INFANT AND YOUNG CHILD FECES MANAGEMENT (IYCFM) AND CARETAKER HYGIENE IN DISPLACMENT SOUTH SUDANESE IN UGANDA, RHINO CAMP SETTLEMENT

by

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Dedication

To the refugee families in Rhino: You welcomed me into your compound, always gave me the best chair, and told me your stories: You knew this research would not personally benefit you, yet you took the time to help me with this paper. I cannot thank you and the communities within Ofua, Ariaze, and Ariwa enough for welcoming me and assisting me with this work. My greatest hope for you is that South Sudan knows a lasting peace and you can return to a prosperous, safe home as soon as possible.

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Abstract

In 2016 Save The Children reviewed documents for humanitarian WASH and found very little guidance for infant and young child feces management (IYCFM) in emergencies. No studies could be found for this topic in displacement, conflict, or epidemic contexts. To address this research gap, formative research was conducted in Rhino settlement, Uganda with South Sudanese refugees using qualitative methods. IYCFM strategies within the settlement were defined using a coded, ten-step process of faeces management and related hygiene practices for children at development stages from birth until ‘independent sanitation’ (from 4 to 7 years). The IYCFM process and coping strategies used by caretakers to manage feces within the context were identified along with significant variations in practices during the night, rainy season, and during diarrheal episodes. Behavioral determinants were collected and analysed using the Integrated Behavioral Model for WASH to help identify useful contextual information for future case studies. Risks beyond unsafe disposal were also identified with suggestions for an extended sanitation chain for those physically or developmentally unable to use latrines. The findings indicate gaps in the current hygiene promotion at addressing IYCFM issues beyond safe disposal. Additional gaps in hardware for child latrine design, ‘adult’ latrine design, and NFI distribution were identified.

Executive summary

Background

UNHCR data suggests that children under five often represent 20% of a displaced population. In Uganda, UNHCR estimated that in 2001, the DRC and Somalian refugee populations under-5 consisted of 25% of the total population. (UNHCR, 2001)
Despite the fact that young children may represent a significant portion of refugee populations, a review by Save The Children of WASH guidance documents for emergencies (STC, 2016) found that none of the current guidance adequately addresses the sanitation of children too young to use latrines. A survey of emergency WASH practitioners in the same review found that over 65% of practitioners did not include any adaptations of sanitation programmes to this population. Most programmes that did provide for this age group only included one intervention to cover all development stages from birth to age five. The review highlights that one of the primary barriers to providing sanitation programmes for this demographic is that little is known about the actual methods used by caretakers to manage infant and young children's feces in emergencies and it is therefore difficult to identify the best solutions.

To date, only one case study has been conducted on young child feces management in an emergency context (Denis 2015). This study looked at practices before, during, and after typhoon Haiyan in November 2013 and found that previously safe disposal was significantly disrupted during the natural disaster. However, no studies have been conducted to help support populations displaced from conflicts or political turmoil. No studies have looked into defining age appropriate solutions for resource constrained contexts where caretakers may be unfamiliar with child sanitation products such as nappies or potties and may have reduced water access. There is almost a complete lack of coherent guidance and research for sanitation provisions of children under-5 in emergencies.

Infant and Young Child Feces Management Behaviors (Non-Emergency)

In non-emergency contexts, there are more studies to support the importance of WASH programmes focused on child feces management. Some studies examine child feces management practices as a component of the research. The wide range of behaviors around the world and even within a given community demonstrate the difficulty in prescribing guidance. Some cultures perceive children to have bladder and bowel control after just a few months of life while others think children do not have this same control until they are several years old (deVries & deVries, 1977). These perceptions

on children's functional control modify caretaker's expectations of when changes to sanitation practices are appropriate. Some cultures control infant bowel movements on a rigorous schedule or with enema laxatives (Gottlieb et al., 2016). Some cultures use products such as disposable or cloth nappies while others may consider it unhygienic to cover a child with these products. Some families may use potties while others openly defecate within homes or in the compound before removal with scoops, brooms, paper, leaves, or by hand. Some families wash children with water after defecation while others use cloths, disposable napkins or dirt (Manoff Group, 2018). A few studies have attempted to explore behavioral determinants for safe disposal of child feces, but have found little useful information beyond weak links of safe disposal with other hygiene behaviors and to socio-economic status (eg. Ayele et al, 2017). Understanding the differences in these practices and how they change will be critical to providing useful guidance for child feces management.

Risks and perceptions of child feces

Studies by Feachem et al (1983) and others have found that although lab tests show that children's feces contain significantly more bacteria than adult feces, they are often considered not as dangerous by caretakers. A 2004 review of relevant literature (Gil et at,) found across multiple studies that poor disposal methods of children's' feces likely increases the risk of fecal-oral diseases for small children. Other studies such as those by Huttley et al in Peru (1998) and Traore et al in Burkina Faso (1994) have attempted to directly link 'unsafe' disposal of child feces with environmental enteropathy, impaired growth, and acute watery diarrhea. An emerging field of research into clean play spaces suggest that young children spending significant time playing on the ground are most at risk from these negative health outcomes as a result of their own feces or the feces of other children if these are not properly managed. (Morita et al, 2017)

One of the primary issues with defining safe interventions for child feces management is there is no current consensus on which practices actually carry significant risk. The JMP provides a definition for safe disposal: feces disposed in a latrine or buried. Currently, these definitions are not supported directly by research and only consider disposal locations, not the complete set of behaviors and practices used to manage child feces. A 2015 Delphi consultation of WASH experts by Bain and Luyendijk discussed the safety and risk of various disposal methods and found mostly anecdotal evidence, demonstrating that actual risks are not well known and more research is needed.

Several studies, recently evaluated by Majorin (2017), have investigated the effects of different interventions at improving the disposal of child feces: hygiene promotion, provision of hardware (scoops, potties, child friendly latrine slabs, etc), or both. Very few focused exclusively on improving child feces disposal, and none appeared to acknowledge age appropriate hardware solutions across the study. Majorin et al. (2014) discovered that the impact of a general CLTS campaign and construction of latrines had not led to improved child feces disposal. Very recently, the Manoff group (2018) performed a set of Trials of Improved Practices (TIPs) across Somalia, Kenya, and Uganda for child feces disposal and found that the participatory methods were very effective at behavioral improvements.

Research Problem/ Topic

Due to the lack of research and effective guidance on young children's feces management in emergencies, this research explored the fecal management practices used by caretakers in a displacement camp through a case study to begin filling the identified gaps in knowledge based on the IYCFM themes identified within the literature review. The research aims and objectives are outlined below.

Research Aim To conduct a case study of IYCFM behaviors within an emergency setting	
Objective 1	To describe the contextual area and assess the applicability of the case study
Objective 2	To describe the IYCFM process and coping strategies employed by caretakers to manage child feces in an emergency setting
Objective 3	To explore how IYCFM practices vary as children develop
Objective 4	To explore new concepts of dynamic practices from changing conditions
Objective 5	To explore caretakers roles for IYCFM
Objective 6	To explore new risks in the management of child feces
Objective 7	To explore new technology themes in the suitability of interventions for infant and young child feces management

Research Methodology

The 2004 review by Gil et al found that all but a few WASH studies of child feces practices have focused on large quantitative studies. These have almost exclusively focused on disposal locations. Suggestions from this review are that qualitative, exploratory research is needed to better understand the range of practices before

disposal that may also carry significant risk such as defecation locations, products used for transfer, cleaning children's bottoms, etc. This suggestion is supported with the literature review conducted as a component of this research as well as the 2015 WSP guidance document for child feces management (O'Connel, 2015) and from the Save The Children Emergency Sanitation for Infants and Young Children scoping study (STC, 2016). For this reason and due to the financial limitations of the researcher, qualitative, semi-structured interviews were selected as the primary data collection tool for this research. Supplementary information was collected with focus group discussions, spot observations, and key informant interviews to help triangulate results.

The study was comprised of:

- Twenty, in-depth, exploratory interviews with caretakers of children too young to use latrines independently. This also included a coded questionnaire and spot observations.
- Four focus group discussions with 16 participants each.
- Three key informant interviews
- Various opportunistic interviews and observations within the case study area.

Case study area:

Uganda was selected as the case study location because it has a large population displaced from various conflicts within central and Eastern Africa, but is a low risk location to conduct research. Loughborough University requires reasonably low risk research settings for MSc students. Rhino settlement was selected for the case study location as it was the primary theater of operation for the local research partner, CEFORD (Community Empowerment for Rural Development).

Summary of key findings:

A summary of the key findings is organized below based on the research objectives.

Key findings for objective 1 - context

- NFI distribution for scoops and hoes for latrine building and agricultural livelihoods was a large contributor to safe IYCFM.
- This research strengthened the argument that financial limitations and household priorities are a major contributing factor in safe IYCFM.
- This research strengthened the argument that a safe disposal location is a necessary requirement for safe IYCFM.

- Lack of solid waste and relevant hygiene promotion led to disposable diapers thrown into latrines
- Based on the evidence discussed with caretakers, risk during the immediate displacement phase was higher due to potentially lower knowledge, the lack of safe disposal locations, insufficient scooping tools, and low water availability.

Key findings for objective 2 – IYCFM process

- Strengthened the argument that more information is needed about the process caretakers use beyond a simple disposal
- Examining the full process helped explain differences in children's ability, variations within the community, and revealed risks.
- Examining the full process helps understand the needs of caretakers to support IYCFM.

Key findings for objective 3 – child development

- Strengthened the argument that children have unique sanitation needs as they develop requiring more than one intervention in an emergency to appropriately, effectively manage children's feces
- Caretakers in the case study area used assisted infant toilet training with later latrine training.

Key findings for objective 4 – changing conditions and dynamic practices

- Caretaker's IYCFM strategies varied significantly within the case study due to changing conditions.
- IYCFM strategies were least consistent in households using open defecation and scooping with caretakers using a variety of processes and coping strategies for nearly every changing condition.
- Diarrhea, during transit, and nighttime were the conditions which modified household IYCFM strategies the most. Due to the lack of case studies on household practices during child diarrheal episodes, this should be shortlisted for future study.
- Addressing changes in practices where they are known to exist (such as during breakouts of diarrheal illnesses) may be a future improvement to public health programming in emergencies.

Key findings for objective 5 – caretaker roles

- Within the case study, multiple family members assisted mothers with IYCFM including fathers, older siblings, and extended family. Future hygiene promotion may include other family members within IYCFM hygiene promotion.

- Within the case study there were some indication that conflicting household priorities may be limiting access to IYCFM products.

Key findings for objective 6 - risks

- Disposal in latrines was a common practice; however, post disposal hygiene such as tool cleaning and handwashing were often outside of latrines.
- Strengthened the argument that there are multiple control points beyond disposal that need to be considered for safe child feces management.
- Demonstrated that by examining risks beyond disposal that different IYCFM strategies carry varying amounts of risk.
- Demonstrated that disposal within latrines may also lead to damage of the latrine infrastructure and the sanitation service chain.
- Demonstrated that the risks of exposure within the IYCFM process may require specific emphasis for handwashing.
- Demonstrated that child latrines may need design modifications or reconsideration and should be a focus of future case studies.

Key findings for objective 7 – technology themes

- Strengthened findings that insufficient water supplies modify child anal cleansing practices and delay washing fecally contaminated cloths.
- Strengthened the argument that scoops are likely not appropriate for rocky areas and may lead to premature latrine filling.

Recommendations

The outputs of the case study focus on providing recommendations for future research with suggestions for both future cases and for the research questions with the highest priority for improving guidance. Cases considered the most important are those of an acute displacement emergency and for epidemics with large diarrheal incidences due to the reported risks during acute displacement and the dynamic practices used by caretakers for IYCFM when children have diarrhea. The top suggestions for future research questions also focus on diarrheal illnesses to understand how caretakers modify practices during cholera. Additional questions are raised on technical themes such as the extent that wash water disposal in latrines affects the integrity of the pit, how to respond to the induction of disposables in an emergency context, and if open defecation followed by scooping provides sufficient protection from contamination.

In addition to better funding and commitment for research into IYCFM in emergencies, the primary step forward identified to improve emergency response is to install an

indicator for sanitation for those unable to use latrines, including infants and young children. Measuring the sanitation for these populations with indicators that make sense beyond providing a location for disposal will ensure action is taken beyond the limited response highlighted within the 2016 STC review.

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1- Introduction

UNHCR estimates that there are currently nearly 69 million people forcibly displaced around the world with over 25 million escaping conflict and persecution (UNHCR, 2018a). Half of these are children below the age of 18, and nearly 7 million live within camps collective centers or reception centers, depending on humanitarian assistance for many essential services (ibid). Within these services, WASH (water, sanitation, and hygiene) plays a critical role in every humanitarian emergency as an immediate life saving measure, as a preventative measure against fecal oral diseases, and to improve quality of life. Sanitation in particular plays a vital role in protecting against these diarrheal illnesses, separating feces from the environment to limit the pathways available for these diseases to reach the mouth of a new host.

This dissertation describes the sanitation options available in emergency situations for people who are not yet able to use conventional sanitation technologies, ie for infants and young children. Because these children are dependent on caretakers for supporting the management of their feces, hygiene practices of these caretakers are also considered. Consideration of the sanitation needs of infants and young children within emergencies is vital for three reasons:

1. Infants and young children are considered to be the most at risk of diarrheal illnesses (Harvey, 2007).
2. Infant and young children's feces contain more pathogens and are potentially more infectious than adult feces. (Mahfouz, et al., 1977)
3. When considering the relative sizes of demographic populations within emergencies, UNHCR data suggests that infants and young children (under five) often represent 15-20% of a displaced population. For example, in Uganda, UNHCR estimated that in 2001, the DRC and Somalian refugee populations under-5 consisted of 25% of the total population. (UNHCR, 2001) Within the Rohingya refugees in Bangladesh 0-4 year old children are currently estimated at 18% of the population (UNHCR, 2018a). Most of these children, as discussed below in the literature review are unable to use adult sanitation options such as toilets and latrines.

Within this introduction section the existing emergency guidance and standards for infants and young children's feces management (IYCFM) are discussed before describing how the relative lack of guidance has led to disjointed humanitarian implementation of IYCFM in emergencies. Then a description is provided for how these deficiencies led directly to the research aim. A brief overview is then given for the development of the research objectives

along with background for the case study area. The introduction concludes with a description of the structure of this dissertation.

1.1 Existing Emergency Guidance and Standards for IYCFM

Despite the fact that young children may represent a significant portion of refugee populations, a review by Save The Children of WASH guidance documents for emergencies (STC, 2016) found that none of the current guidance adequately addresses the sanitation of children too young to use latrines. Two literature reviews examining this topic have been conducted relatively recently, both by Save the Children, one in 2014, and one in 2016. The 2014 scoping study was broad in scope, encompassing all age groups of children and all aspects of WASH services. The 2016 report focused exclusively on emergency sanitation for infants and young children under-5.

Thirteen emergency guidance documents and humanitarian standards were found that mentioned sanitation needs of young children, with very few mentioning the need to adapt programs to children of different ages. The report highlighted the additional deficiencies that guidance is too vague to provide meaningful information to humanitarians. The most common guidelines are to provide information for caretakers on the disposal of feces and to consult with caretakers on which products are needed. Since the publishing of those reviews, other guidance has been suggested within the Baby WASH initiative (World Vision International, 2017) and by EAWAG (Gensch et al., 2018). ACF adapted some of the suggestions from the 2014 review within their recent guidance document for integrating WASH and nutrition programming (Dodos, 2017)

1.2 Humanitarian Experience With IYCFM

With the absence of guidance and indicators for child sanitation, Deniels conducted a large survey of humanitarians on infant and young child feces management (IYCFM) practices in the field in 2004 finding varying amounts of knowledge. Many engineers were unaware of the high population of children in emergency camps or the need to implement developmentally appropriate sanitation options.

The STC 2014 survey of humanitarian practitioners (Ferron and Lloyd, 2014) found that little had changed in humanitarian intervention for IYCFM in the 10 years between Karine Deniel's report with low knowledge and little focus on IYCFM in emergencies. This is seen in in Table 1 to the right asking "Have you provided any of the following excreta disposal methods aimed at children?" (Ferron and Lloyd, 2014) Few humanitarians had implemented any sanitation projects for children unable to use adult latrines and very few of these considered differences of different age groups. Two small field visits were conducted within the study in Ethiopia and Bangladesh. The brief field notes provided primarily focused on children who were able to use latrines, but found that field staff generally were unaware of the need to adapt programming to children of different ages.

Table 1 - (Ferron and Lloyd, 2014) Humanitarian focus on IYCFM

Child friendly toilets in community	26	16%
Potties for young children	27	17%
Child friendly toilets in schools	47	29%
Cloth nappies for babies	10	6%
Disposable nappies for babies	13	8%
Distribution of tools/trowels for burying children's faeces	26	16%
Other	13	8%

A survey of emergency WASH practitioners in the 2016 STC review once again found that over 65% of practitioners did not include any adaptations of sanitation programmes to young child populations. Most programmes that did provide for this age group only included one intervention to cover all development stages from birth to age five. The review highlights that one of the primary barriers to providing sanitation programmes for this demographic is that little is known about the actual methods used by caretakers to manage infant and young children's feces in emergencies and it is therefore difficult to identify the best solutions.

1.3 Developing Research Aims and Objectives

The 2014 and 2016 reports above on young child WASH provisions in emergencies highlighted a number of deficiencies in understanding IYCFM practices; namely that very little was known about how caretakers actually manage sanitation for young children.

Emergency WASH for Children Scoping Study (Ferron and Lloyd, 2014)
"Few case studies exist of sanitation provision for children in emergencies: more would increase sectoral knowledge of the appropriate options and designs available."

This gap led directly to this MSc dissertation research aim:

Research Aim	To conduct a case study of IYCFM behaviors within an emergency setting

Further gaps identified within the 2014 and 2016 reviews of young child sanitation provisions were developed into the research objectives below, supplemented by a review of IYCFM literature within low income contexts. After a thorough collation and reading of the literature (See Appendix I) it was found that there was insufficient information to provide significant direction towards improving IYCFM emergency response. To achieve this research aim, a preliminary informal literature review was conducted to explore as broad of a portion of IYCFM literature as possible within the confines of an MSc to help provide evidence for the information most valuable to gather within the case study. Based on the lack of literature on IYCFM in emergencies, the available literature for IYCFM in low income countries provided the basis for this review.

Literature was reviewed to find common terminology and to briefly define IYCFM practices around the world, including an attempt to understand useful themes relating child development with transitioning sanitation practices. In the initial review of IYCFM literature, it was quickly found that there was insufficient language to describe the processes used by caretakers and insufficient coding of practices to place these within any context. There is an abundance of quantitative studies focusing almost exclusively on disposal (see Appendix I) and few qualitative or mixed method studies building a set of lived experiences to compare IYCFM strategies across contexts. Therefore, few useful coding methods have developed to differentiate between practices, ideas, or broader themes within IYCFM. Without useful coding tools built from qualitative studies, the quantitative studies have a large disparity in the information collected and the terminology used. Disparity within these items and the lack of coding have led to a vague complexity of ‘context specific’ behaviors with little attempt to place studies within a broader global perspective.

Emergency WASH for Children Scoping Study (Ferron and Lloyd, 2014)
"Little is known about how mothers and carers actually manage babies and young children’s faeces in emergencies and it is thus difficult to identify the best solutions.”

To date, the three reviews for IYCFM (Gil et al., 2004, Majorin et al., 2014, Morita, Godfrey and George, 2016) have collated literature into one large theme: that of interventions. No literature reviews have attempted to collate themes of the behavioral determinants mentioned for IYCFM. This task is difficult because while few studies on IYCFM have focused on identifying these pieces of information, behavioral determinants are occasionally mentioned in passing within studies with wide ranging objectives. Unfortunately, many of the studies attempting to understand behavioral determinants have focused on identifying predictive factors answering ‘who’ have poor disposal practices with demographic population studies rather than understanding the ‘why’ behavioral

determinants. This means studies are useful for identifying where to focus hygiene promotion, but not how to adapt messages or what might be most effective. Only a handful of studies have attempted to define the contextual, psychosocial, and technological behavioral determinants influencing caretaker's decisions to use specific IYCFM strategies.

These preliminary literature review findings led directly to establishing the first two research objectives:

Objective 1	To describe the contextual area and assess the applicability of the case study
Objective 2	To describe the IYCFM process and coping strategies employed by caretakers to manage child feces in an emergency setting

In this paper, 'coping strategies' refers to practices that are described as non-ideal by participants as a result of their context.

In the 2016 review, the top research priority based on answerability, priority and impact was:

STC - Emergency Sanitation for Infants and Young Children Under 5, 2016
"How to adapt to different ages? Less than 28, 2 years, etc."

Very few studies in low income contexts have demarcated based on ages, and even fewer have attempted to define sets of practices based on child development stages. A large reason why STC 2016's questions relating to 'how to adapt to different ages' is difficult to answer is due to the fact that very little research has considered sanitation transitions as children develop. To better understand how IYCFM practices are influenced based on children's developmental limitations, the following objective was added to the case study:

Objective 3	To explore how IYCFM practices vary as children develop

After attempting to define the processes used across the world for IYCFM, an emerging theme was mentioned in passing within a few papers (discussed below in section 2.4) that some caretakers reported modifying this process under certain changing conditions. This was noted as a gap in understanding in the recent global review by the Water and Sanitation Program (WSP):

WSP - Management of Child Feces: Current Disposal Practices, (Rand et al., 2015)
"How do practices differ at different times of the day or in different seasons?"

An objective was developed to explore this new theme of dynamic practices in further detail. It was reasoned that if examining IYCFM processes within detail with formative research methods then additional questions examining variations in those processes may easily fall sequentially within the same methodology and add to the descriptive power of the research.

Objective 4	To explore new concepts of dynamic practices from changing conditions

Heads of households and main caretakers within research are almost exclusively mothers. The contributions of other family members as secondary or primary caretakers have largely remained unexplored. The 2016 STC report highlights this issue:

STC - Emergency Sanitation for Infants and Young Children Under 5, 2016
"Who do you ask: who are the key informants to address to assess excreta disposal sanitation practices and challenges?"

To explore caretaker roles, the following objective was added to better understand if there are other household members who may be significantly contributing to IYCFM:

Objective 5	To explore caretakers roles for IYCFM

Next, the literature was reviewed to understand the risks at each process step within IYCFM. Due to the almost exclusive focus on the risk of non-latrine disposal and from emerging themes within the literature challenging the definition of safe-child feces management, an objective was added to the case study to explore potential risks within IYCFM at each stage of the process. Risks are defined here as any potential for contact or contamination with feces by either the child or caretaker.

Objective 6	To explore new risks in the management of child feces

While many of the questions developed within the STC 2016 workshop were oriented toward the applicability of various technologies for IYCFM in emergencies including non food items (NFI), it was found that within the current IYCFM literature there is also a near complete gap in assessment for technical applicability of various IYCFM products and tools (see technical behavioral determinants below).

STC - Emergency Sanitation for Infants and Young Children Under 5, 2016
"Are WASH NFIs distribution appropriate for children needs?"

To help provide guidance for potential future research themes, exploratory research was planned on this topic.

Objective 7	To explore new technology themes in the suitability of interventions for infant and young child feces management

The largest gaps identified within this preliminary review of the literature were found to be a qualitative understanding of caretaker's practices, particularly with regards to sanitation changes as children develop; how practices vary within a given household; the risks within IYCFM processes; and technological themes. The case study was organized to provide formative research and a breadth of information to inform future research using the using the objectives highlighted above.

1.4 Background to Case Study Area

To identify an appropriate case study area, an examination was made of the three broad categories of emergencies: natural disasters, man-made emergencies, and complex emergencies with combined natural and man-made elements (World Vision International, 2017) Only one case study could be found for IYCFM in emergencies, that of Justine Denis (2015) (discussed below within section 2.8.4). This report took place in the Philippines after typhoon Haiyan in 2013 to assess the impact of this natural disaster on IYCFM practices. Although there is still insufficient information for IYCFM in natural disasters, given the complete lack of case studies, the largest gaps for IYCFM in emergencies was identified as man-made or complex emergencies.

Section 3.2 of the methodology describes the pragmatic selection of the displaced South Sudanese population within Rhino Camp Settlement, Uganda as the population for the case study. South Sudan has been in civil war since 2013 when President Salva Kiir accused Vice President Riek Machar of instigating a coup (Shreve, 2018). Although the fighting is officially between the government of South Sudan and the Sudan People's Liberation Army, fighting has taken place largely along ethnic lines with a UN commission on human rights claiming that ethnic cleansing was taking place (ibid). Fleeing this conflict, nearly 3 million people have been displaced both internally within South Sudan and as refugees to surrounding countries from 2013 to 2018. As of July, 2018 over 1 million refugees have made their way to settlements and camps within Uganda (UNHCR, 2018b)

with over 115,000 within Rhino camp settlement (UNHCR, 2018c). Roughly 15% of the population within Rhino is 0-4 years old (ibid)

1.5 Dissertation Outline

This dissertation follows the standard layout proposed within the WEDC course notes for Data Collection, Analysis and Research (WEDC, 2017). After the topic of IYCFM in emergencies was broadly introduced within this chapter, chapter 2 investigates specific themes within the topic to connect research gaps to specific research questions. Chapter 3 connects those specific research questions to specific methodologies to help collect the information needed to address the research objectives. Chapter 4 presents the results of these methodologies before Chapter 5 analyzes the information collected and expands the discussion to include the literature presented in Chapter 2. Finally, Chapter 6 revisits the research aim and the broader topics discussed within this introductory chapter.

This dissertation also includes companion appendices which support the information provided within the body of the report. Appendix I supports the literature review with a meta-analysis and several annotated bibliographies. Appendix II supports the methodology with more in-depth descriptions of the tools, ethical concerns, and challenges within the data collection. Appendix III supports the results with oversized tables and figures. Appendix IV supports the discussion and conclusion chapters with recommendations for future case studies.

2- Literature Review

After developing the research objectives based on an initial informal review of literature, the purpose of the written literature review transitioned to explaining the ongoing conversation around these specific research objectives, providing evidence for the research questions that are addressed in the case study. After explaining the literature review methodology, the research is organized by each research objective beginning with defining the IYCFM process used by caretakers and ending with reviewing the literature for useful contextual behavioral determinants. The literature review concludes with a brief discussion of research gaps to tie together the research objectives and questions with the gaps mentioned within previous research. The literature review heavily references Appendix I which serves as a companion document with a meta analysis of the literature and several brief annotated bibliographies used to collate specific themes.

2.1 Literature Review Methodology

The literature review began by considering the literature included within the 2016 report on sanitation for young children by STC (reference). After this, a brief review was made within the WEDC resource center but no results were found.

Next, a thorough review was completed within the Loughborough University Library Catalogue Plus. The search terms, inclusion criteria, and exclusion criteria used for this search are defined in Appendix I. Seminal groupings of papers were identified, notably the initial papers by Val Curtis and Cousens in Burkina Faso in the mid 90s and then the set of papers by Huttley and Yeager within Peruvian slums in the late 90s, early 2000s. More recent groups of significant work were found focusing on India by Majorin et al (various years) and in Cambodia by Petrie et al (various years). Three large systematic literature reviews on the impacts of child disposal interventions were found. This initial search within Catalogue Plus along with the bibliographies of these papers formed the backbone of the IYCFM literature.

Table 2 - Search Strategies (Based on Tracey Crofts, 2010)

Source of Information	Search Strategy	Justification of Approach
University of Loughborough Library Catalogue Plus	Catalogue plus was combed using the search terms identified in Appendix I. After the initial findings, each search result was title screened using the criteria described..	This method allowed the researcher to find the majority of literature on IYCFM. A more thorough review within multiple research repositories was not possible within the time limits of this MSc.
Open Grey	Open grey was combed using the same search terms and screening as the catalogue plus search.	This method allowed the researcher to locate a portion of unpublished literature on IYCFM.
Bibliographies and previous literature reviews	Seminal papers and larger literature reviews were examined to identify papers that may not be available within the catalogue plus search or contain the search terms used.	With disjointed, decentralized literature, examining the bibliographies of previous papers allowed the researcher to identify seminal work and find literature that was related to IYCFM, but did not contain the search terms used above.
NGO Websites	ACF, MSF, Unicef, BabyWASH (World Vision), Oxfam, Save The Children	This search was conducted to attempt to find new guidance documents for IYCFM within the literature of large humanitarian organizations.
WEDC Resource Centre	Searches were made for 'children's WASH,' 'Baby WASH,' 'Child Feces', 'Child Sanitation'	WEDC is one of the largest publishers of emergency and low income WASH.
Google Search	Searches were made for 'refugee + diaper', 'Refugee baby', 'refugee child feces'	This search was made to identify any information outside of formal literature that might be useful in understanding the issues facing caretakers within refugee camps and settlements.
Personal Contact for Grey Literature Search	Brian Reed (WEDC) Cranfield University (Allison Parker) Peter Hynes (World Vision) Katrice King/ Claudio Deola (Save The Children) Dr. Foyeke Tolani/ Marion O'Reilly (Oxfam) Dr. Fiona Majorin (LSHTM) Emily Rand (Unicef) Dr. Sam and Dr. Amaka Godfrey (Unicef Ethiopia/ Kenya) Dr. Alma Gottfield (University of Illinois, Urbana Champaign)	These contacts were made to those who were identified as prevalent authors within IYCFM literature, currently managing IYCFM initiatives/ WASH technical advisors in organizations with mandates for child health, or leaders in WASH research. This allowed the researcher to identify new literature or initiatives within the IYCFM field and gather advice on conducting fieldwork.

To supplement the information within the initial search, another systematic search was made on Open Grey using the same search terms and inclusion criteria as before (see Appendix I). Then, the authors of seminal works were contacted for any grey literature available along with personal communications on issues to consider within the case study.

NGO websites and WASH technical advisers were contacted for any literature on current initiatives underway within the WASH Cluster. Finally, Google searches were made to locate any informal literature or online reports for young child sanitation. A brief overview of these search results can be also found in Appendix I in the section entitled: Informal Aid Filling Gaps in IYCFM in Emergencies. This work is not included within this literature review but has been included within the appendices to aid in later discussions and for considerations within future research.

While searching, multiple papers were found to be inaccessible online and within the Loughborough University subscriptions. Interlibrary loan was used to access these works, such as the seminal anthropological paper on toilet training ages in Kenya by deVries and deVries (1977). Much of the early work for child feces disposal in the mid 90s was originally published within the Journal of Diarrheal Diseases Research which is unavailable with the Loughborough University subscriptions and with interlibrary loan. Google books was found to host these papers.

2.2 Defining Infant and Young Child Feces Management Practices

The wide range of child feces management behaviors around the world, within a given community, and even within households demonstrate the difficulty in prescribing guidance, providing support, and monitoring & evaluation. There is additional complexity as sanitation practices gradually change while children develop and gain better bowel control. This section develops a framework for describing the differences in the processes used for managing infant and young children's feces based of the literature review meta analysis within Appendix I.

Defining child feces management practices around the world is difficult due to the lack of qualitative studies and descriptions of the range of practices. There are few studies which have provided or used a framework to describe relevant process steps. Gil et al (2004) in a review of different practices in 2004 included five headings for codifying child feces management behaviors: Defecation site, feces disposal, child anal cleansing, child handwashing, caretaker hand washing. Other studies such as Yeager et al, (1999) and Rush (2008) have noted a series of steps within the process but did not define a framework of practices. Two studies, one by Cousens et al (1996) and one by Petrie et al, (2017) explicitly propose a definition for the process. A graphical comparison of these defined processes is included within Appendix I. To review the literature defining the behaviors of child feces management around the world, the following process steps are proposed to the

right as a coding method to help define the practices (not necessarily in suggested order). This is a combination of all of the process steps proposed across the qualitative studies and is meant to be as comprehensive as possible to both introduce a common framework to assess the literature for completeness and to justify the research questions which attempt to fully describe the IYCFM behaviors within the case study. These steps may or may not be noted throughout each study (see below). When noted in the studies, steps may or may not be performed by caretakers (see below).

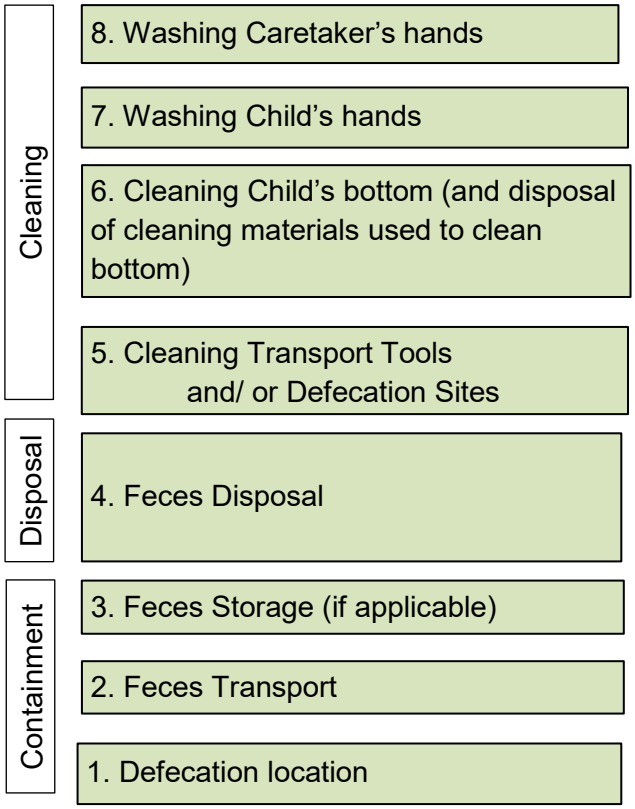

Figure 1 - IYCFM Process Definition used within case study

Additionally, as children develop and practices change, some of these steps may no longer be relevant (eg. the defecation location and the site of feces disposal will likely become the same location as a child age and begin using latrines.

Appendix I contains evidence and examples for each of these process steps. This has been removed from the body of the report to improve flow and reduce length. This process definition and the evidence within the literature for each of these process steps led to the development of the following research questions to understand the IYCFM strategies and behaviors within the case study:

OB2_Q1	What are the range of locations where children defecate?
OB2_Q2	What are the range of hardware options/ child sanitation enabling products used by caretakers to manage infant fecal material? (nappies, scoops, potties, etc.)
OB2_Q3	What practices/ products are employed for anal cleansing? Where is this material disposed?
OB2_Q4	What are the disposal locations/ facilities for the fecal material (and/ or wash water and/or material on tools)?
OB2_Q5	What practices are employed for handwashing for children and caretakers?

2.3 Child Development and IYCFM

The 2016 STC report set out at top priority research goal of understanding how to adapt IYCFM programs to different ages. Appendix I which provides an overview of IYCFM literature and assess its completeness demonstrates the difficulty of adapting IYCFM to different ages because few studies have considered different ages and needs of children within their assessments.A brief overview of bowel and toilet training techniques is included here to assist in understanding how child feces management practices change as children develop in different countries. A complete review of child psychology and the health effects of different toilet training methods is not included as a part of this study. While there are sources that claim negative health outcomes of early toilet trainings, a comparison of the benefits or risks of techniques has not been made as no research outside of a developed context could be found.

Table 3 - Bowel and Toilet Training - Adapted from Vermandel et al, (2008)

	Bowel Control/ Toilet Training	Child Age Begin to train	Age completed	When to begin	Description
Early Training Methods	Assisted Infant Toilet Training (AITT) (aka elimination communication, aka, natural infant hygiene) Variations: Early Readiness/ Environmental Scheduling/ Operant Conditioning)	2-3 weeks to 18 months	4-12 months	When children can show non-verbal signs that they need to defecate.	Caretakers remove clothes and hold children above the ground or potty. Note, there are many different names used within the literature. Operant conditioning may be used with different stimuli to induce defecation at times convenient for caretakers
Later Training Methods	Child Oriented (Brazelton, 1962) Variations: Spock	18-26 months Varies by country (see below)	Avg. 28.5 months	When children show interest in toilet training.	Gradual introduction to toileting and gradually reduced assistance for toilet practices.
	Dry Pants (Foxx and Azrin, 1973) Also, Intensive approach	20-26 months	Avg 25 months		Rapid training procedure

The chart above has been adapted from Vermandel et al, 2008 with additions from the sources above. The process of transitioning sanitation techniques, especially bowel control training and/ or toilet training has been described in low income contexts in only a few studies. Appendix I, contains an annotated bibliography of bowel control and toilet training ages.

While originally written for a high income context, these methods appear to be useful as a way of describing practices within low and middle income contexts. For example, when comparing practices: in rural Kenya in 1977 (deVries and deVries); for some families in Peruvian peri-urban neighborhoods in 1999 (Yeager et al); in Vietnam in 2013 (Duong et al); the anthropological report in an undefined location in China in 2016 (Gotlieb et al); in Odisha, India in 2015 (Routray et al); in Bangladesh in 2017 (Hussain et al); and in Southwest Nigeria in 2017 (Solarin et al), the practices described sound very similar, even though they do not always label the practices as assisted infant toilet training (AITT). In all of these locations infants defecate when held in specific positions when they develop the ability to communicate their need to defecate. This is generally when they are younger than 4 months, often assisted with whistling or ‘shushing noises’ and either held with the feet over the ground or over a potty. In these studies, it is commonly referred that this is due to the workload, water stress, and unpleasantness of handwashing cloths (Yeager et all, 1999). Interestingly, nearly all of the studies in low income contexts that describe any potty training/ bowel control technique describe a process that fits the description of AITT.

The quantitative studies that describe defecation locations, but do not attempt to qualitatively define these practices hint at similar concepts. For example, Val Curtis et al (1997) show how in Burkina Faso by 6 months, very few children are still defecating on linens. Petrie et al (2016) show the same results for defecation locations, by 7 months very few children are defecating in cloth diapers; although those who use disposables continue to use them, with somewhat lesser amounts. Since no other studies make quantitative comparisons between defecation locations/ IYCFM strategies and age, the applicability of this comparison is unknown.

For those using early training methods focusing on developing bowel control, this does not necessarily mean ‘potty training’ (children are using potties) nor does it actually mean ‘toilet training’ (children are using toilets/ latrines). There are a variety of skills that must also be developed before children are managing their sanitation independently, of which bowel control is only one component (Schum et al, 2002). This difference in semantics may seem trivial, but the name ‘Assisted Infant Toilet Training’ implies that children as young as 6 months are using some form of ‘adult sanitation’ when the studies clearly show that it

simply means that children are no longer defecating on cloth, and are now defecating in potties or are held over the ground (Eg: deVries and deVries, 1977). For those using later training methods, developing bowel control, ‘potty training’ and ‘toilet training’ may mean roughly the same thing as children develop bowel control as they learn to use the toilet (Schum et al, 2002).

Any qualitative description of later ‘latrine training’ as a distinct step after early bowel control training could not be found within the literature. Within the quantitative literature there were a variety of ages when caretakers perceived as the appropriate time for children to begin using latrines. This was often split between times when children began using a latrine and when a child can use a latrine without assistance (for example removing clothing, cleaning bottoms, washing hands). Majorin et al (2017) describes caretakers perceived children were ready for latrine training at 3 years, but required assistance until age 5. Petrie et al (2017) also describes children in Cambodia using latrines for the majority of defecation events by the time they are 3 years with the average caretaker believing children should use the latrine independently at 5 years old, and consistent use at age 7. In India, Routray et al (2016) found that many caretakers delayed training until 5 years, finding latrine designs unsafe. Biran, Tabyshalieva, and Salmorbekova (2005) found similar results with caretaker’s perceptions in Kyrgyzstan with children expected to begin using a latrine about the same time they start school, age 6. The annotated bibliography in Appendix I shows the wide variety of ages when children begin using latrines.

A summary of determinants of bowel control/ potty training/ toilet training ages discussed in studies of both low and high income contexts contained within the annotated bibliography is included here. Note that due to the wide range of confounding factors and lack of controls it is difficult to determine which of these factors are causal and which factors are correlative.

- Caretakers who use reusable, washable diapers tend to start potty training much earlier than those who use disposable diapers. (Thaman and Eichenfield, 2014)This is likely due to the lesser convenience of reusable diapers. Children wearing reusable diapers require more attention from caretakers and need to be changed more often than disposables due to the differences in the absorbing material (Thaman and Eichenfield, 2014)
- Caretakers who live in multi-generational homes and rely on extended family for assistance with child feces management tend to potty train earlier. (Pachter and Dworkin, 1997, Thaman and Eichenfield, 2014)
- Caretakers with less education and less access to information tend to start potty training earlier. This includes information for different toilet training techniques and

the current suggestions from the medical field for child centered readiness training. (Thaman and Eichenfield, 2014; Horn et al., 2006)

- Caretakers from lower income brackets, as compared to their peers, tend to start potty training earlier than those of higher income brackets (Eduardo and Machado, 2011). This was noted as a likely result of the burden of cost from disposable diapers in the Brazil study. These findings were also found to be statistically significant by Horn et al (2006).
- Female children on average gain toilet training skills faster than male children. This has been found in both Iran (Hooman et al, 2013) and the United States (Schum et al, 2002)
- Caretakers with access to communal latrines tend to latrine train later than those with private latrines (Majorin et al, 2017). So far no comparisons have been made in the literature between those using latrines and those using toilets.

To help better understand the child sanitation practices within an emergency displacement and to help place these practices within a broader context, the following research questions were developed:

OB3_Q1	What methods are caretakers using to train children/ how are children communicating their need to defecate?
OB3_Q2	At what ages/ development stages do management practices change? (based on the age of the child cared for by caretaker)
OB3_Q3	If used, when is it considered appropriate to begin using a potty?
OB3_Q4	If used, when is it considered appropriate to begin using a latrine?
OB3_Q5	If used, when is it considered appropriate for a child to use a latrine independently?

2.4 Changing Conditions, Dynamic Practices and IYCFM

While the practices described above reference the primary IYCFM strategies used by caretakers, there are a few pieces of research that indicate that IYCFM practices may not be consistent. For example, Cousens et al (1996) mentions in an assessment for observations for IYCFM that there are significant variations in household practices. To better understand consistency in household practices the following states were identified to explore within the case study.

2.4.1 Inconvenient times: when busy, at night, and while travelling

While convenience has been shown to have a large impact on selecting IYCFM strategies (see behavioral determinants above), a few studies have indicated that times that are particularly inconvenient can also modify daily IYCFM practices.

Within the literature on potty training, the time needed to successfully train and effectively use potties, especially with very young children shows that they might not always be used when caretakers are busy or tired (Duong, Jansson, Hellstrom, 2013). Similarly, Petrie et al (2016) mentioned that children who used latrines with assistance could not use them if caretakers were busy. Denis (2015) describes that within the rural research areas in the Philippines that caretakers having difficulties training their children to use the latrine would allow them to defecate outside to reduce the burden of assisting with each defecation event.

