anyone needing to use the latrine would have to find that person to unlock the latrine door. In other cases, caretakers would lose the key to the lock, and then would have to rely on others to open the latrine for them.

Participants also discussed how many parents are careless or lazy, and simply do not take the initiative to walk to the latrine to dispose of child feces into the pit. Others mentioned how some people do not think feces have germs, and therefore do not need to be disposed in a latrine.

Handwashing

Prevention of child illness was the primary reason why caretakers said they washed their hands after last contact with child feces. They discussed how feces and germs could get on their hands when they cleaned the child and disposed of feces. If not washed after fecal contact, the feces and germs from the hands could spread to anything that the mother touched, such as food, utensils, her breast, or the child's hands. If the child's mouth comes into contact with any of the items that the mother touched, the fecal germs would then be transmitted to the child and he might become sick.

This process was well portrayed by one caretaker who stated that "*we must wash our hands because you might clean the child and some feces remain onto your hands. If you give your child food before washing your hands then the child might get diarrhea"* (FGD 1). Similar reasoning was given for washing the child's hands following defecation. One mother described how "m*aybe you have kids who are very naughty and very active. They can touch anything even feces. If you don't wash the child's hands then the child might go down with diarrhea if the dirty hands get to the mouth"* (FGD 1).

From the three discussions, it became apparent that the caretakers knew they should wash their hands following child defecation-related events, but they listed many reasons why it does not happen as often as it should. If the caretaker did not come into contact with feces, they did not feel like they needed to wash their hands. A participant commented that "s*ome of us don't wash [our] hands. Even most of us here don't do that always. Sometimes we forget. Like nowadays many mothers train their children to use*

potty. So when you dispose the potty you will not even touch the feces. You don't need soap. Sometimes you don't even wash your hands" (FGD 3). Mothers also discussed how they can be distracted by a crying child or a chatty neighbor after handling child feces, and as a result forget to wash their hands. In addition to these reasons, participants said that mothers were lazy or simply do not bother to wash their hands. Similar explanations were provided for not washing children's hands following defecation.

The observations revealed that many caretakers immediately began or resumed washing activities following contact with child feces. While their hands were immersed in water, and sometimes soap, they did not appear to be purposively washing their hands. From the discussions, many mothers explained that they would not wash their hands after cleaning the child or disposing of stools if they were planning to wash clothes thereafter. A mother discussed that "*we are being deceived that there is soap in that water that we are using for washing clothes. After cleaning the baby, I will just dump my hands into the water and continue washing my clothes. All the smell and dirt will go away"* (FGD 1).

However, if mothers were going to wash utensils after contact with child feces, they would make sure to wash their hands with soap and water first. One caretaker clarified the discrepancy between these behaviors. *"We use clothes outside our bodies but utensils are used for things that we consume, so you must wash your hands thoroughly before handling them because they might cause diseases if you mishandle them"* (FGD 3). Disease prevention was also the primary reason listed for washing hands

after contact with stools if the next activity was going to be eating, cooking, or breastfeeding.

CHAPTER 4: DISCUSSION, RECOMMENDATIONS, AND CONCLUSION

The purpose of this study was to understand two of the three WHO-recommended hygiene behaviors for promotion in the context of child defecation. The primary behaviors of interest were 1) disposal of child feces and 2) handwashing after contact with child feces. The correct and consistent practice of these behaviors could play a significant role in reducing the spread of fecal pathogens in this low-resource setting. In order to better understand these behaviors, it was necessary to examine other related factors, such as the child's defecation site, anal cleansing methods, and latrine characteristics, as well as explore caretakers' beliefs, motivations, and barriers to these hygiene practices.

Disposal of child feces

Household observations revealed that half (n=13) of caretakers safely disposed of child feces into a latrine, while the other half either disposed in an unsafe location or did not dispose during the observation period. Results from the observation field notes and FGDs suggest that the decision of where to dispose of child feces may depend on several factors, including the child's defecation site, availability of sanitation, and characteristics of latrines.

The child's defecation site may influence where the stools are disposed in a variety of ways. First, the caretaker will only know that the feces need to be discarded if

the child defecates near the household where the stools are in sight. If the child uses the bush or another location away from the house, caretakers might not know that the child defecated and thus will not have the visual cue to dispose of the feces.

Second, caretakers' opinions of child defecation sites were often shaped by the ease of cleaning feces from the site and transporting them to be disposed. Caretakers liked children to use a potty because they thought it allowed for easy removal of stools into the latrine. In contrast, some mothers did not approve of children using a newspaper or magazine for defecation, particularly when they had diarrhea, because the materials often broke during transport to the latrine. If this occurred, the excrement would likely remain on the ground with the torn materials and would not be discarded.

Third, if the child defecates in any material that requires washing (e.g. clothes, a nappy, a potty), it is essential that both the solid stools and the dirty water are disposed of in a safe manner. However, the observations revealed that this does not always occur. On two occasions when the child defecated in his clothes or a nappy, the solid stools were disposed in the latrine while the water used to wash the soiled materials was thrown in the drainage ditch. Caretakers in the FGDs also discussed how dirty water (from washing soiled materials and from anal cleansing) is often thrown in the drainage ditch. This location is not a safe place for disposal, considering that children often play in drainage ditches and sometimes even drink the water.

In order to address these factors, children would need to be trained to defecate in a location near to the caretaker that would allow for easy cleaning of the defecation site and easy disposal of feces and associated washing water. The potty would likely be

the best defecation site to address these factors, and studies have consistently found that disposal of stools into a latrine occurred more frequently after a child defecated in a potty than any other site (V Curtis, et al., 1995; Huttly, et al., 1994; Huttly, et al., 1998; Traore, et al., 1994; B Yeager, et al., 1999). However, the use of a potty is limited to children who are old enough to potty train, and to families who can access and/or afford a potty. Caretakers would need to be motivated to train the child to use the potty, and to perform the following tasks after every use: safely dispose of the feces, clean the potty, and safely dispose of the washing water.

Behavioral trials have shown promising results for the adoption of potties and safe disposal of feces into a latrine (Biran, et al., 2005; V Curtis, Kanki, et al., 1997; V Curtis, Sinha, et al., 1997; B Yeager, et al., 1999), though large-scale intervention trials have not been as successful ((V. Curtis, et al., 2001; B Yeager, et al., 2002). Additional research is required to determine if potties and the disposal of feces into a latrine can be effectively promoted and adopted through an intervention setting.

Availability of latrines may also influence the decision of where to dispose of child feces. Two of the 26 households where defecation events were observed did not have access to a latrine. The caretakers associated with these households disposed of child feces in the bush. Participants in the FGDs noted the lack of latrines as one of the major barriers to the safe disposal of feces in the community. They said that mothers without access to sanitation were often embarrassed to ask to borrow a latrine, and could not afford to spare a few shillings to dispose of feces in a paid community latrine each time the child defecated.

However, access to sanitation does not guarantee that caretakers will use the latrine to dispose of child feces. Similar to other studies (Almedom, 1996; V Curtis, Sinha, et al., 1997), our research found that caretakers disposed of child feces in a variety of locations, regardless of access to sanitation. Results from our study suggest that certain latrine characteristics may influence whether the feces are safely disposed. The qualitative data revealed that poor latrine condition (e.g. cleanliness) was a barrier to safe disposal of child feces. Likewise, the quantitative data found one latrine characteristic - very visible feces on the slab - to be significantly associated with the observed disposal site. The concordance of these results provides compelling evidence that latrine condition is an important determinant of feces disposal practices. This finding is unique to this research, as no other available quantitative or qualitative studies of this type have discussed latrine condition in the context of feces disposal practices.

While disposal of child feces are often addressed as part of a hygiene intervention, this study demonstrates that disposal of child feces and household sanitation are inherently linked. Households must have access to a latrine before they *can* properly dispose of stools, but the latrine must be clean before households *will* use it to dispose of child feces. Therefore, a hygiene program that promotes the safe disposal of feces in a latrine may not be successful unless it is supplemented by a sanitation program that addresses both access to and maintenance of household latrines.

Handwashing after contact with child feces

Household observations revealed that after potential contact with child feces, three caretakers washed their hands with soap and water, and 16 washed their hands with water only or water for washing. Only two of these caretakers appeared to be deliberately washing their hands, while the rest simply had their hands immersed in water while doing the wash.

After defecation, five caretakers washed their child's hands, four of which used soap and water. Handwashing after these events appears to be a universally uncommon practice (V Curtis, et al., 2009; Gilman, et al., 1993; Huttly, et al., 1994; Huttly, et al., 1998; Oswald, et al., 2008). Results from the observations and FGDs suggest that handwashing behavior may be influenced by several factors, including perceived contact with feces and the task that they will participate in after contact.

The FGD participants had a nearly universal view that caretaker handwashing did not need to occur after cleaning the child or disposing of stools unless the caretaker came into direct contact with feces. This perspective also held for child handwashing following defecation, which would explain why handwashing primarily occurred during observations when the child had touched his feces.

Similar to findings from Burkina Faso (Cousens, et al., 1996), caretakers also discussed how their handwashing behavior after contact with feces was influenced in part by the subsequent task in which they were going to participate. Kenyan caretakers spend much of the day doing wash (clothes, dishes, potties, etc.), where their hands are frequently immersed in water. Many participants discussed how they would not wash

their hands after contact with child feces if they planned to wash clothes or potties thereafter. They believed that in the process of washing these items, the smell and dirt of the feces would be removed. However, if they planned to wash dishes, items that would eventually be in contact with a person's mouth, they would deliberately wash their hands with soap and water first. Participants also described how they would carefully wash their hands with soap before performing activities such as cooking, eating, or breastfeeding.

While the caretakers make logical points, handwashing programs need to address the fact that visibly clean hands are not necessarily free of fecal pathogens. Motivations of nurture, disgust, and fear (V Curtis, et al., 2009) could be used to promote handwashing in this context, since mothers highlighted the prevention of child illness as the primary reason to wash their hands after child defecation-related events.

Methodological issues

In this study, observations and questionnaires were used to measure hygiene behaviors. The results showed poor agreement for disposal of feces into a latrine and any caretaker handwashing after last contact with feces, and good agreement for any child handwashing after last defecation event. Over-reporting of these 'good' hygiene behaviors was found at varying alpha levels (0.05 – 0.10), which is consistent with results from previous studies (Biran, et al., 2008; V Curtis, et al., 1993; Manun'Ebo, et al., 1997; Stanton, et al., 1987). This research provides further evidence to support the use of observations in measuring hygiene behavior.

While structured observations may produce more valid results than a questionnaire, they still have a few limitations that require discussion. Variability of behavior and reactivity to the observer are the two major limitations to the use of structured observations in this study. Since we were unable to perform repeated observations due to time constraints, we cannot ascertain whether any of the behaviors of interest would have varied over time, as documented in other studies (Cousens, et al., 1996; V Curtis, et al., 1993). We tried to minimize reactivity by performing unplanned observations that began immediately after consent, and by situating field staff in outdoor locations where they would be an unobtrusive as possible.

Another limitation to this study is the small sample size for both the observations and questionnaires. While the generalization of these findings is limited, the results do provide relevant information regarding the hygiene practices of caretakers in this community. In addition, it is possible that saturation was not fully reached for the FGDs, considering that time limited us to holding only one group for each area of Obunga. However, there was much overlap of responses from the three discussions, which indicates that we may have been close to achieving saturation.

The major strength of this study lies in the mixed methods design that allowed for triangulation of data collection. Through this approach, we were able to validate our findings from both the quantitative and qualitative results and present a detailed discussion of the key hygiene practices of interest and their determinants. The purposive selection of participants for each method, as discussed in the methods, also

facilitated our understanding of the wide range of caretaker hygiene behaviors related to child defecation in this community.

Conclusion

Disposal of feces into a latrine and handwashing after contact with feces are two of the most important behaviors that could have a significant impact on reducing diarrheal disease among children in this community. This study provides important information that could help inform a hygiene/sanitation program to promote these behaviors. Of particular note, our findings indicate that there are multiple external, or environmental, factors that shape whether these behaviors can be adequately practiced at the individual level. This is particularly true for the safe disposal of feces. If households do not have an accessible latrine due to poor coverage or problems with locks, or cannot (or will not) use a latrine due to structural or cleanliness problems, then they cannot be expected to safely dispose of their child's feces. These factors must be addressed prior to any promotion program.

REFERENCES

Ahmed, N., Zeitlin, M., Beiser, A., Super, C., & Gershoff, S. (1993). A longitudinal study of the impact of behavioural change intervention on cleanliness, diarrhoeal morbidity and growth of children in rural Bangladesh. *Social Science & Medicine, 37*(2), 159-171.

Aiello, A., Coulborn, R., Perez, V., & Larson, E. (2008). Effect of Hand Hygiene on Infectious Disease Risk in the Community Setting: A Meta-Analysis. *Am J Public Health, 98*(8), 1372-1381.

Alam, N., Wojtyniak, B., Henry, F., & Rahaman, M. (1989). Mothers' Personal and Domestic Hygiene and Diarrhoea Incidence in Young Children in Rural Bangladesh. *International Journal of Epidemiology, 18*(1), 242-247.

Almedom, A. (1996). Recent developments in hygiene behaviour research: an emphasis on methods and meaning. *Tropical Medicine and International Health, 1*(2), 171-182.

Aulia, H., Surapaty, S., Bahar, E., Susanto, T., Roisuddin, Hamzah, M., et al. (1994). Personal and domestic hygiene and its relationship to the incidence of diarrhoea in south Sumatera. *J Diarrhoeal Dis Res, 12*(1), 42-48.

Aunger, R., Schmidt, W.-P., Ranpura, A., Coombes, Y., Maina, P., Matiko, C., et al. (2010). Three kinds of psychological determinants for hand-washing behaviour in Kenya. *Social Science & Medicine, 70*(3), 383-391.

Baltazar, J., & Solon, F. (1989). Disposal of faeces of children under two years old and diarrhoea incidence: a case-control study. *Int J Epidemiol, 18*(4 Suppl 2), S16-19.

Biran, A., Rabie, T., Schmidt, W., Juvekar, S., Hirve, S., & Curtis, V. (2008). Comparing the performance of indicators of hand-washing practices in rural Indian households. *Tropical Medicine & International Health, 13*(2), 278-285.

Biran, A., Schmidt, W.-P., Wright, R., Jones, T., Seshadri, M., Isaac, P., et al. (2009). The effect of a soap promotion and hygiene education campaign on handwashing behaviour in rural India: a cluster randomised trial. *Tropical Medicine & International Health, 14*(10), 1303-1314.

Biran, A., Tabyshalieva, A., & Salmorbekova, Z. (2005). Formative research for hygiene promotion in Kyrgyzstan. *Health Policy Plan., 20*(4), 213-221.

Bukenya, G., & Nwokolo, N. (1991). Compound Hygiene, Presence of Standpipe and the Risk of Childhood Diarrhoea in an Urban Settlement of Papua New Guinea. *International Journal of Epidemiology, 20*(2), 534-539.

Cairncross, S., Hunt, C., Boisson, S., Bostoen, K., Curtis, V., Fung, I., et al. (2010). Water, sanitation and hygiene for the prevention of diarrhoea. *International Journal of Epidemiology, 39*(suppl 1), i193-i205.

Clasen, T., Bostoen, K., Schmidt, W.-P., Boisson, S., Fung, I., Jenkins, M., et al. (2010). Interventions to improve disposal of human excreta for preventing diarrhoea. *Cochrane Database of Systematic Reviews*(6).