Denis (2015) in the Philippines, Petrie et al (2016), in Cambodia, Kumundi et al (2017) in Papua New Guinea all found caretakers who generally use cloth diapers, use disposable diapers at night and when travelling with a much lower chance of safe disposal. Denis (2015) and Petrie et al (2016) also wrote that even children who use latrines during the day will use potties if they need to defecate at night. Aluko et al (2017) wrote in Nigeria that practices were significantly different at night with caretakers much more likely to safely contain, transport, dispose, clean, and practice hand hygiene at night than during the day. Unfortunately, no qualitative description of changing practices was provided.

To investigate if practices change during these inconvenient times, three research questions are added to better understand consistency of IYCFM practices.

OB4_Q1	Do caretakers have different IYCFM practices when the caretakers are busy? If so, how/ why are these different?
OB4_Q2	Do caretakers have different IYCFM practices at night? If so, how/ why are these different?
OB4_Q3	Do caretakers have different IYCFM practices when they are travelling with children? If so, how/ why are these different?

2.4.2 Diarrhea and IYCFM

While many studies have made links between improper disposal and diarrhea (see the review by Gil et al, 2004), there is only one that describe feces disposal while children are sick with diarrhea. Rush (2011) describes in Kenya that caretakers who have children defecating onto newspapers and magazines find difficulty with this method when children

have diarrhea. Caretakers also modified child cleaning methods during diarrheal episodes with increased water and tissue paper usage. No other studies could be found describing changes in behaviors while children are sick with diarrhea. This gap in research was identified by Majorin et al in 2017.

Majorin et al 2017:"*This is, however, an important research question as presumably diarrhea feces may pose a more significant threat as they may contain more pathogens, thus the disposal of diarrhea feces may be an important question to ask."*

To investigate if the presence of diarrhea has an influence on IYCFM practices, the following question was added to the case study:

OB3_Q4	Do caretakers have different IYCFM practices when children are sick/ have diarrhea? If so, how/ why are these different?

2.4.3 Rain

To better understand how rain, discussed below in the behavioral determinants section, can modify daily IYCFM strategies, the following research question was developed.

OB3_Q5	Do caretakers have different IYCFM practices when it is rainy (local season variations)? If so, how/ why are these different?

2.5 Caretaker Roles

In addition to understanding 'how' caretakers are managing children's feces, emerging themes are focused on understanding 'who' are the key household persons to address within hygiene promotion interventions. The results of caretaker roles from the IYCFM literature are included here; however, future research may benefit from exploring these concepts in broader studies on a variety of hygiene topics.

While many quantitative studies only include women or mothers as the inclusion criteria for their studies (Eg. Cousens et al, 1996), others note only the caretaker present during observations (Eg. Huttley et al, 1994). Yeager et al, 1999 interviewed both men and women, but focused on mothers as they were clearly the primary caretakers in charge of IYCFM. Some fathers assisted with toilet training and removing feces. Munguambe (2006) observed in rural Mozambique that there are multiple caretakers who were managing children's feces, although unfortunately this wasn't explored further. A recent study by the Share consortium in Kenya (Alando, Simiyu, and Mumma, 2018) attempted to investigate these household roles for child health interventions and found that there were multiple

household members assisting with child care, especially when mothers engaged in income generating activities.

Three separate studies have mentioned conflicting household financial priorities influencing IYCFM hygiene practices. Studies in Pakistan (Halvorson, 2004), Kyrgyzstan (Biran, Tabyshalieva, and Salmorbekova, 2005), and Papua New Guinea (Kamundi et al, 2017) all found that female caretakers reported that the purchase of soap for IYCFM hygiene purposes was restricted by male household members. In these studies, handwashing and child anal cleansing generally did not include soap. Munguambe (2006) found similar results of household budgets and women's financial autonomy as a predictive factor for child health interventions; although it was mentioned that this varied based on the products needed.

To explore these roles, the following research questions were developed to better understand who is participating in IYCFM and if secondary caretakers have practices different from primary caretakers.

OB5_Q1	Who are the people involved with managing the child feces in the household? How do these roles change?
OB5_Q2	Do different caretakers have different IYCFM practices within the same household?

2.6 Risk of Child Feces Management Practices

This section highlights the current discussion in IYCFM of defining safe disposal before exploring risks in other steps in the IYCFM process. This researcher reasoned that the primary purpose of IYCFM is to reduce contamination risks within the household and community. With the current focus on safe disposal, there is good indication within the recent literature that there may be significant household risks that have gone unaddressed within previous research and hygiene programming.

2.6.1 Defining ‘safe disposal’ for child feces

Figure 2 – (JMP, 2006) Safe disposal definitions

One of the primary issues with prescribing sanitation solutions for children too young for latrines is the lack of an agreed upon definition of ‘safely disposal’. The JMP, WHO/ Unicef have previously included a question on the safe disposal of children’s faeces within the (MICS) Standard Core Questions on Drinking Water and Sanitation for Household Surveys (JMP, 2006)The definition for safely managed (or sanitary disposal) of children’s feces included using the toilet/ latrine, putting feces into the toilet or latrine or burying the feces. Other forms such as placing children’s feces in the garbage, ‘burying in the open’, or placed into surface water drainage channels are defined as unsanitary. There is no mention of the defecation location, enabling products used (such as diapers or potties), nor sanitation or solid waste chains within the JMP definitions. The only criteria for safe disposal mentioned is the final disposal location.

A 2015 consultation commissioned by the JMP and conducted by Rob Bain and Rolf Lyendijk attempted to clarify the consensus on the safety of burying feces and disposing via garbage by conducting a Delphi consultation with leading experts. Nearly all experts agreed that disposal via garbage was unsafe, although this was justified with an assumption that the solid waste management chain in developing countries is unlikely to be sufficient for safe disposal. The consulted experts highlighted the risks to solid waste scavengers and to those living in proximity to the solid waste dumping sites, although they did admit that there was no evidence that disposal of diapers with solid waste poses a significant health hazard. It was also admitted that disposing of feces into the solid waste chain is not a common practice except in places currently using disposable diapers. (Bain and Luyendijk, 2015)

In the 2015 report by Bain and Lyendijk, there was less of a consensus if child feces burial is a safe method of disposal. Some experts argued that this method was likely to prevent contamination via some of the f-diagram components such as flies and removes excreta from the immediate environment. Experts disagreed if this method would effectively prevent animals such as dogs or chickens from digging up and spreading the feces throughout the environment. Experts also disagreed if this method would effectively prevent contamination from groundwater, especially during heavy rainstorms. The strongest arguments against burial methods come from anecdotal evidence that proper burial sufficiently far away from the home area to a sufficient depth and covered with sufficient soil, are unlikely to occur. (Bain and Lyendijk, 2015) Additionally, it was mentioned that it makes little sense to utilize

the ‘cat method’ for children to dispose of fecal material if latrines are promoted and used by adults as the preferred defecation and excreta disposal location.

2.6.2 Risks of IYCFM practices beyond disposal

The WSP definitions and the majority of public health literature to date appear to rely heavily on defining disposal without consideration of other steps in the child feces management process These deficiencies are supported by recommendations from Share and the London School of Tropical Medicine and Hygiene in their 2015 policy brief, Estimating the Potential Impact of Sanitary Child Stool Disposal.

Estimating the Potential Impact of Sanitary Child Stool Disposal (Sykes et al, 2015)

"Importantly, all of these definitions deal only with the disposal site of the child’s faeces and does not consider the other stages in child faeces management, such as where the child defecates, how the faeces are collected and disposed of, and what hygienic behaviors the caregiver engages in afterwards.”

Three papers were found which intentionally explored risks beyond safe disposal. Majorin et al (2016) examined risks at various stages of the IYCFM process finding that potential exposure points exist for defecation locations, when feces are removed or transferred, if defecation locations are cleaned, during child cleaning, hand hygiene, feces disposal, and the safety of the subsequent sanitation chain. Petrie et al (2016) suggested hygienic and unsafe practices for each step of the IYCFM process. Aluto et al (2017) is the first paper to attempt to define entire sets of household practices as ‘safely managed’ based on five process definitions (defecation location, transport, disposal, tool cleaning, and caretaker hand hygiene) of binary safe/ unsafe definitions. Unfortunately, these definitions were not defined within the paper. Due to the lack of foundational research the suggestions for safe and unhygienic behaviors within these papers are largely a product of reasonable assumptions.

Similar to behavioral determinants, very few papers have explicitly focused on defining risks in the IYCFM process meaning that an attempt to collate isolated mentions of various risks requires significant time. A brief overview specific risks mentioned within the literature is provided here to provide evidence for the selected research questions; however, a more thorough review of the literature may uncover useful additions to consider in future studies.

Defecation location risks

Majorin et al (2016) mentions the need for future studies to compare between defecation locations as providing different levels of containment and protection from children; however, questions regarding containment remain largely unanswered with only a few studies mentioning these issues. For example, Rush (2008) describes containment risks associated with open defecation and scooping:

Risks within defecation locations – Rush (2011)

"…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."

When comparing studies of fecal markers within household soils (Boehm et al 2016; Steinbaum et al, 2016; Pickering et al, 2012) with studies of geophagy (Marquis et al, 1990; Ngure et al, 2013), there are strong indicators of risk to children from fecal contamination while playing on the compound ground. No studies could be found that attempt to define how well removal methods reduce risk from contamination on these surfaces; although Hussain et al (2017) mentions in rural Bangladesh that some caretakers reported that collecting feces with leaves or straw did not sufficiently remove feces and would require cleaning the ground with their feet and water.

A full assessment of these risks would not be possible within the scope of this case study; however, the following research question has been provided to compare defecation locations with the presence of children with the assumption that children's presence in these locations will demonstrate that these are likely locations which may spread contamination.

OB6_Q3	Do management practices include cleaning the ground/ floor if defecating onto the ground? Are residual feces obviously present after cleaning?
OB6_Q4	Are children observed playing near reported defecation locations?

Petrie et al (2016) mentioned that chamber pots used as potties were shared by multiple household members, demonstrating a potential risk of familial contamination. This potential person to person contamination risk will be investigated within the case study.

OB6_Q9	Are any sanitation products shared by members of the household?

Feces transport risks

Majorin et al (2017) and Petrie et al (2016) emphasize that the risks from feces transport are largely a product of potential contact, while moving feces using items such as paper or leaves. As mentioned above Rush (2011) found that caretakers found paper products difficult to transfer feces when children had diarrhea. To investigate if this risk is present within the study area the following research question was developed:

OB6_Q5	Do enabling products provide sufficient protection of caretaker contact with feces?

Feces storage (delayed disposal) risks

No studies could be found that explicitly explore risks of household storage/ delayed disposal. Studies that describe these behaviors mention that it may be a potential source of flies (Yeager et al, 1999). Rush (2011) describes that some caretakers in peri-urban Kenya simply place the cover on the potty, continuously using the potty until it is full and child is sitting on top of feces. To provide additional evidence of the need for future studies on this IYCFM process step, the following research questions have been added to the case study objectives:

OB6_Q1	Are feces left in the defecation location for a period of time before removal?
OB6_Q2	Are there any times when feces are ‘stored’ within the household?

Feces disposal risks

While many studies explore feces disposal risks on a binary scale (within or outside of a latrine) none could be found that explore the conditions when this may create additional risks. For example, in the humanitarian consultation by Karine Deniel (2005) disposable diapers within latrines had a large impact on the sanitation chain, notably on appropriate latrine emptying solutions. Diaper disposal within container based sanitation solutions was reported more recently by McManmon (2016) for camps in Greece. The reported use of disposables within the literature (Kamundi et al, 2017; Petrie et al, 2016; Aluko et al, 2017; etc.) and the lack of guidance for their disposal in low income contexts implies that there are risks with disposable diapers within latrines that should be addressed in further research. A question considering solid waste services within the case study area has already been discussed above in the behavioral determinants section.

OB6_Q8	Are solid waste services and facilities capable of safely managing disposal of infant feces? (if available/ applicable)

Although not mentioned within the literature, the following research question was added to investigate the effect that wash water disposal had on latrines within the case study. (Brian Reed, personal communication)

OB6_Q10	Are latrines visually overloaded with disposal of nappy washing water or at risk of overloading? (if available/ applicable)

Tool cleaning/ defecation location cleaning risks

Due to the limited descriptions of this practice, there is little knowledge of the risks and best practices with cleaning IYCFM tools, including cloth diapers, scoops, and potties. For example, Aluko et al (2017) have defined safe tool cleaning as occurring with both soap and water, but do not mention a cleaning location as a requirement for safe management. Petrie et al, (2016) defines safe tool cleaning as cleaning with soap ensuring the wastewater is disposed in latrines with items disinfected though exposure in sunlight, including cloth diapers. Little is known on the steps needed or how external factors such as an extended rainy season might have on sunlight disinfection.

Majorin et al (2017) recommended researching tool cleaning as a potential source of risk within the IYCFM process. This has been included with the addition of the following research question.

OB6_Q6	Where are enabling products cleaned, if at all? How are they cleaned?

Child anal cleansing and disposal of anal cleansing material risks

Risks for cleaning children's bottoms appear to primarily occur when disposing of the material used for this purpose. While few studies have considered this as an IYCFM process step, Rush (2011) found that the materials used for anal cleansing were often not thrown within the latrine.

The definition of safe cleaning used by Majorin et al (2017) and Petrie et al (2016) is to wash children with soap and water in a basin and then dispose of this material within the latrine. While disposal within the latrine can reasonably be assumed as reducing risk, the relative safety of different cleaning techniques is not well known, for example between using paper or washing completely after each defecation event. Another useful question might be to ask to what extent does soap reduce risks while cleaning children's bottoms?

To help provide evidence for this additional point of risk within the case study, the location of cleaning and the disposal of anal cleansing materials will be investigated.

OB6_Q7	If management practices include the use of wash water for anal cleansing cloths or nappies, where does this washing occur (eg. surface water) and where is this water disposed?

Child and caretaker handwashing

The risk of absence/ presence of post disposal hygiene has been discussed above in the process section along with inclusion within the case study.

Flies and IYCFM

To note if flies were present at any of the locations or obviously present on the CFM tools as a household contamination path, the following research question was added (Robert Chambers, personal communication)

OB6_Q11	Are flies visible at any of these locations? (Defecation location, on IYCFM tools, and in disposal locations?)

While examining the IYCFM process within the case study, any additional risks that become evident while at site will be investigated to provide indication of potential areas of future research.

OB6_Q12	Are there any other risks that need to be explored while at site?

2.7 Technological Behavioral Determinants of IYCFM practices

While few studies consider process steps for IYCFM even fewer attempt to explain the behaviors described. So while there are a number of KAP (Knowledge, Attitude, and Practice) studies demonstrating that unsafe disposal are prevalent in a community, the reasons for those behaviors are often not well known. To demonstrate this, all studies found that described any IYCFM behavioral determinants are presented in Appendix I as an annotated bibliography. This section describes technological behavioral determinants within the integrated behavioral model (Dreibelbis et al., 2013) while the contextual determinants are discussed below. Some items, such as access to water in the immediate section below may have components of both a technological and contextual nature. Unfortunately, due to time constraints, the psychosocial determinants haven not been collated within this review or included within the study.

2.7.1 Access to water

Water stress was mentioned in both quantitative and qualitative literature as a strong theme for modifying behavior. Predictive behavioral factors were explored in 1995 by Curtis et al and found that the most significant factor in predicting safe disposal was the presence of a

domestic water connection. The authors attempted to explain the apparent link between water source and stool disposal by saying that women would have more time to manage these hygiene activities if they were not spending time gathering water. They also hypothesized that mothers with water on plot may have an increased level of hygiene behavior due to the convenience. Majorin et al (2014) mentioned similar results in rural India with water on plot leading to improved rates of safe disposal.

Several studies mention that in times of water stress, caretakers will modify how they wash children's bottoms; instead of using water and soap, caretakers may use paper or leaves (Huttley et al, 1994; Huttley et al, 1999; Halvorson, 2004;)

In other studies, caretakers list the lack of convenient water supplies as a factor in reduced rates of post disposal handwashing (Biran, Tabyshalieva, and Salmorbekova, 2005).

In Papua New Guinea, caretakers reported washing clothes in surface water instead of at home during times of increased water stress in the dry season (Kamundi, Kearton and Souter, 2017)Similarly, in Pakistan, caretakers in a water scarce area used the washing water from diapers within gardens. (Halvorson, 2003)

Within the post-typhoon study within the Philippines, Denis (2015) reported caretakers allowed children to open defecate to save water used for anal cleansing and flushing pour flush latrines.

Based on the literature, there is a strong relationship between water supply and IYCFM practices, particularly in areas of water stress. Two questions are added to investigate these factors within the case study.

OB7_Q3	How much water do families estimate is needed to properly manage the child feces using their preferred method/ products? Do they feel the current water supply is sufficient for this need?

2.7.2 Convenience of technology

Convenience was mentioned in many studies as an influence on different IYCFM process steps.

Convenience is a large factor in a caretaker's choice of defecation location. Caretakers in Peru began using AITT to move children away from cloths as soon as possible due to the inconvenience of washing (Huttley et al, 1999) Within the same study, caretakers of children using OD strategies as opposed to potties cited the primary reason was the

inconvenience of the potties. Rush (2011) mentions similar results in Kenya with some caretakers preferring children defecate in the bush because of the reduced cleaning workload. Routray et al (2015), described similar results within rural India with caretakers considering it convenient for children to defecate on the roadside as this was perceived as not necessitating removal. In locations where disposable diapers are growing in prevalence, these are perceived as more convenient and are used when funds allow (Petrie et al, 2016)

As discussed above, convenience may lead caretakers to 'store' feces within the home or delay disposal until cloths can be conveniently washed or potties can be conveniently emptied (Huttley et al, 1999).

Convenience also can impact disposal. Caretakers in Kyrgystzan cited time constraints, lack of will, and the far distances to latrines as primary barriers to disposing in latrines (Biran, Tabyshalieva, and Salmorbekova, 2005). Routray et al (2015) described similar results in India for caretakers with children defecating in backyards, finding it more convenient to throw feces over the compound wall into a garbage dump than into the latrine. In contrast, Kamundi, Kearton, and Souter (2017) found in Papua New Guinea that disposal within latrines was perceived as being more convenient than burying methods and that it was preferred as animals would often spread feces if improperly disposed.

While comparing the convenience of various IYCFM strategies is too large for this MSc study, the following research questions have been added to the case study to determine if factors of distance to disposal sites influence IYCFM behaviors.

OB7_Q5	What are the distances to facilities (latrines, etc.) used for disposal of infant feces, for water supply, and handwashing? Are these practically close to the locations where child feces are managed?

2.7.3 Emerging technological themes

Although only a handful of studies consider technological factors for IYCFM, technical issues are scattered throughout the literature.

Potty design was described as influencing acceptance by children and caretakers. In Peru, it was found that round bottom potties were unstable, leading children to fall off them and reject them (Huttly et al, 1999). Caretakers then used open defecation and scooping methods. In Cambodia, caretakers found new potty designs much better than traditional designs as the base was more stable, potties were easy to clean, and the cover was useful for preventing flies if disposal was delayed (Petrie et al, 2016). Potties with lids were

preferred by caretakers in Peru and Kenya for similar reasons (Huttly et al, 1999; Rush, 2008)

One issue mentioned in several studies is the higher rates of safe disposal from potties as compared to those using scoops. (Huttly et al, 1994, Cousens et al, 1996; Petrie et al, 2016) For example, Curtis et al (1996) found that households using child potties were 26 times more likely to dispose of feces in a latrine than those not using potties. In Cambodia, Petrie et al (2016) explained that this was likely because caretakers using scoops were purposefully not disposing within latrines. It was explained that this was the result of caretakers finding the dirt clogged pour flush latrines and caused them to fill up prematurely. Similarly, it was found in Bangladesh that caretakers were not placing scooped feces in pour flush latrines so the dirt would not block toilet pipes (Sultana et al., 2013).

Technical issues have been mentioned in several studies with a wide range of issues influencing use directly by children and for disposal. Access to locked latrines, poor maintenance and poor cleaning were all cited as barriers to safe disposal in Kenya (Rush, 2011) Also in Kenya, to prevent latrines from filling prematurely, rags used for anal cleansing materials were disposed outside of latrines (ibid)

Although a full review of latrine acceptability for children has not been included here, there are a few studies which mention its impact on IYCFM behavior. Dangers of falling or conducting diseases from latrines were cited by caretakers as reasons to discourage their use for children in Peru, Pakistan, and Kyrgystan (Huttley et al, 1999, Halvorson, 2003; Biran, Tabyshalieva, and Salmorbekova, 2005) Latrine drop holes too large for small children led to reported later latrine adoption in India. (Petrie et al, 2016) Large diameter bowls on toilets within the Philippines combined with no handrails were uncomfortable for children and made them reluctant to use them without assistance from caretakers (Denis, 2013).

There is very little primary research on the technical aspects of child latrine acceptability. A report provided by WaterAid Malawi for this MSc paper briefly details experiences with household Ecosan child latrines (Sugden, 2003). The smaller, 60cm slab with a very small drophole was found to be popular within the project area due to the lack of a superstructure. This was found acceptable not only by children, but for women to use at night due to the lack of hiding places for snakes and insects. Although a thorough analysis was not completed, qualitative results found that it led to a reduction in children's feces

around the house and was popular because women no longer had the task of picking up feces to place in the latrine.

Because it was not known prior to arriving within the case study which technologies were in use, specific technological questions were not developed prior to arrival. Three general questions were developed according to the issues mentioned within this section and within the STC, 2016 guide to help inform investigation at site.

OB7_Q1	Do caretakers find the current NFI kit contents appropriate and adequate to support their ability to manage their child's feces?
OB5_Q4	What are the perceived challenges and technological barriers experienced by caretakers in managing child feces?
OB7_Q6	What other technological factors are influencing IYCFM practices within this specific context? [To be explored at site.]

2.8 Defining Behaviors in Context

To better understand the factors which have been identified as influencing IYCFM behaviors, IYCFM literature with any mention to behavioral determinants was collated within Appendix I within an annotated bibliography to find research themes. Three large categories of determinants were found: Predictive behavioral determinants, those which describe demographics which might predispose a population to unsafely dispose, the hygiene promotion conducted within an area, and affordability and access to IYCFM products. These have been assessed here in order to develop research questions to help place the case study within a broader context before examining the present research within emergencies to place the research more narrowly within an emergency context. There are likely additional themes which may be present that would be useful for future studies to define.

While mentioned within the literature extensively, an analysis of psychosocial determinants has been excluded from this case study due to lack of time and resources within the confines of the MSc dissertation. Future research may also benefit from completing this analysis and placing each of these determinants within a standard behavior model.

2.8.1 Predictive behavioral determinants

Within quantitative studies examining predictive factors for disposal and comparing to demographic information, five large themes emerged:

- Households with a lower socio-economic status have decreased rates of safe disposal. (Curtis et al, 1995; Munguambe, 2006; Rand et al, 2015; Agaze and Haile, 2015)
- Households in rural areas as compared to those in urban areas have decreased rates of safe disposal (Azage and Haile, 2015; Rand et al, 2015)
- Households with lower caretaker (maternal) education have decreased rates of safe disposal (Curtis et al, 1995; Azage and Haile, 2015)
- Households that have owned latrines for shorter periods of time have decreased rates of safe disposal (Majorin et al, 2014, Petrie et al, 2016)
- Households without access to safe disposal locations (latrines) have decreased rates of safe disposal (Majorin et al, 2014; Azage and Haile, 2015; Rand et al, 2015; Petrie et al, 2016)

Given the current definition of 'safe disposal' as either within or outside of a latrine, it is no surprise that those with access to this technology generally have a higher rate of safe disposal; although, recent reports from Ghana (Ritter et al., 2018) have found that access to latrines for adults does not reliably predict disposal. Denis (2013) describes in the Philippines where nearly all children over two years were using pour flush toilets after Haiyan Typhoon, destruction of this infrastructure led some caretakers to allow children to open defecate. Disruption of solid waste services had a larger impact with caretakers of infants and young children reporting burying disposable diapers, hanging them in trees within plastic bags to wait for garbage collection, or leaving them exposed.

To better understand the support for WASH infrastructure provided within the case study context for safe disposal locations along with water supply and handwashing, the following research objective has been developed:

OB1_Q1	What support has been provided for water supply, sanitation, solid waste, and handwashing facilities?

The other factors mentioned here may be useful in identifying communities for interventions, but are limited in their ability to help develop solutions. Building latrines may be a viable intervention, but improving socio-economic status, moving populations to urban areas, and mandating maternal education are likely outside of the control of those preparing interventions and are possibly correlative factors rather than causal. For this reason, these predictive factors have not been included within this case study objectives.

2.8.2 Hygiene promotion and knowledge of safe IYCFM practices

While knowledge is typically not placed under contextual behavioral determinants it is included here as it is influenced by hygiene promotion interventions within humanitarian contexts and is subject to prioritization amongst other WASH initiatives. Although a review of IYCFM interventions has not been included within this paper, it is worth noting that there have been several hygiene promotion interventions focused on improving hygiene knowledge for IYCFM. Reviews of these interventions by Majorin et al, (2017) and Morita, Godfrey and George (2016) have found evidence is largely inconclusive and inconsistent on the impact of hygiene promotion on modifying IYCFM behavior.

Several studies have commented on caretaker knowledge and the impact that this knowledge has on behaviors. For example, in Papua New Guinea, knowledge was found to be high throughout the case study (Kumundi et al, 2017). It was commented that this clearly wasn't a barrier to safe IYCFM, but that it did not always translate into safe practice. Aluko et al found in Southwest Nigeria that although knowledge of safe disposal was high throughout the study area, there was very little difference in practices between those assessed as having high or low knowledge. In other case studies, such as in rural India (Routray et al, 2015) knowledge is reported as low with correspondingly low rates of safe IYCFM.

In rural Orissa, India, Majorin et al (2014) found in a post Total Sanitation Campaign community that the knowledge gained from this hygiene promotion tool had led to some increase in latrine usage among adults, but that this knowledge had largely not translated to improvements in the safe disposal of child feces.

The current lack of knowledge assessments regarding IYCFM practices make it difficult to assess its importance in influencing behaviors. There is weak evidence that knowledge is a requirement for safe IYCFM practice, but does independently ensure safe IYCFM practice. A full knowledge assessment of IYCFM is not practical within the time constraints of an MSc; however, a research question has been added to the contextual objective to better understand the knowledge gained through hygiene promotion activities in the case study area and to provide evidence for its effectiveness or to show significant gaps.

OB1_Q4	What hygiene promotion activities have occurred targeting child feces management?

2.8.3 Affordability and access to IYCFM products

Financial limitations are reported as influencing behaviors such as the use of cloth diapers as opposed to disposable diapers (Petrie et al, 2016). Tissue was too expensive for child anal cleansing in rural Kenya so newspaper and rags were used instead (Rush, 2008). Potties were seen as desirable, but too expensive for most families in rural Bangladesh so caretakers chose to use the OD with scooping method of IYCFM (Sultana et al, 2013).

Denis (2013) reported within the Philippines caretakers generally used disposable diapers, with those who used cloth diapers claiming this was due to financial reasons. Further, during the emergency access to consumable products such as disposable diapers were disrupted during the disaster leading to some looting.

To assess financial and access barriers during the case study, the following research questions were developed:

OB1_Q2	What infant sanitation products are available in non food items (NFI) kits? How are these items determined?
OB1_Q3	What infant sanitation products are available in the local market to purchase? How expensive are these items? How close is the market to the camps?
OB7_Q1	Do caretakers find the current NFI kit contents appropriate and adequate to support their ability to manage their child's feces?

2.8.4 Emergency specific contextual behavioral determinants

To date, only one full case study has been conducted on young child feces management in an emergency context (Denis 2015). The primary influences of this disaster to child feces management in this context have been included above within the preceding sections on behavioral determinants. To parallel this impact of the natural disaster on IYCFM practices where families remained within their homes, the following research question was adapted to explore how the displacement has influenced IYCFM behaviors from standard practice within South Sudan.

OB1_Q8	How has displacement modified caretakers IYCFM practices?

Within emergency response, three phases are broadly defined by Harvey, Baghri, and Reed (2002): immediate/ acute, intermediate, and long term. These phases are characterized by increasing stability and a shift of priorities from lifesaving to 'sustaining the health and wellbeing of the affected population' (Harvey, Baghri, and Reed, 2002).

Understanding how caretakers manage children's feces during each of these phases is largely unknown, as highlighted in the 2016 report by STC:

> **STC - Emergency Sanitation for Infants and Young Children Under 5, 2016**
> *"What is the difference between emergencies and the difference between phases of an emergency vis-à-vis the degree of risk caused by mismanaged/lack of management of children sanitation and excreta disposal?"*

Similarly, within the 2004 consultation with humanitarians on young child excreta disposal, the primary factors suggested for selecting IYCFM interventions were the phases of emergency and child age taking into consideration initial, pre-emergency practices (Karine Deniel). While a larger case study might be able to consider a larger cross section of conditions or explore more than one emergency phase by monitoring a single response over time, this case study is limited in resources and time and will only be able to cover one specific scenario (See methodology below). To provide reference to conditions and challenges experienced during the immediate or acute emergency phase for future case studies, the following research question was added:

OB1_Q9	Were IYCFM practices any different when families first arrived in Uganda?

2.9 Literature Review Conclusion and Summary of Aims and Objectives

The 2016 report on emergency sanitation for IYCU5 stated that the "Most of the technical guidelines focus on where feces should end up rather than on programme interventions to assist with that process or hygiene behaviors following disposal." This is likely due to the fact that the vast majority of research and interventions on IYCFM in low income contexts have focused solely on that behavior without consideration for the process steps prior to disposal. Significant gaps remain in our understanding of IYCFM practices worldwide. Appendix I shows a collation of the research gaps mentioned throughout the literature, coded by non-emergency and emergency literature. A following section within Appendix I lists the research gaps identified within the 2016 report by STC. The subsequent appendix, number II shows how each of the research questions addresses specific gaps in the literature. The full list of research questions are not included in the body of this report due to the large size of the tables; however, the research aim and objectives are summarized below. Connecting each of those research questions to a methodology is described below.

Research Aim: To conduct a case study of IYCFM behaviors within an emergency setting

- Objective 1 To describe the contextual area and assess the applicability of the case study

- Objective 2 To describe the IYCFM process and coping strategies employed by caretakers to manage child feces in an emergency setting
- Objective 3 To explore how IYCFM practices vary as children develop
- Objective 4 To explore new concepts of dynamic practices from changing conditions
- Objective 5 To explore caretakers roles for IYCFM
- Objective 6 To explore new risks in the management of child feces
- Objective 7 To explore new technology themes in the suitability of interventions for infant and young child feces management

3- Methodology

This chapter defines the methodology used to address the research gaps discussed within the previous chapter. A description of the pragmatic methodology and data collection tool selection is provided before discussing the case study communities and participants. After these sections, a description of each data collection tool is provided. Ethical considerations are then briefly defined along with the methodology for processing the information collected and the methodology for preparing the results and analysis. Finally, the methodology chapter ends with a brief overview of the challenges experienced within the research.

Similar to the literature review, the methodology chapter heavily references its companion document, Appendix II. This appendix contains a table connecting each research tool to each research question, more in-depth information on the ethics and power dynamics experienced within the research, the actual data collection tools used, descriptions of piloting experiences, and an in-depth look at the challenges and opportunities within the research.

3.1 Methodology Selection

The review conducted within this study along with the 2004 review by Gil et al found that all but a few WASH studies of child feces practices have focused on large quantitative studies. These have almost exclusively focused on disposal locations. Suggestions from this review are that qualitative, exploratory research is needed to better understand the range of practices before and after disposal that may also carry significant risk such as defecation locations, products used for transfer, etc. This suggestion is backed by a 2015 WSP guidance document for child feces management (O'Connel, 2015) and from the Save The Children Emergency Sanitation for Infants and Young Children scoping study (2016). While selecting this qualitative case study methodology was a component of the research aim, choosing the individual research tools for the case study followed the process defined by Denscombe (2010) in The Good Research Guide, ensuring the methodology selected was suitable for addressing the research objectives, feasible with the resources and time constraints, while maintaining ethical integrity.

3.1.1 Suitability constraints

As seen above within the review, some of the topics within IYCFM are well known, such as 'feces disposal', but for many of the topics covered within the case study there are only emerging themes available to provide minimal guidance on the topics. Because the literature is disparate on the information available on different topics within IYCFM, a range of tools were considered to meet the various research objectives. The research

methodology needed to do three things: describe the practices that are better defined, deepen arguments of emerging themes (a combination describing and exploring), and explore new themes discovered at site. Figure 7 from WEDC (2017) shows this in graphical format.

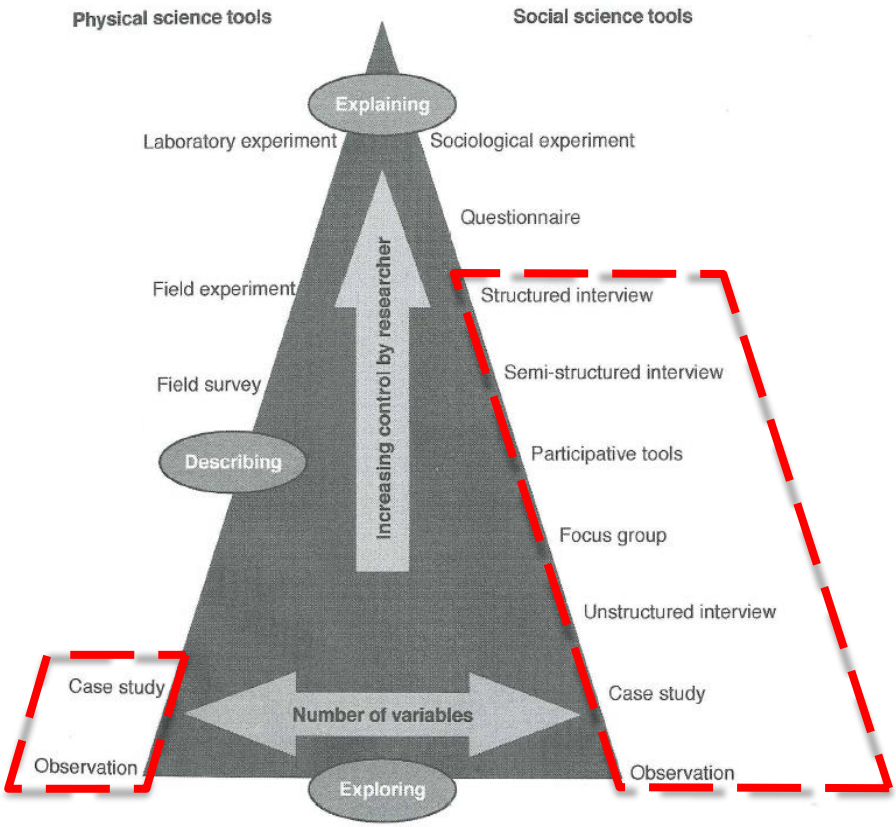

Figure 3 - (WEDC, 2017)Choosing research tools

The red shapes above show the potential options considered suitable for this research by the judgement of the researcher. Based on the need to explore themes, pre-coded questionnaire responses answers were not selected as these would need to be built from descriptions of previous research which largely did not consider many of the research objectives within this dissertation. Doer/ Non Doer studies suggested by an anonymous contact was rejected because this approach is reliant on a clear definition of ‘good’ and ‘bad’ behavior. While ‘disposal’ has a definition for safe/ unsafe behavior and the other process steps have definitions provided by Petrie et al (2016) based on reasonable assumptions, the research objectives sought to explore a wide range of practices with less clear definitions of ‘good’ and ‘bad’ behavior. Similarly, Trials of Improved Practices like those recently conducted by the Manoff Group and World Vision (2018) were rejected as these required a comprehensive idea of the practices within the area and did not fit well within the case study structure. These three methodologies will be useful tools to confirming the results of this case study within future research.

For exploring technology themes, very few pieces of research exist. The physical science tools needed to explore these were more rudimentary than those for the social science tools, with observation and interviews as the only tools available suitable to explore the vague themes uncovered within the literature. A major output from this research was the identification of IYCFM technology themes that could be investigated with research tools unsuitable for this research such as field surveys or laboratory and field experiments.

Another component that was considered but rejected was to focus interviews on local public health teams to better understand their perceptions and knowledge of local IYCFM behaviors; however, interviews with humanitarians have been conducted on this topic three times in the past (Deniel, 2004; Ferron and Lloyd, 2014; STC, 2016) and each time has found low awareness and uncovered very little actionable guidance. The experiences and knowledge of humanitarian teams was not assessed within this case study, but may be an area of interest in future case studies.

3.1.2 Feasibility constraints

The feasibility of different methodologies played a large role in research tool selection. The practicalities of meeting the timing constraints for an MSc dissertation and days available for fieldwork along with the personal funding constraints of the researcher meant that many tools were non-feasible for this research.

For example, payment for large numbers of enumerators to conduct widespread questionnaire surveys was not possible due to funding. Similarly, while longer structured observations would have been a useful tool for confirming the reported behaviors such as in Cousens et al (1996), the time to conduct multiple observations along with the payment and training of enumerators was not feasible during this research. Community mapping was also considered; however, the length of each interview was estimated to be too long during piloting and this activity was removed from consideration. Based on the on-plot sanitation available within each home the removal of this methodology was not considered to have a large impact on the results.

3.1.3 Ethical constraints

While no ethical issues excluded specific methodologies from the research, a number of ethical issues were considered in parallel with methodology selection that are discussed below in section 3.6. For example, interviews with older siblings were considered, but not included within this case study as practicalities of meeting the requirements for ethical research of these populations was seen as unfeasible and with limited benefit to meeting the research objectives; therefore, interviewing refugee children was not a component of

this research. Similarly, to significantly simplify informed consent and the ethical approval, while simultaneously allowing caretakers to feel more at ease, photography of refugees was excluded within this research. Only non-identifying photographs are used to demonstrate the methodologies used.

3.1.4 Data collection tool selection:

To collect the wide range of information needed and to address the feasibility and ethical constraints, qualitative, semi-structured interviews were selected as the primary data collection tool for this research. The WSP Sanitation Marketing Toolkit briefing entitled 'Management of Child Feces: Study Design and Measurement Tips' by Kathryn O' Connel (2015) contains several sample interview questionnaires that provided a base for the interviews. While conducting these household interviews, structured questionnaires helped to code responses and spot observations were used to support the information provided by respondents. To provide triangulation to these household visits, FGDs and key informant interviews were also selected along with a few smaller research tools to investigate themes at site. Table 4 below describes the justification for each tool.

Table 4 - Choosing Research Tools

Research Tool	Justification
Semi structured interviews	Chosen to explore a number of topics and collect new themes within the case study.
Focus Group Discussions	Chosen to compliment the semi-structured interviews and provide additional weight to the results. The structure of the first activity was structured to help triangulate child development's relation to IYCFM. The second activity was selected to rank challenges and solutions and increase participation.
Key Informant Interviews	Chosen to provide greater context and establish societal behavioral determinants that might not be common knowledge within the study population.
Questionnaire	Chosen to provide contextual information to each interview.
Spot Observations	Chosen to increase the validity of the semi-structured interviews for objectives such as absence/ presence of feces, handwashing stations, if IYCFM tools such as potties were actually present in the household or was just aspirational, to see if there were residual feces or flies, etc.
Document Review	Chosen to compare caretaker responses with the hygiene promotion provided within the case study area.
Opportunistic Observations and Interviews	Chosen to investigate IYCFM practices when observed within the community.
Market Analysis	Chosen to investigate local markets, product availability, cost, etc.

Appendix II shows how each of these methodologies is used to answer each research question and the triangulation provided. An explanation of each research method is provided in sections 3.3 to 3.5 below.

3.2 Case Study Communities and Participants

Denscombe's research guide (2010) mentions that proper case study research explicitly mentions case study boundaries and inclusion criteria. While the boundaries are highlighted in Appendix IV as an introduction into considerations for future case studies, the selection of case study locations and participants is described in detail below.

3.2.1 Selection of case study location:

Uganda was selected as the case study location because it has a large population displaced from various conflicts within central and Eastern Africa, but is a low risk location to conduct research. Loughborough University requires reasonably low risk research settings for MSc students. Rhino settlement was selected for the case study location as it was the primary theater of operation for the local research partner, CEFORD (Community Empowerment for Rural Development). The communities of Ofua III, Ariaze, and Ariwa (Table 6 below) were selected by the local partner, CEFORD, as these were in areas of their operations, represented a mixed population of South Sudanese tribes, and were safe for researchers.

Table 5 - Case Study Communities

Community	Tribe
Ofua III	Mixed
Ariaze	Mixed
Ariwa	Kakwa

A request was made to the local partner for different communities within Rhino to make comparisons based on differences in time since displacement, water stress, and varying levels of sanitation coverage. This was an assumption from the researcher that having a varying level of hygiene promotion/ knowledge from a relatively short displacement, access to water for washing, and access to disposal locations would have the greatest impacts on IYCFM practices. Unfortunately, due to the work locations provided by CEFORD all three communities had roughly the same profile for these three contextual factors so these comparisons could not be made with sub-case studies. Differences in results from the three communities were not found to be large and the interviews were processed and reviewed together.

3.2.2 Study population –household interviews

Inclusion criteria was set for household interviews to ensure that children were not yet using latrines or had just began using latrines rather than pre-determining an age bracket for the study as discussed in section 2.3 of the literature review and within Appendix I. Other inclusion criteria and exclusion criteria are discussed below in Table 7.

Table 6 - Household Interview Inclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Self-identified primary caretaker of a child who was not yet using a latrine or had just began using a latrine. • Originally from a country other than Uganda • Living in a displacement camp	Caretakers that are minors, with mental disabilities, or otherwise unable to provide informed consent.

Five pilot interviews were conducted before twenty interviews were conducted. Originally ten interviews were planned for each of the three communities, but this number was reduced due to the challenges listed below. Both female and male caretakers were included within the study as discussed within the caretaker roles section of the literature review, but few males were available for interviews while visiting home compounds. When male household members were present, the female household members were invited to participate so the household interviews were conducted as a couple as described within section 2.5 of the literature review. Males within the household were found to engage within the conversation of IYCFM. This did not appear to influence the veracity of the interviews.