Cousens, S., Kanki, B., Toure, S., Diallo, I., & Curtis, V. (1996). Reactivity and repeatability of hygiene behaviour: Structured observations from Burkina Faso. *Social Science & Medicine, 43*(9), 1299-1308.

Creswell, J., & Plano Clark, V. (2007). Choosing a Mixed Methods Design *Designing and Conducting Mixed Methods Research*: Sage Publications, Inc.

Curtis, V., & Cairncross, S. (2003). Effect of washing hands with soap on diarrhoea risk in the community: A systematic review. *The Lancet Infectious Diseases, 3*(5), 275-281.

Curtis, V., Cairncross, S., & Yonli, R. (2000). Domestic hygiene and diarrhoea - Pinpointing the problem. *Tropical Medicine & International Health, 5*(1), 22-32.

Curtis, V., Cousens, S., Mertens, T., Traore, E., Kanki, B., & Diallo, I. (1993). Structured observations of hygiene behaviours in Burkina Faso: validity, variability, and utility. *Bull World Health Organ, 71*(1), 23-32.

Curtis, V., Danquah, L., & Aunger, R. (2009). Planned, motivated and habitual hygiene behaviour: an eleven country review. *Health Educ. Res., 24*(4), 655-673.

Curtis, V., Kanki, B., Cousens, S., Diallo, I., Kpozehouen, A., Sangare, M., et al. (2001). Evidence of behaviour change following a hygiene promotion programme in Burkina Faso. *Bull World Health Organ, 79*(6), 518-527.

Curtis, V., Kanki, B., Cousens, S., Sanou, A., Diallo, I., & Mertens, T. (1997). Dirt and diarrhoea: formative research in hygiene promotion programmes. *Health Policy Plan., 12*(2), 122-131.

Curtis, V., Kanki, B., Mertens, T., Traore, E., Diallo, I., Tall, F., et al. (1995). Potties, pits and pipes: Explaining hygiene behaviour in Burkina Faso. *Social Science & Medicine, 41*(3), 383-393.

Curtis, V., Sinha, P., & Singh, S. (1997). Accentuate the positive - promoting behavior change in Lucknow's slums. *Waterlines, 16*(2), 5-7.

Ejemot, R., Ehiri, J., Meremikwu, M., & Critchley, J. (2008). Hand washing for preventing diarrhoea. *Cochrane Database of Systematic Reviews*(1).

Esrey, S., Potash, J., Roberts, L., & Shiff, C. (1991). Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. *Bulletin of the World Health Organization, 69*(5), 609-621.

Fewtrell, L., Kaufmann, R., Kay, D., Enanoria, W., Haller, L., & Colford, J. (2005). Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *The Lancet Infectious Diseases, 5*(1), 42-52.

Fleiss, J. (1981). *Statistical methods for rates and proportions*. New York: John Wiley.

Gil, A., Lanata, C., Kleinau, E., & Penny, M. (2004). *Children's Feces Disposal Practices in Developing Countries and Interventions to Prevent Diarrheal Diseases: A Literature Review*. Washington, D.C.: Environmental Health Project.

Gilman, R., Marquis, G., Ventura, G., Campos, M., Spira, W., & Diaz, F. (1993). Water cost and availability: key determinants of family hygiene in a Peruvian shantytown. *Am J Public Health, 83*(11), 1554-1558.

Gorter, A., Sandiford, P., Pauw, J., Morales, P., Pérez, R., & Alberts, H. (1998). Hygiene behaviour in rural Nicaragua in relation to diarrhoea. *International Journal of Epidemiology, 27*(6), 1090-1100.

Han, M., & Moe, K. (1990). Household faecal contamination and diarrhoea risk. *J Trop Med Hyg, 93*(5), 333-336.

Huttly, S., Lanata, C., Gonzales, H., Aguilar, I., Fukumoto, M., Verastegui, H., et al. (1994). Observations on handwashing and defecation practices in a shanty town of Lima, Peru. *J Diarrhoeal Dis Res, 12*(1), 14-18.

Huttly, S., Lanata, C., Yeager, B., Fukumoto, M., del Aguila, R., & Kendall, C. (1998). Feces, flies, and fetor: findings from a Peruvian shantytown. *Rev Panam Salud Publica, 4*(2), 75-79.

Jinadu, M., Esmai, O., & Adegbenro, C. (2004). Disposal of children's faeces and implications for the control of childhood diarrhoea. *J R Soc Promot Health, 124*(6), 276-279.

Kenya National Bureau of Statistics, & ICF Macro. (2010). *Kenya Demographic and Health Survey 2008-09*. Calverton, Maryland: KNBS and ICF Macro.

Lanata, C., Huttly, S., & Yeager, B. (1998). Diarrhea: whose feces matter? Reflections from studies in a Peruvian shantytown. *The Pediatric Infectious Disease Journal, 17*(1), 7-9.

Luby, S., Agboatwalla, M., Bowen, A., Kenah, E., Sharker, Y., & Hoekstra, R. (2009). Difficulties in Maintaining Improved Handwashing Behavior, Karachi, Pakistan. *Am J Trop Med Hyg, 81*(1), 140-145.

Luby, S., Agboatwalla, M., Feikin, D., Painter, J., Billhimer, W., Altaf, A., et al. (2005). Effect of handwashing on child health: a randomised controlled trial. [Article]. *Lancet, 366*(9481), 225-233.

Luby, S., Kadir, M., Yushuf Sharker, M., Yeasmin, F., Unicomb, L., & Sirajul Islam, M. (2010). A community-randomised controlled trial promoting waterless hand sanitizer and handwashing with soap, Dhaka, Bangladesh. *Tropical Medicine & International Health, 15*(12), 1508-1516.

Manun'Ebo, M., Cousens, S., Haggerty, P., Kalengaie, M., Ashworth, A., & Kirkwood, B. (1997). Measuring hygiene practices: a comparison of questionnaires with direct observations in rural Zaïre. *Tropical Medicine and International Health, 2*(11), 1015-1021.

Mertens, T., Jaffar, S., Fernando, M., Cousens, S., & Feachem, R. (1992). Excreta Disposal Behaviour and Latrine Ownership in Relation to the Risk of Childhood Diarrhoea in Sri Lanka. *International Journal of Epidemiology, 21*(6), 1157-1164.

Oswald, W., Hunter, G., Lescano, A., Cabrera, L., Leontsini, E., Pan, W., et al. (2008). Direct observation of hygiene in a Peruvian shantytown: not enough handwashing and too little water. *Tropical Medicine & International Health, 13*(11), 1421-1428.

Rabie, T., & Curtis, V. (2006). Handwashing and risk of respiratory infections: a quantitative systematic review. [Article]. *Tropical Medicine & International Health, 11*(3), 258-267.

Ram, P., Halder, A., Granger, S., Jones, T., Hall, P., Hitchcock, D., et al. (2010). Is Structured Observation a Valid Technique to Measure Handwashing Behavior? Use of Acceleration Sensors Embedded in Soap to Assess Reactivity to Structured Observation. *Am J Trop Med Hyg, 83*(5), 1070-1076.

Schmidt, W.-P., Aunger, R., Coombes, Y., Maina, P., Matiko, C., Biran, A., et al. (2009). Determinants of handwashing practices in Kenya: the role of media exposure, poverty and infrastructure. *Tropical Medicine & International Health, 14*(12), 1534-1541.

Siegel, S., & Castellan, N. (1988). *Nonparametric statistics for behavioral sciences*. New York: McGraw-Hill.

Stanton, B., & Clemens, J. (1987). An educational intervention for altering water-sanitation behaviors to reduce childhood diarrhea in urban Bangladesh. II. A randomized trial to assess the impact of the intervention on hygienic behaviors and rates of diarrhea. *American Journal of Epidemiology 125*(2), 292-301.

Stanton, B., Clemens, J., Aziz, K., & Rahman, M. (1987). Twenty-four-hour recall, knowledge-attitude-practice questionnaires, and direct observations of sanitary practices: a comparative study. *Bulletin of the World Health Organization, 65*(2), 217-222.

Traore, E., Cousens, S., Curtis, V., Mertens, T., Tall, F., Traore, A., et al. (1994). Child defecation behaviour, stool disposal practices, and childhood diarrhoea in Burkina Faso: results from a case-control study. *J Epidemiol Community Health, 48*(3), 270-275.

UN-HABITAT. (2005). *Situation Analysis of Informal Settlements in Kisumu*. Nairobi, Kenya.

UNICEF, & WHO. (2009). *Diarrhoea: Why children are still dying and what can be done*.

Waddington, H., & Snilstveit, B. (2009). Effectiveness and sustainability of water, sanitation, and hygiene interventions in combating diarrhoea. [Article]. *Journal of Development Effectiveness, 1*(3), 295-335.

Water and Sanitation Program. (2009). *Are your hands clean enough? Study findings on handwashing with soap behaviour in Kenya*. Nairobi: WSP, UNICEF, Republic of Kenya.

World Health Organization. (1992). *Improving water and sanitation hygiene behaviors for the reduction of diarrheal disease: The report of an informal consultation*. Geneva.

World Health Organization. (2006). *Country Health System Fact Sheet 2006: Kenya*: World Health Organization.

Yeager, B., Huttly, S., Bartolini, R., Martha, R., & Lanata, C. (1999). Defecation practices of young children in a Peruvian shanty town. *Social Science & Medicine, 49*(4), 531-541.

Yeager, B., Huttly, S., Diaz, J., Bartolini, R., Marin, M., & Lanata, C. (2002). An intervention for the promotion of hygienic feces disposal behaviors in a shanty town of Lima, Peru. *Health Educ. Res., 17*(6), 761-773.

FIGURES AND TABLES

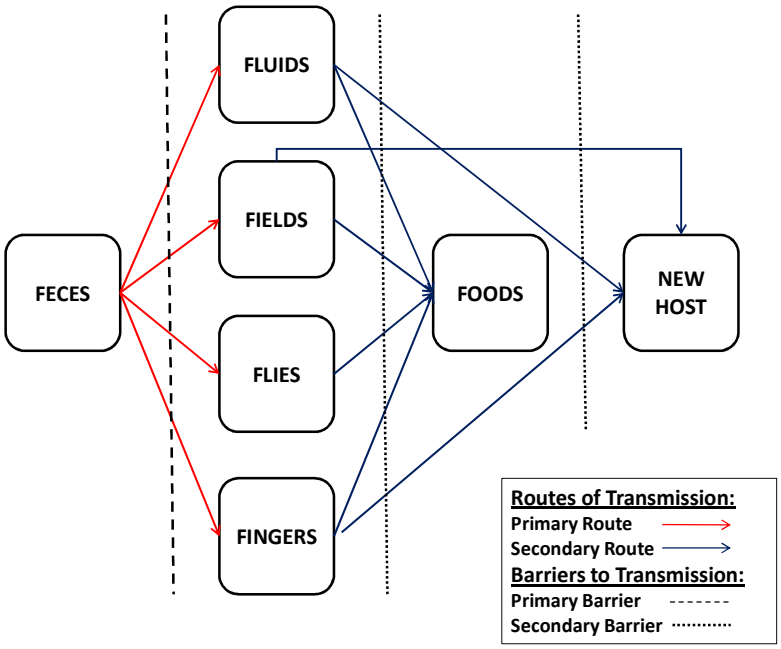

Figure 1. F-Diagram, adapted from Curtis 2000 (V Curtis, et al., 2000)

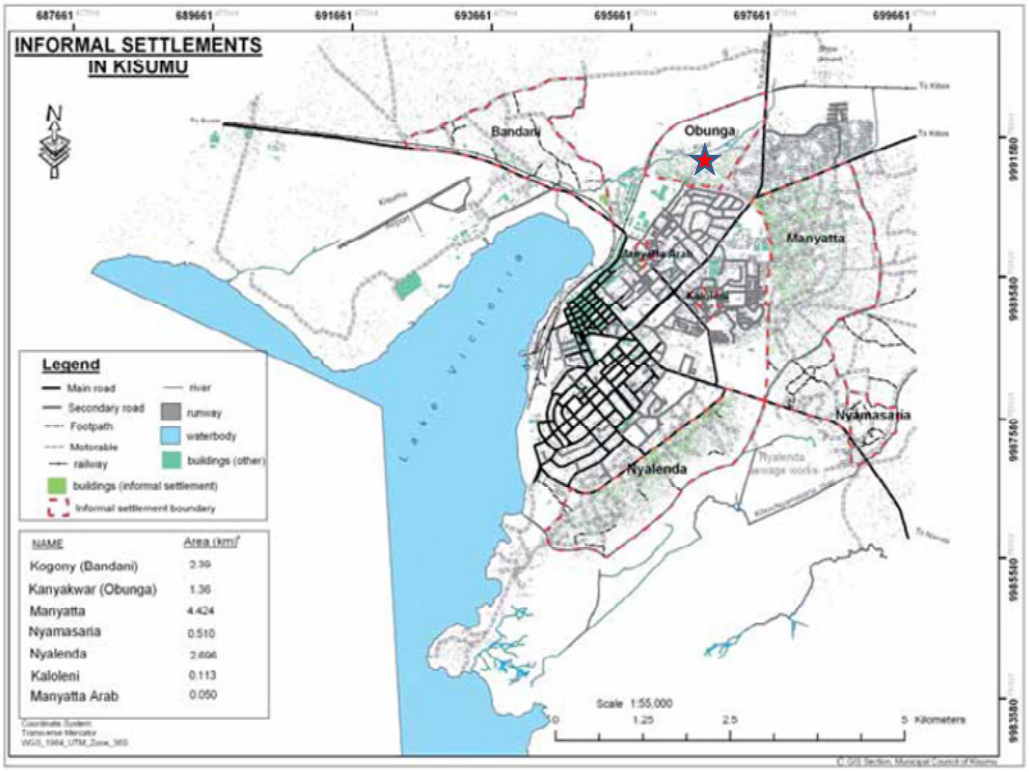

Figure 2. Map of informal settlements in Kisumu (UN-HABITAT, 2005)

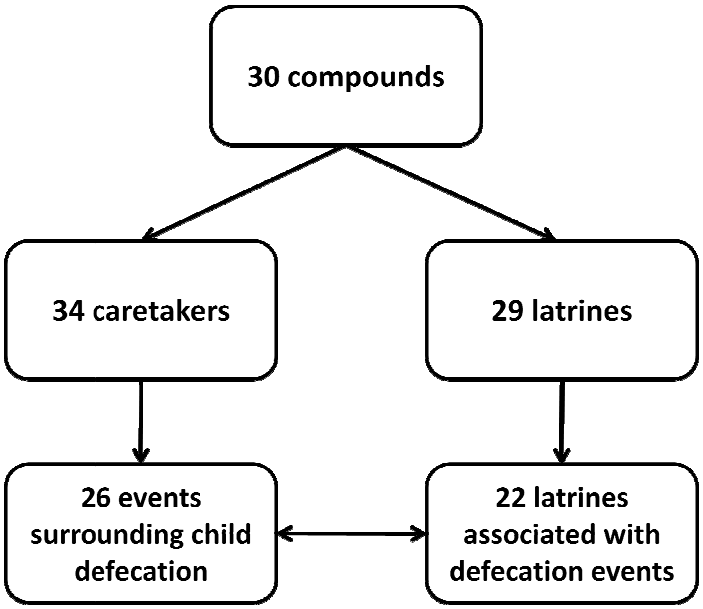

Figure 3. Compound observations

Table 1. Observed hygiene behaviors surrounding child defecation (n=26)	
Behavior	**n (%)**
Child's defecation site[1]	
Clothes	6 (23)
Household soil	5 (19)
Potty	5 (19)
Other	8 (31)
Not observed	4 (15)
Cleaning method[2]	
Rags / Paper	7 (27)
Child's clothes	4 (15)
Tissue paper	4 (15)
Other materials	5 (19)
Not observed	9 (35)
Disposal Site[3]	
Latrine	13 (50)
Outside / Bush	5 (19)
Drainage ditch	4 (15)
Garbage pile	2 (8)
Not observed	4 (15)
Caretaker handwashing after last contact with child feces	
Water and soap	3 (12)
Water only / washing water[4]	16 (62)
Not observed	7 (27)
Child handwashing after defecation	
Water and soap	4 (15)
Washing water[4]	1 (4)
Not observed	21 (81)

[1] Two events had two defecation sites each.
[2] Three events had two cleaning methods each.
[3] Two events had two disposal sites each.
[4] The presence or absence of soap in the washing water could not be determined.