Table 7 - Household interview populations

Community	Women	Women and Men
Ofua III	5	1
Ariaze	6	2
Ariwa	6	1

Seventeen of the household interviews were with women, while three of the household interviews included both the mother and father. The differences in responses were not found to be significant when describing the IYCFM practices so these responses have been processed and reviewed together. Additionally, the pilot results have not been included for questions which were refined using the piloting process described in Appendix II. Qualitative information from the pilot interviews, when relevant, has been included on questions which were not modified during following the pilot.

Households were chosen by selecting a spot at random while walking down the road within each community to begin moving house to house asking if caretakers were interested in participating in the study and met the inclusion criteria. In some instances, 2-3 houses were

skipped as the caretakers had walked through the compound in previous interviews and potentially listened to the discussions, biasing their responses. The subject of each interview was the youngest child within the household for all but three interviews. A mid-study assessment on study population discovered that there was a gap in the ages collected. To remedy this, some households were interviewed regarding a child who was not the youngest to match the ages needed to ensure a distribution of children between birth and independent sanitation.

3.2.3 Study population – focus group discussions

Selection of participants was done by health promoters/ CEFORD community organizers according to the following inclusion/ exclusion criteria.

Table 8 - FGD Inclusion Criteria

FGD #	Inclusion Criteria	Exclusion Criteria
1 Ofua III	Father of a child five years or younger	Caretakers that are minors, pregnant, with mental disabilities, or otherwise unable to provide informed consent. Any person who had previously participated within a household interview.
2 Ofua III	Mother of a child five years or younger.	
3 Ariaze	Older mother/ grandmothers	
4 Ariwa	Mother of a child five years or younger.	

While these FGDs participants were originally intended to provide a broader base of comparison within the community, only minor differences were found. These are discussed in the results below.

3.3 Household Interviews

After the piloting process described in Appendix II the following method was used to conduct the household interviews. Each visit began with an explanation of the study and the contents of the informed consent (Appendix II). Household interviews were conducted in a mixture of English and South Sudanese Arabic through an interpreter from the local CEFORD/ Oxfam community organizers. Questions were asked by the enumerator and then translated through the interpreter to the participant. Responses were given by the participants, translated by the interpreter, and then transcribed in situ by the researcher. Audio was recorded to improve the quality of the in situ transcription during later data processing. Data collection consisted of three separate data collection tools: a brief questionnaire of background information with pre-structured answers, a large semi-

structured interview with preset questions and open answers, and a set of spot observations. Each household visit lasted approximately an hour. Appendix II shows how the interview questions within each of the following sections relates to the study objectives. Figure 8 below shows the sequence of events within the household interviews.

Structured questionnaire: Used to provide information to code children and caretakers into distinct categories based on age, mobility, play location, diet, and clothing. The same questions were asked to each participant regardless of previous answers. See Appendix II for the questions contained within the structured questionnaire.

Semi-structured interviews: This interview questionnaire was adapted to best suit the study objectives from Kathryn O' Connell's 2015 paper entitled "Management of Child

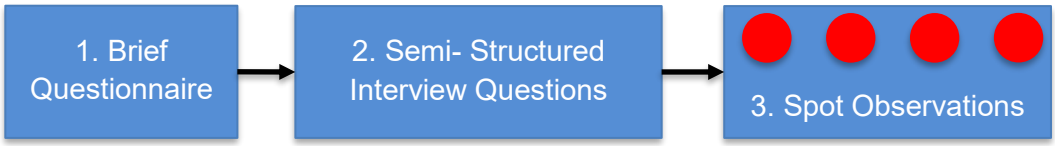

Figure 4 - Household Interview Sequence of Events

Feces: Study Design and Measurement Tips." Questions were split between multiple sections to understand IYCFM behaviors, challenges in IYCFM, daily changes IYCFM practices, developmental changes to IYCFM, and the impact that displacement has had on IYCFM. The semi-structured interviews were the same for each person with the same questions asked to each respondent with a few exceptions mentioned below. See Appendix II for the questions contained within the semi-structured interviews.

- For respondents who stated their child used the latrine, many questions regarding storage, transfer, cleaning, etc. were not applicable and were skipped.
- If using a potty, the respondents were asked if the potty was shared with other household members.
- If using a potty or cloths and participant mentioned they immediately empty or clean, the participants were asked if there were any times when they choose to not immediately empty or clean.
- Based on the defecation location, the tool cleaning question was also asked in different ways based on the tool used. This is described in the piloting question below.
- Caretakers were directly asked if practices were modified by displacement. In some families, children were born within Uganda and had no older siblings. If a household met these criteria, this question was not asked to those caretakers.

Spot-observations: Used to assess risks based on reported household practices and to triangulate results in the semi-structured interviews. The same information was collected for each family. This included presentation of IYCFM tools described within the interviews, presence of feces on the compound ground, inspections of latrines, and inspections of handwashing stations. Appendix III describes these in more detail.

3.4 Focus Group Discussions:

Each FGD began with an explanation of the study and the contents of the informed consent (Appendix II). FGDs were conducted in a mixture of English and South Sudanese Arabic through an interpreter from the local CEFORD/ Oxfam community organizers. Answers to the activities were recorded in English on poster paper which were later transcribed by the researcher. Each FGD lasted approximately 1.5 hours.

Additional probing questions and explanations were provided by the researcher and enumerator and then translated through the interpreter to the participants. Responses were given by the participants, translated by the interpreter, and these quotations were then transcribed in situ by the researcher. Audio was recorded to improve the quality of the in situ transcription during later data processing. Two activities were planned with a following set of semi-structured group interview questions.

Table 9 - FGD Activity Completion

FGD	Activity 1	Activity 2	Group Interview Questions
1. Ofua III – Fathers	Conducted	Conducted	Insufficient time
2. Ofua III – Mothers of Under-5s	Conducted	Conducted	Insufficient time
3. Ariaze – Older Mothers and Grandmothers	Conducted	Conducted	Insufficient time
4. Ariwa – Mothers of Under-5s	Conducted	Insufficient time	Insufficient time

The table above shows the activities which were conducted in each FGD. In all FGDs there was not enough time to conduct the group interview questions originally planned. These questions were supplementary, triangulating questions and were not seen as subtracting significantly from the research. Appendix II shows how the FGD activities relate to the study objectives. Included below is a description of the two activities followed by methodology notes to assist with future research using these same tools.

3.3.1 Activity 1 - IYCFM process and child development: The first activity was adapted to best meet the study objectives from Kathryn O'Connel's 2015 paper "Management of Child Feces: Study Design and Measurement Tips." This activity consisted of multiple steps and was explained completely to the participants before starting. The first stage began by breaking the larger group into 5 sub-groups of roughly the same size (3-4 people in each). This activity was designed to allow each person to have a voice in defining the IYCFM practices within the community where a larger group might more easily be dominated by a few voices. Each group was assigned to an easily recognizable child development stage based on physical capabilities:

A. Child cannot yet sit up
B. Child can sit, but not crawl
C. Child can crawl, but not yet walk
D. Child can walk, but not yet dress self
E. Child can dress self

These categories were meant to align with the development stages within the interview questionnaires; however, the research decided that FGDs would become impractically large if a sixth group between 'holding up head' and 'child cannot yet sit up' was included. For this reason, these development stages are grouped together for the FGDs. Each of the sub-groups filled out a poster board of questions for children within their assigned development stage with specific instructions to include practices for how they manage child feces at their home, and not how they would ideally manage feces in their home. The questions began by asking who is involved in managing child feces at this development stage. Then the participants filled out columns for 'defecation location,' 'storage/ transfer,' 'feces disposal locations,' and 'post disposal hygiene practices.'

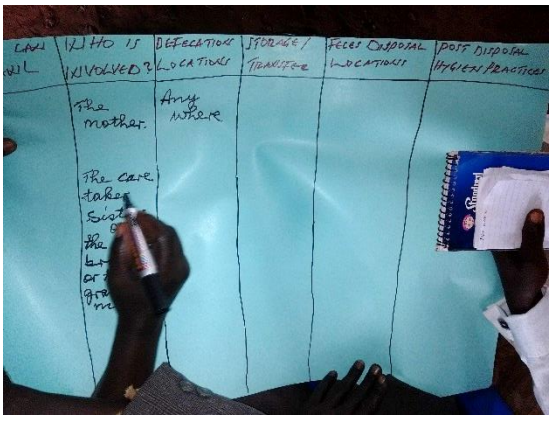

Figure 5 - Participants fill out the first activity poster for 'children who can crawl, but not yet walk'

After all of the sub-groups had completed the posters, the larger group reconvened to discuss. For each sub-group, starting with the first development stage, a brief presentation of the results was provided with verbal responses recorded in the researcher's field notebook to supplement the information captured on the posters. Depending on the presenter's preferences this was either conducted in English and translated for the benefit of the entire FGD or was conducted in South Sudanese Arabic and was translated for the benefit of the researcher and enumerator. Next, confirmations or disagreements on practices were discussed from other members within the FGD to better understand the

variations in practices throughout the community. Finally, the researcher asked some clarifying questions relating to the practices described. Figure 10 below demonstrates this sequence of events.

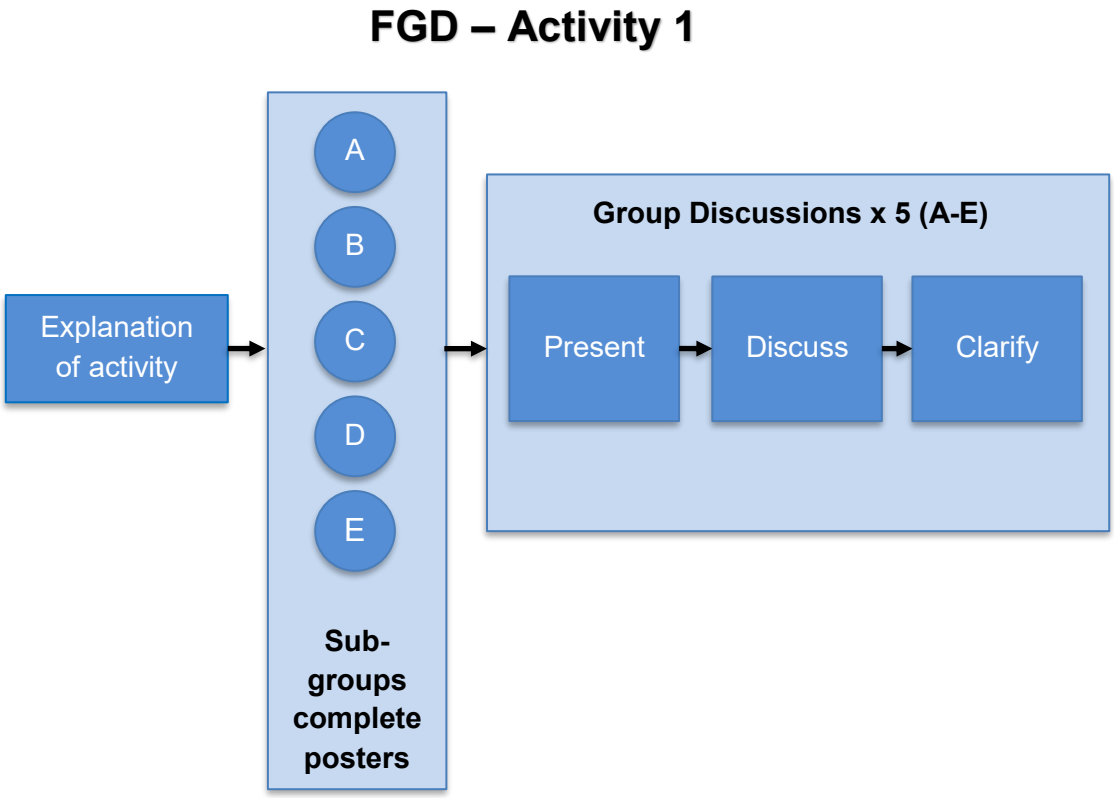

Figure 6 - FGD Activity 1 sequence of events

3.3.2 Activity 2, Challenges and Solutions: This challenges/ solutions activity was adapted to best meet the study objectives from Tracey Croft's 2010 study on MHM within Uganda. This activity consisted of three brief steps conducted with the entire focus group.

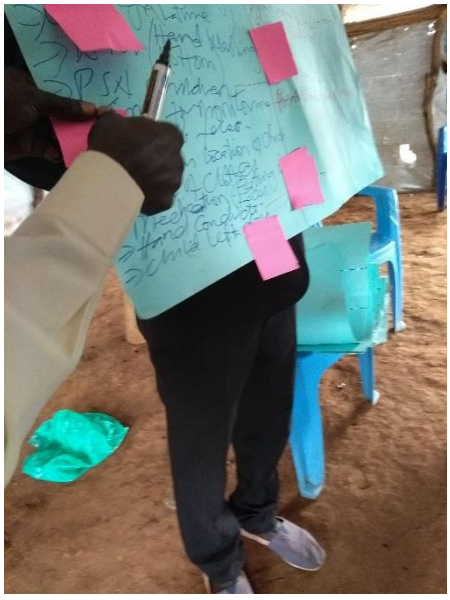

Figure 7 - Activity two voting activity is explained

1. An unranked listing of the challenges faced in the community for managing child's feces
2. Brainstorm solutions for each challenge
3. A voting exercise to rank the challenges using an open voting system with 'sticky-notes' placed by each participant on the items as seen in Figure 8 below. In discussions with the enumerator, it was decided that a private voting system was unnecessary within this context. Due to time constraints and budgets a sticky-note based voting system was adopted.

3.5 Additional methodologies used within the research:

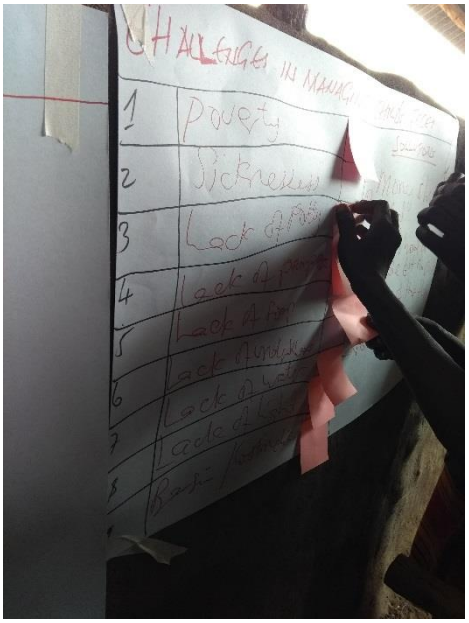

Figure 8 - Participants vote on challenges within FGD activity two

Key informant interviews – To help better understand the contextual factors influencing IYCFM within key informant interviews were performed with members of WASH sector operating within Rhino. The questions posed within these key informant interviews regarded priorities, challenges, risks, and limitations.

Document review – hygiene promotion documents provided by key informants were reviewed to help provide context and triangulate the information provided by the primary data collection tools. Some were not available such as recent population statistics. The camp had recently had issues determining exact population numbers due to people living within local cities and leaving camps without registering movement. Demographic information was therefore unavailable for Under-5s.

Opportunistic observations – To help triangulate the results of the household interviews for all seven days of field work while walking through the community both the enumerator and researcher were actively looking for evidence of child feces within home compounds, within bushes, and along paths. Additional observations for people washing baby clothing, disposing of wash water, water trucking etc. were collected and recorded within the field notes.

Opportunistic interviews – To provide additional insights and to more deeply explore emerging themes, a series of unstructured interviews were conducted when the opportunity presented itself. These are not included within any quantitative results, but are included within the qualitative results when relevant.

- Hygiene Promoter/ Translator
- Nursery School Head Teacher/ Nursery School Teacher
- FGD early arrivals
- Women washing baby clothes at water pump
- Medical Teams

"Snapshot" market analysis – To triangulate the information provided in household interviews regarding the products used, all of the shop-owners (5 shops) within one of the communities (Ariwa) were briefly interviewed with the following questions. Abbreviated participant information was provided before

- What child sanitation products are available in your shop?
- How much do each of these cost?
- How many do you sell of each per month?
- Are these products sold to the same people or different people?
- Where do you purchase these products?

3.6 Ethics

Ethical approval was first gained at Loughborough University before approval was gained by the Ugandan Office of the Prime Minister to conduct research within Rhino Settlement. Written consent was obtained by asking the participants to sign a consent form after the participant information was read. For the participants who were unable to write, a witness filled out the form with the participant's permission and signed the 'witness' line of the informed consent form.

The participant information and informed consent form used during the interviews and focus group discussions are included in Appendix II. While this research was considered low-risk, the key risks considered within the research are included within Appendix II. The most critical ethical issues within the project were ensuring the household interviews did not place an undue time burden on the participants and ensuring informed consent was willingly provided for the research.

Benefits for participants of household Interviews: There were no direct benefits to participants (such as incentives, payments, etc.), but participants were provided with a chance to express their opinions to contribute to the body of knowledge.

Benefits for participants of FGDs: Participants benefit from the engaging activity as a form of both learning and entertainment. The focus group activities generated a very positive response. Additionally, FGD participants were provided with a small snack and beverage in appreciation of participation. This was the appreciation suggested by the local partner, CEFORD, as commonly used for other local research.

Research power disparities

Due to the nature of the population involved within the study, careful attention was given to the power dynamics at play during data collection beyond the steps mentioned within the

ethical approval. Although this is not a typical component of an engineering MSc dissertation it is included as it was a continuous component to the research process in this context. Completely balancing these power dynamics was not possible within this study and no structured methodology was employed; however, the actions outlined in Appendix II were taken in recognition of the power disparity. These included self reflection of demographics, adjusting household interview structures during piloting, and allowing communities to review the work before final publication.

3.7 Methodology for Data Collation, Processing and Coding

The qualitative data required significant collation and processing to prepare the results for this case study. The methods used to process this information is described here.

Household Visits:

1. A form was prepared within Excel with each question from the questionnaire representing a column of the excel spreadsheet, separated into groups based on research objective. This allowed coding to naturally follow the progression of the questionnaire without additional processing. This form included all three of the methodologies used within the household visits: the structured questionnaire responses, semi-structured interview questions, and observations. Excel was used out of the researcher's previous experience using this tool for data processing. Nvivo was perceived as the preferred tool but was not used due to the time constraints of learning to use another tool.
2. Each interview was transcribed into a row within the excel form. The semi structured interview responses within the excel form included both direct quotes and abbreviated answers. When needed to confirm the quality of individual quotes, the audio recording was consulted to improve the quality of the transcription.
3. To assist with subsequent data analysis, participants were arranged in order based on age and coded with development related demographic information provided within the structured questionnaire such as diet, mobility, and locations where time is spent. Table 20 in Appendix III shows the participants organized by developmental markers.
4. Within each column, a unique code was used to distinguish between practices. For example, the defecation locations were coded 'CLOTHES' or 'POTTY' or 'CLOTHES/ GROUND'. Questions within 'Changing Daily Practices', each participant's response to each question was labelled as either 'SAME' or 'DIFFERENT' with a brief description and with accompanying supporting information and transcribed quotations.
5. Cross cutting risks were color coded within the spreadsheet as these were discussed by participants in multiple objectives.

6. When appropriate, quantitative data was processed by grouping the coded responses and applying simple statistical tools.

Photographs were coded by placing into appropriate folders relevant to each IYCFM strategy or specific themes.

Field notes were transcribed into a word documents based on each field day and coded according to relevant observations relating to research objectives.

FGD posters were transcribed directly into an excel form, organized by activity and child development stage. Quotes collected from the accompanying presentations and discussions were then added in locked cells below these written responses to provide qualitative context when needed. Cross cutting themes were color coded similar to the household interviews. These results were used to supplement the information provided within the narrative prepared with the household results.

Key informant interviews and informal impromptu interviews were transcribed into separate word documents and color-coded according themes.

3.8 Methodology for Results and Analysis

After the data was coded and processed, results were prepared. The original result section outline discussed each research objective and question sequentially; however, this was found too confusing and some of the results were presented out of order to improve the flow.

The first assessment that was completed sought to understand useful subdivisions of practices within the case study area. Practices were organized by age and by CFM technology employed (clothes, potties, open defecation and scooping, etc.) The reported developmental/ age-based sanitation changes were placed within a table. The ages at which children were reported as having begun using a CFM product or were planned to occur in the future were placed into an Excel chart. The chart below shows the collation of this assessment.

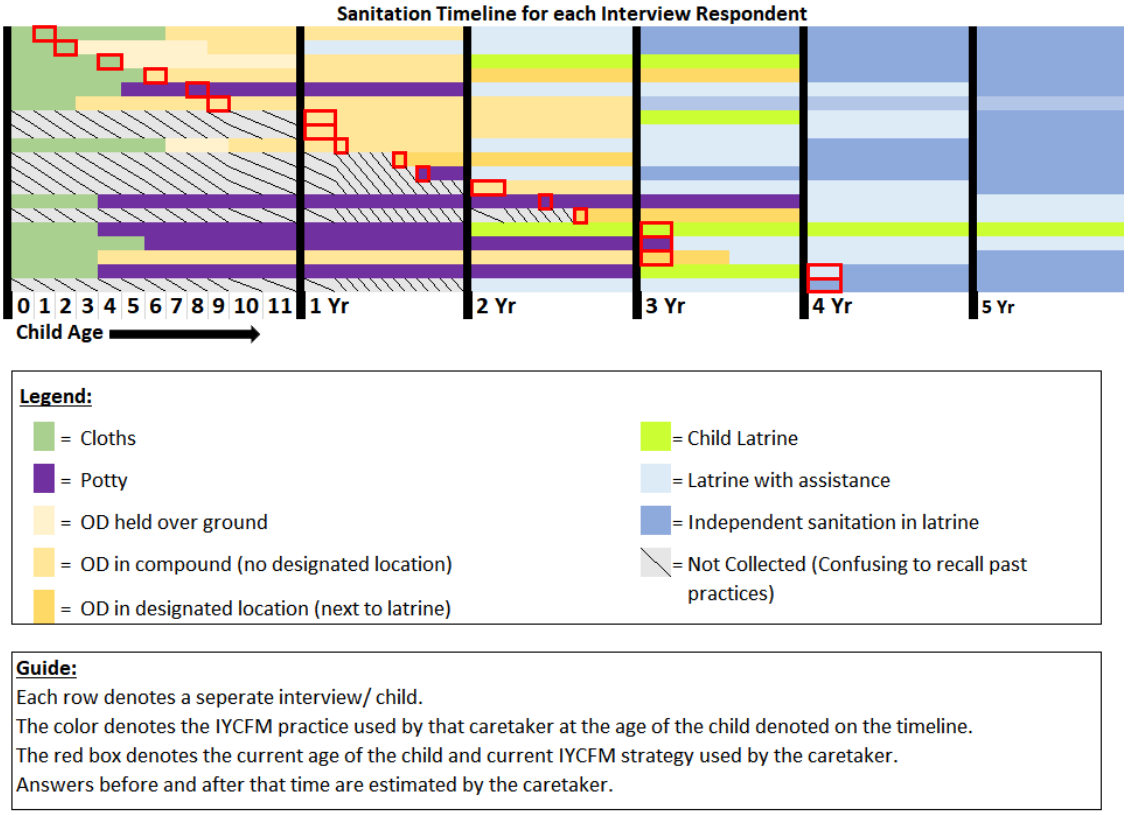

Figure 9 - Collated IYCFM practices initial assessment

Following this initial assessment, the results for child development were used as an introduction to describe the progression of child sanitation from birth until children use latrines before describing the process used within each sanitation strategy (cloths, potties, open defecation with scooping, child latrines or adult latrines). The variations of the process were discussed within each CFM strategy as the variations were found to be largely a result of the limitation of the products used (see section 5.4 in the analysis). An assessment of the challenges discussed in household interviews and challenges showed that the issues faced by caretakers were largely economic and not technological. This was presented within the contextual results to improve flow. The rest of the results were presented in sequential order and required little processing beyond the initial coding described above.

3.9 Challenges and Opportunities in the Research

There were a number of challenges with this research, most notably the financial constraints of the researcher and the logistics involved with data collection within Uganda. There were also many opportunities, most notably with skilled enumerators and successful data collection piloting. These are presented in detail in Appendix II and are abbreviated here to save space.

4 – Results

The results of the household interviews, focus group discussions, and key informant interviews, are presented within this chapter. Supporting information from the secondary data collection tools such as opportunistic observations are provided when appropriate. This chapter begins with a brief description of the context specific words used within the results before describing the case study context (objective 1). Following this information, the results are presented as described within methodology for results and analysis with a presentation of quantitative results of the critical control points of IYCFM before explaining how children transition through IYCFM practices as they develop (objective 3). Then the process is described for each sanitation technology (objective 2) along with variations in practices (objective 4). Caretaker roles are examined next with the variations in practice from secondary caretakers (objective 5). Risks within different processes are then examined before the results conclude with a presentation of the technology themes.

Similar to the previous chapters, Appendix III was prepared as a companion to the results chapter for tables and figures too large to fit within the body of the results.

4.1 Vocabulary Used Within Quotations and Qualitative Results

'Carpet'/ 'Dulucon' –Plastic laid down for urine and defecation events while the child is sleeping or laying down.
'Clothes' – (Pronounced Cloh-theys) Any cloth that is used to wrap around children for excreta management, generally not equivalent to cloth diapers in that these cloths are not purpose made.
Fufu – Defecate/ feces
Kavera – Plastic bag or plastic lining cut to replicate a masama when funds were unavailable
Masama – Purpose made, 'soft-plastic' wrapped around cloths to capture urine and loose stools.
Omo – Laundry detergent
'Pampers' – Universal term to all disposable diapers. Typically refers to 'pull-up' style disposable pants.

4.2 Case Study Context

To define a case study, contextual information must be provided to understand if this is an extreme or typical case. Due to the complex web of behavioral determinants identified it is

difficult to define this case study as either extreme or typical. Appendix III shows a diagram of the interrelated Rhino case study contextual behavioral determinants. some factors were negatively influencing the context, some neutral, and others are more positive. These are discussed briefly in narrative format here built from key informant interviews, household interviews, snapshot market analysis, document review, and opportunistic observations and interviews.

4.2.1 Emergency stage

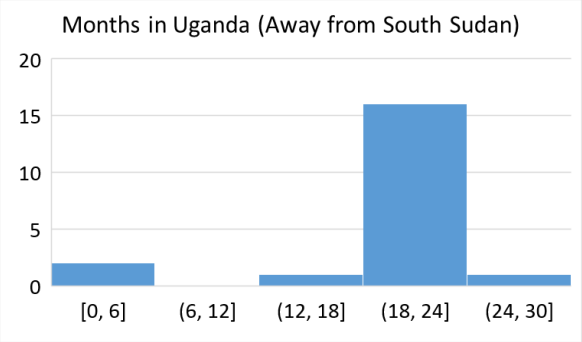

Figure 10 - Household interview response: *"How long have you been in Uganda (since leaving SS?)"*

All but a few respondents within the case study arrived in 2016 during an increase in violence within South Sudan. Households were provided with small plots of land courtesy of the Ugandan government to build houses and for farming. All households visited had constructed houses with latrines. Churches were present within the communities and social structures had developed with elected representation. By the time this case study was conducted in 2018, the communities were considered by key informants to be transitioning from a short-term phase to a long-term emergency phase.

4.2.2 WASH priorities (Issue explored at site)

The priority of the WASH working group within Rhino was focused heavily on reducing water trucking, but was limited by severe budget cuts. The box below discusses how WASH priorities were influenced by large influxes of refugees, financial constraints and the water stressed environment.

Limited Budgets and WASH Priorities

Rhino WASH Funding Agency – Anonymous: *"In 2016, no one anticipated the explosion of the population. As a direct consequence of moving into new settlements, water trucking was a huge chunk of the budget. Funding before the influx was struggling, so many gaps. Funding was based on the planned population, with funds devoted per person. The focus was on other camps and took time to move funds over to Rhino."*

Rhino WASH Working Cluster Lead – Danish Refugee Council: *"[The] response is underfunded and heavily reliant on water trucking ($10k/ day). Low priority for child latrines, MHM, cash for work, jerry cans. … Focus now is to eliminate water trucking and not on sanitation because water is a basic right."*

Rhino Operating Partner - Oxfam: *"In some cases, [we] push for CFM, but competing priorities for life-saving WASH interventions. The major limitation is funding."*

This information is provided here to demonstrate that funds were not available for all WASH initiatives and competing priorities meant that fringe issues such as IYCFM were not addressed.

4.2.3 Support for water supply

Water supply within the three settlements was through a combination of solar pumping station and hand pumps with supplementary water trucking as shown in figure 15 to the right. Further discussion of the water supply is discussed below in the technology themes section of the results, although a full assessment was not conducted as a component of this case study.

Figure 11 - A water truck arrives in Ofua.

4.2.4 Support for sanitation coverage

Sanitation coverage was high within the study area due to a PHAST based promotion campaign and significant physical support in the form of slabs, tarps, poles, and digging tools. Every family interviewed had a latrine on plot of varying quality (see sample latrines below within the "Big Latrines" Section). Within Rhino, WASH partners reported that 88% of Rhino population had access to latrines; although, only a quarter had latrine coverage based on ownership. A comparison of IYCFM practices between communities with high ownership and those with lower rates of ownership could not be made within this case study.

4.2.5 Support for hygiene promotion and handwashing

Significant hygiene promotion had been conducted within the study area by Oxfam and CEFORD teams, including topics around child feces management and handwashing. For example, the billboard to the right from the Ofua settlement shows handwashing after cleaning baby's bottom as a critical moment of handwashing.

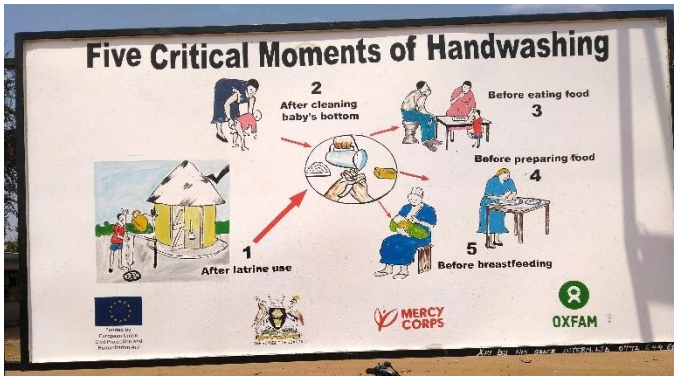

Figure 12 - A sign in Ofua showing critical handwashing times.

Handwashing jerry can kits were provided in NFI by Oxfam for households to construct tippy-taps. Appendix II contains the abbreviated public health promotion notes used for promotion of safe management of IYCFM. Throughout the case study, caretakers very evidently had internalized these messages and were keen to demonstrate the knowledge they received, emphasizing the triangulation with spot and opportunistic observations used within the research.

4.2.6 Support for solid waste management

Communal solid waste services were non-existent within the camps. Within the hygiene promotion materials, households were instructed to construct two rubbish pits within the compound to manage solid waste: one for biodegradable items and one for non-biodegradable items. These were not assessed as a component of this research, but have been noted where relevant.

4.2.7 NFI provision and market access

During the pilot it became clear that families had not received any NFI for IYCFM outside of handwashing kits and these questions were removed from the questionnaire. Discussions with key-informant interviews confirmed this finding and clarified that IYCFM NFI had not been distributed with Rhino due to the lack of funding mentioned above. Soap has been infrequently supplied within the camps and is available for purchase within most shops. Oxfam partner below describes how funding restrictions had limited NFI distribution and how these distributions occurred within previous camps in the past.

Rhino Operating Partner - Oxfam: *"As Oxfam, depending on funding, we provide NFI for managing of child feces. We consult with mothers within the community and we do agree on what would work for management of child feces…In previous projects 2-3 years back (In Imvepi and Yumbe), we provided children's potties and we also provided scoops. They support mothers to scoop feces and place into latrines. To support mothers whose children cannot yet use latrines. … Different communities prefer different arrangements depending on what they use back home…Consultation and community engagement are very key."*

Rhino WASH Funding Agency – Anonymous: *"Donors have conditions for funds for proposals with set indicators…WASH needs a sub-indicator for under-5 sanitation for this to be worked on."*

When discussing the particular sanitation needs of children too young to use scoops or potties, local WASH partners again confirmed that no provisions had been made.

Rhino Operating Partner - Oxfam: "*For younger children, nothing is provided."*

Rhino Implementing Partner - Danish Refugee Council: *"For these young ones, we don't provide anything... [There is] no WASH NFI kit in the world that provides these materials."*

With no NFI provision, all the products used by families for IYCFM were obtained using three methods. The use of each of these items is discussed in the narrative below:

Provided by NGOs for purposes other than IYCFM: In addition to the hoes and spades provided for agricultural purposes, local medical centers give mothers the plastic sheets used in childbirth as part of a 'mama kit' to incentivize mothers to come to the medical center for childbirth. These sheets seen in figure 17 to the right are placed under children to catch loose stools and urine. No other IYCFM items were provided within these kits.

Figure 13 - Plastic sheeting called 'Delocon' or 'Carpet'.

Salvaged from other items: Cardboard boxes, food sacks such as seen in figure 18 on the right, plastic bags, and old clothes were repurposed by caretakers for IYCFM.

Figure 14 - Food box plastic lining placed under young children for loose stools and urine.

Purchased by the family: With the stable context within Uganda, a private sector supply chain developed markets within each community run by South Sudanese who purchased supplies from Ugandan wholesalers in nearby Arua town. For Ofua III this market was directly within the community. For Ariaze this market was 1.5km away, and for Ariwa this market was between 0-1km depending on the household. Within these markets families purchased potties, 'pampers', or 'masama' plastics to wrap their children. Additionally, a few caretakers commented that they had purchased hoes and spades for multipurpose use, both removing child's feces and for farming.

Ariwa Market – Child Sanitation Products for Sale

Ariwa shops selling CFM products:	Potties		Disposable diapers	
	Price	Quantity sold / month	Price	Number sold/ month
One	4.5k UGX (£0.92)	10	Sold in each shop for the same price: 1k UGX each (£0.20)	25
Two	Out of Stock. Typically 5k UGX (£1)	15		50
Three	Not sold	-		25
Four	Not sold	-		25
Total Quantity:		**25**		**125**

For reference, within high income contexts, many children use 200-350 disposable diapers per person per month depending on age (NHS, 2018). Additional child sanitation products such as *masama* or the plastic sheet *delocon*/ 'carpets' were out of stock at the time the interviews were conducted within Ariwa. No shops sold dedicated, reusable diapers and few had children's clothing for sale.

Figure 15 - 'Pampers' for sale within Ariwa market

4.2.8 Livelihoods within Rhino (Explored at site)

To support the purchase of these products, household livelihoods were a reoccurring theme within the key informant interviews, FGDs, and household interviews. Although this was not an original objective to research within this project, results are presented here to give indication for future research on the integration of WASH with livelihoods, particularly

where products are needed to safely manage children's feces and these are not provided as a component of NFI. These concepts are discussed below from key informant interviews with themes of varying priorities and the lack of livelihoods leading to less sustainable sanitation solutions.

Livelihoods discussed by NGOs

Rhino Operating Partner - Oxfam: *"We need to have an integrated approach in WASH interventions with livelihoods to maintain after funding is gone…Livelihoods at the settlement level has been the most stressed and underfunded even though it is the backbone of all these interventions, the whole response I must say. We need to think of an integrated approach. How do we bring in a support of livelihood into sanitation? It is very key."*

Anonymous funding partner: *"Desired input is increased livelihood funding, but needs advocacy to increase priority. Should be foundation for all other interventions to achieve long-term objectives. We are trying, but it is difficult with remote settings, a hard nut to crack. The focus is on life-saving. Now, there will be more focus will be on livelihoods moving forward."*

Household interviews, and FGDs followed up on issues dealing with livelihoods. Agricultural livelihoods were limited with the lack of space, lack of rain, and from intrusions from livestock from host communities. Several grain mill livelihood projects, shown in figure 16 on the right, were in disrepair from lack of maintenance. No other potential sources of income generating activities were observed within Rhino; the remote location of Rhino camp also appeared to limit access to alternate livelihoods. Others mentioned the lack of casual work, such as the mother in Ariwa below:

Figure 16 - Grain mill livelihoods project in Ariwa decommissioned from lack of maintenance.

Ariwa woman: *"… [In South Sudan] She does a small bit of casual work and gets money. But since [the] first day here there is no casual work to get money."*

Ariwa Woman: *"These implementing partners with money maybe to run a business in a group so we will have money to buy soap."*

4.2.9 Displacement's impact on IYCFM practices

Roughly half of caretakers said that there was no change from their IYCFM practices within South Sudan. For those that mentioned that their displacement had impacted these behaviors, two themes emerged. The most prominent theme modifying IYCFM practices

was the reduced ability to access and purchase IYCFM products as discussed immediately above

> **Ariwa woman:** *"When she was in her country in South Sudan, there the access to getting soap and things for managing child feces was simple, but here you depend on things being provided."*

Some caretakers mentioned directly how this influenced their ability to manage children's feces with caretakers who previously used pampers now using cloths and caretakers previously using potties now using the open defecation and scooping methods. One caretaker mentioned how this had led to using paper boxes as a substitute for potties.

> **Ariwa woman:** *"In South Sudan, they'd get money and buy potty for baby. Here no money to buy potty and she begun using paper box for managing feces."*

The other theme mentioned by a few caretakers was that the modified diet provided by NGOs heavy in beans meant that children more frequently passed loose stools making it more difficult to manage.

> **Ofua Woman:** *"Nutrition is not well balanced; all it is is beans beans beans."*

Caretakers mentioned that a solution to both issues in the absence of viable livelihoods was to sell food rations to purchase varied food goods and to purchase items such as soap.

4.2.10 Caretaker experiences during initial displacement

Caretakers recollected several challenges experienced when first arriving within Rhino settlement. While many of these were similar to the challenges still faced by the caretakers during the time the study was conducted, several of the challenges were unique to initial displacement.

For disposal, caretakers reported before household latrines were built that they buried feces or simply covered with soil.

Initial Displacement – No Safe Disposal Location

FGD 1: *"Upon arrival, using burial [because] most people do not have a latrine."*

Ariwa woman: *"At first when she arrived, there was no latrine in place. When the kid defecated she found it difficult to dispose."*

Others stated that burial was also difficult before they had acquired hoes or spades for digging. This led some caretakers to use leaves for scooping.

Initial Displacement – No Digging Tools

Ariaze Woman: *"When child defecated, no hoe for covering feces of child."*

Ariwa Woman: *"When she first arrived here, they were not given a spade or anything so it was difficult to scoop feces so she would get leaves from tree for cleaning feces at that time."*

Caretakers mentioned that during transit they were unable to carry many of the items needed for IYCFM such as potties or cloths; making IYCFM during resettlement difficult. The caretaker below mentions the lack of cloths

Initial Displacement – No Cloths or Potties

Ofua Woman: *"… I came without anything. I only had two or three clothes always changing."*

Other caretakers mentioned that the extremely water stressed situation during initial displacement made managing children's feces particularly difficult and led to reduced ability to wash clothing and children. Key informant interviews mentioned within Ariaze that water supply dipped down as low as 2l per person per day during the acute emergency phase.

Initial Displacement – No Water

Ariaze Woman: *"No water sometimes and no soap for washing buttocks when child defecates. Sometimes they fetch water long distance. If water is not around, the child is not washed, [and] it will get diseases."*

Ariaze Woman: *"No water that makes it difficult to clean your used clothes."*

Despite these challenges, other families mentioned that during this time they prioritized IYCFM; carrying clothes and potties during transit explicitly for children to use.

Figure 17 - Potty carried during transit from South Sudan.

Initial Displacement – Prioritizing IYCFM
Ofua Woman: *"First, [I brought] clothes for kids and potty because latrine at transit center is very dirty. When we came from South Sudan I used pampers during [the] journey but used potty for fufu." (Potty is seen in Figure 21 below)*

Similarly, one family stated that they were concerned with the lack of appropriate sanitation for their children upon arrival to Rhino. Finding a communal latrine was already present, they built a child latrine before they constructed their own household latrine:

Initial Displacement – Prioritizing IYCFM
Ofua Woman: *"During that time, that one [latrine] for the community was being dug, they [this household] dug the child latrine because the community had a 'big latrine."*

4.2.11 Challenges within IYCFM

While challenges within IYCFM was originally planned to explore technology themes, the open ended questions returned results that primarily strengthened the themes presented above within section 4.2.9 describing the impact of displacement on IYCFM practices. For that reason it is included here within the contextual information and not within the technology themes in section 4.7 below. Within the challenges mentioned by caretakers, some were common across all of the IYCFM strategies, such as the affordability of soap and the availability of water as shown in table 11 below.

Table 10 - Household Interviews - Challenges to IYCFM per IYCFM strategy

	Household Interviews	Soap	No money	Cloths	Potty	Water	
		Challenges					
IYCFM Strategy	Cloth	67%	33%	100%	0%	0%	n = 3
	Potty	80%	40%	20%	20%	40%	n = 5
	Ground	67%	67%	33%	58%	33%	n = 12
	Latrine	67%	0%	33%	0%	33%	n = 3
	Total %	70%	48%	39%	35%	30%	n = 23

Other challenges were based on the IYCFM strategy used by the caretaker and child. The primary concerns of caretakers with young infants using cloths was the number of cloths they had for managing their children's feces, the lack of detergent used to wash those cloths, called *omo*, and the affordability of soap for handwashing. Those currently using open defecation with scooping mentioned they would prefer using potties with specific references to lack of funds preventing the purchase of this IYCFM technology.

Challenges of caretakers currently using open defecation with scooping

Ariaze Woman: *"There is no potty, that is why she is holding [In feet]. As long as no potty, will defecate on the compound."*

Man, FGD 1: *"Mother will hold on her feet if can't afford a potty. Baby will cry by telling mother and she will hold the baby and defecates on the soil. After child is done you clean the bottom and put in the latrine, bury or burn"*

Discussions of challenges and solutions within FGD also largely confirmed the results within the challenges mentioned due to displacement. As seen in table 11 below with the top 5 results within challenges voting activity in the FGDs, poverty and lack of money were reported as large barriers to purchasing IYCFM products along with water.

Table 11 - FGD Challenges Ranking Activity (Only top 5 challenges)

FGD - Challenges Ranking Activity Top 5 Challenges	Potty [No Money]	Soap [No money]	Hoe/ Spade	Water	Child Eating Feces	Poverty [No money for anything]	Clothes (No Money)	
Mens Ofua III	3	3	13	6	9	N/M	N/M	n= 48 (16 people with three votes)
Women Ofua III	19	13	N/M	N/M	N/M	N/M	5	n= 48 (16 people with three votes)
Old Women Ariaze A	5	3	2	7	N/M	9	4	n= 48 (16 people with three votes)
Total	27	19	15	13	9	9	9	

When comparing the challenges mentioned between FGDs the priorities between the men and women of Ofua largely did not align with men mentioning hoes and spades as the primary challenge and women mentioning potties.