Table 2. Comparison of observed versus reported behaviors for feces disposal and handwashing practices

	Reported					
	Disposed of feces in latrine (n=22)[1]		Any caretaker handwashing after last contact with child feces (n=26)		Any child handwashing after defecation (n=26)	
Observed	Yes	No	Yes	No	Yes	No
Yes	11	0	19	0	5	0
No	7	4	6	1	5	16
k statistic (95% CI)	0.36 (0.06 – 0.66)		0.20 (0.00 – 0.53)		0.55 (0.24 – 0.87)	
McNemar's p-value	0.0156		0.0313		0.0625	

[1] Does not include the four observations that either had two observed or two reported disposal sites.

Table 3. Associations between latrine characteristics and disposing of child stools in a latrine

Characteristic	Households that used latrine (n=24)	Households that disposed of child stools in latrine[2]	Fisher's exact p-value
Latrine Block	9 (38)[1]	4 (44)	0.7501
Shared Latrine	21 (88)	11 (52)	>0.9999
Latrine located 10+ meters from household	8 (67)	5 (63)	0.8889
Type of latrine			
Traditional pit latrine	12 (50)	6 (50)	>0.9999
VIP latrine	9 (38)	6 (67)	0.6002
Other	3 (13)	1 (33)	0.8696
Door that did not close completely	8 (35)[3]	5 (63)	>0.9999
Lock	4 (17)	3 (75)	0.7267
Strong smell inside and outside	8 (33)	2 (25)	0.1101
Very visible feces	9 (38)	2 (22)	0.0427
Puddles of urine	6 (25)	3 (50)	>0.9999
Flies inside and outside	3 (13)	0 (0)	0.4783
Dilapidated or no roof	7 (29)	3 (43)	0.7902
Dilapidated walls	2 (83)	0 (0)	0.8800
Unstable slab	4 (17)	2 (50)	>0.9999

[1] The figures in the parentheses are percentages

[2] Denominator for percentage equals the number of households that used a latrine with specific characteristics (column 2)

[3] n=23 – One household used a latrine that did not have a door

APPENDICES

Appendix A. Consent forms

Observations/Questionnaire

Hello. My name is _____. I am working in coordination with Great Lakes University of Kisumu and Emory University to understand practices related to child health. We will be performing household observations over the next few days and would like you to participate. You were selected to be in this study because you are the primary caretaker of a child under the age of five. If you agree to participate, I will return to your home tomorrow morning and observe your daily activities from 8 a.m. to 11 a.m.

Your participation is completely voluntary. All the information collected will be kept confidential and we will not write your name on any project documents. Once the information from the observation has been sufficiently reviewed, the observation record will be destroyed. No one other than our research team will have access to your information. Participation in this study presents no risks to your health greater than those found in daily life. Your participation may benefit you and other communities by helping us understand the ways in which we can improve the quality of life.

If you have questions or concerns about the interview or about your rights as a participant, you may contact Mr. Peter Waka, the chief study person in the CARE office in Kisumu, Kenya (*CARE-Kenya, PO Box 88, Kisumu, Kenya. Tel + 254-57-20010*). For additional information about your rights as a participant, you may contact Emory IRB at irb@emory.edu or +01-404-712-0720.

Focus Group Discussions

Hello. My name is _____. I am working in coordination with Great Lakes University of Kisumu and Emory University to better understand the sanitation and hygiene situation in your neighborhood. We would like to have a group discussion today to learn about your perspectives and experiences. You were selected to be in this study because you are the primary caretaker of a child under the age of five. If you agree to participate, our discussion today should only last approximately 1 hour.

Your participation today is completely voluntary and you are free to leave at any time if you don't feel comfortable. However, we do hope that you will stay and contribute your perspectives, as they are all important to this study. If you do not feel comfortable sharing information, you do not need to share. If you have any questions during the discussion, you can ask me at any time. All the information that you provide will be kept confidential and we will not write your name on any project documents. With your permission, we will record our conversation today so that we can later review the information that you share with us. Once the information has been sufficiently reviewed, the recording will be destroyed. No one other than our research team will have access to your information. Participation in this study presents no risks to your health greater than those found in daily life. Your participation may benefit you and other communities by helping us understand the ways in which we can improve the quality of life.

If you have questions or concerns about the interview or about your rights as a participant, you may contact Mr. Peter Waka, the chief study person in the CARE office in Kisumu, Kenya (*CARE-Kenya, PO Box 88, Kisumu, Kenya. Tel + 254-57-20010*). For additional information about your rights as a participant, you may contact Emory IRB at irb@emory.edu or +01-404-712-0720. If it is OK, may I begin?

Appendix B. Compound and latrine observation tools

INSTRUCTIONS: The use of this tool begins once a defecation event is observed. The observer will watch for and take detailed notes on the following key practices/behaviors following a defecation event. Once the caretaker has moved on to another task, the observer will consider that particular defecation event closed. If additional defecation events occur during the observation period, then new observation forms will need to be filled out for each one.

1.0 OBSERVATION CHARACTERISTICS		
1.01	Observer ID	
1.02	Compound ID	
1.03	Number of households being observed in compound	
1.04	Date of observation	___ / ___ / ___
1.05	Arrival time to compound	:
1.06	Departure time from compound	:

2.0 COMPOUND OBSERVATIONS				
Number	**Practice/Behavior**	**Options**	**Time of Event**	**Notes**
2.01	Child mobility	1. Not mobile 2. Crawls 3. Walks 99. Don't know	N/A	
2.02	Child's initial defecation site *(For all responses except potty, please proceed to **2.06**)*	1. Potty → **2.03 – 2.05** 2. Nappy 3. Diaper 4. Clothes 5. Other linens 6. Latrine 7. Household floor 8. Soil outside of household 9. Bushes/field 88. Other, specify _____ __ 99. Don't know		
2.03	Location of potty	1. Inside the house 2. Outside the house	N/A	
2.04	Cleanliness of potty before use	1. Clean (no urine or feces present) 2. Dirty (urine or feces present) 99. Don't know	N/A	
2.05	Cleaning of potty after use	1. Water 2. Water and soap 3. Rag		

		4. Tissue paper 5. None 99. Don't know		
2.06	Cleaning of child after defecation	1. Water only 2. Water and soap 3. Rags/leaves/paper 4. Tissue paper 5. None 88. Other, specify _____ 99. Don't know		
2.07	Handwashing of caretaker after cleaning child	1. Water only 2. Water and soap 3. None 99. Don't know		
2.08	Handwashing of child after defecation	1. Water only 2. Water and soap 3. None 99. Don't know		
2.09	Disposal of child's feces (final destination)	1. Buried 2. Latrine 3. Garbage pit/pile 4. Drainage ditch 5. Outside/open air/bush 6. None 88. Other, specify _____ 99. Don't know		
2.10	Handwashing of caretaker after disposing of child's feces	1. Water only 2. Water and soap 3. None 99. Don't know		