4.3 Quantitative Results of IYCFM Practices: Critical Control Points and Post Disposal Hand Hygiene

Within household interviews, caretakers universally reported disposing feces within latrines. There were also no feces present within the spot observations nor while walking through the settlement. The two other critical control points demonstrated that there were other potential locations for feces to enter the home environment.

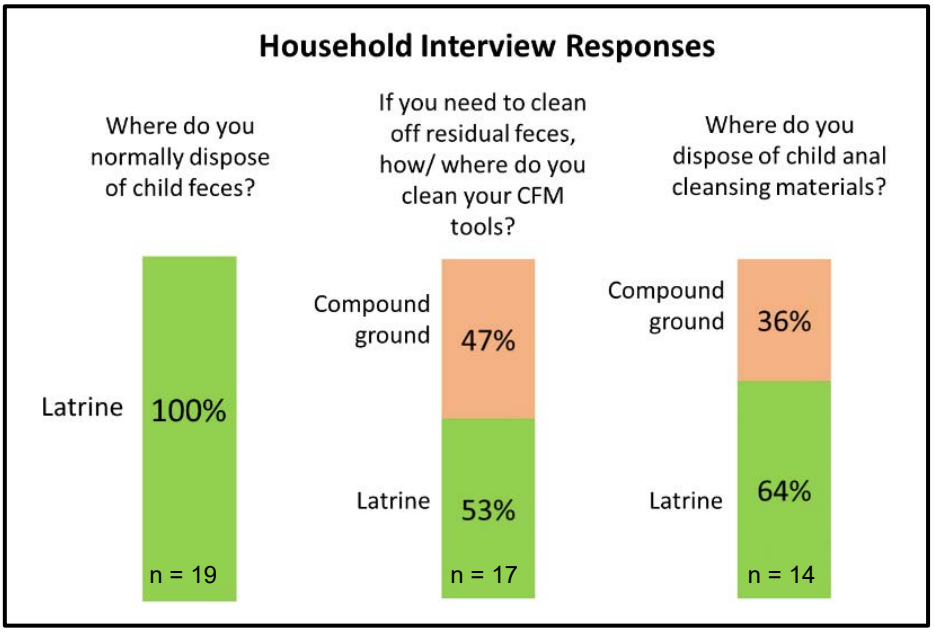

Figure 18 - Comparison of disposal with other IYCFM process steps

This figure above showing this information was produced with the raw IYCFM process data from table 19 in Appendix III. After managing children's feces, regardless of IYCFM strategy, caretakers almost universally reported washing their own hands within the household interviews. Additionally, all but two of the FGD sub-groups (20) reported caretaker handwashing as a post-disposal hygiene steps. Very few reported child handwashing as a step within either the focus group discussions or within the household interviews as shown in figure 23 below.

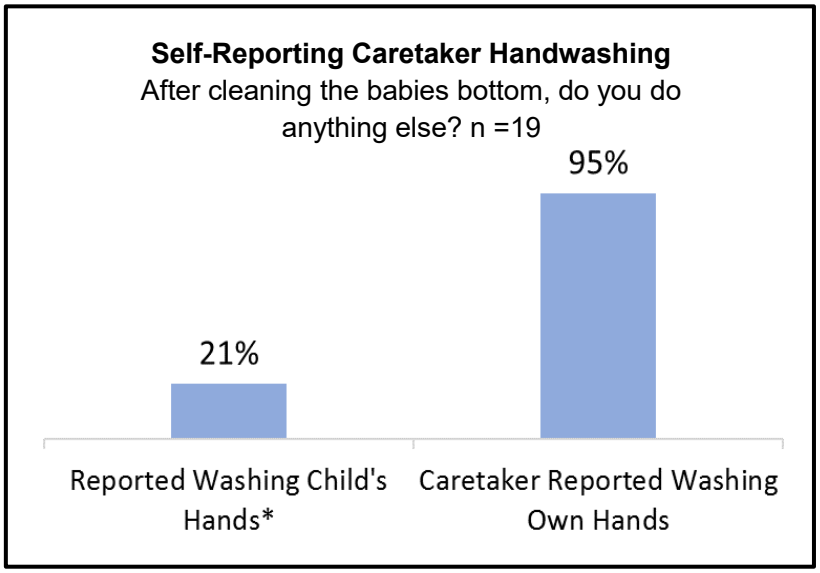

*Figure 19 - Household interviews, quantitative results of post-disposal hand hygiene. *Most children were reported as being bathed completely after defecation.*

Those with children using latrines both mentioned that they supported children handwashing, but a few families of younger children mentioned this as well. It is unclear when caretakers perceive is the correct time to begin washing children's hands after defecation. This may be influenced by the practice of completely bathing children after defecation until children are ready to begin using a latrine.

Washing Children's Hands after Defecation

Ariwa Woman: *"I give him soap to wash his hands to avoid germs."*

Woman, FGD 3: *"Child should be trained to wash hands"*

Within household interviews caretakers commonly mentioned that if they did not have soap, they would use ash. This was suggested as an alternative within the hygiene promotion materials; however, in all of the households without soap (74%), no ash was seen at any of the handwashing stations. Additional observations of handwashing facilities indicated that handwashing may be lower than reported with many stations not present, or without soap and/ or water.

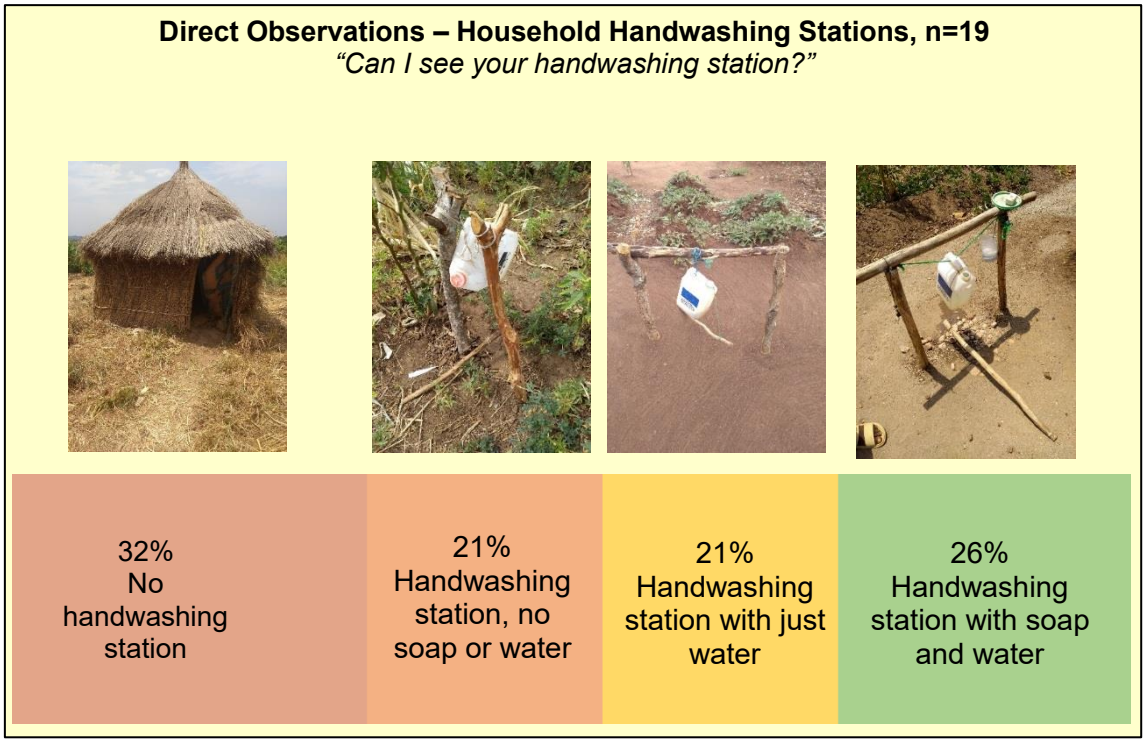

Figure 20 - Comparison of household handwashing facilities

4.4 Qualitative Results: Child Development IYCFM Practices

Within the case study area, five primary IYCFM strategies were identified based on the locations where children defecate: cloths, potties, open defecation with scooping, child latrines, and 'big latrines.' Table 18 in Appendix III shows the raw data of household interviews organized by age and showing the process used by those using each of these IYCFM strategies. A brief description of the sanitation development process is included here based on the household interviews and FGDs before describing the IYCFM process used by caretakers using each of these strategies. Table 20 in Appendix III compares development markers to IYCFM strategies. These results are supplemented with opportunistic observations and interviews where relevant.

4.4.1 Qualitative introduction – child development and IYCFM in Rhino

Figure 21 – Complete sanitation supplies for a family with a young baby.

Caretakers reported when children are first born they are unable to control their bowels nor communicate their need to defecate for several months. To manage this inconvenience, caretakers lay children on cloths to catch urine and feces, often with a plastic sheet, *Dulocon,* underneath to prevent the liquid excrement from soaking into the bed where they spend most of their time. Once babies are a few months old they are still unable to control their bowels nor communicate their need to defecate; however, they are no longer laid on a cloth as they begin to spend more time playing on the ground outside, often on a mat. Cloths are then tied around children held with a thin black belt made of string, also used by mothers to check if the child has been 'gaining' (gaining weight). Figure 25 above shows the complete sanitation supplies for a household with a young baby including: Old sheets for cloths, black plastic *dulocon* to lay down for nighttime use, blue *masama* for journeys (see below), and a basin for washing the clothes and child.

Figure 22 - Potty design available within local markets

Due to the inconvenience of constant clothes washing, caretakers transition away from this practice as soon as possible. Once children are between 3-6 months old, they still cannot control their bowel movements, but caretakers are able to recognize a child's non-verbal signs that they need to defecate, generally a kicking or a 'squirming' motion. At this time, caretakers begin using one of two different methods: some families choose to purchase a potty at the local market (see figure 26 to the right) while some begin holding children to defecate above the ground in a "saddle" with their feet before scooping feces to the latrine. Caretakers comment below on when to begin using a potty.

FGD2 Q: When to start using a potty?

Woman A: *"2 months"*

Woman B: *"If it is a girl, 3 months. If it is a boy, 4 months. Girls are strong, boys have weak muscles."*

Figure 23 – Hoe and basin used for washing clothes

When children are this young, both potty use or holding children over the ground requires significant attention because children cannot yet effectively control their bowels. Also, children cannot take off their clothing and cannot sit on the pot without support. When a caretaker notices the signs that a child needs to defecate, s/he quickly removes the child's clothing and holds the child over the pot or the ground. During this time, children often still defecate into clothing, especially if the caretaker is busy and doesn't see the signs that the child needs to defecate. The picture to the left is from a family currently using both scoops and cloths for several months while children transition between practices and the box below highlights the difficulties faced by caretakers during this transition.

> ***Ariaze Woman and Man:*** *"Sometimes when she is down playing, she may just defecate…Fufu [defecate] in potty in the morning, but I am otherwise during the day busy so I don't have time to put her there."*
>
> **Ariaze Woman:** *"[The child] used to defecate on [the] clothes you have, and wash. If she is on my arm, I hold her like this [in saddle demonstration] and she defecates on the ground. Sometimes she does still go in the cloth. When she is laying down I will not even realize and she will defecate in the cloth."*

As children develop the ability to sit, caretakers no longer need to hold children above potties. Similarly, children defecating above the ground are held by caretakers for defecation until they can stand and squat without assistance, generally between 8 to 12 months, depending on the child. At this time, children defecate on the ground without assistance if not wearing clothes, and with assistance removing clothes if these are worn. In some families, children do not wear clothes to make it easier for them to defecate.

> **Ariwa Woman:** *"When the child is walking, they no longer need help holding while squatting. They can squat themselves and defecate themselves in the house and on the ground."*

For those using potties, as children develop bowel control they require less attention and can slowly begin using the potty more successfully. If children have an accident outside of the potty caretakers use a hoe or spade to take the feces to the latrine. Gradually, children can verbalize their need to defecate and eventually use a potty without assistance except for help with clothing and bottom cleaning. For those using scoops, once children can

understand specific instructions, some caretakers tell children starting from 18 to 24 months to defecate outside the latrines to keep the compound ground from contamination.

Training a child to defecate in a defined location on the compound ground

Ariaze Woman: *"When the child is 2 years I can tell them to go and defecate near the latrine. And I can take [the feces] into the latrine to prevent flies and prevent illnesses."*

Ariwa Woman: *"Because [the child] fears going in the latrine. Because for this younger child, she tells baby, if you want to defecate, you go there, because she [caretaker] does not want baby to just defecate anywhere. She wants baby to defecate in just one place."*

For both groups of children, at this age they can verbalize their need to defecate and eventually in some households they tell caretakers that there are feces that need to be cleaned after defecating.

Figure 24 - Child latrine in the weeds at the edge of the compound.

Although most continue to use potties or open defecation with scooping until children are ready for “big latrines”, some families chose to build a child latrine, such as figure 28 on the right, once children are two to four years old to reduce the hassle of managing children’s feces and to begin training children for latrine use. There was disagreement between households when in a child’s development a child latrine was most appropriate. Some families claimed two years as a good time to construct a child latrine, while others mentioned three years.

Child latrine ages

Ariwa Woman, planning to use child latrine: *"Maybe [at] 2 years have [the] father to dig a small latrine for baby and teach her if she wants to defecate to come here.”*

Ofua Woman, currently using a child latrine: ***“****At first, use potty till 2 years, then prepare latrine for child. Stop using potty, because tired of carrying feces. [The] latrine for old people is specific for people who know how to use latrine.”*

Ariwa Woman, finished using the child latrine*: At three years, this child stopped using potty. "When he left the potty, they dug a latrine for this child. Now they have covered this latrine and he uses the adult latrine."*

Although specific ages were not mentioned within the FGDs, child latrines were not mentioned by any development stages until the sub-group for children that can walk, but not dress themselves. Three of the four focus group discussions mentioned this as an option for child defecation locations. By the time a child is both walking and dressing themselves, only two FGDs mentioned this defecation location. Within the household interviews, four years was the age generally agreed to stop using the child latrine and begin using the 'big latrine', although one family considered it appropriate for children to continue using the child latrine until eight years old.

Figure 25 - A dirt slab latrine.

Caretakers begin helping children use "big latrines" such as figure 25 to the right. when they are two to five years old. There was significant variation in the age caretakers considered the appropriate time for children to begin using a latrine. Typically, caretakers accompany children to the latrine for one to two years until children are comfortable using the latrine independently. During this time, children may still need assistance removing difficult clothing and helping cleaning their bottoms.

Caretakers discussing using latrines with assistance

Ofua Woman: "*She [mother] removes clothes and he goes alone [to latrine], he comes back, she washes buttocks and then puts on baby's clothes."*

Ofua Woman: *"Around two years the baby can go to the latrine if taught, the baby goes by self [but with] help with buttocks and hands"*

Ariwa Woman: "*When baby is now 3 years - baby can tell mama he needs to defecate. "mama, I need to ease myself." When baby is starting you take and demonstrate because when first time he will not go because he fears."*

Caretakers emphasized that the training process involved caretaker's willingness to participate and that this impacted the age which children began using latrines and when they would be ready to use them independently. The criteria given to participants for independent sanitation were: when the child no longer needed to notify the caretaker they needed to defecate and no assistance was required for any part of the sanitation process. There was a wide range of ages when caretakers considered it appropriate for children to practice independent sanitation as demonstrated in the box below. The ability of a child to dress herself/ himself was the line that many caretakers discussed as the time for independent sanitation within the FGDs

Caretaker Perspectives on Latrine Training Ages

Ariwa Woman: *"Depending on how baby is getting trained and how to use latrine if baby is now 3.5 to 4 provided the hole to the latrine is small because the child could have fear of falling…When the baby is now 5 years that is when the baby can do these things without asking for help."*

Ariwa Woman: *"She [caretaker] can start training when she [child] is 4 years, when she [child] is 5 years she knows it is good to defecate in the latrine. You as a mother, can still guide and help…When the child is now 6-7 years [does] these things by herself."*

Ofua Woman and Man*: "That is the process whereby you give the child the wisdom to let them learn. Wisdom comes from mother. If mother does not train the child, [by] 6-7 years [the child] may not use the latrine by themselves."*

FGD 3: "*Child at this stage [walking and dressing self] can defecate in the latrine."*

FGD 4: *"The child himself, he now knows to dress himself. He will know to go to the latrine."*

Although most children spend their time at home or playing in the neighborhood, some young children go to a local, private nursery school. This school consists of three classes: baby class (2.5 to 4 years), middle class (4 to 5 years), and top class (5 to 6 years). The following excerpt is an interview with the head teacher and the teacher of the baby class which discusses latrine training within this setting. Similar themes of children's ability to dress themselves and caretaker's willingness to participate in latrine training were mentioned.

Latrine Training at Ofua Nursery School – Interview with baby class teacher

Figure 26 - Current latrines with plastic slabs. Note fecal material on slab.

Figure 26 – New nursery school latrines currently under construction.

Figure 28- School handwashing station. This station was away from the latrines in the central courtyard. Note the soap holder on the right.

"We give them latrine training. In the latrine training we train them how to use the latrine. First one is to go into the latrine, how to take toilet paper and to sit. After finishing everything you clean yourself and come to wash your hands before entering class. Two weeks of training from start of school…. At first they find it hard, but after the training, they get used to [it]… Some are using latrines at home, but now the environment is different. They have the fear when they first arrive because it is [a] new place."

"Sometimes [children] find difficulty holding themselves and difficulty removing clothes, mostly in baby class.... Small ones are escorted by bigger ones that need assistance. [By] Three to four are able to use same latrine labelled according to gender with plastic latrine slab…. Sometimes newcomers arrive and defecate on the ground. We then take that child and train that child and put them in a group who use the latrine."

"[Some] still have some accidents when they are playing. [The] Cleaner washes clothes and mother brings new clothes… Depends on how the children are brought from home. Some who are not well brought it [incontinence] can continue up to middle class. They can susu [Urinate] on their body. Like some parents, when the child wakes they help, others have not helped when they arrive and must be taken."

The experiences of caretakers within Rhino using cloths, potties, open defecation with scooping, child latrines, and 'big latrines' are described below.

4.4.2 Caretaker experiences with cloths and pampers: process and variations

Within this context, purpose made cloth nappies were not used by any families. These were not distributed nor were they available for sale within the local markets. Spare cloths from household linen and old clothes were the primary cloth used by caretakers to manage

feces of very young babies. When the child defecates within these cloths, they are removed as soon as caretakers notice the child has defecated.

Child bottom cleaning

The child's bottom is cleaned with cloths initially, but once the child is a few months to half a year-old anal cleansing practices change and she is completely bathed by hand after each defecation event.

Figure 29 – Basin for bathing and washing clothes

Washing cloths and disposing wash water

After cleaning the child, cloths are then placed into the basin and hand washed using the same water and soap as shown in the figure to the right. For example, in the picture to the right, during this interview the child was bathed and the clothes washed with the same soap and water. If no soap is available, the child and the clothes are washed without soap. Caretakers mentioned that they found washing without soap was leading to 'itching'.

Challenges of caretakers with children currently using cloths

Ariaze Woman: *"if you don't wash with soap it can smell and itch the baby."*

If limited water is available, the caretaker might wait until water trucks arrive to wash the soiled cloths. After washing, the cloths are then hung to dry.

Fecally contaminated wash water was universally reported as being disposed within the latrine in the household interviews. However, within the FGDs there was some disagreement on this practice indicating this may not be a universal practice.

Discussions on Wash Water Disposal

FGD 1

"For the clothes, you have to wash in the basin and dump into rubbish pit."

FGD 4

Woman A: *"Can also excavate a pit just to pour in water for washing and then cover with soil."*

Woman B: *"… she has a latrine, what is the purpose of digging another hole to dispose of washing?"*

Woman A: *"The latrine is used by many people, if someone may be using it so she digs a small hole to put it there."*

The local hygiene promotional material provided by Oxfam mentions the need to dispose of all child feces within the latrine and to minimize the amount of feces disposed within rubbish pits such as figure 30 below but does not provide guidance explicitly for fecally contaminated wash water. Additional discussions within the FGDs showed that there was some confusion as to when children's feces were dangerous.

Discussions on Wash Water Disposal in Rubbish Pits - FGD 4

Woman C - "*Clothes dirty with feces, after washing, then the water you use for washing you are advised to pour into a latrine and also into rubbish pit."*
Woman D- *"If you throw feces into the rubbish pit, how will you control the flies if you throw it [there] it is open!"*
Woman C- *"[She] is saying for infants, their feces are not similar, the same as one who is older … the feces is not the same. The water is not full of feces so they can throw in the rubbish pit"*

Figure 27 - Rubbish pit reported during a pilot interview to be used for disposal

Once the cloths are cleaned the wash water is disposed and the cloths are then hung up to dry.

Changes in cloth based sanitation from varying conditions

When caretakers are busy, there is very little reported difference in practice. For example, when cooking, the mother pauses her work, manages the feces, cleans hands and goes back to cooking. Focus group discussions mentioned that there still may be some times when caretakers are not aware of children defecating.

FGD 2: *"If you go to fetch water, you may see the child has defecated and even has dirt on hands and is eating feces."*

Similarly, for rain, caretakers continue to replace and wash the clothes when children defecate. During the rainy season practices remain the same except clothes may be hung inside to dry instead of drying outside. When the child defecates at night the process is also similar, except the cloths are left to soak within the basin until morning due to lack of light. When children are sick, caretakers also continue using cloths, but notice an increase in the number of cloths required to clean.

Nighttime and sickness modifying practices of those using cloths

FGD 2: *"At night, store to wash in the morning. During day, wash immediately to avoid bad smells and flies."*

FGD 4: *"For small infants, when they have frequent defecations [such as when sick], for them as mothers, they cannot sleep. If the baby is not sick the baby can show a sign to identify that they want to defecate or urinate. If sick, cannot show any sign."*

For young babies, caretakers strongly prefer 'pampers', the phrase used for all disposable diapers regardless of branding. Several caretakers were quick to state that their children wore pampers, but then later admitted that these were only used for special occasions, mostly when the mother is taking the child on a journey (such as to Arua).

FGD 1: *"[if going] To church or on a journey [you] use a pamper to not inconvenience you."*

To triangulate the pampers usage information provided by caretakers, market sellers were asked if they sell pampers in large quantities to the same people. Each of the market sellers confirmed that pampers were only purchased one or two at a time and rarely to the same people, indicating that these items were not used in large quantities, but for special circumstances. These are not used more frequently because they are too expensive for daily use. Once used, the pampers are nearly always thrown into the latrine, but are sometimes thrown into the bush if no latrine is available. Pampers disposal are not mentioned within the hygiene promotional material and it appeared that most caretakers interpreted the messaging on child feces disposal to include pamper disposal within the latrines. When pampers are too expensive or for shorter journeys, a purpose made soft plastic *masama,* is purchased for 500 UGX (£0.10). This *masama* is placed over cloths to contain watery stool and urine. This thin plastic masama is used for around a week and then thrown into the latrine once it begins to deteriorate. When the *masama* is too expensive, plastic bags called *Kaveras* are used for the same purpose as well as the plastic linings from bulk food distribution. Figure 35 to the right shows a sugar bag with a lining that is used over cloths for containing urine and loose stools.

Ofua Woman and Man: "*Wears pampers in public so feces does not come out. You just throw it away. If there is a public toilet, you just throw it there."*

Figure 28 - Sugar bag linings used for managing infant feces and urine.

When to use pampers and when to use masamas

FGD 2: *"If you are going far, you use pampers; if you are staying close, masama."*

4.4.3 Caretaker experiences with potties: process and variations

Figure 29 - Potties for sale in Ariwa Market

Most families using potties purchased them at the local market for 5000 UGX (£1) (See figure 32 on the left). One family had purchased their potty during transit (see photo on the right) and one had brought their potty from Sudan (see initial displacement below)

Disposal and potty cleaning

After the child has defecated and is cleaned, the feces are put into latrine. All the families using potties reported cleaning residual feces into the latrine within household interviews; often by rinsing with water from the nearby tippy and then pouring into the latrine. Some families use a stick with a small piece cut from a bulk food bag to scrub off feces.

Washing potties

FGD 1: *"The best place to wash a potty is at [the] latrine. There is a jerry can. You can use this and then put in the latrine"*

Once the potty is cleaned, it is set out in the sun to dry, ready for the next use.

Child bottom cleaning

When families begin using potties, most children's bottoms are cleaned with a complete bath in a basin after each defecation event, typically twice per day. Most caretakers dispose of this water in the latrine, but about a third dispose of this material in the bush. As children become older, some families may change to using a water and a rag with soap, without a basin such as figure 33 to the right. Once a child is around two years old some families begin using leaves or cardboard boxes. Caretakers expressed a preference for toilet paper if funds were available, however this did not appear to be commonly used. Caretakers commonly stated that water was used a substitute for toilet paper.

Figure 30 - Soapy water and rag used for cleaning a child's bottom. This water was then used to clean the plastic latrine slab.

Cleaning children after potty use

Ariaze Woman and Man: *"I like using water. Cannot use leaves because she is too young. You always wash baby in basin and put water in the latrine."*

Ariwa Woman: *"Any time the baby defecates; she will have to wash."*

FGD 1: *"If you do not have toilet paper, you use water."*

Changes in potty based sanitation from varying conditions

Similar to caretakers of children using cloths as the primary defecation location, caretakers of children with potties universally prioritized managing their children's feces over other household activities, but some admitted that they may not be able to use the potty in time if they aren't nearby when the child shows signs of needing to defecate and the child may go inside cloths or on the ground.

Rain, similarly, had little change for caretakers using potties. During rain, children were set on potties under the veranda instead of using the potty outside in the compound.
At night, the caretakers universally reported within household interviews that they continued to use potties and that feces disposal was immediate due to smells and flies. Similar to the discussions of wash water at night, there were disagreements within the FGDs whether this disposal was immediate.

Using a potty at night

FGD 2: *"Feces can remain and at morning you can take to the latrine."*

FGD 3: *"When it is day hours, feces are not supposed to be kept. If it is the night hours, feces can be kept in potties or basins, then you take it where you want to go."*

FGD 3: *"You as the mother, if the child defecates in the potty [you] need to put water in the potty and place outside to put in the latrine in the morning."*

There were large differences in practices for families using potties when they are travelling or in public. No families brought their potty along during travel and even for children as old as three chose to use pampers or cloths with a *masama* or *Kavera*.

Diarrhea and sickness were the biggest reported modifiers of household potty use. Caretakers almost universally stopped potty usage and instead used cloths with underlying plastic sheeting when children were sick, noting that the children could defecate at any time rather than express their need to defecate with the usual signals. In one instance the caretaker stated that if they became tired of constantly cleaning the potty from diarrhea

they sometimes sent the child outside to defecate before mixing feces with dirt and scooping to the latrine.

Potty use during diarrheal episodes

Ofua Woman: *"If baby has diarrhea, she [caretaker] covers with cloths for the baby to defecate into. She [caretaker] washes these and then cleans hands. With diarrhea, the baby can defecate when she [caretaker] does notice so she cannot use the potty so she uses cloths."*

Ariaze Woman and Man: *"If she has diarrhea she will defecate at night, you don't know she will defecate. She will defecate at any time, even while you are still cleaning the last one; [You are] constantly changing, and in the morning you wash. "*

4.4.4 Caretaker experiences with open defecation with scooping: process, variations

Hoes and shovels such as those shown in figure 34 to the right were provided to groups of households for latrine building and some hoes were provided for agriculture livelihoods projects. With six households to a latrine building group, caretakers reported negotiating with other households without children to exchange other tools within the latrine building kit to ensure they had access to hoes and spades for IYCFM. Some caretakers also purchased hoes for agricultural purposes that were then used for IYCFM. Although each family within the household interviews who mentioned a feces removal tool provided the tool for observation, there were discussions within the FGD that emphasized that access to these tools were not universal.

Figure 31 - Hoe and spade used for IYCFM.

Options in the absence of spades or hoes

FGD 4: *"When there is no spade or hoe [you] have to resort to leaves or box as an alternative."*

Disposal and scoop cleaning

After children defecate on the ground, caretakers reported immediately scooping feces into the latrine. Although generally with the soft sandy soils in the study area, scooping methods prevent the tool from touching the feces, sometimes feces need to be cleaned off the hoe or spade. Cleaning strategies for these residual feces on the tools varied widely. The most common method was to stick the hoe into the ground to allow the passing dirt to clean off the feces. Some caretakers washed the hoe at the tippy tap station or in ‘the bush’. Some

caretakers used a stick with a scrap of food bag to scrape off feces into the latrine. One caretaker did not clean the tools, feeling that sufficient items for cleaning were lacking. Only a few caretakers rinsed water on the hoe into the latrine. Each household interview presented IYCFM tools as a component of the spot observations with no residual feces were seen on any scooping tools. Additionally, no scooping tools were shared between households.

Cleaning hoes and spades

FGD 1: *"Sometimes feces [are] sticking onto [the] hoe or spade. You go out here and make like digging the hole and in the process you clean the hoe or spade."*

Ariaze Woman and Man: *"You pour away into the bush to prevent her [the child] from infection."*

While conducting observations, caretakers pointed out that divots in the ground such as figure 35 to the right indicate recent removal of feces. Sometimes fresh soil is sprinkled over the divots after removal.

Figure 32 – Divot in the ground indicating feces removal.

Child bottom cleaning

Practices for cleaning children's bottoms was the same for those using potties, with caretakers preferring to fully bathe children by hand when young (figure 36 below) and then transitioning to hard materials as children grew older Caretakers commented on the urgency of washing a child to prevent the child from spreading feces. Some caretakers also discussed coping strategies such as using clothes when soap and water were not available.

Cleaning children after open defecation and scooping

Ariaze Woman: *""Washes with basin with water and soap. [Then] puts on ground outside the latrine."*

Ofua Pilot Woman: *"In case there's no soap and water, she uses clothes or paper for cleaning the baby's bottom"*

Ofua Woman and Man: *"Clean anus with laundry detergent in basin because that detergent kills some germs. You see, feces have germs. Use this detergent to prevent infection to you or the baby. [Then] you just pour away in the bush"*

FGD 1: *"African tradition is to use leaves to clean the child. Now we are resulting to use boxes or water."*

Changes in open defecation with scooping sanitation from varying conditions

When caretakers are busy or the children are away, caretakers again mostly reported immediately leaving chores to manage the feces and cleaning the children, citing that children may dirty themselves with the feces or eat the feces if not washed immediately. However, within discussions of challenges within the FGDs there were indicators that this may difficult in practice and feces may not immediately be removed.

Figure 33 - Hoe is ready for scooping feces and basin is ready for bathing the child after the next defecation event.

Caretakers discuss IYCFM practices when they are busy

FGD 1: *"Because they are moving, you cannot know where they go."*

FGD 2: *"For babies who can walk, you cannot know where baby has defecated. He is just walking around the compound."*

FGD 2: *"For these children who is now walking, he may go to [the] neighbors and defecate there and they will not take care of it."*

If children need to defecate at night, there is significant variation in the strategies used by caretakers. While several people used the same practice of allowing the child to defecate outside, at night some children were afraid to go outside and required an adult to accompany them. One family who primarily used the OD scoop method had a potty to exclusively use indoors at night because their child was afraid to go outside. The lack of light was cited as a difficulty for identifying if children needed to defecate and to clean children when they defecate at night. Because of this, some children defecated on bedding which was washed in the morning. Some families without potties instead used wash basins or buckets at night inside the house and used clothes for anal cleansing instead of water. One caretaker helped their child squat over scraps of cardboard food distribution boxes within the house which were then taken to the latrine (figure 37).

Figure 34 - Food distribution box used for defecation at night

Lighting was mentioned in several interviews as a difficulty at night

FGD 3: *"At night if there is no light, it is very difficult to clean the buttocks of the child."*

While travelling or in public, practices for caretakers using the open defecation and scooping method were similar to those who use potties. No caretakers reported taking their scooping IYCFM tools on journeys. For younger children, clothes with a masama were used. If funds were available, pampers were purchased to use for the journey and were thrown into available latrines or into the bush. For older children, caretakers helped children open defecate or use a latrine if available.

Figure 35 - An overhanging veranda reported by some caretakers as the preferred child defecation location during the rainy season.

During rain events, there is also significant variation in the strategies used by caretakers. While some caretakers still send children outside to defecate, others use a basin inside similar to the practices used at night. Some have children defecate on the ground under an overhanging veranda such as figure 38 to the left while others have children defecate inside on the dirt floor before scooping and taking to the latrine.

There were two primary strategies used by caretakers using the open defecation method when children have diarrhea. If children are still able to defecate outside, caretakers mix the watery stool with soil before scooping to the latrine. If not, most caretakers using scoops reported similar practices to those using potties when children have diarrhea; they place down plastic sheeting or wrap a child in a *Kavera* and cloths while the child lays down. These cloths are replaced when a child defecates, washed and then the wash water is disposed in the locations discussed above. Some caretakers also mentioned that children with diarrhea who are able to defecate outside during the day defecate onto clothes at night.

Diarrhea's influence on practices for those using open defecation and scooping

Ariaze Woman: *"Yeah, if baby is diarrheating because passes all the time. [It is] not very clean so you immediately wash her up. If you don't tie with kavera she will defecate on bed [so] you prepare the place up nice…You wash and dispose in the latrine. Much more washing and if you have money, omo, because it has bad smell."*

Ariaze Woman and Man: *"When she [child] passes watery stool frequently, she [caretaker] passes outside here and mixes with soil and then takes feces to the latrine."*

Ofua Woman and Man: *" When it is diarrhea, you don't know when it will come. You put down cloths and remove and replace with new cloths. Then you go soak and put water into the bush. In hospital you pour in septic place. We do not have this here so*

4.4.5 Caretaker experiences with child latrines: process and variations

Figure 36 – Home designed child latrine slab

Although only a few respondents mentioned child latrines (figure 39) within the household interviews, they are an important intermediate sanitation step for some families within Rhino settlement, both for those using potties and for those using OD + scoop methods. It was mentioned multiple times that child latrines were a useful for training children to use latrines as seen below.

Child latrines as a way to train children to use latrines

FGD 1: *"[If] parents are good, they have trained their children, they have a small latrine for their child."*

FGD 4: *"You can excavate a small latrine and begin training the child to use a latrine."*

One of the primary benefits of child latrines mentioned by participants is that the latrine does not require any transfer because the defecation location is the same as the disposal location. Additionally, the child latrine needs minimal cleaning or washing, and is much more accessible to young children to use independently than the larger latrines. By this age, children can control their bowels and verbalize their need to defecate to a caretaker. Some children will still need some assistance with dressing/ undressing and with cleaning themselves after defecation. The child latrine shown above was shared between households and had some feces visible on the slab, a potential risk within the neighborhood. These feces were the only feces spotted in the research outside of the slab in the nursery school. Child latrines were, reportedly used often as both a rubbish pit and for children's defecation as mentioned in the field notes to the right.

Child Latrine Field Notes:

- Small hole opening
- No super-structure
- Visible solid waste in pit
- Visible child feces on slab
- Slab construction: Dirt/ tarp covered logs
- App.0.5m deep
- App. 0.75m diameter

Changes in child latrine usage from varying conditions

Although the sample size is small, with only one family actively using a child latrine, there were no reported differences in practices due to any of the varying conditions.

4.4.6 Caretaker experiences with “big latrine”: process and variations

Figure 37 - Plastic squat plate. Note the carboard box scraps used for anal cleansing.

The title given “Big Latrine” was given by participants for latrines more commonly used by adults (see examples to the left in figures 40). Latrine building kits with slabs, poles, and tarps were provided to each family after pits were dug and inspected. There was a large variation in the quality of latrines present within the case study with superstructures built from a variety of materials such as straw, tarps, wood, or concrete. The latrine shown above in section 4.3 is made of straw with no handwashing facility available. The latrine below in figure 41 is made of concrete and has metal doors, gendered facilities, and a tippy tap with soap and water.

Figure 38 - High quality latrine

Similar to child latrines, the primary benefit of using latrines is that the defecation location is the same as the disposal location requiring no transfer. Cleaning may be involved if children are not successful in defecating into the drop hole (see the feces on the school latrines in section 4.4.1 above)

By the time children begin using the latrine bottom cleaning is generally done by pouring water, either inside or outside of the latrine.

Common method for children to clean themselves after defecation
Ariwa woman: “Washes himself out of the latrine just pouring water with a basin.”

Changes in young child latrine usage from varying conditions

Because children were mostly using latrines independently, caretakers were confident that when they were busy or children were with other caretakers that they would continue using latrines as mentioned in the box below.

Ofua Woman: *""At this age, he can go by himself. You leave cooking when he is done and clean him and then wash your hands before going to cook."*

Ofua Woman: “*She [mother] removes clothes and he goes alone, he comes back, she washes buttocks and then puts on baby’s clothes…If no one is there to help him, he rubs himself on the ground. If she [mother] is there, she pours water and washes*

There were some reported differences from the varying conditions. One caretaker whose child was using a latrine with assistance reported that when the child had diarrhea that she used a potty. Another caretaker mentioned that for children of this age, if they need to defecate while travelling, they take the child to the bush. This same caretaker mentioned that the child did not use the latrine at night, preferring to defecate next to the latrine.

Changing conditions' influence on children using latrines

Ofua Woman: *"When child has diarrhea, she uses potty or bucket and pours to the latrine. Washes potty with soap and puts near the child."*

Ariwa Woman: *"[During travel] just take him in the bush and go there."*

Ariwa Woman: *"At night, he defecates on the ground near the shelter and I scoop and put in latrine with a hoe.*

4.5 Caretaker Roles

Within FGDs, when asked 'who is involved' in the management of child's feces, each sub-group created a hierarchy of caretakers. The primary caretaker responsible for IYCFM within each household is unanimously the mother. Table 21 in Appendix III shows the raw listing of caretakers by each FGD sub group for each child development stage. There were many secondary caretakers mentioned as assisting with IYCFM tasks within both the FGDs and household interviews. This role varied by household. Within the household interviews, older siblings, both brothers and sisters, were commonly cited as assisting with younger siblings' sanitation. Fathers, grandmothers, and aunts were also mentioned as helping with IYCFM. In some families the child did not have older siblings, or other family members might not be present. Table 12 below shows an aggregated ranking of FGD for children based on their mobility. This table was produced by collected the sum total of mentions for each caretaker within each development stage, regardless of their rank (ie this is not a weighted ranked table).

Table 12 Caretaker rankings by number of mentions within the FGD groups.

Aggregated Caretaker Rankings from Four FGDs					
Ranking	**Children Who Cannot Yet Sit - up**	**Sitting, not crawling**	**Crawling, not walking**	**Walking, not dressing**	**Walking and dressing**
1	Mother	Mother	Mother	Mother	Mother
2	Grandmother	Grandmother	Sister	Father	Father
3	Father	Sister	Father	Grandmother	Sisters
4	Sister	Brother	Grandmother	Sisters	Brother
5	Brother	Father	Brother	Brother	Grandmother

Based on the household interviews and FGDs there was only weak evidence from the FGDs and household interviews that secondary IYCFM caretaker roles change as children develop. By comparing the results from FGD sub-groups (Table 20 in Appendix III) based on the development stages, supported by household interviews there is weak evidence that mothers generally do not depend on secondary caretakers when children are very young, with only some support from family matriarchs. As children develop, the entire family provides some secondary support until a child is managing her own sanitation independently.

One potential source of household risk is that small children are often taking care of smaller children.

Young children help younger children with their sanitation

Ariaze Woman: *"Small ones, school boys when they come, they sometimes are helping the child."*

Ariaze Woman *"Sometimes if she is not around, other small children help take care."*

There were some disagreements on the role that men play in the household for IYCFM despite mentions within both household interviews and FGDs. Within FGDs some caretakers emphasized that men did not actively assist with managing children's feces as they were busy with other tasks. But in other households, both women and men mentioned that the men did assist with these tasks.

Men participate in IYCFM

Ofua Man: *"If I'm busy, tell the mother to scoop and carry to the toilet. If I am not busy, I do it. If it is in the presence of the mother. She does this."*

Several caretakers mentioned that men were in charge of household finances and purchased IYCFM products such as potties children to use. The potty to the right (figure 46) was purchased by the father during transit. In FGDs with women within Ofua the group emphasized that if finances were provided for potties that it should be given to women within the household or it would otherwise not be spent on potties.

Figure 39 - "Her father bought her a potty"

Figure 40 - A child who is crawling, but not yet walking assists a FGD sub-group with the first activity. This assistance was assumed to have no impact on the caretakers' responses.

During the household interviews it was observed that older siblings frequently were taking care of younger siblings, although no defecation events took place during any interviews to confirm that they assist with these tasks. It was observed within the two FGDs with mothers currently parenting small children that roughly half the of the mothers brought children along to the FGD, such as figure 47 to the left. As the FGD progressed, an increasing number of young children were brought to the FGD by older siblings for nursing. Within the FGDs with older women only one child was present and no children were present in the FGD with men.

4.5.1 IYCFM practices of secondary caretakers

Primary caretaker's reporting on varying practices when a child is cared for by these secondary caretakers did not appear to be strongly conclusive within this case study. For those using cloths, mothers reported that the practices were the same when with another caretaker, with older siblings trained in assisting younger siblings. In one interview with both the father and mother, it was explained that in the mother's absence that the father would clean the child and replace the cloth but would leave the clothes for the mother to wash as this was her work.

For children using potties mothers explained in the interviews that the older children had been trained by the mother to help their siblings use the potty. Those using scoops

reported the same with most mothers reporting practices as the same when children are with secondary caretakers, but mentioned that at times others may not use the hoe to scoop or that they were uncertain if there were any differences.

Disagreements on the IYCFM practices of secondary caretakers

Ariaze Woman *"…It is the same, with a hoe or spade."*

Ofua Woman and Man *"Grandmothers do these things different. Go get leaves to handle feces. Now it is not so good so I give them directions to use hoe and wash hands or she may forget. [There are] micro-germs you cannot see with your eyes."*

Ariwa Woman: *"She [caretaker] cannot know if the person does it differently in her absence."*

For those using child latrines or latrines, children were expected to use these independently or with support from siblings if the mother was busy.

4.6 Risks Within IYCFM

The potential risks for contamination below are described based on spot observations and reported practices during the household interviews with supplementary information from the FGDs and key informant interviews when relevant.

4.6.1 Risks -Feces left in defecation location for a period of time before removal

All caretakers reported immediately removing feces from the home environment; however those using scoops reported that these feces were easily missed depending where the children defecated outside.