3.0 LATRINE OBSERVATIONS				
Note to observer: Fill out 'Options for Single Latrine' if the household only has one latrine or if they primarily use one latrine within the latrine block. Fill out 'Options for Latrine Block' if the household uses multiple latrines within a latrine block.				
#	**Need to assess:**	**Options for Single Latrine**	**Options for Latrine Block**	**Notes**
3.01	Distance to latrine(s) from household (*please note distance in meters*)	1. _____	1._____	
3.02	Private or shared latrine(s)	1. Private → **3.04** 2. Shared	1. Private → **3.04** 2. Shared	
3.03	Number of households sharing the latrine(s) *(please ask head of household)*	1. _____	1._____	
3.04	Does the latrine(s) have a door?	1. Yes 2. No → **3.06**	1. Yes, there are ____ doors 2. No → **3.06**	
3.05	Does the door(s) close completely?	1. Yes 2. No	1. Yes, _____doors close completely 2. No	
3.06	Does the latrine(s) have a lock?	1. Yes 2. No	1. Yes, _____ latrines have a lock 2. No	
3.07	Type of latrine(s)	1. Flush toilet 2. Traditional pit latrine 3. VIP latrine 4. Above ground vault 5. Mobilets 88. Other, specify _____	1. Flush toilet 2. Traditional pit latrine 3. VIP latrine 4. Above ground vault 5. Mobilets 88. Other, specify _____	
3.08	Smell of latrine(s)	1. Minimal smell 2. Strong smell inside 3. Strong smell inside and outside	1. Minimal smell 2. Some have a strong smell inside 3. All have a strong smell inside 4. Some have a strong smell inside and outside 5. All have a strong smell inside and outside	
3.09	Cleanliness of latrine(s)	1. Clean 2. Slightly dirty 3. Dirty	1. Clean 2. Some slightly dirty 3. All slightly dirty 4. Some very dirty 5. All very dirty	

3.10	Presence of feces	1. No feces 2. Small amount of feces 3. Very visible feces	1. No feces 2. Some have a small amount of feces 3. All have a small amount of feces 4. Some have very visible feces 5. All have very visible feces	
3.11	Presence of urine	1. No urine 2. Small amount of urine 3. Puddles of urine	1. No urine 2. Some have a small amount of urine 3. All have a small amount of urine 4. Some have puddles of urine 5. All have puddles of urine	
3.12	Flies in latrine(s)	1. No flies 2. A few flies 3. Flies inside and outside	1. No flies 2. Some have a few flies 3. All have a few flies 4. All have flies inside and outside	
3.13	Latrine superstructure - roof	1. No cracks 2. Cracks 3. Visible holes 4. Dilapidated/unstable	1. No cracks 2. Cracks 3. Visible holes 4. Dilapidated/unstable	
3.14	Latrine superstructure - walls	1. No cracks 2. Cracks 3. Visible holes 4. Dilapidated/unstable	1. No cracks 2. Cracks 3. Visible holes 4. Dilapidated/unstable	
3.15	Latrine platform/slab	1. Secure 2. Initial stages of erosion 3. Large holes between platforms and ground (water will easily enter the pit) 4. Platform/slab not stable	1. Secure 2. Initial stages of erosion 3. Large holes between platforms and ground (water will easily enter the pit) 4. Platform/slab not stable	

Appendix C. Caregiver questionnaire

Note – These questions are free response. Please do not list the options below. Let the caretaker provide an answer, and then circle the corresponding response. One questionnaire should be filled out for each caretaker under observation.

4.01 – Where does your child *usually* defecate?
Nyathini dhi ga oko kanye?

1. Potty → *Ask to see potty/Describe in field notes/Take a picture*
2. Nappy
3. Diaper
4. Clothes
5. Other linens
6. Latrine
7. Household floor
8. Soil outside of household
9. Bushes/field
88. Other, specify _____

4.02 – Where do you *usually* dispose of your child's stools?
Ere kama ija wito e ga oko mar nyathini?

1. Bury them
2. Latrine
3. Garbage pit/pile
4. Drainage ditch
5. Outside/open air/bush
6. None
88. Other, specify_____

4.03 – The *last time* your child defecated, how did you clean your child?
Chieng mogik mane nyathini opielo,ne iyueye nadi?

1. Water only
2. Water and soap
3. Rags/leaves/paper
4. Tissue paper
5. None
88. Other, specify _____

4.04 – The *last time* your child defecated, did you wash your child's hands?
Chieng mogik mane nyathini opielo,bende ne iluoko luete?

1. Yes
2. No → **4.06**

4.05 – The *last time* your child defecated, how did you wash your child's hands?
Chieng mogik mane nyathini opielo,ne iluoko luete nango?

1. Water only
2. Water and soap
3. None
88. Other, specify _____

4.06 – The *last time* you came in contact with your child's feces, did you wash your hands?
Chieng mogik mane imulo chieth nyathini, bende ne iluoko lueti?

1. Yes
2. No → **4.08**

4.07 – The *last time* you came in contact with your child's feces, how did you wash your hands?
Chieng mogik mane imulo chieth nyathini, ne iluoko lueti nang'o?

1. Water only
2. Water and soap
3. None
88. Other, specify _____

4.08 – When was the *last time* that you came in contact with your child's feces?
Ne imulo chieth nyathini mogik kar ang'o ?

1. Cleaning the child
2. Disposing of the child's feces
88. Other, specify _____

Appendix D. Focus group discussion guide

Introduction and Guidelines - English

Start the recording now.

Hello everyone! Thank you all for coming to our focus group discussion today. My name is _____ and I will be conducting the discussion with the help of my assistant, _____.

We are working in coordination with Great Lakes University of Kisumu and Emory University to better understand the sanitation and hygiene situation in your neighborhood. We would like to talk to you to learn about your perspectives and experiences related to sanitation and hygiene. You were selected to be in this study because you are all the primary caretakers of children under the age of two.

Your participation today is completely voluntary and you are free to leave at any time if you don't feel comfortable. However, we do hope that you will stay and contribute your perspectives, as they are all important to this study. If you do not feel comfortable sharing information, you do not need to share. If you have any questions during the discussion, you can ask me at any time. All the information that you provide will be kept confidential and we will not write your name on any project documents. With your permission, we will record our conversation today so that we can later review the information that you share with us. Once the information has been sufficiently reviewed, the recording will be destroyed. No one other than our research team will have access to your information. Participation in this study presents no risks to your health. Your participation may benefit you and other communities by helping us understand the ways in which we can improve the quality of life.

Once we begin, the discussion will be very informal. We will start by asking a question, and then anyone who would like to answer or share their opinion is free to do so. Don't feel like you have to wait to be called on in order to speak. However, if we do call on you, it is because we haven't heard much from you and we would like to get your input. Please take turns responding so that everyone has an opportunity to share their thoughts. Only one person should be talking at a time to ensure a good recording of the conversation. We encourage you all to speak honestly and openly. Every one of your opinions is valuable and we know that we will learn a lot from you through this discussion. Feel free to respectfully disagree with others in the group. There are no right or wrong answers to any of our questions. We ask that you please keep all identities and information from this discussion confidential once you leave here today.

Introduction and Guidelines – Luo

Start the recording now.

Amosou uduto! Aduokonu erokamano koum biro riwore kodwa ee mbakawa ma kawuono. Iluonga ni_____to abiro tayo mbakani ka akonyora gi nyawadwa ma iluongo ni_____.

Watiyo kaachiel gi mbalariany mar Great Lakes ma Kisumo kod mbalariany mar Emory ka watemo ng'eyo matut weche maluwore gi ler kod ler mar aluora ee ng'engu ka.Dewaher loso kodu ka wapuonjore kaluore kod pachu kod gigo ma usekadhe maluore kod ler mar aluora. Oyieru e nonroni nikech un ee jorit mag nyithindo ma hikgi tin ne ariyo.