4.6.2 Risks -Times when feces are 'stored' within the household (Delayed Disposal)

Those using cloths and potties were reported as waiting until morning to dispose and wash when children defecate at night. Additionally, those using cloths may wait to wash until water is available if water sources are unreliable.

4.6.3 Risks - Children playing near defecation locations

Children were observed playing outside, on the ground, in locations were children were said to open defecate. No children were observed to be playing with IYCFM cloths, with potties, or in latrines.

Another issue discussed by some caretakers is the dirt that children eat within the compound. This was not originally a risk considered within this research nor was this question probed at any time. The interviews contained a question on the 'nature of the feces' or the consistency of the last stool passed by the child to segue into conversations of practices during diarrheal episodes. However, within these responses, multiple caretakers mentioned that their child's feces were black from eating the soil in the compound.

Presence of geophagia within the case study area

Ariaze Woman and Man: *"Sometimes she is eating this soil and if she takes this soil it can be black."*

Ariwa Woman*: "If baby eats soil, it will be black like soil."*

Other caretakers mentioned that for very young children, they may play with their feces if not cleaned up quickly.

FGD 1: *"Sometimes child who crawl, but not stand, that child may play with the feces or other children. [They] may eat the feces."*

4.6.4 Risks – Ground cleaning and residual feces

The dirt ground was not conducive to cleaning and ground cleaning was not mentioned nor observed. All compounds were noted as having been recently swept. The ability of the scooping method to sufficiently remove feces was not measured within this research. The use of leaves and cardboard boxes when hoes and spades are not available likely mean that these tools cannot scoop into the ground to pick up feces. Caretakers reported the ground was very hard during the dry season, implying that under these specific circumstances all feces may not be removed.

4.6.5 Risks - Enabling products – exposure to caretakers

Washing of fecally contaminated cloths by hand appeared to be a significant time for exposure to caretakers. Those using potties and scoops largely have no contact with feces except when cleaning children's bottoms. When scoops are not available, the use of leaves and cardboard boxes may provide an additional exposure to caretakers. These exposure points may be exacerbated with the low handwashing facilities available.

4.6.6 Risks - Shared Sanitation Products

This did not appear to be a large risk, with nearly all caretakers reporting that IYCFM products were for specific children. Scooping tools, particularly hoes, were used for agricultural purposes. The spades were occasionally used for digging pits. Only one potty was shared between households (seen in figure 44 to the right). The child latrine observed within the household interviews was used by all children within the neighborhood. Household latrines were used by all members of a household; although, some households also shared with neighbors.

Figure 41 – Potty shared between two households

4.6.7 Risks – Disposal of cloth wash water and anal cleansing water

In discussions with the Oxfam public health promotion team, an issue was raised with the practice of disposing wash water within latrines and potential impacts on pit subsidence with the unlined pit latrines in poor soils. It was mentioned that this had the potential to collapse latrine pits in the poor soils within the camp.

Rhino Operating Partner - Oxfam:

"We would not encourage to dispose of that [wash water] into the latrine. Some of the soils are weak and it might cause them to collapse. In areas where the soil formations are good, we would encourage it because if they put in the rubbish pit it would be exposed, it is essentially open defecation."

Researcher Q: "*What about pit lining?"*

"Not lined. Very few donors would support this. Instead, we are playing with pit designs with curving sides…On average, around 7 [Rhino communities] are in areas with collapsible soils [including Ariaze and Ariwa]. Three are in rocky soils. That's 10 villages in Rhino out of around 30 total…It's an area we have not done a lot, we haven't really looked at it, creating an option for disposing. In areas with good soils, would be ok."

There was no strong consensus within Ariwa and Ariaze on the effect this was having on their latrines. Roughly half of the households that disposed of wash water within latrines had noticed some form of pit subsidence. This was confirmed through the latrine inspections; although, the original design life of these latrines was not investigated.

4.6.8 Risks – Pampers latrine disposal

Although not commonly used, pampers disposal within latrines was reported nearly universally by caretakers who mentioned their use. With no solid waste services available within the camps, this was likely safer than disposal in household solid waste pits. However, as mentioned by the public health promotion team leader of Oxfam below, this may lead to desludging risks in the future.

> **Rhino Operating Partner - Oxfam:** *"Pampers are a big problem. We have not been keen on coming down and finding how to manage and how they are disposed of…The only advantage is that they are household latrines and not emptied…For transit centers and reception centers they are an issue because they make it difficult to desludge and cause latrines to fill up quickly…Even at household level – they fill up so fast, then they ask for more materials to build a new latrine. Otherwise they put in rubbish pit and burn with feces."*

4.6.9 Risks - child latrines

The use of child latrines within Rhino is actively discouraged by the WASH working group within Rhino Settlement despite the popularity of the technology. One of the cluster leads was unaware not only of their popularity but of their existence within the camps. Other public health teams mentioned that these were often simply covered rubbish pits that often flood in heavy rain contaminating the compound ground and are a source of flies within households. In discussions with the family who had previously owned a child latrine, the family confirmed that their child latrine did flood during the rainy season. One key informant also mentioned that since these are also used as rubbish pits that emptying child latrines is particularly toxic as they must be manually emptied. Within the case study area caretakers reported simply filling the pits and covering with soil once the child began using the 'big latrine.'

4.7 Technology Themes

Technology themes were identified with observation, household interview responses, and FGD topics. Water stress played a role in influencing caretaker's practices as did a number of emerging themes mentioned below.

4.7.1 Water usage and water stress

In the water stressed environment presented within the contextual results, there was no consensus between caretakers whether water supplies were sufficient with roughly two thirds of the caretakers reporting that the current water situation as affecting their ability to perform effective IYCFM. Although, the small sample sizes exclude statistical comparisons

between the three communities, there were some differences in the perception of water between the three communities.

Table 13 -Water mentions within the household interviews (n=19) and in FGDs

Community	Indirect questioning of challenges with CFM - Unprobed mentions of difficulties with water	Direct questioning water not always sufficient for CFM	FGD Rank of water as a challenge within CFM challenges ranking activity
OFUA	17%	67%	6
ARIAZE	38%	75%	2
ARIWA	0%	40%	(Not Collected)
Total	26%	63%	-

Figure 42 - In Ariaze jerry cans are lined up waiting for water distribution.

The effect of water provision on IYCFM was assessed in three ways. First by asking an indirect question on household challenges with IYCFM, second by a direct question if water is sufficient for managing child feces, and finally by an open question within the FGDs on challenges with IYCFM. All three methods show that Ariaze caretakers have a higher percentage of caretakers experiencing difficulties performing IYCFM due to water provision than the other communities. For this case study, caretakers' general experiences with water provision are presented before discussing how this effects their ability to practice IYCFM. As seen in Figure 45, many families complaints center around waiting for distributions and long wait times.

Water availability within the case study area

Ofua Woman (Pilot): *"Sometimes water is not available in the camps. It is not coming frequently on time."*

***Ariaze Woman**: "Sometimes there is no water. Water trucks cannot transport."*

Ariaze Man and woman: *"Our challenge mostly here… water is the problem. Most difficulty only one borehole and when it is empty, lines."*

Ariwa Woman: *"Here water can be excess because of heavy sun [with solar system]. If there is cloud and signs of rain, there is no water. She goes and fetches water from that borehole. Fetching from that borehole, you pump 1 or 2 jerry cans and get tired. For the whole family this may not be enough."*

Ariaze Woman: *"Sometimes water goes off, almost 5 days no water."*

Still others expressed that the water supply was sufficient for their needs or that household storage was a larger priority.

Water availability within the case study area

Ariwa Woman: *“If no sunlight [solar system] she goes to borehole. It is enough"*

Ofua Woman: *“Water is there. It is enough.”*

Ofua Woman: “*Water depends on how many jerry cans you have. If you don't have enough and you run out of water you may find there is no water.”*

There were three IYCFM process steps identified that used water within the case study. First, tool cleaning of potties, scoops, or cloths. Second, for bathing children including washing babies’ bottoms. Third, for washing caretaker and children’s hands. Between the IYCFM strategies there were no universal consensus or useful comparisons on the effect of the current water situation on IYCFM practices, despite the fact that those using cloths appear to have more washing. This may be due to the practice described in the 4.4.1 section above; young children are completely bathed after each defecation event with the same water that would otherwise be used for washing clothes. Caretakers reported modifying their practices based on water availability, primarily in their methods of cleaning children and their ability to wash cloths.

Impact of Water on IYCFM behaviours

Ariaze Woman: *“When there is no water, the child will stay dirty. Even the clothes will not be clean.”*

Ofua Woman: *“If there is no water, she uses the clothes to clean the buttocks.”*

Ariaze Woman: *“If no water, uses pieces of cloth for cleaning babies bottom and waits until water comes to clean the cloths.”*

Ariaze Woman and Man: *“When there is water, can keep ourselves clean. Then, keep child clean and child's clothes clean."*

An assessment of the water volumes used by caretakers was attempted; however, there was a large range of water quantities estimated by caretakers needed to perform each of these tasks. The box below shows the wide range of water volumes needed daily for IYCFM.

Daily Water Needs for IYCFM

Ariwa Woman: *"Any time the baby defecates she will have to wash [with] half of a 5l jerry can" [2.5 to 7.5l/ day]*

Ariaze Woman: Water usage: 3-4 liters for bathing, approximately 4 times/ day. [12 to16 l/ day]

Ofua Woman and Man: *"Two jerry cans we use to keep baby clean. If you have a baby that is young you have to have all that water. Having own water there [within household] for cleanness."*

Ariaze Woman: *"The whole day I use 2-3 [20 liter] jerry cans because anytime she defecates I have to wash the baby and the clothes…Yes, 60 liters of washing to be clean and have clean child."*

4.7.2 Technology themes explored at site included for potential future research

The following themes were identified at site to explore in future case studies.

Figure 43 – Latrine slab interference prevented basins from passing through the doorway.

If cloths are used, latrine doors must be able to open wide enough to accommodate local basins for disposal (See figure 46 to the right). For the basins shown above, the latrine design produced an interference between the door and latrine slab (door only opened inwards). The basin did not fit through the doorway. This caretaker reported she transferred the water to a bucket that would fit through the door. Although all the latrines were built by individual households within Rhino, in other emergency situations where latrines are constructed, infrastructure will need to ensure that these dimensions are considered. In hygiene promotion campaigns this design point might create an opportunity to emphasize prior to construction that this is the preferred location for wash water disposal.

Scoops may not be appropriate for areas that are rocky or have hard soils. This was not assessed as a component of this research but should be confirmed with additional case studies in rocky areas.

Ground Conditions and Scooping

Rhino Operating Partner - Oxfam: *"…a hoe may not be appropriate in rocky areas. Scooping is really a problem. A potty could be appropriate."*

Open defecation followed by scooping will lead to some volume of soil accumulating within latrines. This scooping volume is not currently known, but could have a significant effect on latrine life, especially in families with multiple children at the age.

Several of the thin plastic potties had clearly bleached and cracked in the sun through common drying practice. The research enumerator explained while comparing field notes that it is common for the cheap potties available locally to break and for caretakers (such as himself) to purchase multiple potties over the 2-3 years that children use them.

5- Analysis and Discussion of Research Objectives

This chapter analyzes each project objective sequentially, connecting the research to the literature and discussing the implications of the findings for future research and response. Further discussions on each of these topics, including gaps and suggestions for future research is included within Appendix IV.

5.1 IYCFM Strategies in Context

Contextual behavioral determinants were assessed on multiple levels according to designations by the integrated behavioral model (Dreibelbis et al., 2013): individual/ household, community level, and broader societal determinants. These are portrayed in a graphical format in in Appendix III. Based on the reported practices within the study, three individual level contextual factors directly influenced IYCFM strategies: IYCFM products within households (including both hardware and consumables), availability of safe disposal locations, and water available for IYCFM hygiene. These household factors were each influenced by decisions from the WASH cluster, livelihoods cluster, and the private market.

The IYCFM products used by households were influenced by the products available within markets and NFI distribution. In this case, NFI was not provided explicitly for IYCFM, but tools distributed for agricultural and latrine building were used by children who were within the OD with scoop age bracket. Had these not been provided, families currently using scoops would likely be without a IYCFM product within the household and may use riskier items such as leaves and paper boxes to remove feces as was reported by caretakers when they first arrived. This could be seen also within the coping strategies of those using cloths. The unavailability of cloth diapers within markets, combined with the lack of distribution, combined with the expense of disposables meant that caretakers used spare cloths to manage child feces.

Each of these was also impacted by frequently mentioned, but non-assessed, household funding and spending priorities along with the lack of income generating activities. Most notably within the households, the reported unaffordability of soap meant families were washing fecally contaminated cloths without soap and handwashing stations were frequently seen without soap. These results on the impact of affordability and access to IYCFM products aligns with the research discussed in section 2.8.3 of the literature review with caretakers in Kenya, Bangladesh, and Cambodia choosing to modify practices due to the lack of funds and low household spending priority (Petrie et al, 2016; Rush, 2011; Sultana et al, 2013).

When looking at the universal availability of safe disposal locations within households, these were influenced by the physical latrine coverage support and PHAST promotion activities provided by the WASH cluster. These findings agree with general predictive findings discussed in section 2.8.1 that access to safe disposal locations may lead to safe disposal (Majorin et al, 2014; Azage and Haile, 2015; WSP, 2015; Petrie et al, 2016) When comparing the situation discussed in initial displacement to the current stabilized situation the lack of a safe disposal location early in the emergency led many caretakers to dispose of feces unsafely. It is this author's opinion that the necessity of a safe disposal location is self-evident as a requirement for safe management.

Further hygiene promotion from Oxfam also very likely impacted disposal practices at a household level. The apparent high levels of awareness made it difficult to discern the reliability of responses with participants possibly anticipating answers that would portray themselves as compliant to the advice given in the hygiene promotion. For example, when comparing the handwashing stations with the reported rates of handwashing, knowledge appeared to be high, but practice appeared to be low. Knowledge gained during hygiene promotion was not directly assessed within this research, and it was an assumption that the knowledge came from the large amounts of hygiene promotion conducted within this camp. This also likely means that the risks before hygiene promotion were much higher if caretakers were unaware of the need to dispose within latrines.

Handwashing and other IYCFM practices were also related to water availability within the context which is discussed within the technological factors in section 2.7.1 below.

Each of these WASH cluster initiatives was impacted by the WASH cluster priorities discussed within the results section. The strength of this assessment is the focus on elements of IYCFM within the control of humanitarians to set priorities that can influence behaviors at household levels. Caretakers will need reasonable access to affordable products along with disposal locations to facilitate safe management. Caretakers will also need hygiene promotion depending on initial practices and, depending on IYCFM strategies, sufficient quantities of water and water storage. Having an awareness of how WASH priorities and external factors influence these household situations will allow public health teams to more quickly understand the challenges faced by caretakers and respond appropriately.

The general priority of addressing 'adult sanitation' with latrines will provide a safe disposal location for non-disposable products and addressing water trucking and improving water infrastructure would also improve the ability of caretakers to manage children's feces. The

largest gap within the case study area is product availability which could be addressed with NFI distribution, a strong refocus towards livelihoods or some form of a voucher system for IYCFM products. Public health professionals should also be aware of the risks of non-provision of NFI in situations when families have little resources and assess whether the risks (section 5.6) are appropriate.

5.2 IYCFM Strategies and Process

The process steps introduced in section 2.2 in the literature review were conclusive for this study in that they were all observed to be taking place: defecation location, transfer, storage (delayed disposal), disposal, tool cleaning, child bottom cleaning (and disposal), child handwashing, and caretaker handwashing. By investigating each of these process steps used by each IYCFM strategy an explanation for child development (section 5.3 below), comparisons of risks (section 5.6 below) and variations of practices (section 5.4 below) were easily introduced in a way that would not be possible when only examining disposal practices. This also provided a deeper anthropological perspective of the lived experience of IYCFM practices within the study communities that would not be possible in a study examining only disposal.

Examining the full process used for IYCFM also reveals sanitation needs of different caretaker sets for hardware and consumables not directly used for defecation locations and disposal. For example, understanding that all children below approximately 6 months use cloths and knowing that hand washing cloths is an essential step to baby sanitation may highlight the need for soap and water not just as a post disposal hygiene item, but as essential to safe sanitation. Wash basins were also used extensively throughout the case study area for washing sanitation products. While the process itself may not produce interesting results without attaching other research objectives such as in this case study, understanding the process used locally for IYCFM can help humanitarians best know how to support these activities.

5.3 Child Development and IYCFM

The results provided within the household interviews demonstrated that sanitation practices are heavily tied to a child's development and attempted to provide a comprehensive description of changing sanitation practices during this development. Children of different ages have different capabilities in bowel control, defecation communication, mobility, and motor skills all affecting the sanitation options available to them. Within the case study caretakers employed three general steps to managing their children's sanitation: cloths, then either potties or scoops, then latrines. Some families used a child latrine between

potties/ scoops and latrines. Within each of these general steps, there were some sub steps identified such as initially holding children during open defecation or assisting children with latrine usage until they are fully trained.

To attempt to provide more breadth in the case study understanding of developmental sanitation changes, each caretaker was asked about sanitation practices and transitions in the past and planned future changes. This is shown on figure 9 within the methodology section. The original intention was to learn if the transitions happened at distinct developmental markers such as when children begin sitting up or when children start walking. Caretakers generally provided an age in months and these developmental markers were inferred by comparing between responses. Discussing these past sanitation practices was a confusing topic for many caretakers. Based on the children who were currently transitioning from one sanitation stage to another, this may be explained by the fact that these transitions are not instantaneous and appear to take place over several months. For example, those transitioning from cloths to scoops or potties will still use cloths as well for many months while children develop bowel control. This blend of practices may make it difficult for a caretaker to be precise about the timing of this transition. Caretakers may also have not wanted to recall the sensitive time periods when children were making these transitions; in some cases, families were within the conflict in South Sudan or in transit to Uganda. Additionally, some caretakers plainly admitted that they had forgotten, the previous transitions happening years ago in South Sudan.

Future plans were more concrete, but again were provided by caretakers as an age, not based on a definite step of child development. These results may have been influenced by the majority of relatively inexperienced caretakers with only their first or second child without a clear idea of when children would make future changes to latrines. No comparison of more or less experienced caretakers were made during this research as this was out of scope of the study objectives; although the results show that there were some caretakers with 4+ children and some caretakers with only one child. These variations might also be explained by caretakers unfamiliar with latrines themselves and the culture around latrine usage may be weak. Without generational knowledge of this technology or strong societal pressure to conform, caretakers may make personal judgement calls based on a variety of unexplored factors. In one interview, the caretakers discussed the differences in familiarity with latrines:

Differences in Experience with Latrine Technologies

Ariaze Man: *"Some [people are] brought from towns, some from villages. Some are used to latrines, but others are not."*

It was observed that the initial sanitation transition from cloths to potties or scoops matched the descriptions of ‘assisted infant toilet training’ (without operant conditioning) techniques described in section 2.3. The best inference is that, currently in low income countries, caretakers with insufficient funds to consistently purchase disposable products are using assisted infant toilet training techniques to train children to use potties or open defecate starting from a few weeks to a few months of age (deVries and deVries, 1977; Yeager et al, 1999; Doung et al, 2013; Gottlieb and DeLoache, 2017; Routray et al, 2015; Solarin et al, 2017).

When looking at the sanitation practices after this assisted infant toilet training there were secondary sets of sanitation training occurring. These were noted when children were instructed to defecate in one location, when they were instructed to use a child latrine, when they were instructed to use a latrine through assistance over a long period of time, and when they are taught to assist younger siblings. While studies such as deVries and deVries (1977) discuss the training steps involved with assisted infant toilet training, they fail to examine the subsequent training practices later in children’s development such as those mentioned in developed countries by Schum et al (2002). An anthropological study within similar contexts may provide a more in depth view of these practices. No studies could be found attempting to understand these transfers of knowledge and the factors influencing them in low or middle-income countries or with latrines rather than toilets. They have not been explored beyond identification within this study; however, it was evident that reported latrine training ages varied significantly within Rhino, effecting the sanitation strategies used for young children. The latrine training ages roughly matched those reported by Majorin et al (2017) and Petrie et al (2016) with caretakers beginning to use latrines around age 3 and using them independently sometime between 5 to 7 years.

Another interesting component within the research was found when asking caretakers if children could control their bowels. This was formatted to be used to demonstrate why children are unable to use potties, based on the assumption that children cannot use some IYCFM products without this ability. However, most caretakers appeared to interpret ‘bowel control’ as the child’s ability to communicate a defecation need and the caretaker’s ability to read this sign. Within the questionnaire, the subsequent question after bowel control dealt with communication, but this question was rarely asked as the response had already been provided. Table 20 in Appendix III shows how this ability to communicate defecation directly correlates with a child starting to use either potties or being held over the ground by the caretaker. This confusion of actual control of bowel movements and ability to use assisted infant toilet training made it difficult to discern when in this context children were actually able to control their bowel movements.

By examining the different practices as children develop, an assessment can be made for a few useful components of IYCFM support: what percentage of the population will need their feces managed with technologies other than latrines and the unique needs of children within the community. Caretakers within this context will have put potties to use from a very young age. Although key informants did not have population statistics available, the latest fact sheet for Rhino produced 6 months before the study (UNHCR, 2018b) placed the 0-4 age category at 14% of the population. Knowing that within this case study 3 years is the age when children generally begin to use latrines and 5 years is the age when many caretakers felt children should be using latrines independently shows that most of this 14% of the population need support for sanitation beyond latrine infrastructure. A small percentage of this group (up to around 6 months) need support for cloth based sanitation as they are completely unable to use potties or scoops. The rest will needed to be supported from this age until three to four years with potties or possibly scoops. Children just starting to use latrines may benefit from latrine improvements similar to those proposed by Deniel (2004).

These ages may not be consistent in other emergencies. The families described by the researchers in Kenya (deVries and deVries, 1977) or The Ivory Coast (Gottlieb and deLoache, 2017) might begin using a plastic potty within a few weeks of birth. Those families requiring IYCFM support in an emergency who use later toilet training methods might not begin to use a plastic potty till 24+ months. The current guidance estimates the beginning age of potty applicability as 18 months (Dodos, 2017); suggesting a consultation with local communities. When discussing consultations with the key informant interviews, there does not yet appear to be any standardized consultation. Key informants focused on what products are needed and not exactly who will be able to use them effectively. The 2016 STC review of humanitarian experience with IYCFM shows that in the rare instance of WASH programs including IYCFM interventions, they generally only include one intervention to cover all development stages from birth to age five. A brief review of interventions collated by Gil et al (2004) Majorin et al (2017) indicates that even for interventions attempting to improve disposal, none have focused on understanding current practices as children develop and address different needs of children as they develop, instead broadly focusing on under-5s as a single block. The hygiene promotion within the case study area (Appendix III) also did not take into account these differences. The results here indicate that this likely means that significant portions of under-five are completely overlooked and unsupported. The results also show that although children go through different developmental stages, it is difficult to say precisely at what age they will need specific supports, and a range of supports should be offered to all children under 5.

While precision on ages may be useful for guidance documents and planning a response, it largely does not reflect the household IYCFM realities and will mean some children will miss out.

The current literature indicates that providing terminology to describe these differences and assessment tools for humanitarians to place these practices within context is the best path forward to adapting IYCFM programs in emergencies. Developing hygiene promotion around a culturally appropriate, yet safe solution that considers these differences will likely be more successful than a standardized child feces management response.

5.4 Changing Conditions and Dynamic Practices

This research also attempted to explore if various conditions modified practices in any way finding that caretakers had a variety of strategies to deal with a variety of conditions.

When directly comparing the effect of these changing conditions between the IYCFM strategies, open defecation with scooping appeared to be the most responsive to changing conditions. Children largely did not defecate outside at nighttime due to fear and lack of lighting. Without a IYCFM tool to defecate into (such as a potty), caretakers reported a large variety of practices. Rain had a similar effect with children largely not defecating outside and caretakers managing indoor defecation with a variety of methods. The ability of an IYCFM tool to facilitate caretakers' response to changing conditions was not an objective of this research. Potties allow caretakers to more easily respond to defecation events in varying conditions when compared to scoops. For children that are able to use potties, these are more easily used at night and during rain than scooping methods when children are less likely to want to defecate outside. Additionally, potties appeared to provide a centralized location for children to defecate into while caretakers were busy. To date, open defecation and scooping methods have not been compared within the literature other than potties' ability to facilitate disposal more consistently than scoops. From a consistency and ease of use standpoint during changing conditions, potties were considerably better at maintaining safe operation than scoops.

Table 15 below shows this comparison between IYCFM strategies with green showing no change or only minor modifications to the IYCFM strategy, yellow indicates that caretakers move to using a different IYCFM strategy during the changing condition or make major modifications, orange shows a major variation in IYCFM strategies with potential for significant risk or lack of disposal. See section 4.4 within the results for a complete description of these changes.

Table 14 - Dynamic Practices by IYCFM strategy

	Cloths	Potty	OD + Scooping	Child Latrines	"Big Latrines"
Diarrhea	Increase wash and water	None/ Use Cloths	None/ Use Clothes	No change within study	None/ Use potty
Travelling/ In public	None/ Use Pampers	Cloths/ Pampers	Cloths/ Pampers	No change within study	None/ OD in bush
Nighttime	Delayed Disposal	Delayed Disposal	Various coping strategies	No change within study	None/ OD + Scoop
Caretaker Busy	No change within study	None / reduced usage during training	None/ may miss scooping	No change within study	No change within study
Rain	Dry cloths inside	No change within study	Various coping strategies	No change within study	No change within study
Child with Secondary Caretaker	No change within study	No change within study	No change within study	No change within study	No change within study

As seen in section 2.4 there are very few studies to compare results. The strongest comparison that can be made is when caretakers are travelling and use pampers. This was mentioned in three separate studies in low income contexts by Denis (2013) Petrie et al (2016) and Kamundi, Kearton, and Souter (2017). The increasing use of these products within very low resource environments, even if not used as the primary IYCFM strategy for a given child, should be a call of action for the WASH community to develop solutions to their management when solid waste services are not a viable option.

Another connection to be made within the literature is with the study by Duong, Jansson, and Hellstrom (2013) finding that similar to this study caretakers may not always be able to use potties for children undergoing training if the caretakers are busy. This emphasizes that not only is this a large time requirement for caretakers, they may also have additional needs during this time period, for instance supply of both cloths and potties. The consistency of caretaker hygiene during these conditions may be a factor to consider in future studies, but was not included within this research.

Other comparisons can be made with caretakers at night reporting modifying practices similar to Aluko et al (2017); however in this study, rather than safer practices at night, caretakers typically reported more questionable practices such as delaying disposal, not using latrines, using cardboard boxes, etc. Similar to Denis (2013) and Petire et al (2016) some children who use latrines during the day, defecated indoors at night, using potties or

other methods. In emergencies, potties may need a wider distribution if children are not using a latrine during this time

The usefulness of this assessment for humanitarians is that it gives indicators for conditions requiring humanitarian action when reasonable, useful assumptions are needed. Transit centers during displacement will see caretakers with children who are travelling. A cholera outbreak will most likely see increased numbers of children experiencing diarrhea. Case studies within these conditions can provide additional information on how IYCFM behaviors are modified, if this presents any additional contamination risk, and if there are better ways to support IYCFM during these conditions. For example, if potties and scoops were distributed for IYCFM prior to an outbreak of a diarrheal illness, very young children may not be able to use them once they begin having diarrhea, instead requiring cloths, plastic sheets, water, wash basins, and soap for washing the cloths.

Transit centers may require solid waste management to accommodate disposable diapers whether these are provided in NFI or purchased within the private sector. Transit centers might also need locations to wash cloth diapers and safely dispose of fecally contaminated wash water. Transit centers might also benefit from properly designed child latrines. Outside of this research and piecemeal anecdotal information, these needs and risks are not well known. Without other case studies to compare, it is difficult to know if these variances within practices are common across different contexts.

5.5 Caretakers Roles

The results of IYCFM caretaker roles strengthen the argument that there are multiple caretakers assisting with IYCFM. Men participated in the interviews and FGDs along with their wives, showing interest in the topic. Nearly all family members were seen assisting with childcare of younger children similar to recent results by Alando Simiyu and Mumma (2018)

Similar to studies within Pakistan (Halvorson, 2003), Kyrgyzstan (Biran, Tabyshalieva, and Salmorbekova, 2005), and Papua New Guinea (Kamundi et al, 2017) there were some indicators that women were more willing to prioritize spending on IYCFM products than men within the household. Within the FGDs women emphasized that if finances were provided for IYCFM tools to not give them to men. Additionally, within the FGDs men and women had different priorities on provision with men emphasizing tools that could be used for other purposes around the home and women emphasizing IYCFM tools with a dedicated purpose such as potties. Future hygiene promotion may consider addressing family groups or addressing men if they are to assist with these household activities.

5.6 Risks

One of the primary objectives of this research was to challenge the nearly exclusive focus on disposal within latrines by confirming the potential risks within IYCFM beyond safe disposal as proposed by Petrie et al (2016) and Majorin et al (2017). Appendix III shows how each of the risks considered connects to each of the IYCFM process steps examined within the case study. A discussion of disposal risks is conducted before exploring risks beyond disposal and a comparison of risk between IYCFM strategies.

5.6.1 Disposal Risks

Disposal of feces outside of latrines did not appear to be a large risk within these communities. Caretakers universally reported this specific practice within household interviews and spot observations and continuous inspection while walking through the study area did not find any child feces throughout the entire study. Interestingly, FGDs mentioned disposal in locations other than latrines, but typically qualified that this was only acceptable in the absence of a latrine. ‘Disposal within latrines’ was a heavily covered topic within the hygiene promotion materials and this was the reported practice during the household interviews, supported by the spot observations. This study also found two potential risks within the disposal process step showing that ‘safe disposal’ may be more nuanced than ‘in or out’ of a latrine.

Disposable diaper disposal inside latrines are anecdotally known and discussed in several studies as a risk to future latrine emptying. While this disposal is currently regarded as safe within the JMP definition, risks to future latrine emptying options may mean that this definition requires a reconsideration. Within Rhino, there is currently no latrine emptying as the relatively large plots within the settlement allow households to simply build new latrines. However, considering most families within the case study communities had only been present within Rhino for two years, and considering that UNHCR currently estimates that the average forced displacement to last 26 years (UNHCR, 2018a), it may be inferred that the plots within Rhino may not sustain latrine building indefinitely and will eventually require more sustainable sanitation solutions involving fecal sludge management. Additional issues of deforestation from latrine building were discussed in key informant interviews, emphasizing that latrine emptying may become more common within Rhino in the future if the recent peace turns back to conflict in South Sudan and latrine design, mandated by funding partners, is not modified. Partners emphasized that the current latrine design employed treated poles produced from local forests and the frequent latrine building was affecting local forests.

Solid waste disposal within latrines, including disposable diapers, will likely have a large impact on this fecal sludge management. While this risk is mentioned by Deniel (2004) as needing safe disposal if provided within NFI, the need for safe solid waste management is mentioned only in passing in the latest IYCFM guidance (Gensch et al., 2018) The decision to distribute these products via NFI may be influenced by the capacity of the local WASH cluster to safely manage solid waste, but this represents only one source of these products. The local private sector within Rhino supplied pampers, and they were used by caretakers regardless of the capacity of the local WASH cluster to safely manage this waste. More research is needed to understand how infectious solid waste can be best managed in low resource contexts where the WASH cluster has no control over its distribution.

Another risk within latrine disposal is that of latrine subsidence in poor soils due to cloths washing and bathing water disposal. Gaps within the hygiene promotion did not directly address this issue and public health promotion teams were undecided if the risk from open disposal was greater than the risk of unlined pit latrines subsiding in poor soil conditions.

5.6.2 Risks other than disposal

When examining other steps in the IYCFM process, knowledge of disposal did not appear to translate directly into an understanding of the dangers of child feces. Just as Majorin et al (2016) explored in India, other control points represented significant risk within the household. To represent the concept that there are multiple control points a modified sanitation service chain is presented here in figure 47.

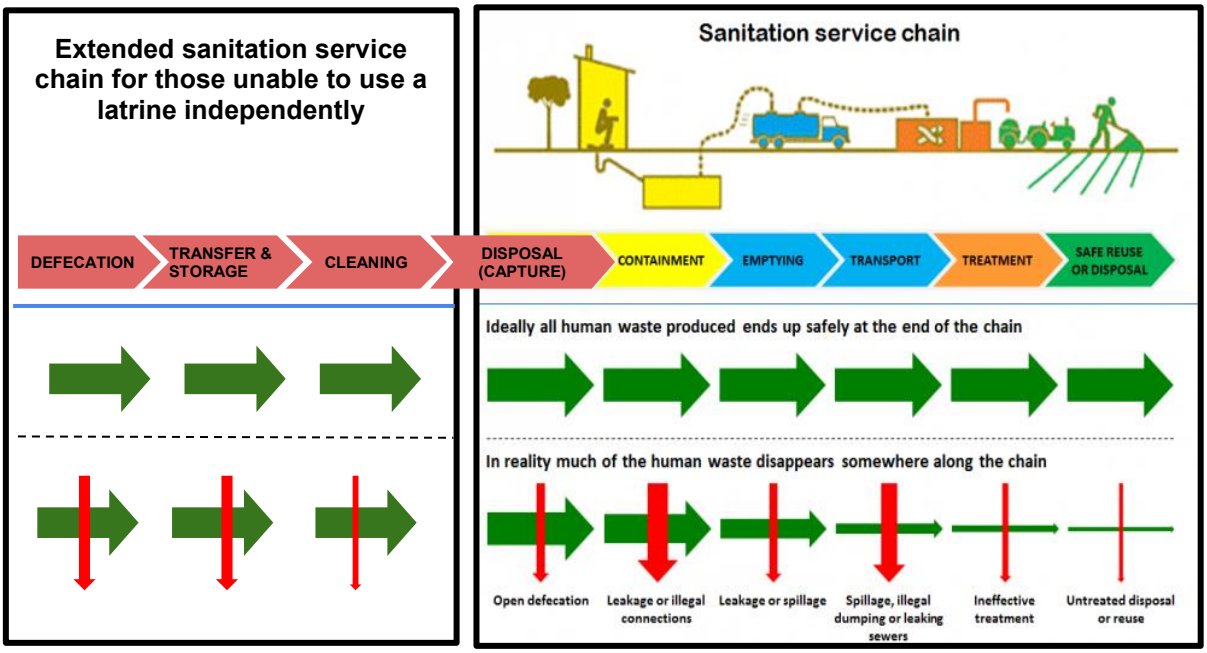

Figure 44 -Extended Service Chain. Original sanitation service chain figure referenced from (Sanford and Baetings, 2016)

Within this ‘extended service chain’ findings were most significant for tool cleaning and child anal cleansing. Similar to findings by Rush (2011) and the recent TIPs by the Manoff group and World Vision (2017) caretakers were often disposing of anal cleansing materials outside of the latrine, even if they were disposing of feces within latrines. When comparing the hygiene promotion materials used in the community by Oxfam this represents a gap that could be addressed in future hygiene promotion activities.

Within the IYCFM process there were also several opportunities for considerable caretaker hand contamination. Handwashing of fecally contaminated clothes, transferring feces with leaves when scoops were not available, and child bottom washing all were potential sources of hand contamination. When combined with the low prevalence of sufficient handwashing facilities within the case study, this may be introducing significant risk of fecal contamination within the household.

When comparing IYCFM strategies for risk table 23 within Appendix III shows that risks varied between the strategies. Although most of the sanitation stages are in series as a child develops, the most interesting comparisons are those that are in parallel, most notably between caretakers using scoops and those using potties.

The risks of scoops in comparison to potties could be large with open defecation potentially leading to contamination of the ground and caretaker’s hands if insufficient tools are available. As discussed above, potties have much more consistent use, with those using open defecation and scooping switching to secondary sets of practices during changing conditions. Another issue with open defecation is the lack of initial containment and feces directly entering the home environment even if later disposed by caretakers with a scoop. An important question that has remained unasked and unanswered within IYCFM literature is how effective are scooping tools at removing fecal contamination from these surfaces after open defecation and does this represent a higher risk to children than those using potties? No studies could be found that directly compare risks of different defecation locations outside of a developed context comparing disposable diapers with cloth diapers (Holaday et al,1995; Babu et al, 2015). A useful question to ask is: if child feces are considered at least as dangerous as adults, would the WASH community consider risk to be adequately managed if adults defecated on the ground and then scooped these feces into a latrine? Probably not. The risks identified within this research suggest that more information is needed to determine best practices for IYCFM. With the present information available, with children reported as eating soil and playing in these locations, a reasonable assumption is that while scooping feces into a latrine after open defecation does reduce some risk within the household this should not be equated with IYCFM strategies that

provide a dedicated place to contain feces after defecation. The entry of these feces into the environment from open defecation, even if moved later by scooping, might mean that more pathogenic bacteria and worms are entering the ground; fecal material is tracked into homes on feet; and are potentially leading to fly proliferation, although flies were not observed in these locations within the case study.

The risks of child latrines discussed in key informant interviews was unexpected including flooding and household risk of flies. Based on the total lack of case studies examining technical issues of child latrines, these issues will need to be investigated in future case studies. Current designs might be improved by adding a roof or using domed slabs similar to those by Water Aid Malawi (year) to help shed rain.

The strength of formative qualitative research lies in identifying a range of potential issues to explore in future case studies. Further, this research adds weight to the previous research suggesting that the definition of safely managed needs to be expanded beyond safe disposal (Sykes et al, 2015; Petrie et al, 2016; Majorin et al, 2016). More research is needed on a number of topics identified here to build a definition based on research rather than reasonable assumptions.

5.7 Technological Themes

Water was used extensively at multiple steps in the IYCFM process. Similar to studies by Huttley et al (1994; 1999) and Halvorson (2004), the results show caretakers reporting insufficient water supplies as modifying practices, confirming the literature review section 2.7.1 that water availability is critical to IYCFM hygiene practices. Although no families had water on plot, reported practices emphasized high levels of safe disposal with observations indicating this was common practice. These results contrast with results by Curtis et al (1995) and Majorin et al (2014) showing that water on plot may not be a fully reliable predictive factor if caretakers have sufficient knowledge of safe disposal. Results on volumes of water needed for IYCFM hygiene practices varied widely. Appendix IV describes how future research could help provide more reasonable estimates than found within this research.

It was originally assumed that some form of NFI for IYCFM would have been distributed. Upon arrival it was found that NFI kits were not distributed for IYCFM and were therefore not assessed as a component of this research; however, deficiencies exist within NFI provision for IYCFM that can be answered within the literature. For example, the WASH sector working group provides advice to distribute 25 disposable diapers per month for children 0-12 months and then washable nappy cloths for children 12-24 months (WASH

Sector, 2016) The origins of this number are unclear. Fortunately, a reasonable estimate of actual needs can be easily found with any number of resources online. Disposable diaper needs for a single child range from an estimated 240 to 320 disposable diapers per month (New Kids-Center, 2018).

From the current scant literature, this is only partially confirmed in low income contexts; although it may be safe to assume that babies defecate and urinate at approximately the same rates around the world. For example, in Peru, children typically require 6 reusable diapers/ day (Yeager et al, 1999) and mothers considered 12 reusable nappies to be the absolute minimum needed to manage young child feces on a two-day washing and drying rotation (ibid) The review of informal aid and informal literature (see appendix I) describe informal diaper distribution in high income contexts using disposable products and the inadequacy of current NFI distribution. The best evidence currently available suggests that the 25 disposable diapers per month, when distributed, is likely to only last for a few days. The best evidence currently available also suggests that 5 reusable diapers is also insufficient to be able to wash and dry before the cloths are needed again.

This opens a number of questions. While the logistical and financial constraints of distributing so many disposable products in active emergencies are likely prohibitive to meeting demand, the WASH cluster should deliberately understand the implications of an inadequate distribution if caretakers will still need to source 90% of these products outside of the distribution. Should the WASH Cluster actively work to convince caretakers to use cloths instead of disposables in the absence of adequate supply and solid waste facilities? Should the WASH Cluster encourage early training techniques for children to use potties from a much earlier age despite the advice of medical professionals in high income contexts? To what degree should the WASH Cluster balance the modification of parenting behaviors and meeting felt needs? More research and a broader professional base than public health and engineering are needed to answer these questions.

In observations of scooping, a small volume of soil was moved into the latrine similar to the reports mentioned by Petrie et al (2016). This volume of soil was not measured as a component of this research; however an example calculation is provided below using a conservative estimated volume of 0.1L/ scoop.

Example Calculation – Soil Accumulation Rate

Assuming soil volume moved with each scoop is 0.1L and child defecates an average of twice/ day with 100% of feces going into the latrine.

365 days/ year * 2 feces requiring scooping / day * 0.1L/ scoop
= **73L/ child/ year accumulation rate**

When comparing this volume to the expected fill rate of a latrine of 40 to 90 liters per adult per year (Reed, 2014) depending on soil conditions, a household using scoops may find pit latrines filling up much faster than those who use other IYCFM strategies such as potties, especially in households with multiple children. This may help explain why multiple pit latrines were full or nearly full within the project area, despite their young age. The picture to the right is of a shallow unlined pit under construction after the previous pit filled in a short time. Appendix IV describs the need for more research to explore this issue in relation to scoops.

Figure 45 - A new, unlined shallow pit is under construction

6- Conclusions and Recommendations

This conclusion section revisits the research from a broader perspective to ensure that the research aim was achieved before presenting the key findings for each objective. Implications for future research are then discussed briefly (with considerable supplementary material within Appendix IV) before discussing implications for future response. The conclusion chapter brings the dissertation to a close by laying out the next steps to improving IYCFM in emergencies.

6.1 Revisiting the Research Aim

This section reviews the extent to which the research aim was achieved. See section 2.9 for an overview of the research aims and objectives. First, this case study highlighted the difficulties of researching and discussing IYCFM. This neglected topic lies at the heart of WASH with all components of WASH involved. Water is used extensively for both direct sanitation practices such as cleaning IYCFM tools and for post disposal hygiene such as washing hands. IYCFM is itself the sanitation available to children unable to use latrines. Solid waste management or the lack thereof influences the risks involved with disposing products and on the sanitation service chain. Hygiene and the promotion that influences it play heavily into the practices used by households. Other cross cutting themes such as gender, livelihoods, household dynamics, infrastructure all influence the practices used to manage young children's feces. The presence of each of these components shows that IYCFM is that while IYCFM is managed at a household level, there are many community and societal level factors to consider.

Within this research, IYCFM was explored in multiple dimensions primarily to cope with the lack of a defined case study structure for ICYFM. Not only did this research attempt to understand each stage of the process used by caretakers to manage child feces, it

attempted to understand this process for children of different ages and when caretakers make transitions between practices. This consideration of additional process steps and developing sanitation practices was useful as it allowed the research piece to build a more complete narrative of the variety of caretaker experiences with IYCFM, true to the holistic nature of case study methodology. Providing developmental and contextual information within the case studies also allowed the research to connect to previous research such as the connection to training techniques observed in many other low in come settings. The more complete narrative allows the work to better connect the anthropological and public health research into new themes of child development and engineering. It also allowed this research to better understand and code the variety of practices present within the case study area. These key findings are listed here organized by objective.

Key findings for objective 1 - context

- NFI distribution for scoops and hoes for latrine building and agricultural livelihoods was a large contributor to safe IYCFM.
- This research strengthened the argument that financial limitations and household priorities are a major contributing factor in safe IYCFM.
- This research strengthened the argument that a safe disposal location is a necessary requirement for safe IYCFM.
- Lack of solid waste management and relevant hygiene promotion led to disposable diapers thrown into latrines
- Based on the evidence discussed with caretakers, risk during the immediate displacement phase was higher due to potentially lower knowledge, the lack of safe disposal locations, insufficient scooping tools, and low water availability.

Key findings for objective 2 – IYCFM process

- Strengthened the argument that more information is needed about the process caretakers use beyond a simple disposal
- Examining the full process helped explain differences in children’s ability, variations within the community, and revealed risks.
- Examining the full process helps understand the needs of caretakers to support IYCFM.

Key findings for objective 3 – child development

- Strengthened the argument that children have unique sanitation needs as they develop requiring more than one intervention in an emergency to appropriately, effectively manage children's feces
- Caretakers in the case study area used assisted infant toilet training with later latrine training.

Key findings for objective 4 – changing conditions and dynamic practices

- Caretaker's IYCFM strategies varied significantly within the case study due to changing conditions.
- IYCFM strategies were least consistent with households using open defecation and scooping with caretakers using a variety of coping strategies for nearly every changing condition.
- Diarrhea, during transit, and nighttime were the conditions which modified household IYCFM strategies the most. Due to the lack of case studies on household practices during child diarrheal episodes, this should be shortlisted for future study.
- Addressing changes in practices where they are known to exist (such as during breakouts of diarrheal illnesses) may be a future improvement to public health programming in emergencies.

Key findings for objective 5 – caretaker roles

- Within the case study, multiple family members assisted mothers with IYCFM including fathers, older siblings, and extended family. Future hygiene promotion may include other family members within IYCFM hygiene promotion.
- Within the case study there were some indication that conflicting household priorities may be limiting access to IYCFM products.

Key findings for objective 6 - risks

- Disposal in latrines was a common practice; however, post disposal hygiene such as tool cleaning and handwashing were often outside of latrines.
- Strengthened the argument that there are multiple control points beyond disposal that need to be considered for safe child feces management.
- Demonstrated that by examining risks beyond disposal that different IYCFM strategies carry varying amounts of risk.
- Demonstrated that disposal within latrines may also lead to damage of the latrine infrastructure and the sanitation service chain.

- Demonstrated that the risks of exposure within the IYCFM process may require specific emphasis for handwashing.
- Demonstrated that child latrines may need design modifications or reconsideration and should be a focus of future case studies.

Key findings for objective 7 – technology themes

- Strengthened findings that insufficient water supplies modify child anal cleansing practices and delay washing fecally contaminated cloths.
- Strengthened the argument that scoops are likely not appropriate for rocky areas and may lead to premature latrine filling.

6.2 Implications for Future Research

The general trend in IYCFM literature to 'skip' the qualitative studies needed to better understand contexts and going straight to quantitative studies focusing on identifying 'where' and 'who' are unsafely disposing has meant that more basic questions have gone unanswered such as 'why should we work on this', 'what are the specific risks,' and 'how can we develop locally appropriate solutions'.

Rather than jumping straight to asking which interventions best modified behavior or have reduced illness, future research may benefit from taking a step back and ensuring we fully understand IYCFM behaviors and the factors which influence them. Programming can then be built around simultaneously addressing caretaker's needs and public health objectives rather than a set of reasonable assumptions.

Introduction of known disciplines within emergency WASH research may improve the quality of research. For example, the majority of research on this subject has been conducted by public health experts, with no apparent background in child development, a well-established discipline within high income countries. With IYCFM resting at the intersection of multiple broad disciplines, cross discipline teams bringing together anthropologists, child development experts, public health professionals, and engineers will likely provide the best results within future case studies. Any one researcher may struggle to adequately synthesize the lived experiences, children's capabilities, public health risks, and technical issues. Based on the current literature gaps, it is the opinion of this researcher that the WASH community does not currently have the capacity to adequately explain the lived experience of children and caretakers and should collaborate with other disciplines in future research to fill this gap.

While not an objective of this piece of research, the lack of comprehensive guidance for preparing ICYFM case studies was seen as a major gap by this researcher. Appendix IV was prepared as a companion document to begin addressing this gap and includes recommendations for additional useful objectives in future case studies before describing improvements to this case study's objectives. Additional research questions built from this case study are organized by each project objectives. The following three questions were selected as the key issues to consider for future IYCFM research:

- Within a cholera context, how are caretakers practicing IYCFM? Similar to this study, are children previously using other sanitation technologies such as potties or scoops using cloths during cholera? How do water needs increase for IYCFM washing during cholera? If there is a large increase of wash water disposal in latrines during this time is this creating any additional risks? How practical is it to adapt hygiene promotion around IYCFM to address different variations in this context?
- Does open defecation followed by scooping to a latrine provide sufficient protection to be considered safe? Does this significantly change the fecal coliform count within soils where children are playing and potentially eating dirt? Should the definition of 'safe disposal' be updated to 'safe management' and include aspects of the IYCFM process beyond disposal? How would this be measured and monitored?
- To what extent will wash water disposal in latrines affect the integrity of the pit in a variety of different soil conditions? Are there inexpensive, appropriate latrine linings to make latrines more suitable for wash water disposal in areas with collapsible soils? Are there any soak-away designs for this water that would provide sufficient protection from flies and fecal contamination? If not, are there any innovations that could be made to conveniently handle fecally contaminated wash water in resource constrained environments? How will wash water disposal work in emergencies with high population to latrine ratios?
- How can humanitarians respond to the introduction of disposables into an emergency context if there are insufficient resources to safely handle these products? Are there solutions such as communal incineration that might be more appropriate for child sanitation solid waste? Has this been piloted anywhere? What are the implications for their improper disposal in extended displacements with limited land for new latrines?

Appendix IV also makes suggestions for future case study contexts to consider for future researchers. The top two priorities based on these case study results are mentioned below with a brief explanation:

- Acute displacement to better understand practices for children of different ages when disposal locations are not yet available, when water for hygiene is severely restricted, and when no IYCFM products are available.

- Epidemics with large diarrheal incidences to assess changing IYCFM practices in a location with an active outbreak of diarrheal disease.

6.3 Possible Next Steps for IYCFM Within the WASH Cluster

Based on the 2004 (Deniels), 2014, and 2016 STC consultations with humanitarians, and the findings from this research, the top priority item for action to be taken on IYCFM in emergencies is to implement a sanitation indicator for children unable to use latrines. Currently, the implementation of IYCFM interventions is inconsistent (STC, 2016) and dependent on the sense of urgency from individual humanitarians. It may be a reasonable assumption that in the absence of useful evaluations for IYCFM that WASH priorities in limited resourced emergencies are first focused on items with established indicators. To put it more colloquially, this is not measured and therefore it is not getting done. Having useful measurements for IYCFM will help establish IYCFM within the WASH priorities during an emergency response.

Finally, greater commitment is needed from WASH partners to fund research on this topic. While guidance can be updated with the information provided within this report, the global WASH community needs more case studies are needed to develop comprehensive guidance to support these caretakers. Some suggestions have been made within the discussion chapter for improving this guidance; however, preparing coherent guidance will require significant time and was considered out of scope for this report. For consultation on improving guidance on IYCFM in humanitarian emergencies please contact the researcher. As this research shows, improving guidance for support to caretakers for IYCFM is needed; it is a priority within households with small children, may carry significant risk to children and their caretakers, and have a large impact on the quality of life and dignity of those in emergency situations.

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APPENDIX I – Companion Document to Literature Review

I.1 Terminology: "IYCFM" vs Alternative Phrases

Within this report, the phrase IYCFM is used throughout as an abbreviation for 'Infant and Young Child Feces Management.' This phrase, coined by Miller-Petrie et al (2016) was considered the most accurate representation of those requiring assistance managing feces within a household. There is currently no consensus on the terminology used with IYCFM research and there are multiple other phrases currently used that were considered:

"Child feces disposal" used by recent studies such as Ayele et al (2017) was not considered accurate as this implies that disposal is the only component to research or promotion. Other variations of "child feces disposal" such as "infant feces disposal" were also not considered. See section 2.2 within the literature review for justification of consideration of other process steps.

"Infant Feces Management (IFM)," used in recent studies such as Kamundi, Kearton, and Souter (2016), was not considered accurate given the current definition of 'infant' used by WHO (WHO, 2006) and others as under one year, this would imply that children older than one year do not require feces management. Section 2.3 within the literature review demonstrates that feces management is always required beyond one year until a varying maximum age.

"Sanitation for Infants and Young Children Under 5" as proposed by the title within 2016 STC review was not considered accurate as this implies that children above the age of five do not require feces management and that those under 5 do require feces management. Section 2.3 within the literature review demonstrates that in some communities there are many children beyond age 5 not yet using latrines and some communities with most children using latrines well before age 5. The age of 5 is useful for study inclusion criteria and health statistics but is somewhat arbitrary when examining the lived experience of children and caretakers and does not accurately represent which households might require assistance with feces management in an emergency.

IYCFM was chosen as it succinctly demonstrates three themes. First, that infants will require feces management from birth, perhaps with distinct needs from 'young children'. Second, there is a vague upper boundary of 'young child' represented in section 2.3 of the

literature review that varies significantly between communities and households. Third, that managing children's feces is a process of which disposal is just one component.

I.2 Search Terms and Inclusion Criteria

Search Terms Used and Number of Articles Found (after filtering using criteria)

Catalogue Plus (Title Only Considered)

Search Phrases	Child*+ (phrases in left column)		Infant +(phrases in left column)		Baby +(phrases in left column)	
	Found	Title Screen	Found	Title Screen	Found	Title Screen
Faeces or feces	86	13	47	1	9	0
Fecal or faecal	418	4	52	0	2	0
Stool (Excluding Patents for seating devices)	226	1	38	0	4	
Sanitation	217	3	17	0	0	0
Defecation/ Defecate (Defecat*)	74	3	3	0	6	0
Shit	4	0	0	0	2	0
Excreta	2	2	0	0	0	0
Poop	2	0	2	0	3	0
Nappy (exclude patents)	11	0	10	0	1	0
Nappie* (exclude patents)	3	0	0	0	0	0
Diaper (exclude patents)	21	0	17	0	43	0
Potty (exclude patents)	11	2	2	0	4	0
Potties (excluding patents)	1	1	2	0	0	0
Toilet (exclude toilet)	105	2	7	0	9	0
Totals	**1181**	**31**	**197**	**1**	**83**	**0**

Title screening was employed to find articles explicitly for child/ infant/ baby fecal disposal.

- A large number of articles are present when searching for child fecal material (all versions of the word) that focus on medical applications. All of these were filtered that focused on the presence/ non presence of various contaminants or diseases in children's faeces.
- A substantial amount of articles relating to air pollution, heavy metal contamination, dental health, water treatment, respiratory illnesses, etc. Articles focused on nutrition were also excluded where not linked to sanitation.
- Articles relating to hand-washing when unrelated to child sanitation practices were filtered
- Articles on diaper rash, urinary tract illnesses from diapers, etc. were filtered
- Non-English articles were filtered if no abstract was provided in English.
- Exposure to animal feces and adverse health effects were filtered although these are often (in other studies) mentioned as a hygiene promotion activity along with child feces disposal. Similarly, any other articles dealing with other aspects of animal feces were excluded.
- Any studies focusing on school-aged children were filtered
- Articles that discussed WASH impacts, even on young children, but did not link these to disposal of fecal material were filtered.

Additional criteria such as 'emergencies,' 'disaster,' refugee,' 'humanitarian' etc. were eliminated in order to capture both emergency, development, and developed topics. Additionally, words such as 'disposal,' management,' etc. were not included to ensure that all terms for those phrases would be included. Due to the few resources available, the initial search was kept as broad as possible to ensure that no papers were excluded. A matrix of searches was conducted that paired the words at the top of the chart: Child*, Infant, and Baby with the phrases on the left side of the chart: Faeces, Feces, Fecal, Stool, etc.

For example the search 'Infant + Faeces' found 47 papers. After screening the titles, one paper was found and added to the depository of the literature review.

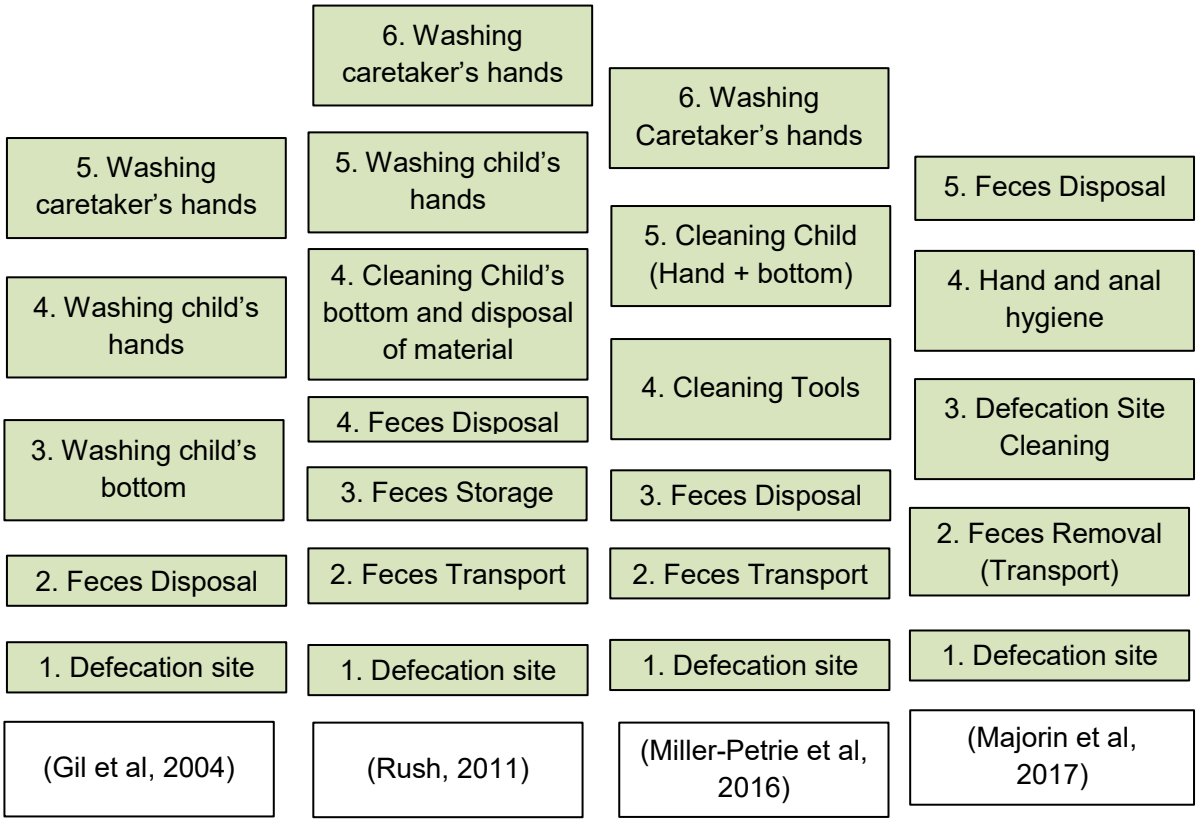
Note: The asterisks on the words includes all variation spellings of the word after the asterisk character. For example "Child*" incorporated both child and children.

Final search conducted 11/05/2018

Open Grey - All fields considered

Search Phrases	Child*+ (phrases in left column)		Infant +(phrases in left column)		Baby +(phrases in left column)	
	Found	Title Screen	Found	Title Screen	Found	Title Screen
Faeces	4	1	0	0	0	0
Feces	2	0	1	0	1	0
Fecal	4	0	3	0	0	0
Stool	7	0	2	0	0	0
Sanitation	30	0	0	0	2	2
Defecat*	4	0	0	0	1	0
Shit	0	0	0	0	0	0
Excreta	0	0	0	0	0	0
Poop	0	0	0	0	0	0
Nappy	0	0	0	0	0	0
Nappie*	0	0	0	0	0	0
Diaper	1	0	1	0	0	0
Potty	0	0	0	0	0	0
potties	0	0	0	0	0	0
Toilet	6	0	1	0	1	0
Totals:	58	1	8	0	5	2

I.3 Comparison of Child Feces Management Process Definitions



I.4 Meta Analysis of IYCFM literature

Study Location and Reference	Ages in study (months)	Considers differences development stages or ages? (Numbers provided are months)	Process Step Described in Study								Additional Notes
			Defecation Site	Feces Transport (Description of tools, process)	Feces Storage	Feces Disposal	Cleaning of Tools or defecation site	Cleaning Child bottom	Handwash with Soap (Child)	Handwash with soap (caretaker)	
Studies focusing on behaviors and behavioral determinants											
WSP (26 countries) (Rand et al., 2015)		Limited to structured blocks 0-1 1-2 2-3 3-4	No	No	No	Quant	No	No	No	No	
Burkina Faso (Cousens et al., 1996)	2-36	No	Both	Qual	No	Quant	No	Quant	No	Both	Testing reliability of observations for measuring child feces disposal
Burkina Faso (Curtis et al., 1995)	0-36	Limited to structured, 5 month blocks (also limited qualitative descriptions)	Quant	Yes	No	Quant	No	No	No	No	Included observation of child stools on ground. Examined behavioral determinants
Ethiopia (Ayele et al., 2017)	0-60	No	Quant	No	No	Quant	No	Quant	No	Quant	Examining behavioral determinants

India (Routray et al., 2015)	0-60	Limited Qualitative Descriptions	Qual	No	No	Qual	No	No	No	No	Small component of larger study
Nigeria (Aluko et al., 2017)	0-60	1-2 and 3-5 Some description of changing ages	Quant	Quant	No	Quant	Quant, tool cleaning	Quant	No	Quant	Examines changes in behavior day to night and other behavioral determinants
Kenya (Rush, 2011)	0-24	Limited Qualitative Descriptions	Qual	Qual	Qual	Qual	No	Qual	Qual	Qual	Strong qualitative interviews around child feces management practices
Mozambique (Munguambe , 2006)	0-60	No	Both	No	Qual	Both	No	Both (with disposal)	No	Quant	Examines behavioral determinants for wide range of hygienic practices
Kyrgyzstan (Biran, Tabyshaliev, Salmorvekova, 2005)	Not Specified	No	Qual	No	No	Both	No	No	No	Qual	Component of larger WASH behavior change programme
Peru (Huttly et al, 1994)	0-35	No	Quant	Quant	No	Quant	No	Qual	Quant	Quant	Observational study on IYCFM and handwashing
Peru (Yeager et	0-60	Yes, defined by local	Qual	Qual	Qual	Qual	Qual, tool cleaning	Qual	No	No	Understanding wide range

al., 1999)		practices									of practice and variability within a community
Cambodia (Miller-Petrie et al., 2016)	0-60	Yes, 0-6 7-12 13-24 25-36 37-60 and some description of changing ages	Both	Both	No	Both	Qual, tool cleaning	Both	No	Both	Introduces framework used in this chart. Looks closely at products and parents acceptability of products and examines behavioral det.
Zaire (DRC) (Manun'Ebo et al., 1997)	Not specified	No	No	No	No	Quant (Latrine disposal)	No	No	No	No, but at other times	Component of larger study on hygiene behaviors – reported vs observable results. Also uses proxy of feces visible on ground
Nigeria (Omotade et al, 1995)	0-60	No	No	No	No	No, although mention need to look at disposal, doesn't study	No	Quant	No	Quant, both after cleaning child and disposal	Baseline study of larger hygiene promotion initiative. Proxy indicators – feces present,
Thailand (Rauyajin et	0-24	Limited Qualitative	Qual	No	No	No	No	Qual, Includes	No	Qual, when they feel	Looks at behavioral

al, 1994)		Differentiation 'Young Children' 'Those who could walk'						disposal		necessary	determinants of disposal and perceptions of risk of different kinds of diarrhea
Papua New Guinea (Kamundi, Kearton, Souter, 2017)	0-60	No	Both	Qual	Qual	Qual	Both, including location	Both	No	Both	Describes differences in caretaker roles and very in depth Sanifoam based behavioral determinants study
Pakistan (Halvorson, 2004)	Not specified	Some differentiation	Qual	No	No	Qual	No	No	No	No	In depth interviews on environmental health, caretaker roles, hygiene behavior
Toilet Training, Bowel Control, and Child Development											
Kenya (deVries & deVries 1977)	3-12	Yes, toilet training only	Qual	No	No	No	No	No	No	No	Description of bowel training
Various Countries (Thaman and Eichenfield, 2014)	Misc.	Yes, toilet training only	Qual.	No	No	No	No	No	No	No	Description of ages of toilet training around the world

Iran (Hooman et al, 2013)	2-60	Yes, toilet training only	No	No	No	No	No	No	No	No	Description of age of toilet training
Nigeria (Solarin et al, 2017)	0-60	Yes, toilet training only	Quant.	No	No	No	No	No	No	No	Cross-sectional Description of age of toilet training
Vietnam (Duong, Jansson, Hellstrom, 2013)	0-24	Yes, toilet training only	Qual.	No	No	No	No	No	No	No	Qualitative Description of age of toilet training
Various Countries – World of Babies (Gottlieb and DeLoache, 2017)	Misc.	Limited qualitative descriptions	Qual.	Qual.	No	Qual.	No	Qual.	No	No	Anecdotal work based on expert experience.
Belgium (Nunen et al., 2015)	30-36	No	No	No	No	No	No	No	No	No	Cross-sectional Description of age of toilet training
USA (Schum et al., 2002)	15-42	Yes, detailed quantitative and qualitative descirptions	No	No	No	No	No	No	No	No	Statistical analysis and qualitative descriptions of gradual acquiring of toilet training skills
Brazil	36-72	<18	Quant	No	No	No	No	No	No	No	Determinants

(Eduardo and Machado, 2011)		18-30 >30									of readiness for toilet training and comparison of socioeconomic status
Exposures and Risks											
USA (Babu et al., 2015)	Neonates (0-1)	No	Quant	No	No	No	No	No	No	No	Study looking at infections between cloth diapers and disposable diapers
Zimbabwe (Ngure et al., 2013)	0-18	No	No	No	No	No	No	No	Quant	Quant	Study looking at the frequency of child putting fingers in mouth and exposure to fecal contamination
Peru (Marquis et al, 1990)	0-60	No	No	No	No	No	No	No	No	No	Study looking at the frequency of child putting fingers in mouth and exposure to fecal contamination
Bangladesh (Vujcic et al., 2014)	0-36	No	No	No	No	No	No	No	No	No	Study looking at exposure to fecal contamination

											from toys
India (Majorin et al, 2017)	0-60	Pre-ambulatory vs ambulatory	Quant	Quant	No	Quant	Quant, place cleaning	Quant	Quant	Quant	Cuts across sections - Exploratory research into practices looking into potential for exposure at various process steps
Ghana (Wang et al., 2017)	0-60	No	No	No	No	No	No	No	No	No	Study looking at the frequency of child putting fingers in mouth and exposure to fecal contamination
Bangladesh (Boehm et al., 2016)	0-60	No	No	No	No	No	No	No	No	No	Study looking at fecal contamination of compound soils and children's hands (supposedly for child feces management)
Kenya (Steinbaum et al., 2016)	0-36	No	No	No	No	No	No	No	No	No	Study looking at helminth eggs in soils of young child play areas

Bangledesh (George et al., 2015)	0-60	6 month intervals	No	No	No	No	No	No	No	No	Study linking child geophagia events with environmental enteropathy and stunting
Tanzania (Pickering et al., 2012)	0-60	No	No	No	No	No	No	No	No	No	Study looking at fecal contamination of compound soils
Health Outcomes											
Bangledesh (Lin et al., 2013)	0-48	No	No	No	No	Quant	No	No	No	No	Study linking household environement al conditions to enteropathy and impaired growth
Bangledesh (Morita et al., 2017)	0-30	No	No	No	No	No	No	No	No	No	Study looking at the frequency of child putting fingers in mouth and exposure to fecal contamination
Misc Countries (34) (Bauza and Guest, 2017)	0-60 & 0-24	No	No	No	No	Quant	No	No	No	No	Desk study of DHS data comparing child feces disposal to

											health outcomes
Ethiopia (Mihrete, Alemie, Teferra, 2014)	0-60	0-6 6-11 12-23 24-60	No	No	No	Quant ('Safe Vs 'unsafe')	No	No	No	No	Desk study of multivariable DHS data relationship to health outcomes
Indonesia (Cronin et al., 2016)	0-24	No	No	No	No	Quant	No	No	No	No	Desk study of DHS data comparing child feces disposal to health outcomes
India (Bawankule et al., 2017)	0-60	0-5 6-11 12-17 18-59	No	No	No	Quant	No	No	No	No	Desk study of DFHS data comparing child feces disposal to health outcomes
Bangladesh (Islam et al., 2018)	0-36	0-18 18-36	Quant (Odd definition)	Quant (Odd definition)	No	Quant	No	No	No	No	Links disposal to flies, diarrhea, and presence of feces in home
Bangladesh (Alam et al., 1989)	6-23	No	No	No	No	Quant (Odd def.)	No	No	No	No	Diarrhea with diff. hygiene behaviors
Burkina Faso (Traore et al., 1994)	0-36	0-5 6-11 12-17	Quant (limited definition)	No	No	Quant (Limited definition	No	No	No	No	Disposal, presence of feces in

		18-23 24-36									compound and diarrhea
East Africa (Kenya, Tanzania, and Uganda) (Tumwine et al., 2002)	Un-specified	No	No	No	No	Quant (odd def.)	No	No	No	No	Disposal linked to diarrhea
Sri Lanka (Mertens et al, 1992)	0-60	0-24 24-60	No	No	No	Quant (odd def)	No	No	No	No	Disposal and other variables to diarrhea
Indonesia (Aulia et al, 1994)	0-36	0-5 6-11 12-17 18-23 24-29 30-35	No	No	No	Quant	No	Quant	No	No, not in relation to child feces management	Description of wide range of hygiene behaviors and relation to childhood diarrhea
Philippines (Baltazar and Solon, 1989)	0-24	No	Quant	No	No	Quant (odd def)	No	No	No	No	Disposal linked to diarrhea
Nicaragua (Gorter et al, 1998)	0-24	No	Quant (Diaper use only)	Quant (Removal)	No	Quant (odd def)	No	Quant	No, but at other times	Not, but at other times	Hygiene Behaviors to Diarrhea Also uses proxy indicators of feces present
Environmental Impact											
Zimbabwe (Tembo and Chazireni, 2017)	0-18	No	No	No	No	Quant (location of diaper disposal)	No	No	No	No	Environmental impact of diaper disposal

Interventions											
Study Location and Reference	Ages in study (months)	Considers differences, development stages or ages?	Process Step Described in Study (Where included in intervention, also mentioned)								Additional Notes
			Defecation Site	Feces Transport (Desc. of tools, process)	Feces Storage	Feces Disposal	Cleaning of Tools or defecation site after disposal	Cleaning Child bottom	Handwash with Soap (Child)	Handwash with soap (caretaker)	
Peru (Yeager et al., 2002)	15-47	15-23 24-35 36-47 (In results, not in intervention)	Quant	Quant	Quant	No (does not appear to use feces disposal as marker)	Quant, potty cleaning	Quant	Quant	Quant	Intervention (Hardware, potties + information) based on 1999 study by Yeager et al
Burkina Faso (Curtis et al., 2001)	0-36	No	Quant (potty only)	No	No	Quant	No	Quant	No	Quant	Hygiene Promo effectiveness on various practices
India (Majorin et al., 2014)	0-60	Pre-ambulatory Ambulatory (in results, not in interventions)	Quant	No	No	Quant	No	No	No	No	Post CLTS behaviors for children feces and other determinants
Kenya (Christensen et al, 2015)	0-36	No	No	Quant.	No	Quant	No	No	Quant	Quant	Multi behavior change program + hardware (scoops and potties) Indicators for

											Child feces: risk belief Disposal Presence in compound
Kenya (TIP) (Manoff Group, 2018)	2-24	No	Qual	Qual	No	Qual and comp.of trial	No	Qual (Incl. disposal of material)	Qual and comp.of trial	Qual and comp.of trial	Notes on play spaces, risks from animals, beliefs of feces, presence of feces in compound, behavioral determinants and motivations
Somalia (TIP) (Manoff Group, 2018)	0-36	No	Qual	Qual	No	Qual and comp.of trial	No	Qual	Qual and comp.of trial	Qual and comp.of trial	Notes on play spaces, risks from animals, beliefs of feces, presence of feces in compound, behavioral determinants and motivations
Nigeria (Jinadu et al., 2007)	0-60	0-6 7-12 13-24 25-60	Quant (Potty use only)	No	No	No	No	No	No	Quant	Also included absence/ presence of child feces in compound and latrines – Poorly defined

											markers
Zimbabwe (Shine Trial) Mbuya et al., 2015)	0-18	Timing of intervention, but not of practice	No	No	No	No, but mentioned as comp. of interv.	No, but describes floor type	No	Qual (mentions the need to wash too regularly for practicality)	No, but mentioned as comp. of interv.	Prepared guidance to reduce child feces ingestion based on formative research on hygiene behaviors (Clean play spaces, etc.)
Bangladesh (Hardware - scoops) (Sultana et al, 2013)	0-60 0-36	Description of pattern development	Qual	Qual and comp. of trial Good desc. Of technology	No	Qual	Qual, place cleaning and tool cleaning	No	No	No	Trial of scoop device. Differentiates between solid and liquid feces. Describes risks to other children
Bangladesh (Hardware - potties) (Hussain et al., 2017)	0-36 7-36	Description of pattern development (Used to select intervention population) and applicability of the pottie for young children	Both	Qual and comp. of trial Good desc. of technology	Qual (as compone nt of potty)	Both and comp. of interventio n	Qual Place cleaning	No	No	No	Trial of potties. Describes division of labor, perceived benefits, barrers
Cambodia (Hardware –	0-60	6 month intervals.	Both	Both	Qual (as comp.	Both	Qual Tool	Quant (Incl.	No	Quant	Perceptions and beliefs of

various) (Miller-Petrie et al, 2016)		Also, description of pattern development			of potty)		Cleaning	disposal of material)			child feces Comparison of techniques leading to safe disposal Satisfaction with various products Predictors product availability within Cambodia
Bangladesh (Hygiene Promo) (Ahmed et al., 1993)	0-18	No	No	No, but part of interventio n	No	No, but part of interventio n (burying)	No, but part of interventio n (sweeping)	No, but part of interventio n	No, but part of interventio n	No, but part of intervention	Used proxy observational indicators only to indicate improvements , included clean play spaces. Changes to diarrhea
Nigeria (Blum et al., 1990)	0-60	0-12 12-23 23-60	No	No	No	Quant (just use of latrine)	No	No	No	No	Looked at provision of VIPs on change to child feces management
Bangladesh (Hygiene Promo) (Stanton et al, 1987)	0-72	No	Quant	No	No	No	No	No	No	No	Proxy indicators used – feces in compound Results inconclusive Small

											changes in behaviors from intervention.
Lesotho (Hardware-Latrines) (Daniels et al., 1990)	0-60	6 month intervals, but not for disposal, just diarrhea	No	No	No	Quant	No	No	No	No, just handwashafter mother defecation	Provision of Latrine on child feces disposal and diarrhea

Inclusion/ exclusion into the meta-review of child feces management studies:

Inclusion

1. Any study describing any stage of the child feces management process in any developing country. This includes those that discuss toilet training (may not be comprehensive) which may skew results since some of these studies only mention the ages at which this occurs and not the sanitation practices before or after toilet training.

Exclusion

1. There are multiple studies included which are summary documents of smaller studies examining feces disposal around the world using DHS/ MICS data. By splitting these summaries into their smaller studies, quantitative feces disposal would be even more represented (Approximately doubling the number of studies) Additionally, more information is available for a variety of countries on disposal on the DHS website that may or may not have been included in studies.
2. Studies on child feces management in emergencies. One study: (Denis,2015)
3. Studies found after data was collected. One study: (Ritter, 2018)
4. Guidance documents/ non orignal research including expert opinions. These do not provide original insight into the practices.
5. Child Feces Disposal may be a component of more studies examining hygiene behavior or within hygiene program interventions, but these are difficult to find as it is often not mentioned within the title. This was mentioned as an issue in the 2014 review by Majorin and the 2017 review by Morita and Godfrey. The hygiene programs targeting child feces disposal in those reviews are included as well as any others that could be found with a simple title search using the process described above. All other programs that have included child feces disposal in the intervention but not within the title have been excluded. Additional studies would likely further exaggerate the focus on safe disposal.
6. Similar to additional studies examining safe disposal, more studies on handwashing at critical times, including after disposal of child feces, are likely available. These have been excluded due to the time constraints of the study and the difficulties finding these studies as the relation to IYCFM is not mentioned in the title. If these were included, caretaker handwashing would likely be more represented in this meta-analysis.
7. Environmental studies looking at the impact of disposable diapers on the environment where disposal location is assumed in the study to be in a safely managed solid waste facility with low risk(developed countries).

Study comparisons and completeness

The chart below visually shows how different studies examine child feces management. In this chart ‘A’ and ‘B’ represent variations in practices within a given stage. This is used to represent that there may be more than one set of practices occurring in a given community for children of the same development stage. An attempt at defining these stages and their boundaries is discussed below within the child development and IYCFM studies although very few studies have attempted to define the changing practices from birth until a child can

adopt ‘adult sanitation’ practices. Due to the lack of qualitative studies, all studies describing any aspect of child feces management have been included in this review to attempt to build a broader understanding of these practices

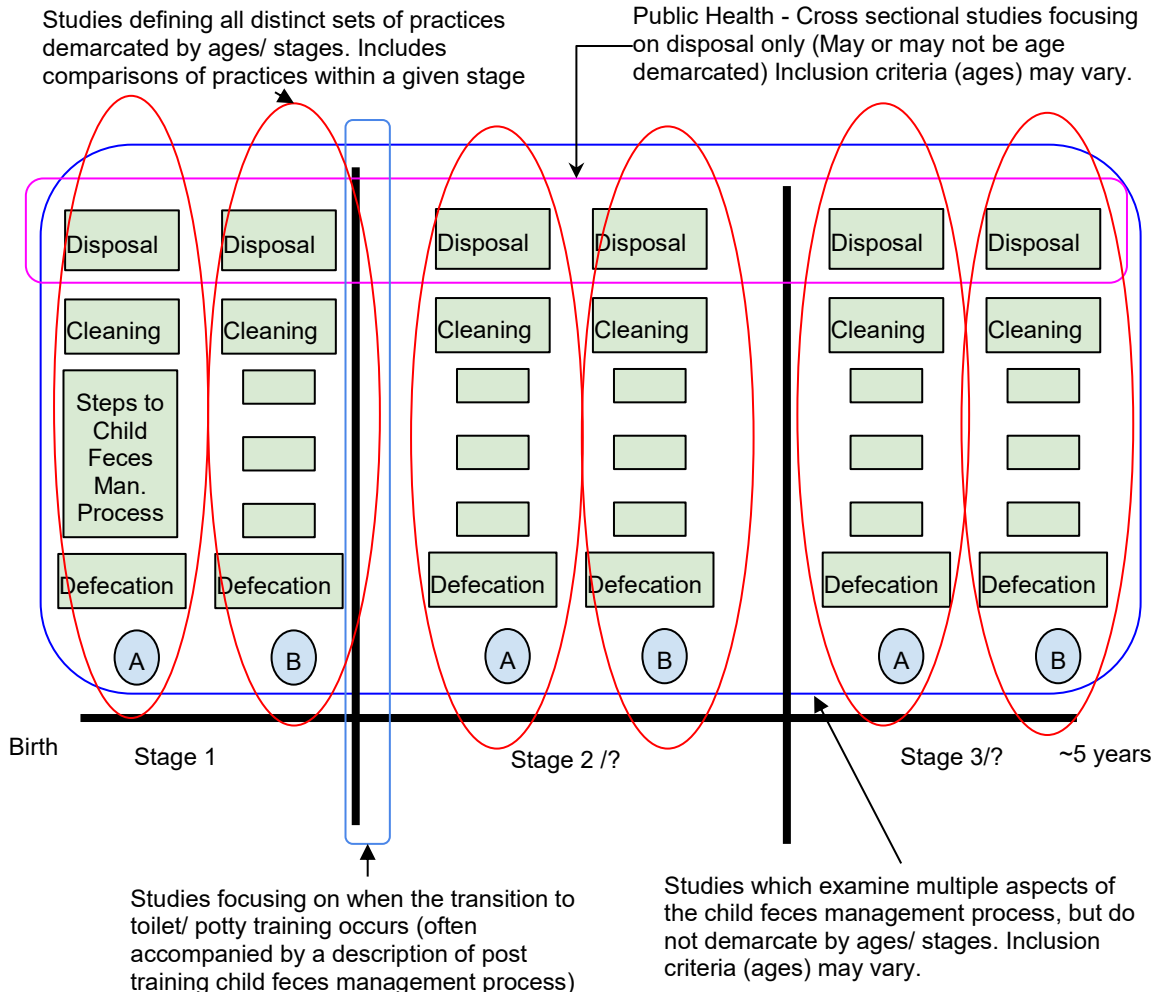
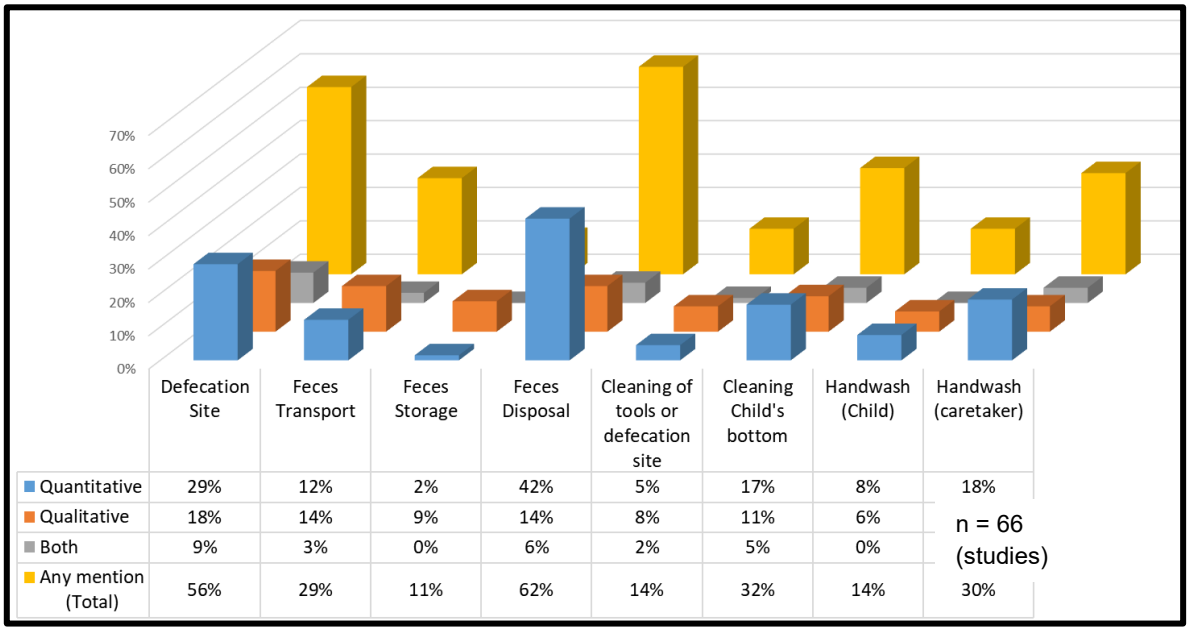


Figure 46 - Segmentations of IYCFM studies

The chart below summarizes the results of the search and percentage of studies that contain information on the process steps identified earlier to show the relative gaps in understanding of IYCFM practices.

Table 15 - Studies on IYCFM - Information collected of various process steps. n= 66 studies



	Defecation Site	Feces Transport	Feces Storage	Feces Disposal	Cleaning of tools or defecation site	Cleaning Child's bottom	Handwash (Child)	Handwash (caretaker)
Quantitative	29%	12%	2%	42%	5%	17%	8%	18%
Qualitative	18%	14%	9%	14%	8%	11%	6%	
Both	9%	3%	0%	6%	2%	5%	0%	n = 66 (studies)
Any mention (Total)	56%	29%	11%	62%	14%	32%	14%	30%

This chart and table show there is a wide range of information collected, with only a few studies considering how feces are transported from defecation site to disposal, if feces are ever stored within households, how IYCFM tools are cleaned, and handwashing. This chart also shows that IYCFM literature has focused on quantitative assessment of feces disposal. Based on the inclusion criteria, KAPs and other surveys which include feces disposal within assessments of other hygiene practices have not been included, meaning the focus on quantitative assessments is likely underrepresented within this chart. The original IYCFM research that began in the mid-90s focused on quantitative disposal assessments almost exclusively. Only recently have studies began to build a stronger understanding of the qualitative process that caretakers use to manage children's feces.

Discerning useful trends in IYCFM practices with the current fragmented information available is difficult outside of understanding geographical locations practicing safe disposal. A quantitative assessment was conducted in 2004 by Gil et al comparing the prevalence of practices across different countries and continents with inconclusive results. A summary of enabling products used in child feces management was conducted in 2016 by Petrie et al.

It is further difficult to extrapolate the results from the meta analysis as some studies focus exclusively on rural populations, others focus on urban, and still others look at peri-urban populations. Numerous confounding predictive factors add complexity to establishing useful generalities between populations. Additionally, few studies make comparisons or include more than one group across the study (see behavioral determinants below), particularly for practices other than disposal.