Chiwruokni kawuono en mana kuom yieni , to ka iwinjo ka ok in thuolo saa asaya to inyalo wuok. To kata kamano wageno ni ubiro bet kendo ubiro chiwo pachu nimar giduto tee gilong'o ni nonroni.

Ka iwinjo ka ok in thuolo loso e wach moro to ok ochuno ni nyaka ilosi.Ka in gi penjo moro amora sama wagoyo mbaka to inyalo penjo saa asaya. Weche ma wabiro wacho kawuono ibiro ket maling ling kendo ok wabindiko nyingu kamoro amora. Kuom yie maru, wabiro mako mbakawa ma kawuono nimar mae biro konyowa bange ee ngeyo kaka ne waloso kod gigo mane wawacho. Ka wasetieko ngiyogi, wabiro ruchogi tee. Onge ngato ma opogore gi jogo ma watiyogo mabiro neno wechegi. Onge gima biro hinyo ngimani ka ichiwori e nonroni. Chiwruokni kawuono nyalo konyi kod gwenge mamoko ka gikonyowa ngeyo yore ma nyalo kelo lokruok ne ngima.

Ka wachako, mbakani oyaw ne jii duto. Wabiro chako gi penjo, kendo ngato angata mabiro bedo thuolo chako duoko penjono thuolo biro bedo mare. Kik ine ni ber mana ka isiemi mondo eka ilosi. To kata kamano ka wasiemi to en manani pok wawinjo mangeny kaoa kuomi to dewaher mondo in bende wawinj moa korka kori. Wakwayou ni ka uduoko penjo to obed ngato achiel ka achiel mondo jii duto oyud thuolo mar loso.Wakwayo ni jii olos achiel achiel mondo yayud yot ee mako duol. Wajiwou uduto mondo ulos ka un thuolo kendo uwach adiera ma kende. Pach ngato ka ngato oyiego kendo wangeyo ni wabiro puonjore mangeny kaluwore gi paro ma ugolo e mbakanika po nono ni pachi opogore gi pach jowadu, to inyalo bedo thuolo mar kwero gi luor. Onge duoko maber kata marach ne penjowa gi. Wakwayoni weche ma wawacho obed maling ling bange ka wase wuok ka kawuono.

Warm-Up (~ 5 minutes)
This is for rapport-building and to help note taker put names to faces.

Let's begin by going around the room and introducing ourselves. Please tell the group your name and the ages of your children. I will go first.

Opening Questions (~ 5-10 minutes)
These are meant to be easy discussion questions that will help the group get used to bouncing ideas off of one another.

Please ask 1-2 open-ended and straightforward questions to start the discussion. If you can somehow use them as a segway into the hygiene questions, that would be ideal.

1) Can you give me some examples of 'dirty things' that (1. you; 2. your child) touch(es) throughout the day? Why do you consider these things to be dirty?

2) How do you know when (1. your; 2. your child's) hands are dirty?

Key Questions

Topic 1: Hygiene (~ 25-35 minutes)

In the first half of the discussion today, we will be talking about hygiene.

1) Can you tell me about particular events during the day when it would be a good idea to wash (1. your; 2. your child's) hands?
Bende inyalo nyisa kinde ma uneno ni ber mar luoko lwedo?
Kinde mage maber ka iluoko lwet nyathi?

For the probes, please focus on handwashing after the following events: cleaning the child after defecation, disposing of child's stools, child defecation*

Possible Probes:

- Why is it a good idea to wash (1. your; 2. your child's) hands before/after these events?
Ang'o ma omiyo ber luoko lwedo e kinde ma pok utimo /timo gigo?

- How consistent are you in washing (1. your; 2. your child's) hands before/after these events?
Ijaluok lweti marom nade ka pok itimo/ ise timo gigo?
Do you always wash (1. your; 2. your child's) hands before/after these events? Why or why not?

- Think about the last time you *insert event here* and you did not wash (1. your; 2. your child's) hands. Can you tell me the reasons why you didn't wash (1. your; 2. your child's) hands?
  Par ane chieng mogik mane _____to ne ok ilogo
  Bende inyalo nyisa gima omiyo ok ne iluoko lweti?

2) When is it a good idea to use soap for washing (1. your; 2. your child's) hands?
Kinde mage ma iparoni ber luoko lwedo gi sabun?

****For the probes, please focus on handwashing after the following events: cleaning the child after defecation, disposing of child's stools, child defecation****

Possible Probes:

- Why is it a good idea to wash (1. your; 2. your child's) hands with soap before/after these events and not other events?
  Ang'o ma omiyo iparoni ber luoko lwedo gi sabun ka pok/ka ise timo gini to ok gik ma moko?
  - *Compare this 'washing with soap' list to the previous list. Why do these events need soap for handwashing while the others do not?*

- How consistent are you in using soap to wash (1. your; 2. your child's) hands before/after these events?
  Ijaluok lweti gi sabun marom nade ka pok itimo/ ise timo gigo?
  Do you always use soap to wash (1. your; 2. your child's) hands before/after these events? Why or why not?

  Do you always have soap available for handwashing?

- Think about the last time you *insert event here* and did not wash (1. your; 2. your child's) hands with soap. Can you tell me the reasons why you didn't use soap for handwashing?
  Par ane chieng mogik mane _____to ne ok iluoko lwete gi sabun.
  Bende inyalo nyisa gima omiyo ok ne iluoko lweti gi sabun?

3) If you were doing *task X,* and then stopped that task to clean your child after defecation or to dispose of stools, how would you wash your hands before returning to *task X*?
Kaponi ne itimo X kasto iweyo tijno mondo iywe nyathini ka osepielo kata ka iwit chiethne, ere kaka ibiro logo ka pok idok timo X?

(Ex: If you were washing clothes, and then stopped to clean your child or to dispose of stools, how would you wash your hands before returning to washing clothes?)

If you finished *task X,* and then moved on to clean your child after defecation or to dispose of stools, how would you wash your hands before starting a *new task*? **Kaponi itieko timo X, kasto idhi yweyo nyathini ka osepielo kata wito chiethne, ere kaka ibiro logo kapok ichako tich machielo?**

(Ex: If you finished washing clothes, and then moved on to clean your child or to dispose of stools, how would you wash your hands before preparing food?)

I want to know if caretakers consider 'washing' as handwashing since their hands are immersed in water (sometimes with soap)…even though they were not deliberately washing their hands in that water.

Example tasks:

- Washing (clothes, utensils, etc.)
    - *What is the difference in handwashing practices when washing clothes vs. washing utensils?*
    - *Does this water for washing always have soap?*
- Preparing food
- Eating
- Feeding the child
- Breastfeeding
- Cleaning house

For moderator and note taker:

- *Are there differences in handwashing depending on the tasks they were doing before or after stopping to clean their child after defecation or to dispose of stools? Ask why?*

4) In our observations, we noticed that caretakers in this community have a variety of ways to clean their children following defecation.
Kuom gik mane waneno, newafwenyo ni jorit nyithindo e gweng' ka nigi yore mangeny mopogore opogore ma giyweyogo nyithindgi ka opielo.

Note taker: Start writing the list (be sure to leave a few out): water only, water and soap, rags, paper (newspaper or magazine/book paper), tissue paper, child's clothes, linens.

Possible Discussion Questions:

- What else would you add to this list?
  Gin ang'o ma unyalo medo e magi?

- What is the (1. most common; 2. easiest; 3. safest) way to clean your child following defecation? Why?
  Ere ma mohinyo timore, mayot, malongo e yore mag yweyo nyathi ka opielo. Nang'o?

- When would you use *item X* to clean your child?
  Kinde mage ma inyalo tiyogi X ee ywee nyathi?