Evidence and examples of IYCFM process definition

The primary barrier experienced after selecting this coding method and defining child feces management practices around the world is the variability in the data collected across studies of child feces management. The literature on child feces management is largely written by the public health sector with the intention of bringing

awareness of the risks related to improper feces disposal. From this objective, these studies focus primarily on quantifying improper disposal location, and mostly do not define other practices or attempt to differentiate beyond broad age categories. Other literature, written by medical professionals or by marketing firms for disposable diapers focus on defining toilet training ages and when children stop using diapers. These do not clearly define the process used to manage the actual feces. Only a few studies attempt to define practices other than disposal. These are rarely comprehensive within the coding practices defined above and are rarely demarcated by ages or by development stages. Just a handful of studies look at defining the entire set of practices within a community and find the different stages of sanitation development as defined by the community. For these reasons, only an overview of the potential behaviors for each process step is included here without attempting to explain where in the world they have been observed

Defecation Sites

Roughly half (32) of the studies reviewed discuss defecation sites of young children**.** With considerable variation described.

A common issue with determining the defecation site in some studies is the structured methodology used by the researchers. For example, Cousens et al in Burkina Faso (1996) while attempting to link defecation sites to diarrheal outcomes for children 2-36 months asked ‘where does child defecate’ but only allowed two answers: ‘Pot/ Latrine’ (74%) and ‘Elsewhere’ (26%). Other studies use a wider variety of inclusion criteria. In Ethiopia, Ayele et al (2017) used six locations to decode child feces defecation locations: into potty (24%), diaper (0.9% - not described as disposable/ reusable), household floor (47.9%), went in yard (3.1%), went outside the premises (20.7%), went on his or her clothes (3.1%) Rush in 2008 found in per-urban Kenya that caretakers listed more than ten defecation sites for children under the age of two in their community. The four most common were potty, magazine/ newspaper, household floor/ soil beside the house, and field/ bush. Majorin et al in 2016 in India differentiated between 12 defecation sites using a combination of products and locations within and around the home.

For purposes of this study, ‘defecation location’ means the product or surface into or onto which a child defecates. If the practice is open defecation, the location within or around the home is noted.

- **Product Based (Consumables)–** A child defecates either into a hygiene product that is worn such as disposable diaper or onto a disposable surface such as a sanitation pad or newspaper. In some instances children defecate onto cardboard or paper.
- **Product Based (Reusable) -** A child defecates either into a hygiene product that is worn such as a reusable diaper or old cloth; into a potty, bowl, or chamber pot; or onto a dedicated cloth or plastic sheet. These products are intended to be cleaned and reused. In some instances, children may defecate into his or her clothes (Ayele et al, 2017)
- **Infrastructure Based –(Child Latrine)** –A child defecates into a latrine purposefully made for child sanitation
- **Infrastructure Based (‘Direct to Sanitation Chain’)** – A child defecates into a latrine or toilet. As a child becomes older, use of a latrine becomes possible.

- **Open Defecation –** A child defecates directly onto the ground. This may be inside the house, outside on the compound ground or outside the compound in a variety of places. In some instances, this is the end of the child feces management chain and the feces are left at the defecation site.

To understand the locations where children defecate, a research question was developed to inform the second research objective.

OB2_Q2	What are the range of locations where children defecate?

Feces Transport

Approximately a quarter of all studies describe some form of feces transport. For the purposes of this study 'Feces Transport' means any item or process used to transfer feces from the defecation location to the final disposal site. This may or may not be the same item used for defecation.

- **Product Based - (Directly using defecation products) –** A diaper or potty may be carried to the disposal site where feces are dumped or scraped off of the product. This may or may not also include a wash basin or storage container.
- **Product Based (Open defecation removal tools) –** For those whose children practice open defecation shovels, scoops, hoes, brooms, etc. may be used to remove the feces from the local environment for disposal. These tools may or may not be dedicated for feces removal.
- **Disposable products/ items for removing feces (from open defecation) –** In some communities where children practice open defecation other methods for removing the feces from the local environment may be used. These include leaves, sticks, paper, plastic bags, pieces of cardboard (Petrie et al, 2016) or by hand.

To assess the tools used to transfer feces, a research question was developed to inform the second objective.

OB2_Q3	What are the range of hardware options/ child sanitation enabling products used by caretakers to manage infant fecal material? (nappies, scoops, potties, etc.)

Feces Storage (Delayed Disposal)

Only a few studies have described feces storage as part of the child feces management process. For the purposes of this study, 'Feces Storage' is any time when caretakers choose to delay cleaning or disposal.

Storage may occur when caretakers are busy and do not have time to immediately empty out potties. This has been mentioned in two of the exploratory, qualitative studies conducted by Yeager in 1999 and by Rush in 2011. Also mentioned in the study by Yeager in 1999 is that since small children defecate multiple times per day, soiled diapers are stored until sufficient quantities are available for washing, typically washing once per day due to limited diaper supplies. Munguambe noted this same behavior in 2006 for households in rural Mozambique showing that these are often stored on the floor in a pile or in an empty plastic basin.

Interestingly, storage is not mentioned by Petrie et al in 2016 as a process step for child feces management, although several respondents discussed the benefits of child potties as being convenient at night, assumedly

because it allowed caretakers to delay disposal until the day. A research question was developed to assess if this practice occurred within the case study. This question ties together both the process (objective 2) and risk objectives (objective 4). The risks of temporarily, purposefully keeping feces within the home environment are not well known. This research will provide further evidence for its existence, but will not assess the level of risk from this practice.

OB4_Q2	Are there any times when feces are 'stored' within the household?

Feces Disposal

The majority of studies focus solely on child feces disposal. While some studies examine just disposal behavior, this is often a primary component of broader research such as KAP studies (Knowledge, Attitudes, and Practices), studies attempting to link unsafe disposal to health risks, studies attempting to link unsafe disposal to behavioral markers, or studies attempting to evaluate and monitor the effectiveness of safe disposal interventions. Similar to the issues defining the defecation locations, there is a wide variety of coding used across studies for feces disposal.

The WSP have published a large set of research across 26 countries based on MICS/ DHS survey data in response to the question, "The last time your child defecated, where were the stools disposed of?" (Rand et al., 2015)The report found that most of the countries had a majority of households unsafely disposing of child feces with 10 countries reporting that less than 20% of child feces safely disposed (ibid)

For purposes of this study, 'Feces Disposal' is the final location where the majority of feces is deposited by caretakers after children defecate.

- **Open Defecation (Onto ground) –** This may include feces left within compound grounds or those disposed outside the compound grounds.
- **Consumption by Animals –** Feces may be eaten by pigs or dogs
- **Into Surface Drains -** Fecally contaminated waste water may be thrown into surface drains or children may open defecate into these drains.
- **Burial –** Child feces may be placed within a hole and buried.
- **Incineration -** Feces may be burned in household solid waste pits or disposable diapers may be burned within incinerators.
- **Into Solid Waste Stream –** This includes household solid waste management and municipal solid waste.
- **Into Sanitation Chain (Latrines and toilets) –** Feces disposed within a sanitation facility is the only criteria for safe child feces management currently considered by the JMP. For a discussion on the safety of feces disposal, see IYCFM risks below.

To add to the body of knowledge of child feces disposal and to inform the second project objective, the following research question was included.

OB2_Q5	What are the disposal locations/ facilities for the fecal material (and/ or wash water and/or material on tools)?

Cleaning transport tools and cleaning defecation location

Relatively few studies make any mention of cleaning practices for the reusable products used to capture, store, or transport feces. This includes cleaning potties, reusable diapers, scoops, shovels, etc after the feces have been disposed as well as cleaning the ground after feces removal. The purpose for this cleaning is to remove residual feces and prevent fecal contamination through the vector route (flies). For the purpose of this study, 'Tool cleaning' and 'defecation location cleaning' mean any method used to remove residual feces from products or surfaces after the majority of feces have been disposed.

Tool Cleaning - There is little agreement on what to measure for the cleaning of these tools. In the quantitative studies some look if any cleaning occurs at all (Yeager et al., 2002) while others look if the cleaning method includes water and soap (Aluko et al, 2017) The qualitative information describes a range of practices used to clean tools.

Potties may be rinsed with water and/or soap and/ or scrubbed with a brush or swabs of old rags after initially removing the feces (Yeager et al, 1999). Petrie et al (2016) mentioned the same practices for potty washing including water and brushes.

Scoops, hoes, and shovels may be cleaned with water and/ or soap. Sultana et al in 2013 found that some mothers in Bangladesh reported that they 'rinse the hoe with water and scrubbed it with their bare feet.' Petrie et al, (2016) mentioned that caretakers did not wash shovels and scoops unless they considered them 'dirty.'

Reusable diapers represent a more challenging and time consuming tool to clean. Yeager et al (1999) mention that diapers are often soaked for a period of time after the initial feces are removed. After this soak, each diaper is scrubbed with laundry soap and then rinsed thoroughly.

Defecation location cleaning - Majorin et al (2017) included defecation site cleaning in her analysis of child feces management practices in an urban slum in India finding that of those who practiced the open defecation method, the ground was not cleaned in 7% of cases for preambualtory and in 12% of cases for ambulatory children. Of the cases that were cleaned, over 50% was with water only or with cowdung, sometimes in combination with sweeping with a broom. The cow dung was noted as a potential additional source of fecal pathogens (Majorin et al, 2017) Tool cleaning was not mentioned in the study. Few other studies which report child open defecation comment on practices cleaning the site. This may be because the ground used for defecation is often soil and sufficient soil is scooped with the feces to ensure that ground cleaning is not needed. (Yeager et al 1999; Petrie et al, 2016)

Similar to feces 'storage,' this research question connected objective of IYCFM process with the risks inherent within that process.

OB4_Q6	Where are enabling products cleaned, if at all? How are they cleaned?

Child anal cleansing and disposal of anal cleansing materials

There are a wide range of child anal cleansing practices. Rush (2011) collated the literature on child anal cleansing and describes the variety of cleaning methods including the use of water, water and soap, cloths, soiled clothes, the edges of used diapers, and various types of paper.

Disposing of material used for cleaning children's bottoms is not considered in many studies. Rush (2011) describes this in her study in Kenya finding this material may be disposed in latrines, but often the water used for washing children may be disposed on the compound ground and newspapers may be left in the compound and not discarded. Rags used for anal cleansing purposefully not thrown in latrines as these were seen to fill up latrines quickly so they were thrown in bushes or trash cans. Recent TIPs within East Africa by The Manoff group and World Vision International (2018) also included the disposal of these materials within their intervention. Within the study population in rural Kenya, mothers were using pieces of cloth which were then burned or 'thrown over the fence'

To better understand these practices, a research question was developed to inform the second research objective.

OB2_Q4	What practices/ products are employed for anal cleansing? Where is this material disposed?

Child handwashing

Young child handwashing is largely neglected within IYCFM literature with only a few studies describing its prevalence, generally with or without soap. This low prevalence within IYCFM literature may be due to the inclusion criteria included within this study focusing on the management of the feces and not including search terms for child handwashing in other studies. When described within literature, child handwashing occurs considerably less than caretaker handwashing (Eg. Huttly et al, 1994) Recent TIPs within Kenya found that mothers began washing baby's hands around six months to one year of age. Similar findings were reported in Somalia with caretakers reporting washing child's hands when they start crawling at 9 months. Within the Shine trial study in Zimbabwe (Mbuya et al., 2015) on reducing young child feces ingestion, recommendations are provided to wash crawling babies hands three to four times a day; however, it is mentioned that this may be ineffective and that to effectively reduce contamination risk would require washing babies' hands with 'implausible regularity.' Very little research has been conducted on this topic to better understand when children are able to wash their own hands and how to advocate for young child handwashing as part of larger hygiene promotion initiatives, especially for children too young to wash their own hands.

Caretaker Handwashing

Caretaker handwashing as the final stage of the IYCFM process is more commonly explored within IYCFM studies, generally finding a wide prevalence of the practice depending on the context. Gil et al (2004) compares these practices, but finds little difference between contexts. Practices are described as either not occurring, handwashing with water, and with water and soap. In some instances, such as in a case study in Thailand by Rauyajin et al (1994) caretakers perceive that handwashing is not necessary if feces are not touched by hands or if hands are washed while washing the fecally contaminated clothing.

To inform the second project objective a research question was added to the case study to investigate both child and caretaker handwashing.

OB2_Q6	What practices are employed for handwashing for children and caretakers?

Completeness of child development information within IYCFM Literature

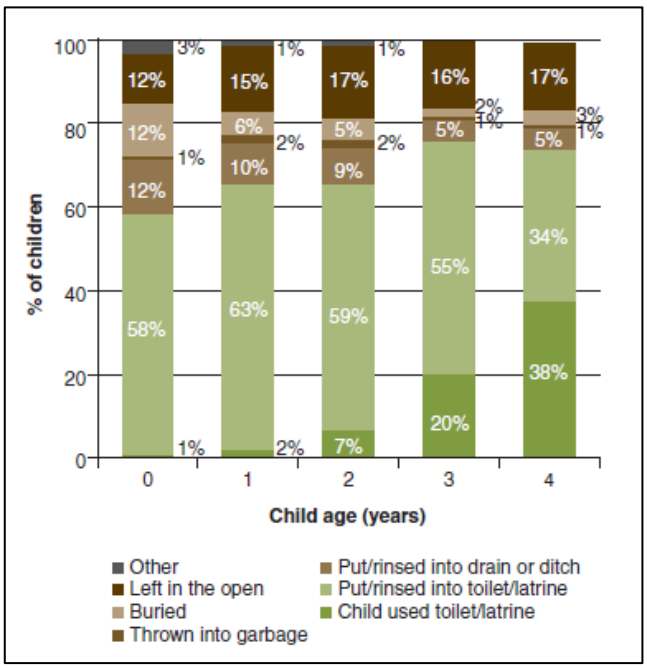


Figure 47 -(Rand et al., 2015) WSP Report on the effect of age on safe disposal in Haiti

One of the issues encountered when reviewing this literature is that there are few sources that show a broad overview of sanitation practices as a child develops. This appears to largely be a product of the methodology most commonly used, questionnaires and structured surveys (see methodology below). Most studies attempting to explain feces management for children do not demarcate between age groups and look at the longitudinal range of practices for large age groups of children (for example Aluko et al, 2017). Of those that do demarcate between age groups, most attempt to define child feces management within predetermined age brackets, rather than examine the developmental markers leading to changes in sanitation practices such as figure 50 above from the global WSP study using MICS and DHS data.. Almost all of these studies (such as WSP and all of the studies looking into disposal) draw connections between each age bracket and the likelihood that the feces is disposed within a latrine. While these are useful at demonstrating that as children get older there is an increasing chance that feces will be disposed safely in a latrine, they do not effectively describe the sets of practices used for disposing as children age. Some studies use qualitative markers such as 'Ambulatory' and 'Pre-ambulatory' to differentiate between sets of sanitation practices (Majorin et al, 2017). Only a handful of studies attempt to define behaviors from birth to adult sanitation. These examine the changing child feces management practices based on the definitions provided by the study population, explicitly recognizing the range of increasing capabilities which open up new feces management options as children gain more independence and cognition. No coding tools could be located to help define distinct stages of sanitation practices. Only a handful mention the developmental markers used by communities to begin tranistioning from one set of practices to another. To demonstate this the studies included within the previous meta-analysis were examined for consideration of child development.

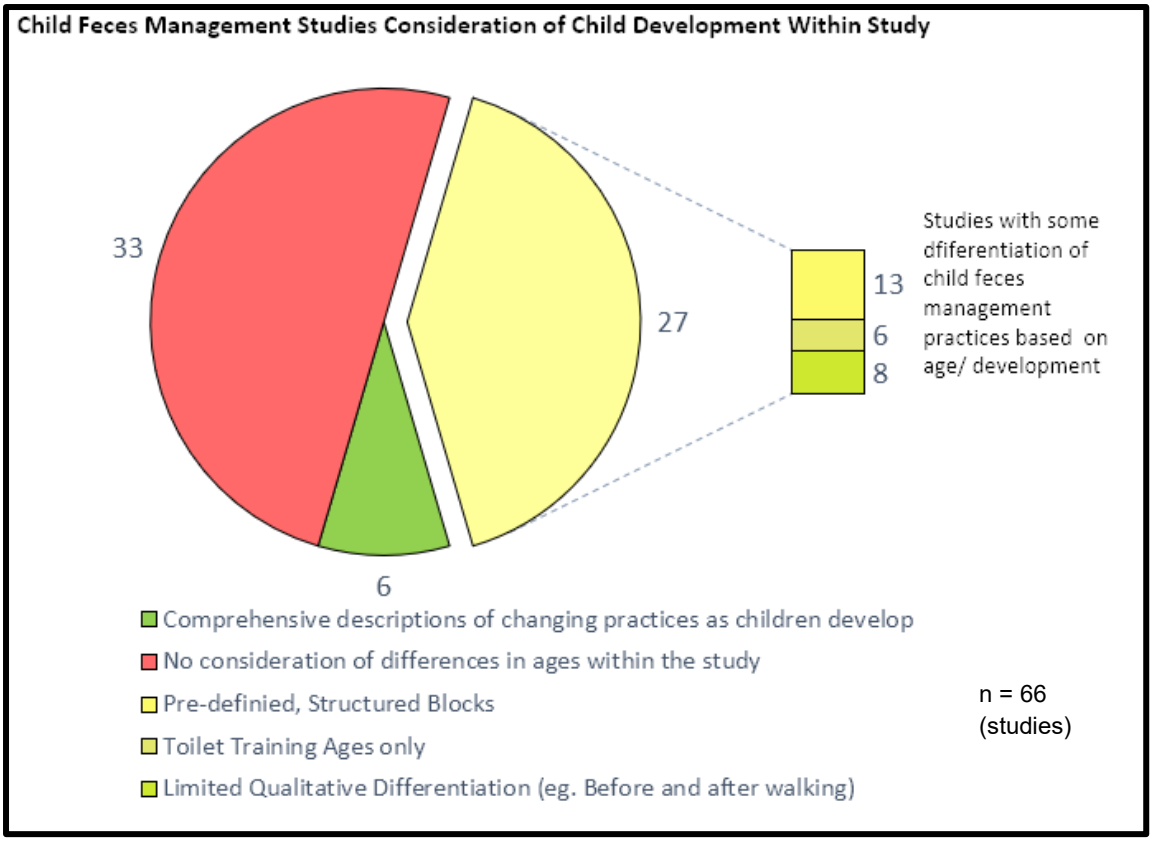


Figure 48 - ICYFM Study Considerations of Child Development Within Study. n=66

Inconsistency with inclusion criteria also make it difficult to compare across studies. Nearly half of all studies look at the feces management of children under five, some studies look at all children under 3, others all children under 2. Even differences between the age range inclusion criteria collected by the MICS (0-36 months) and DHS (0-60 months) surveys on disposal show the disparity of information collected (DHS, 2018, MICS, 2018).

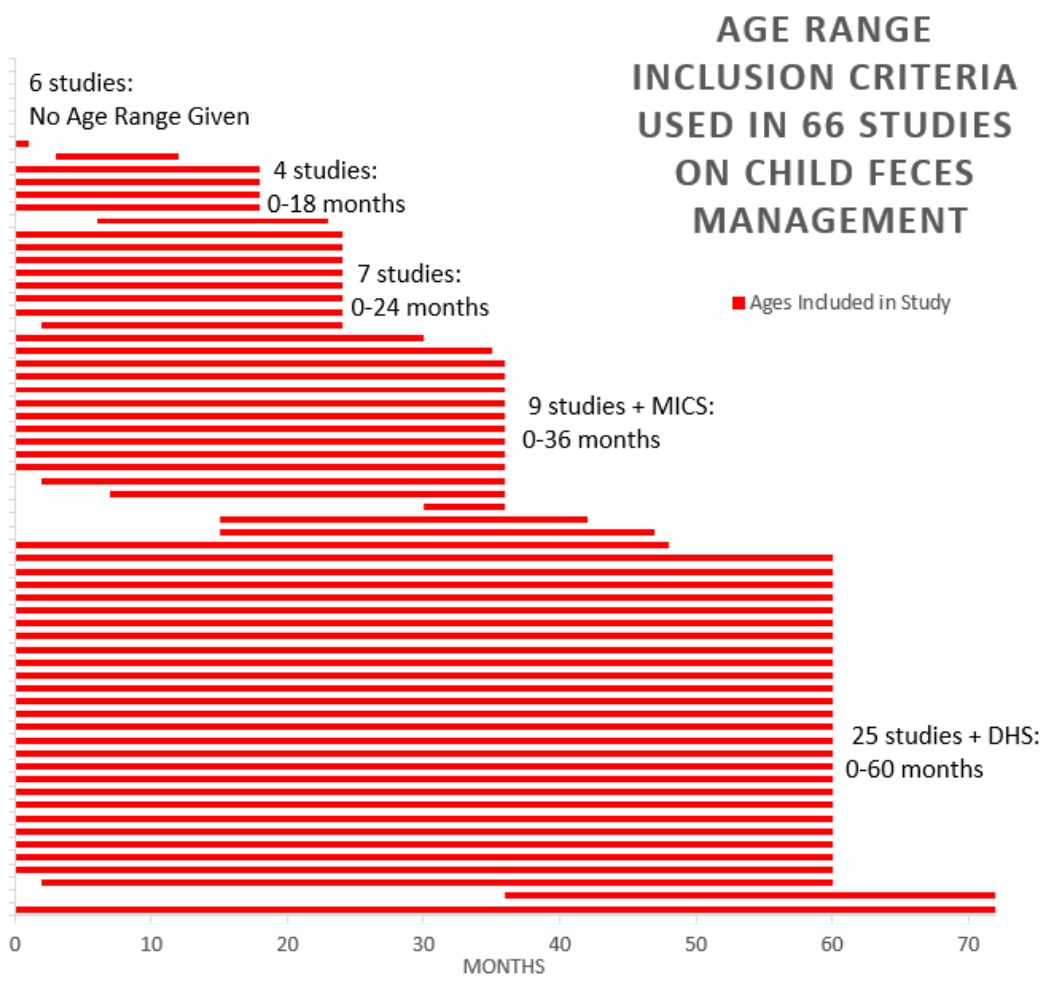


Figure 49 - Age Range Inclusion Criteria used in 6 studies on IYCFM

There are few justifications for age range inclusion criteria within the 66 studies. Cronin et al (2016) in Indonesia stated their reason for using 0-24 months in their study to examine safe disposal as a determinant of diarrhea as: “Children aged less than 24 months were chosen because of the increased risks associated with diarrhea and, due to their exposure and vulnerability, to multiple transmission routes” Similarly, Alam et al (1989) attempting to link various hygiene practices including unsafe disposal to diarrhea listed their inclusion criteria as 6-23 months based on a previous study stating these were the ages where diarrhea is the most common. George et al (2016) attempting to link unsafe disposal to environmental enteropathy in rural Bangladesh listed their criteria as 6-23 months to target children most susceptible to growth faltering. Some studies such as Traore et al (1994) conducted at a health clinic in Burkina Faso use the age range (0-36) allowed into the pediatric ward at the hospital. Most studies that use 0-60 months as age inclusion criteria appear to do so to match the 0-5 year definition of ‘young child’ used across various health and WASH statistics, although this is not explicitly stated.

While these studies had other objectives and provide useful information on a variety of topics, their limited range of ages and their focus on the disposal step of the child feces management process based on health outcomes show their diminished usefulness at describing the range of practices from birth to adult sanitation. The limited depth of information collected for each step in the child feces management chain (see above) combined with a lack of developmental demarcation within the studies and inconsistent age range inclusion show significant gaps in the body of knowledge on child feces management around the globe. Below we examine the developmental markers discussed in the literature and the transitions in sanitation practices.

I.5 Annotated Bibliography on Sanitation Transitions

Quoted frequently in the literature for child feces management, deVries and deVries (1977), conducted a study in Kenya on the cultural relativity of toilet training. Bladder and bowel control training began at 2-3 weeks through a process of body positioning and operant conditioning 'shushing' noises. As the child developed, caretakers identified signals from the child and brought the child outside of the house to defecate onto the ground (AITT). By 4-5 months of age, nearly 90% of caretakers reported children were successfully 'toilet trained;' although in this context this was used to indicate that the child had sufficient bladder and bowel control to successfully defecate at appropriate times, in more convenient locations, with minimal accidents.

Other, less formal reports in the anthropological book, 'Imagined Healthcare Guides in 7 countries, Gottlieb et al (2017) describe early bowel and bladder control training in The Ivory Coast starting 'the day the umbilical cord fell off.' This bowel and bladder training involved the use of an enema twice a day to develop consistent defecation timing to reduce accidents (Operant Conditioning). Once a child is a few months old it is expected to have daytime bowel control.

In China, toilet training is reported as starting early by Western standards (Thaman and Eichenfield, 2014) . Gottleib and deLoache (2017) describe imagined advice to Chinese mothers:

'You should begin to toilet train the baby as soon as possble, watching his or her facial expressions to determine when he or she is pooping, and making shushing sounds to encourage him or her to pee when held over the potty. A baby's genitals need to breathe, so the best ways to toilet train are the traditional ones in which a baby wears split-pants, with a cloth in between to catch excrement if possible. Since most houses are tiled and it's totally appropriate for babies to pee overa tree or poop on newspaper beside the road, don't worry too much about accidents as these are part of learning. Baby poop and pee aren't dirty, they're part of life, and babies will quickly learn how to care for themselves if you reinforce these traditional ways of toilet training"

In Burkina Faso, Val Curtis et al (1995) described how infants defecate into linen (either wrapped around the child or laid on the ground) until they can hold up their heads (at approximately 4-5 months). At this time, children's defecation is scheduled with enemas to allow the mother to better control when and where the defecation occurred, most often into a pot (Operant Conditioning). The 50% reporting pot use from birth in the quantitative portion of the study was not explained in the qualitative sections of the study; however, the chart below shows how defecation locations changed as children developed bowel control and increasing capabilities. In Burkina Faso, Curtis et al found that between the ages of 2-8 years children are not trusted to use a communal latrine without dirtying and danger of falling into the pit.

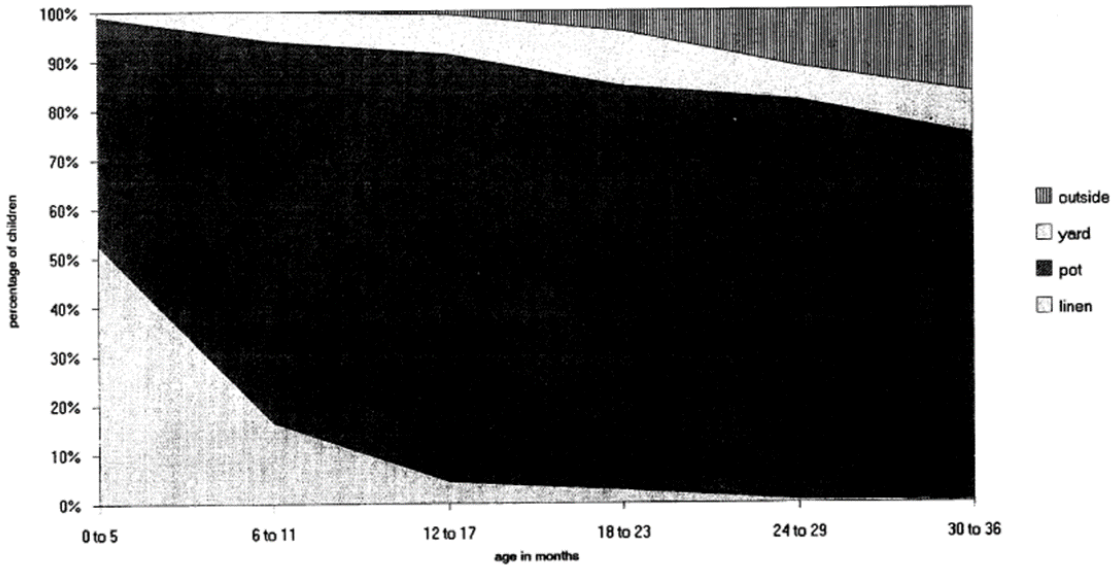


Fig. 3. Child defaecation behaviour among 2779 children aged 0–36 months by age, Bobo-Dioulasso.

Figure 50 -Curtis et al, 1995 Changing sanitation practices as children age

Solarin et al in 2017 noted that in Southwest Nigeria most families were using the assisted infant toilet training method, even among higher income and higher educated families. Most caretakers began training under 1 year with many children achieving the same results as the Kenya study under 12 months. Another 2017 study in Southwest Nigeria by Aluko et al found in their quantitative study that 94% of respondents agreed with the statement: 'Since infancy, under five children should be potty trained.'

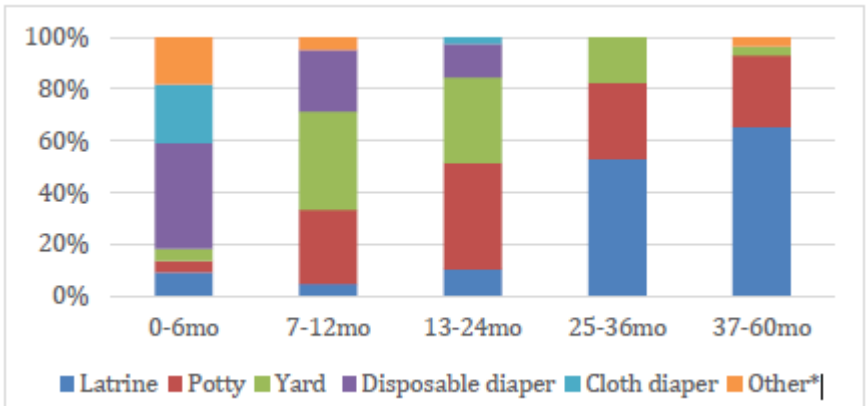


Figure 51 – Miller-Petrie et al, 2016 - Defecation Sites by Child Age in Cambodia

In Cambodia, Petrie et al (2017) did not describe any bowel control or toilet training practices, but found significantly decreasing reliance on disposable and cloth diapers by the time children were one year old with nearly equal splits between open defecation in the yard and potty use. This indicates that some form of early training is likely practiced. Latrine usage gradually increased until it was used for the majority of defecation events between 25-36 months. The average age caretakers felt a child could use a latrine independently was 5 years with consistent use achieved by most children in the community at age 7.

Majorin et al (2017) reported for slums in Odisha, India that the median age that caretakers with private and shared latrines perceived children were ready for latrine training was 3 years. For those with communal latrines this age was 4 years old. Independent sanitation was expected to be achieved by age 5 for those with private or shared latrines and by age 6 for those with communal or no latrine. Other developmental markers were not discussed as part of the study and it is not known if any early bowel control training is prevalent.

In rural Bangladesh, Sultana et al (2013) conducted focus group discussions for a pilot of an improved scooping tool. It was found that very young children defecated into a cloth wrapper or onto the mother's clothes until they began crawling at approximately 6 months. Once the child started crawling until they were approximately 3 years old, they defecated on the ground in the courtyard or within the house. Around 3 years old was the age commonly considered as appropriate for children to start learning how to use household latrines. Another pilot project for child feces management tools in Bangladesh by Hussain et al in 2017 found that caretakers considered ages 6-7 months as a good time to begin using plastic potties as this was the age when they were able to begin sitting up.

Also in Odisha, India, Routray et al (2015) described the training process for young children.

Infants and very young children (toddlers) are made to defecate inside the house or compound on a paper or cloth, or directly on the ground, depending on the extent of their mobility. Their faeces are usually disposed either in the waste/garbage pit, or a vacant plot next to the house. When the faeces is watery and cannot be separated from the cloth, the same is rinsed and then washed in water bodies.

Mothers train the child to defecate at an early age, by being made to sit on the mother's feet and squat. Later as they become older, they are taught to squat on bricks instead of the feet. A few mothers used a potty (a plastic portable squatting pot, designed especially for children) and the stool collected was disposed of in a vacant site close or next to the house.

Duong et al in 2013 describe the ongoing development of children's bowel and bladder control ability in Vietnam and the influences on toilet training. All mothers started potty training around three months, learning to recognize the signals that the child needed to defecate or urinate and also using a whistling sounds and defecation positions (AITT + Operant Conditioning). By six months the training was allocated to a family member while the mother worked out of the home. At this age, the children had a regular schedule of potty use at opportune times. By the time the child is 24 months the child is expected to handle all of their toileting needs except for removing difficult, tight clothing and help with some anal cleaning and drying.

In peri-urban Peru, an often quoted study conducted by Yeager et al (1999) describes a mixture of early and late potty training practices. Most caretakers waited until the child became more 'independent,' a word defined by range of development markers such as "able to walk or sit by himself, or indicate that he needs to defecate, or when he has an established defecation schedule." (Child Oriented Approach) This was generally between 12 to 18 months old; although some mothers delayed potty training until summer regardless of age as it was perceived that the diaper provided additional, needed warmth. Others began to hold their child over a potty at around 2 months old when the child was most likely to defecate (AITT). In this context, for both groups, nearly all young children used washable, reusable diapers of some form. The inconvenience, workload, and water demand of washing these products was cited as a strong driver to begin potty training. (Yeager et al, 1999) The

caretakers in this study stressed that potty training was a process that requires a gradual reduction in reliance on diapers during increasing potty usage. The transition from potty to toilet typically occurred at around age 4 for families with access to both potties and toilets. For families using latrines, the age to begin using was reported as the same. Both of these groups reported continued assistance for child defecation for an undefined period of time. For families practicing open defecation, age three was reported as the typical age when children stopped defecating within the compound and were taught to use the ‘adult’ open defecation site.
Gottlieb et al (2017) also report Palestinian women starting to potty train at about fourteen to fifteen months old, but did not mention a method.

In Kyrgyzstan, Biran, Tabyshalieva, and Salmorbekova (2005) reported that children were expected to begin using a latrine about the time they start school (age 6) as latrines were considered unsafe for children. Transitioning practices before this time were not explained as part of this study.

Routray et al (2016) found similar results in India stating “Mothers do not find toilet designs to be safe for young children to use on their own, and they delay training the child to use a latrine until they are about 5 years old.”

In Iran, (Hooman et al, 2013) found toilet training methods split between child oriented approaches (52%) and intensive, dry pants method (44%) with roughly half of all children gaining continence before 24 months. The average independent toileting age was 28.8 months for females and 33.5 for males.

Five studies were found that compared differences in toilet training ages. Three of these papers compare these differences in a high-income setting. The first was conducted in Hartford, Connecticut, USA by Pacter and Dworkin in 1997 as a portion of a larger study comparing parental opinions on the ages when children should reach various milestones of child development. Significant cultural differences were found in perceptions of child development and caretaker roles, notably between collectivist and individualist cultures. Beginning ‘toilet trainable’ ages varied significantly between ethnic lines, from 20 months for African Americans to 28 months for European Americans. Another study was conducted within Washington DC in 2006 by Horn et al. This research also noted the largest differences in toilet training ages as those between ethnic lines. African American families began toilet training on average at 18 months and Caucasian families began at an average of 25 months. Both of these quantitative studies were significantly limited in their descriptive ability and note that ‘no explanations are readily apparent' in the toilet training ages. (Pacter and Dworkin, 1997)

A paper written by Schum et al (2002) examined the gradual acquisition of toilet training skills by children in a largely wealthy, European-American study in Milwaukee, WI. Interestingly, it was stated that the study largely consisted of white children because the criteria for the study excluded the minority populations who began potty training much earlier (around 15 months). The study showed that there was significant variation in the acquisition of skills and reinforces the concept that developing continence and successful toileting skills is a sequential process with steadily decreasing dependence on caretaker support.

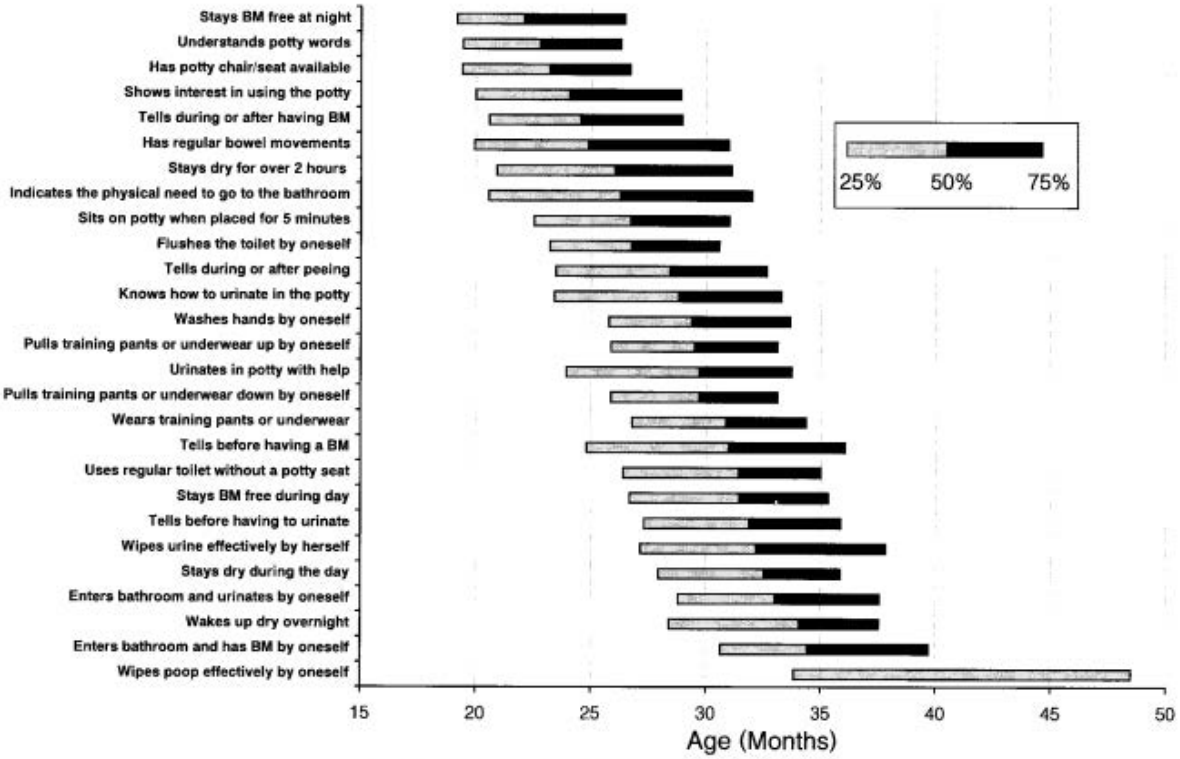


Fig 1. Age of attaining toilet-training skills—girls.

Figure 52 – (Schum et al, 2002) Attaining toilet training skills

One paper was found that provides a high level comparison of toilet training ages between countries. This study focused on middle and upper income countries, by Thaman and Eichenfield, (2014) as consultants for Procter and Gamble, a global diaper manufacturer. While the data for the study is sourced from unpublished Proctor and Gamble market research which may question its academic integrity, it suggests there is a great variation within toilet training practices and ages around the world (see chart on the right). Other market research was found, but is placed behind paywalls and was therefore not included in this study.

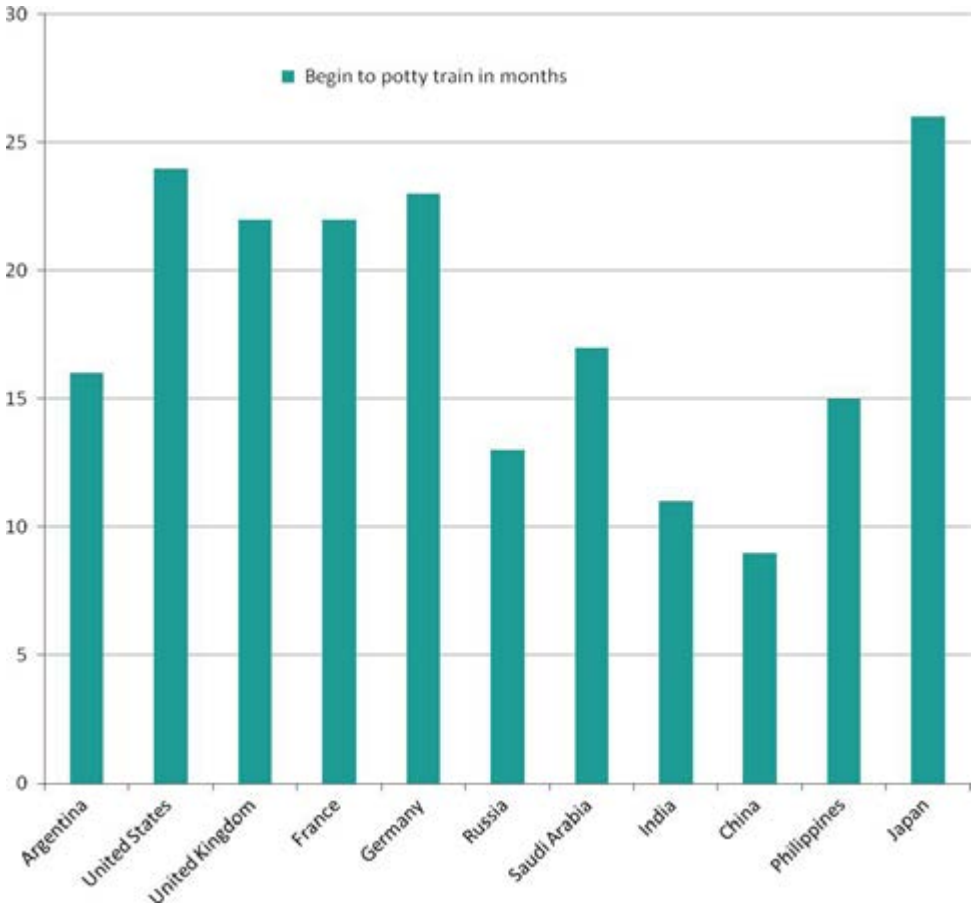


Figure 53 – (Thaman and Eichenfield ,2014) - Comparison of a selection of middle and high income countries potty training ages

One other study, conducted in Brazil by Eduardo and Machado (2011) compared a number of factors to toilet training ages. In the study area, disposable diapers were the primary child feces management tool used by parents and the ages to begin toilet training varied considerably. The age brackets used to delineate the population made the results difficult to interpret. 31% began training before 18 months, 58% began between 18 and 30 months while 11% began greater than 30 months.

I.6 Annotated Bibliography for Behavioral Determinants

1994 – Peru – Periburban (Huttly et al., 1994): Observational, largely quantitative research into handwashing and defecation practices found that those who used potties more consistently disposed of children feces into a latrine than those who used other defecation locations. Significant water stress was mentioned, but was not compared to either handwashing or child feces disposal; however, child anal cleansing was reported as 90% paper with no soap and water.