- How would you clean your child for: *urine only, solid stools, diarrhea*?

- *If rags or paper are mentioned*: Where do caretakers get rags or paper to clean their children following defecation?

- What do you do with *item X* after you have cleaned the child? Why do you put it in this location?
  Itimo X nade ka iseywego nyathi?Ang'o ma omiyo ikete kama iketeno?

Topic 2: Sanitation (~ 15-25 minutes)

Now we are going to change topics and begin to focus on sanitation. *Some of the issues discussed here may be unappealing, but they are important to our research. Remember that you are free to leave at any time if you ever feel uncomfortable during the discussion.*

5) In our observations, we noticed that young children (<2) in this community defecate in a variety of locations.
Kuom gik mane waneno, newafwenyo ni nyithindo ma higki tin ne ariyo e gweng' ka pielo kuonde ma opogore opogore ma gi piele.

Note taker: Start writing the list (be sure to leave a few out): potty, nappy, diaper, clothes, household floor, soil outside household, garbage pit, newspaper on ground.

<u>Possible Discussion Questions:</u>

- What else would you add to this list?
  Gin ang'o ma unyalo medo e magi?

- How do you feel about children defecating in *site X*?
  Iwinjo nade ka nyithindo pielo e X?

- Which site do you think is the best/worst place for children <2 to defecate? Why?

Ere kama uparo ni ber/ rach ka nyithindo ma hikgi tin ne ariyo piele? Nang'o?

- Which defecation sites are the easiest/hardest to clean up? Why?
  Gin kuonde mage ma yot/ tek yweyo? Nang'o?

- Are there any defecation sites where caretakers could leave the feces and not dispose of them? Why these sites?
  Bende nitiere kuonde mamoko ma jorit nyithindo nyalo weye chieth nyithindo ma ok owito? Nang'o?

6) In our observations, we noticed that caretakers in this community disposed of children's stools in several locations.
Kuom gik mane waneno, newafwenyo ni jorit nyithindo mane gqweng ka wito chieth nyithindo kuonde ma opogore opogore.

Note taker: Start writing the list (be sure to leave a few out): latrine, garbage pit, drainage ditch, outside/bush.

Possible Discussion Questions:

- What else would you add to this list?
  Gin ang'o ma unyalo medo e magi?

- How do you feel about caretakers disposing of children's stools in *site X*?
  Iwinjo nade ka jorit nyithindo wito chieth e X?

- Which site do you think is the (1. most common; 2. easiest; 3. safest) place for caretakers to dispose of children's stools? Why?

- If you saw old/dry feces on the ground, would you need to dispose of them? Why or why not? Where would you dispose of them? *Discuss if this is a different site than where they would dispose of new/fresh feces*
  Kaponi ineno chieth motuo e laro,bende inyalo wite? Nang'o? ok kamano nang'o?.

- If you were washing soiled clothes/nappies/potties, where would you dispose of the water? *Discuss if this is a different site than where they would dispose of solid feces*
  Kaponi ne iluoko lewni, napkin,kata potty,ere kama inyalo puko e pi ma iluokogi no.

7) What are some of the reasons why people in this community do not use a latrine to dispose of children's feces?
Gin gik mage mamiyo jii man e gweng' kae ok ti gi choo e wito chieth nyithindo?

Possible Probes:

- *If not discussed above, can ask about:* cost; distance; cleanliness; smell; structure; locks; night time; etc.

Closing (~10-15 minutes)

Summarize key topics of discussion

Now that we are nearing the end of the discussion, is there anything else that you would like to add to help us to better understand the hygiene and sanitation situation in your community? Do you have any questions for me?

Thank you again for your excellent contribution to this discussion. All of the information we obtained will be very useful to our study.

Koro ka watieko,bende nitiere gimoro amora ma unyalo medo manyalo konyowa e medo ngeyo matut yore mag ler kod ler mar aluora e gweng' ka? Bende nitie nga't manigi penjo?

Erouru kamano kendo kuom riworu kodwa e mbakani. Pachu go duto te biro konyowa e nonro ni.

Appendix E. IRB documentation

EMORY UNIVERSITY

Institutional Review Board

TO: Rosalyn Rush Principal Investigator
DATE: June 3, 2010
RE: **Notification of Submission Determination: No IRB Review Required**

IRB00044397
Sanitation and Hygiene Practices Following Child Defecation among Peri-Urban Households in Western Kenya

The above-referenced study has been vetted by the Institutional Review Board (IRB), and it was determined that it does not require IRB review because it does not meet the definition of "Research" or the definition of "Clinical Investigation" under applicable federal regulations. Accordingly, IRB review is not required.

45 CFR Section 46.102(d) defines "Research" as follows:

Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge. Activities which meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program which is considered research for other purposes. Based on the information included in the submission, the purpose of the study is to identify factors that influence excreta disposal and hygiene-related practices of caretakers at the household level. The primary intent of the study is to use the results from the observations and focus groups to develop recommendations for Center for Global Safe Water (CGSW) and Great Lakes University of Kisumu (GLUK) to improve their local system of care regarding the water, sanitation and hygiene (WSH) programming in Kisumu, Kenya. The results of the study will not be generalized beyond the CGSW's and GLUK's WSH programming elsewhere in Eastern Africa at this time.

The IRB has determined that this study does not constitute "Research" under the foregoing definition.

In addition, the IRB has determined that the study is not a "Clinical Investigation" under applicable Food & Drug Administration regulations because it does not involve a test article and does not otherwise meet the requirements of the definition of "Clinical Investigation" as set forth in 21 CFR Section 50.3(c).

Please note that any changes to the protocol could conceivably alter the status of this research under the federal regulations cited above. Accordingly, any substantive changes in the protocol should be presented to the IRB for consideration prior to their implementation in the research.

Sincerely,
Carol Corkran, MPH, CIP
Senior Research Protocol Analyst
This letter has been digitally signed

Emory University 1599 Clifton Road, 5th Floor - Atlanta, Georgia 30322 Tel: 404.712.0720 - Fax: 404.727.1358 - Email: irb@emory.edu - Web: http://www.emory.edu/irb *An equal opportunity, affirmative action university*

GREAT LAKES UNIVERSITY OF KISUMU
(GLUK)

P. O. Box: 2224-40100 KISUMU, Tel: 254-057-2023972,
Cell. 0722-683813
Email: info@gluk.ac.ke , vcoffice@gluk.ac.ke

Certificate of Approval of Research Protocol
GLUK Ethical Review Committee (GERC)
Ref: No. GERC/009/2010

To: Rosalyn Rush – Principal Investigator

Date: Tuesday, 20th July 2010

Proposal Title:

EXCRETA DISPOSAL AND HYGIENE PRACTICES FOLLOWING CHILD DEFECATION AMONG PERI-URBAN HOUSEHOLDS IN OBUNGA

This study is eventually approved on the basis of the request that instead of observing one single household during each observation period, several houses within a compound be observed at one time and that this procedure is not going to alter the status of the outcomes of the study.

We concur with the declaration of the Emory IRB00044397 of June 3, 2010 that the study does not meet the definition of "Research" nor a "Clinical Investigation" under federal regulations from which our interim SOPs are drawn.

The IRB is assured that participants will be consented and informed of their rights. Neither are participants anticipated to experience significant psychological discomfort since the field staff have previously worked in Obunga and are familiar to the participants.

This approval is in retrospect to the project start – end schedule. However, should the PI wish to extend the study she will be obligated to seek fresh approval form this Committee.

All applications / re-submissions should reach the GERC Secretary two weeks before the next scheduled meeting. Ordinary meetings are held **EVERY FIRST MONDAY of the month.** Thank you.

Sincerely,

29th July 2010.

Prof. Charles Obonyo / Dr. Bernard O. Abong'o
CHAIR / CO-CHAIR, GERC