1995 – Burkina Faso – Urban (Curtis et al, 1995): A quantitative study using household interviews to explore predictive factors for various hygiene practices. This study found the most significant factor associated with safe disposal was the presence of a domestic water connection. The authors attempted to explain the apparent link between water source and stool disposal by saying that women would have more time to manage these hygiene activities if they were not spending time gathering water. They also hypothesized that mothers with water on plot may have an increased level of hygiene behavior due to the convenience. Other comparisons with water on plot found that mothers were twice as likely to wash their hands after cleaning a child's bottom and twice as likely to immediately wash cloth diapers without storage. The study found that those using child potties were 26 times more likely to dispose of feces in a latrine than those not using potties. Weaker correlations were found relating socio-economic status and education to improved disposal.

1997 – Burkina Faso – Urban: Following up from the 1995 study, a methodological assessment determined the researcher effects for observational methods on child feces disposal behavior. It was found that structured observations may be useful for population level behavioral research, but due to the high variability in practices may lead to 'misclassification' if only one observation occurs. (Cousens et al, 1997)

1997 – Phase 4 DHS begins. This is the first DHS to include an indicator on the disposal of children's stools. (DHS, 2018)

1997 – Zaire (DRC) (Manun'Ebo et al., 1997): A continuation from the Burkina Faso team, a methodological assessment determined that hygiene behaviors (including child feces disposal) was generally over reported in surveys when compared to observations. The authors hypothesized that mothers over-report 'desirable' behaviors.

1999 – Peru – Periurban (Yeager et al., 1999): A continuation of the work by Huttley et al in Peru (1999), the first qualitative study was conducted to deeply explore child feces management behaviors in a specific context. A

number of factors influencing behaviors were discussed. Proximity to convenient locations were reported as an influencing factor to safe disposal. Time constraints and the practicalities of washing multiple diapers per day lead mothers to store diapers until sufficient quantities had been soiled. The inconvenience of washing diapers led mothers to attempt training as early as possible. Increasing foul smells from changing diets (at around 6 months) influenced when mothers considered the feces to become more dangerous and (dirty) and also lead them to begin potty training. Potty design also played a role in their acceptability by children. Round bottom potties were found to cause children to fall over and reject the potties. Additionally, stressful events and aggressive potty training were also found to influence children's potty use and those that experienced a stressful event often regressed back to diapers or defecation into clothes. Rejection of potties was also reported to lead to increased open defecation of children. Inconvenience was once again a factor in storage of feces within potties with some mothers reported to leave feces until it was convenient to dispose of them. For this reason, potties with lids were preferred to prevent flies. The researchers found that between those using potties and those who did not was due to convenience of not needing to wash a potty and it prevented judgement when walking past other homes with a potty in hand for disposal. Those who had recently migrated from rural areas were reported to continue using open defecation 'rural behavioral patterns.' Open defecation was considered more acceptable within the home than outside as it was less of a public embarrassment from neighbors. Anal cleansing was exclusively from scrap paper products. Water stress was once again reported as high and toilet paper was considered too expensive to use on children. Parents reported delaying toilet or latrine use for children due to children being afraid of falling and risk of disease from adult feces and urine. A microtrial for mothers to try a child-centered approach to potty training was found to be successful in eight out of eleven families, even for those that had previously rejected potties.

2004 – First review of child feces management literature by Gil et al.

2004 – Pakistan – remote rural village (Halvorson, 2003). An in depth, qualitative look into women's hygiene behavioral choices in the home environment was conducted to inform future hygiene promotion. Although child feces management was not the focus of the study, a few behavioral factors were discussed on this topic. Wash water from diapers was often dumped into gardens or fields. This was attributed to convenience and water scarcity. Children were also instructed to use sticks and small rocks for anal cleansing, apparently from water scarcity. Soap was considered a luxury item and was therefore rarely used for handwashing after defecation. Knowledge of concepts such as 'germs' was high, but did not appear to transfer to topics such as child feces management. Competing internal, household priorities and low women's empowerment lead many women to feel powerless to make improvements in household hygiene.

2005 – Kyrgyszstan – rural (Biran, Tabyshalieva, and Salmorbekova, 2005): A mixed method study into hygiene promotion to inform future hygiene promotion very similar to the 2004 study in Pakistan. Use of latrines was discouraged for children as they were seen as dangerous. Open defecation was discouraged in front of the house as this was considered shameful, but behind the house, in the gardens and fields were considered acceptable places to defecate and dispose of feces. Removal of child feces from the home and yard was attributed by participants due to smell and because child feces were dirty. Improper feces disposal outside of a latrine was explained by participants as due to time constraints, lack of will, and the far distances to latrines.

Handwashing after child anal cleansing was low, especially with soap. This was discussed in length as a result of multiple factors: the expense of soap, lack of convenient water supply, cold temperatures in the winter, and the perception that hands would be cleaned while the child was being cleaned. Similar to the study in Pakistan, competing internal household priorities were reported when buying soap.

2005 – MICS 3 begins (MICS, 2018). This is the first Multiple Indicator Cluster Survey to include an indicator on the disposal of children's stools.

2006 - Mozambique (Munguambe, 2006): Munguame found in a large, multivariable quantitative study that the strongest predictive factor for increased safe disposal was higher family socio-economic status. No descriptive qualitative information was provided.

2011 – Kenya – Peri-Urban (Rush, 2011). This study used structured observations, questionnaires, and focus group discussions to explore child feces management behaviors. Four defecation sites were compared in focus group discussions. Mothers considered potties as the best defecation site for young children quoting ease of use, ease of cleaning, and facilitation of learning for the child on the importance of proper sanitation. Some respondents described how potties led to storage as it was inconvenient to take the potty for disposal. In this case, potties were covered to prevent flies. Magazines and newspapers were discussed as a defecation site. Some mothers thought they made IYCFM easier as they could be folded and easily disposed. During diarrheal episodes these materials made disposal difficult due to thin material. Defecation within the home was generally disapproved by all respondents as it was shameful, especially when guests were present, and it made cleaning difficult. Open bush was disfavored by some mothers as they feared their children would come into contact with other adult's feces, but favored by some because it was less work to clean. Cleaning methods for children were mostly through rags and old newspapers when available and leaves when not available. A difference between practices during diarrhea was mentioned; mothers typically then swapped to water (with or without soap). Tissue paper was considered prohibitively expensive for child anal cleansing. These materials were primarily disposed in the latrine, except for rags to prevent the latrine from filling up faster. Disposal in the peri-urban setting was described as hindered from the crowded conditions. Mothers would not dispose of another child's feces and could not distinguish between children's feces. Presence of flies and smell were strong motivators to removal and disposal. Protection of children playing in drainage ditches prevented some mothers from disposing in those locations. Access to locked latrines, poor maintenance, and poor cleaning were all cited as barriers to safe disposal. Handwashing knowledge was shown to be high in the study, but was shown to be low. A number of explanations by participants were given: distraction and perception that washing clothes afterwards would clean their hands sufficiently.

2013 – Rural Bangladesh (Sultana et al, 2013): Potties were seen as too expensive for most families so agricultural hoes were generally the primary IYCFM tool used. Tool cleaning influenced by child feces smell once children begin eating solid foods. Feces were thrown into the bush beside the house as opposed to the latrine as this would block the toilet pipe. Difficult to scoop feces with the hoe when feces were watery.

2014 – Rural India (Majorin et al., 2014): Total Sanitation Campaign had not led to significant improvements in safe disposal. Only households with latrines safely disposed of feces, but this was still uncommon. Households with an extended history of latrines were more likely to safely dispose. Those with water on plot were more likely to safely dispose. The use of potties or nappies as opposed to OD methods were weakly associated with safe disposal; however, these were also generally unsafely disposed.

2015 - Ethiopia desk study (Azage and Haile, 2015): focused on identifying safe disposal predictive factors based on DHS survey data. 'Being an urban resident, having a higher wealth quantile, high levels of maternal education, older child age, having a lower number of under five years old children, and the presence of an improved latrine were factors associated with safe child feces disposal practices.'

2015 – WSP (Rand et al, 2015): WSP conducted a series of child feces management studies based on DHS and MICS data and focusing on feces disposal. Three global trends were found by comparing other categories of DHS and MICS data. Safe disposal was less prevalent in rural areas, poorer families, and in families without latrines.

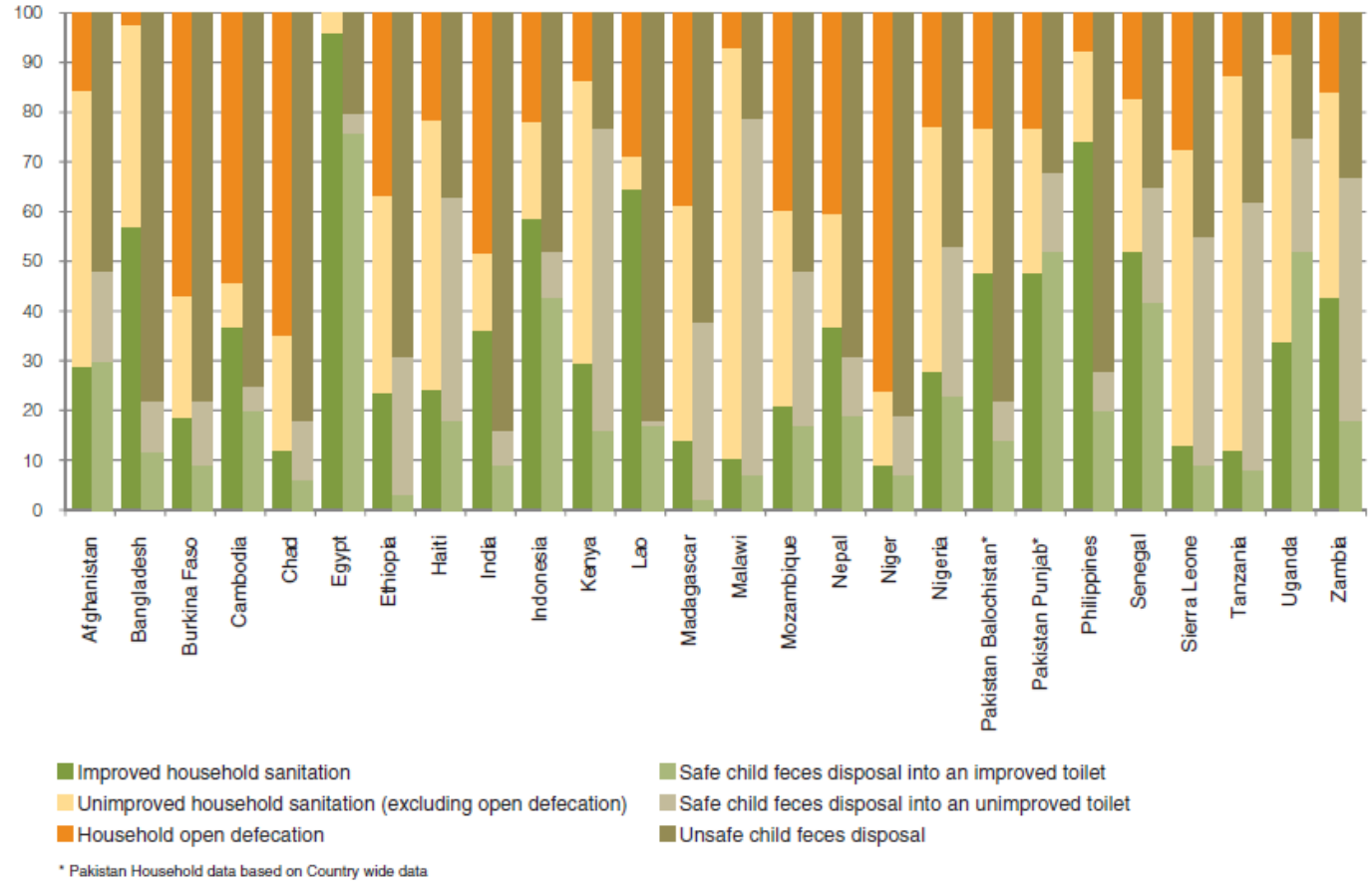


Figure 54 Rand et al (2015) - Household Sanitation impact on safe disposal

2015 – India – Rural Brahmin class as described succinctly by Routray et al

"Faeces of children above 3 years are considered impure as by that age, the child starts eating rice and the faeces smell. Mothers develop a disgusting feeling for it. For a baby who defecates on the ground or floor, the mother may pick up the faeces with straw or other old materials and dispose of it in the bush or the waste/garbage pile. Mothers are unaware of the need for safe disposal, or of methods to do so, and prefer to avoid changing their own clothes which would be necessary if they entered the latrine to dispose of children's faeces or help young children use the latrine. It is more convenient for them to throw these faeces on vacant land next to the house or in the backyard, and have young children defecate outside… Making or helping a child use the latrine and then having to flush it, is considered more time consuming for mothers as it requires extra effort including her own purification after entering the latrine. Therefore, they find it more convenient to have the child defecate in the back yard and throw the child's faeces into a garbage heap, than to have them use or dispose their faeces in the latrine. Women felt it is more convenient if children defecated on the road side or in fields, and then cleanse themselves in the public pond or another open water body in and around the village."

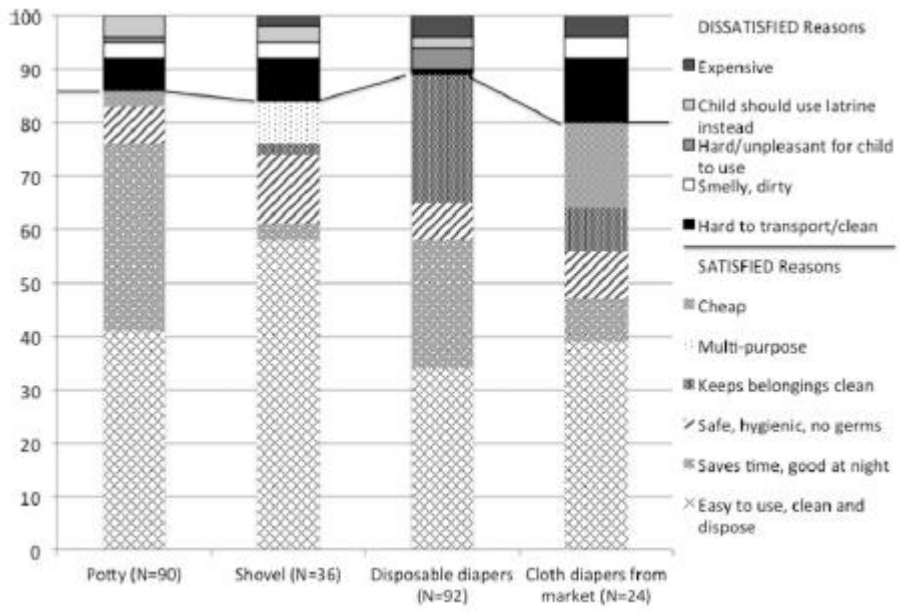


Figure 55 –(Miller- Petrie et al, 2016) - Satisfaction and Dissatisfaction with IYCFM enabling products

2016 – Cambodia

(Miller-Petrie et al., 2016) found that defecation location had a large impact on disposal location with those using potties much more likely to dispose in a latrine than those using scoops and shovels as seen in figure 58 to the right. This was explained as likely due to the prevalence of pour flush latrines and the fact that the dirt from scooping would cause these latrines to clog. The study found that households with a longer history of latrine ownership, more consistent adult latrine usage, and older caretakers were more likely to hygienically dispose. Those with younger children and without IYCFM tools were found to dispose of feces safely less often. Some families were using disposable diapers from the increased convenience, especially at night, but found they were rarely disposed of hygienically. Most caretakers used cloth diapers due to the cost, but found these were often not washed and disposed in the latrine. Suggestions were made for incorporating messaging for wash water disposal into future hygiene messages. Suggestions were made for product design changes. Case study area had high latrine coverage and most families had on plot water supply. These were suggested as conditions favorable to the safe disposal within the study.

2017 – Southwest Nigeria (Aluko et al, 2017) examined a number of behavioral determinates on the child feces management chain. Knowledge of safe child feces management was high throughout the study, but it was found that unsafe practices were just as common in those with knowledge of safe child feces management as those who had poor knowledge. Knowledge was assessed with a series of agree/ disagree questions on the necessity to perform various actions in the IYCFM chain. Another significant finding of the study was that child feces management practices were considerably safer during the night than during the day (19.7% vs 69%) The study did not offer a qualitative description. Other data was collected as part of the study such as distance from household to toilet and distance to water sources, demographic information, etc., but unfortunately their effect on child feces management practices was not assessed. Subsequent studies using the raw data from this study may be useful in determining the effects of these factors on safe IYCFM.

2017 - Ethiopia (Ayele et al, 2017) Used a cross sectional questionnaire to find behavioral determinants for safe disposal. Comparison of raw data and conclusions suggest inconclusive results.

2017 – Papua New Guinea (Kamundi, Kearton and Souter, 2017) – Formative Research to explore the behavioral determinants for 'infant feces management' (0-5 years) in alignment with the Sanifoam framework. Women reported that placing feces within the latrine was more convenient than other methods because otherwise dogs and other animals would spread the fecal matter throughout the community. Access to reliable water sources affected practices, particularly during the dry season, leading many caretakers to wash reusable cloth diapers in surface water and skip handwashing. Wastewater disposal was also commonly reported as disposed within surface water. Disposable diapers were commonly used at night time and when caretakers were travelling since they are more convenient. The high price for these items led most caretakers to use reusable diapers most of the time. Access to funds and competing household priorities for hygiene products such as soap reduced caretaker's ability to practice hygienic practices. IFM practices were largely not spoken about within the community as it was seen as a private "women's" issue so no social norms around the practice existed. Nurture determinants were found to be strong motivators for mothers to allow children to smell and look nice and healthy. Knowledge did not appear to be a large barrier to safe management within the case study communities.

I.7 Informal Aid Filling Gaps in IYCFM in Emergencies

An interesting component to infant sanitation in emergencies that has not yet been addressed by academic literature are the contribution efforts of the 'informal aid sector'. When searching for infant sanitation in emergencies on internet search engines a number of websites were found featuring stories and fundraisers for small charities or individuals within the global North providing both disposable or washable diapers to refugee camps. While these are not academic or professional in nature, their qualitative information when collated may provide useful indicators of the shortcomings of IYCFM in emergencies.

These appeals, often accompanied by shocking, exploitative images of refugee children in overloaded diapers (Don't Hate Donate, 2016), demonstrate that for many, the thought of a child going without

sufficient diapers is not considered an environmental health hazard, but an emotional subject. The appeals often include phrases such as:

“I feel strongly about helping these poor families with babies….the lack of clean baby diapers is causing innocent infants to live in unsanitary and painful conditions” (Griffith, 2017)

Figure 56 - (Riuz-Grossman, 2016) A woman changes a diaper during transit

Others point to (anecdotal) current deficiencies in the camps:

“There is a huge need for disposable diapers in these camps. The inability to wash reusable diapers, or old clothes used as diapers, had led to outbreaks of diseases and illness in children and families in the camps.” (Religious Freedom Coalition, 2017)

“One in 10 women attempting to travel to safety are pregnant, and often alone. These women have next to nothing to prepare them for the arrival of their babies and it is our aim with our new project to provide them with essential items for the first crucial weeks after birth...We’re raising money for nappies, wipes, pads and nappy cream. All the little things that we take for granted when we have a baby but that are in incredibly short supply in the refugee camps.” -(Sansom, 2016)

These points raise questions regarding the adequacy of NFI distribution through formal emergency response channels. If diapers are needed at the frequency mentioned above, and if the NFI kit standards are mentioned above, and if the risks for improper disposal mentioned above are not being mitigated, what is the purpose of an inadequate distribution?

While these donations are often ‘funneled’ through large, international NGOs, they can also take place less formally and directly provide aid to refugees (see example above). This represents an opportunity of support to the refugee population, but may pose challenges to engineers and camp planners who may be unable to support either the water requirements for reusable diapers or the solid waste management of disposable diapers. Many of the appeals mention that they themselves are parents (Griffith, 2017). There is little information on ability of NGOs to coordinate these donations on the ground, and any conflicting information or product distribution may pose challenges to the formal aid sector in providing coherent infant sanitation solutions, especially in highly publicized emergencies with more informal actors.

Partnerships between the informal aid sector and formal aid sector
Amy Peake, a mother from Cornwall became concerned with multiple issues of hygiene and sanitation in refugee camp. Here is an excerpt on a project in Jordan at the Za'atari camp.

Meanwhile, she has been working on a second pilot project, to produce re-usable nappies for babies, children and adults. These don't need special machinery, just sewing machines, which she is buying now. A manufacturer in Turkey sold her the materials needed to make up to 40,000 nappies, at a 'ridiculously good price'. 'He put a nappy factory in a container and sent it to the camp.' (Peake, 2017)

The project has the backing of the United Nations High Commission for Refugees (UNHCR) and will be run by the Norwegian Refugee Council (NRC). 'The UN have given us a massive tent, their old gas distribution centre. The floor is being concreted this week. The cutting tables and sewing machines will be in portakabins. UNHCR will pay 15 of the most vulnerable women – heads of households who are caring for their families alone – to do the work.' While she was in Za'atari in April the first prototype nappy was produced and, by the time you read this, the factory will be running." **–** *(ibid)*

Although a complete study of these informal structures and emergency responses has not been completed here, it appears as if there is a disjointed set of priorities in some settings where infant sanitation is not considered an environmental health issue, but as an individual health issue and a parental support. While the current guidance for engineers and humanitarian professionals focus on preventing the spread of disease through proper excreta disposal, the small charities and individual parents often focus on individual issues surrounding diaper care more often associated with western contexts, those such as convenience and pleasantness (see above). Others mention individual medical issues such as diaper rash, chafing, bladder infections, yeast infections, etc. (see above)

Engineers and humanitarian professionals attempting to implement sanitation solutions and hygiene promotion might find value in viewing the situation from the perspective of these parents concerned for the health of their individual child rather than the health of the entire camp. This may include considering if implementing nappies might introduce more individual health problems than communal solutions if not promoted properly in areas where they are not well understood. Additionally, programming and services (such as solid waste) may need to take into account that child sanitation products may be entering the camp through structures other than those provided within NFI and introducing environmental health risks.

I.8 Complete Literature Review Gaps in Child Feces Management

Non-Emergency	Research Gaps and Questions Identified [NON-EMERGENCIES]	Source of suggestion
NE.1	Research to better understand caretaker management practice	(Gil et al., 2004) + (STC, 2016)

NE.2	Research into the risks of various behaviors to determine what is actually safe or not and to better compare across studies	(Majorin et al, 2017) + (STC, 2016) + (Bain and Luyendijk, 2015)
NE.3	Studies to connect safe disposal to positive outcomes of child health	(Majorin et al, 2017) + (STC, 2016)
NE.4	Studies are needed investigating the acceptability of the interventions proposed, namely trials that investigate acceptability of potty use by children between 1 and 5 years, and acceptability of different forms of hand-washing facilities in the homes.	(Munguambe, 2006)
NE.5	There are no accounts of studies investigating conflicts of interest amongst householders with regards to giving priority to practices specific to preserve children's health. Do conflicts of interest exist in most households, i. e., men are generally less interested in the health outcomes of their children, resulting in more autonomous women being more successful at pursuing health protective practices as an outcome of an effective bargaining process	
NE.6	Research into the effectiveness of interventions at modifying caretaker behavior	
NE.7	How do safe collection, transport, disposal, and cleaning differ as children age and their diet and mobility change?	(Rand et al., 2015)
NE.8	What is known about the intra household dynamics and the roles of men and women in assuring safe disposal of child feces?	
NE.9	What safe options exist for households with limited water or other resources	
NE.10	What programs and practices can improve management of child feces?	
NE.11	How do practices differ at different times of the day or in different seasons?	
NE.12	How are children learning sanitation habits	
NE.13	How is hand hygiene after linked to the disposal to child feces?	

Emergency	Research Gaps and Questions Identified [EMERGENCIES]
EM.1	“Need for evidence in the implementation of effective hygiene promotion within emergency settlement in order to change the behavior of carers regarding children’s faeces and their disposal.”
EM.2	The design of super- and infrastructure following anthropometric data for children”

EM.3	“Further research in different emergency contexts would be needed in communities that did not received sanitation help from major NGOs, to provide a wider hindsight of possible sanitation approaches for infants and young children in emergencies.”
EM.4	Little is known about how mothers and carers actually manage babies and young children’s faeces in emergencies and it is thus difficult to identify the best solutions.
EM.5	A clear gap exists in planning how WASH, Health and Nutrition teams can work together to deliver an effective package of services for babies, infants and young children, so that sanitation, hygiene, IYCF and healthcare approaches can work together.
EM.6	More data is needed to provide firm evidence for the assertion that “significant improvements in public health outcomes depend on an area being 100% open defecation free” and whether this includes babies and infants’ excreta.
EM.7	Few case studies exist of sanitation provision for children in emergencies: more would increase sectoral knowledge of the appropriate options and designs available.
EM.8	The level of risk of very young babies’ faeces is not fully understood and it is therefore not possible to prioritize excreta management for children of different ages e.g. should we give greater importance from infancy onwards as opposed to focusing on young babies’ excreta?
STC	
STC.1	How to adapt to different ages? Less than 28, 2 years, etc..
STC.2	What is the interaction of hygiene and nutrition programs?
STC.3	What is already happening in M&E of other sectors that we can get sanitation for children into?
STC.4	How to support caregivers to manage nappies in different contexts and scenarios, including one of reduced water availability? Here by manage we include dispose as well as wash
STC.5	What are the range of hardware options? Is there a viable open defecation option, including use of scoops and/or biodegradable pee-poo bags?
STC.6	How/when to involve children in the design?
STC.7	Can we have a sanitary survey within a home that is particularly child faeces focused? (group 1) (or, group 2 suggestion, would we be best placed to standardize the presence of 2 specific questions on the topic within a generic sanitary survey?)
STC.8	Who do you ask: who are the key informants to address to assess excreta disposal sanitation practices and challenges?
STC.9	How/when to involve children in the assessment?
STC.10	How to design short, targeted participation session for children focusing on speed of participation (group 1)?

STC.11	What is the motivation of caregivers and the drivers for change around excreta disposal in emergencies? (group 3)
STC.12	What indicators are appropriate?
STC.13	Do we have appropriate assessment tools, and to we have evidence of their effectiveness? (3)
STC.14	VfM/cost effectiveness: are we investing enough in this? Are there lower priority things that we should drop to do this instead? What?
STC.15	How to ensure that non-health risks (protection, nutrition) are carefully assessed?
STC.16	What are best options to deliver children sanitation through different channels of delivery/sector?
STC.17	Are the minimum standards adequate for this?
STC.18	How to choose between the range of options?
STC.19	What works better to dispose of grey water from laundry (it is normally not considered faecal contaminated, except for when reusable nappies are washed in it)?
STC.20	Is there scientific evidence of a causal link between sanitation and severe and acute malnutrition?
STC.21	How can tools be adapted?
STC.22	Do mass distributed potties work and are appropriate and effective in reducing exposure in particular context? (M&E)
STC.23	How to relate health outcomes with epidemiological data to support improvement in this field?
STC.24	How to make it easy for practitioners to take this on board at initial phases of emergencies?
STC.25	How can we be accountable to affected population on this?
STC.26	What interactions with other vulnerable groups should we consider?
STC.27	Are there already surveys in the sector that systematically include sanitation?
STC.28	How effective /accepted are new latrine designs (clip on sections to slabs)
STC.29	What is the contribution of children excreta in cholera outbreaks?
STC.30	Are WASH NFIs distribution appropriate for children needs?
STC.31	Are there particular myths that are important to dispel?
STC.32	Can indicators be standardised? (group 1)
STC.33	Is orally administered cholera vaccine efficacy decreased in emergencies?
STC.34	What is the difference between emergencies and the difference between phases of an emergency vis-à-vis the degree of risk caused by mismanaged/lack of management of children sanitation and excreta disposal?

STC.35	Is there a mapping available of sanitation practices in development, “pre-emergency” settings? [preparedness]
STC.36	How to disseminate the evidence we gather to different audiences?
STC.37	Should we mainstream infant and children sanitation in normal programming or have it as a separate type of programme?
STC.38	Do routinely used WASH monitoring processes and systems cover infant and children sanitation practices?
STC.39	How to improve data and tools sharing between agencies?
STC.40	What are the most efficacious action if you can only do one (VfM)?
STC.41	What M&E skills/competencies we need for the implementers? (group 1)
STC.42	How can we learn from other sectors?
STC.43	How to involve governments at national and local level?
STC.44	What is the unit of assessment: households or individuals?
J. Pitts	**Gaps identified by the researcher**
JP.1	What specific water needs are there for young child feces management. What coping strategies do caretakers employ when there are insufficient quantities of diapers, water, etc. to manage infant feces?
JP.2	What are the perceived barriers to managing child feces? Infrastructure, Product, Personal (knowledge, time, willpower, etc.), financial, institutional
JP.3	Are there aspects of child feces management that have not been considered? From an engineering perspective? From a parenting perspective?
JP.4	Are there conditions that significantly change the management coping strategies of caretakers? - eg. during diarrhea episodes, at night, when cared for by alternate caretaker, different seasons, availability of water?
JP.5	Has the emergency prolonged incontinence or created any barriers to potty training?
JP.6	What motivating factors lead families to choose different toilet training methods?

Appendix II – Companion Document to Methodology

II.1 Connecting Research Questions and Tools

CODING KEY

Gaps Within Literature Coding
EM = Identified within (very limited) emergency literature for IYCFM
STC = Identified within 2016 STC review focused on IYCFM
NE = Identified within non-emergency literature for IYCFM

Research Objectives and Questions
OB = Objective
OB_Qx = Research Question tied to Objective

Research Tools Columns
HHV = Household Visit (Column used to cover Structured Questionnaire, Semi Structured Interviews, Spot Observations)
FGD = Focus Group Discussions
Oth = 'Other' (Column used to cover Document Reviews, Key Informant Interviews, Market Analysis, and Transect Walks)

Research Tools
SS = Semi-Structured Interview
FGDA1/ 2 = FGD activity one or two
KI = Key Informant Interviews
SQ = Structured Questionnaire
SO = Spot Observation
DR = Document Review
MA = Market Analysis
OOI = Opportunistic Observations and Interviews (Including Field Notes)

Research Objectives	Research Questions		Lit. Gap	Research Tool		
				HHV	FGD	Oth.
OB1 - To describe the contextual area and assess the applicability of the case study	OB1_Q1	What support has been provided for water supply, sanitation, solid waste, and handwashing facilities?	EM.7	SS16 SO8 SO9 SO10	-	OOI DR KI
	OB1_Q2	What infant sanitation products are available in NFI kits? How are these items determined?		-	-	KI
	OB1_Q3	What infant sanitation products are available in the local market to purchase? How expensive are these items? How close is the market to the camps?		-	-	MA
	OB1_Q4	What hygiene promotion activities have occurred targeting child feces management hygiene activities?		-	-	KI
	OB1_Q5	What other contextual factors are influencing IYCFM practices within this specific context? [To be explored at site.]		SQ1 SS21 SS +	FGA2	KI OOI
	OB1_Q6	How has displacement modified caretakers IYCFM practices?	JP.4	SQ1 SQ2 SQ3 SS34	-	-
	OB1_Q7	Were IYCFM practices any different when families first arrived in Uganda?		SS35	-	-
OB2 - To describe the IYCFM process and coping strategies employed by caretakers to manage child feces in an	OB2_Q1	What are the range of locations where children defecate?	NE.1 EM.4	SS2	FGA1	-
	OB2_Q2	What are the range of hardware options/ child sanitation enabling products used by caretakers to manage infant fecal material? (nappies, scoops, potties, etc.)	NE.1 EM.4 STC.5	SS2 SS5 SO12	FGA1	
	OB2_Q3	What practices/ products are employed for anal cleansing? Where is this material disposed?	NE.1 EM.4	SS14 SS15	FGA1	-
	OB2_Q4	What are the disposal locations/ facilities for the fecal material (and/ or wash water and/or material on tools)?		SS8 SS11	FGA1	-

emergency setting				SS12 SS17		
	OB2_Q5	What practices are employed for handwashing for children and caretakers?		SS18 SS19 SS20 SSO8 SO9 SO10	FGA1	-
OB3 - To explore how IYCFM practices vary as children develop	OB3_Q1	What methods are caretakers using to train children/ how are children communicating their need to defecate?	NE.12	SQ8 SS1	FGA1	-
	OB3_Q2	At what ages/ development stages do management practices change? (based on the age of the child cared for by caretaker)	NE.7 STC.1	SQ2 SQ3 SQ4 SQ5 SQ8 SS30 SS31	FGA1	-
	OB3_Q3	If used, when is it considered appropriate to begin using a potty?		SS30 SS31	FGA1	-
	OB3_Q4	If used, when is it considered appropriate to begin using a latrine?		SS32	FGA1	-
	OB3_Q5	If used, when is it considered appropriate for a child to use a latrine independently?		SS33	FGA1	-
OB4 - To explore new concepts of dynamic practices from changing conditions	OB4_Q1	Do caretakers have different IYCFM practices when the caretakers are busy? If so, how/ why are these different?	JP.4	SS24	-	-
	OB4_Q2	Do caretakers have different IYCFM practices at night? If so, how/ why are these different?		SS25	-	-
	OB4_Q3	Do caretakers have different IYCFM practices when they are travelling with children? If so, how/ why are these different?		SS26	-	-
	OB4_Q4	Do caretakers have different IYCFM practices when children are sick/ have diarrhea? If so, how/ why are these different?		SS29	-	-

	OB4_Q5	Do caretakers have different IYCFM practices when it is rainy (local season variations)? If so, how/ why are these different?	NE.11	SS27	-	-
OB5 – To explore caretakers roles for IYCFM	OB5_Q1	Who are the people involved with managing the child feces in the household? How do these roles change?	STC.8	SS3 SS9	FGA1	OOI
	OB5_Q2	Do different caretakers have different IYCFM practices within the same household?	NE.8	SS28	-	-
OB6 - To explore new risks in the management of child feces	OB6_Q1	Are feces left in the defecation location for a period of time before removal?	NE.2	SS4	-	-
	OB6_Q2	Are there any times when feces are 'stored' within the household?		SS6 SS7	FGA1	-
	OB6_Q3	Do management practices include cleaning the ground/ floor if defecating onto the ground? Are residual feces obviously present after cleaning?		SS5 SS1 SO1	FGA1	-
	OB6_Q4	Are children observed playing near reported defecation locations?		SQ5 SO4	FGA2	-
	OB6_Q5	Do enabling products provide sufficient protection of caretaker contact with feces?		SS21	FGA2	-
	OB6_Q6	Where are enabling products cleaned, if at all? How are they cleaned?		SS5	FGA1	-
	OB6_Q7	If management practices include the use of wash water for anal cleansing cloths or nappies, where does this washing occur (eg. surface water) and where is this water disposed?		SS8 SS13 SS17	FGA1	-
	OB6_Q8	Are solid waste services and facilities capable of safely managing disposal of infant feces? (if available/ applicable)		-	-	OOI KI
	OB6_Q9	Are any sanitation products shared by members of the household?		SS10	-	-
	OB6_Q10	Are latrines visually overloaded with disposal of nappy washing water or at risk of overloading? (if available/ applicable)	NE.2 STC.19	SS + SO +	-	-
	OB6_Q11	Are flies visible at any of these locations? (Defecation location, on IYCFM tools, and in disposal locations?)	NE.2	SO11		
	OB6_Q12	Are there any other risks that need to be explored while at site?		SS +	-	-

				SO +		
OB7- To explore new technology themes in the suitability of interventions for infant and young child feces management	OB7_Q1	Do caretakers find the current NFI kit contents appropriate and adequate to support their ability to manage their child's feces?	STC.30 STC.4	SQ9 SS21	FGA2	-
	OB7_Q3	How much water do families estimate is needed to properly manage the child feces using their preferred method/ products? Do they feel the current water supply is sufficient for this need?	JP.1 STC.4	SS + SS23	FGA2	DR
	OB7_Q4	What are the perceived challenges and technological barriers experienced by caretakers in managing child feces?	JP.2 STC.4	SS21 SS22	FGA2	-
	OB7_Q5	What are the distances to facilities (latrines, etc.) used for disposal of infant feces, for water supply, and handwashing? Are these practically close to the locations where child feces are managed?		SO12	-	OOI
	OB7_Q6	What other technological factors are influencing IYCFM practices within this specific context? [To be explored at site.]				

II.2 Ethics, Participant Information, Informed Consent Form, and Power Dynamics

Consideration	Mitigation Measures Taken	**Risk Level** (after mitigation steps)
Questionnaire containing sensitive material	IYCFM did not appear to be a sensitive topic within the literature. However, care was taken to be conscious of sensitive questions such as those involving experiences with IYCFM during the conflict. If participants were visibly uncomfortable, no additional probes were used and the interview continued with less sensitive questions.	**None to Low**
Ensuring informed consent is given willingly	Informed consent was gained for each participant with information provided explaining the nature of the study, the uses of the information, and the way in which the results will be disseminated. Care was taken to ensure that only those who were able to provide informed consent participate in the study. The participant information and informed consent form used in the research are included below.	**None to Low**
Questionnaire creating an undue time burden on participants	As part of the informed consent, the estimated questionnaire timing was explained. Freedom to withdraw at any time for any reason was also clearly explained to all participants. Questionnaire length was timed as a component of the pilot and was found to be 30min to 1hr depending on the level of English spoken within the household.	**None to Low**
Questionnaire raising false hope for an improved WASH response	As part of the informed consent, a clear explanation was provided that participation will not modify the current response nor personally benefit the respondent in any way.	**None to Low**
Photographs will be taken during observations of enabling products and infrastructure	Care was taken to ensure that no people were present in the photographs. This was explained as part of the informed consent.	**None**
Security and protection of research participants	Care was taken to ensure the household visits were always conducted with both researcher, an enumerator, and the translator present.	**None**
Non-Disclosure of identity	All answers were anonymized and data kept in a protected location.	**None**

Loughborough University

Sanitation for Non-Toilet Trained Children and Caretaker Hygiene in Emergency Context

Participant Information Sheet

(Read and then given to participants)

Investigators Details:

Jacob Pitts
Loughborough University (WEDC)
pcvjakepitts@gmail.com

Thank you very much for talking with me today. We would like to invite you to take part in our study. Before you decide we would like you to understand why the research is being done and what it would involve for you. One of our team will go through the information sheet with you and answer any questions you have. Talk to others about the study before making a decision if you wish.

Who is doing this research and why?

This study is part of a student research project by Jake Pitts supported by Loughborough University in the United Kingdom and supervised by Rebecca Scott.

Approval to conduct this research has been given by the Office of the Prime Minister and the Research Ethics Committee of Makerere University.

I am interested in learning more about how families dispose of young children's feces in your community. Your experience will help us understand how we can help families to better look after their children in communities that are displaced from their homes. You have been selected for this interview because you have a child under the age of five and have identified yourself as the primary caregiver.

Are there any exclusion criteria?

To take part in this study we want to ensure that you are above the age of 18, are not currently pregnant, and do not have any mental disabilities. This is to ensure you are fully able to understand and consent to participating in this study.

What will I be asked to do and what information will be required from me?

You will be asked to answer a series of questions about how you handle your youngest child's feces. There are no right or wrong answers, and you should feel free to say anything you like.

If possible, you may be asked to show locations and objects where critical steps occur. If you agree, photographs of these locations and objects may be taken. These photographs will not include you or your family. You may review these photos before the researcher leaves today.

As part of the interview, we would like to record audio so that we can review your responses in the future and so the information can be fully translated to the researcher's language. If this is an issue, please let the researcher know at this time.

Once I take part, can I change my mind?

Yes. After you have reviewed this information and asked any questions you may have if you are happy to participate we will ask you to complete an Informed Consent Form. If at any time, before, during or after the sessions you wish to withdraw from the study please just contact the main investigator. You can withdraw at any time, for any reason and you will not be asked to explain your reasons for withdrawing.

However, once the results of the study are published and submitted (September 1st, 2018) it will not be possible to withdraw your individual data from the research.

How long will it take?
This questionnaire is expected to take approximately one hour to complete. If this is too long of a time, please let the researcher know at this time. You will be able to end the interview at any point if it becomes too long for you.

Are there any disadvantages or risks in participating?
There are no disadvantages or risks to participating in this study other than the time it takes to answer the questions.

What are the possible benefits of participating?
There are no direct benefits of participating in this study. There will be no change in services or financial gain as a result of participation. However, by participating in this study you will have a chance to share your experiences and contribute to the body of knowledge. This research may help guide future research and improve guidance to organizations working in emergencies.

Will my taking part in this study be kept confidential?
The information that you give me will be kept completely anonymous; your individual privacy will be maintained in all written materials produced from the study. All of the digital data will be kept on a secure laptop and will only be accessible by the researcher and the research supervisor. All physical copies of forms and field notes will be stored in a secure location in the research supervisor's office.

What will happen to the results of the study?
The results of this study will be written into a research thesis report. This report will be shared with academics at Loughborough University and Makerere University. This report will also be shared with the Ministry of Water and the Environment and with NGO's such as Save The Children and World Vision. A local copy will be provided to CEFORD if you wish to review after publication.

What if I am not happy with how the research was conducted or have more questions?
You may ask any additional questions you have now. The researcher contact info is provided above and may be contacted at any time before, during, or after the study. If you have any questions at any time, you may contact them at the included address or phone. If you would like to talk to someone other than the researcher(s) about; (1) concerns regarding this study, (2) research participant rights, (3) research-related injuries, or (4) other human subjects' issues, please contact:

Dr. Stella Neema The Chair Makerere School of Social Sciences Research Ethics Committee Telephone: +256- 772 457576 E-mail: sheisim@yahoo.com	or	The Executive Secretary The Uganda National Council of Science and Technology, Kimera Road. Ntinda P. O. Box 6884 Kampala, Uganda Telephone: (256) 414 705500 Fax: +256-414-234579 Email: info@uncst.go.ug

Additionally, Loughborough University requests that if you are not happy with how the research was conducted, please contact the

Secretary of the Ethics Approvals (Human Participants) Sub-Committee
Research Office, Hazlerigg Building, Loughborough University
Epinal Way, Loughborough, LE11 3TU
Tel: +44 01509 222423.
Email: researchpolicy@lboro.ac.uk

The University also has policies relating to Research Misconduct and Whistle Blowing which are available online at http://www.lboro.ac.uk/committees/ethics-approvals-human-participants/additionalinformation/codesofpractice/

Loughborough University

Sanitation for Non-Toilet Trained Children and Caretaker Hygiene in Emergency Context

INFORMED CONSENT FORM

(to be completed after introdudtion has been read)

Please initial box

Taking Part: The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethics Approvals (Human Participants) Sub-Committee, the Research Ethics Committee of Makerere University, and the Ugandan Council for Science and Technology. ☐

Voluntariness: I understand that I am under no obligation to take part in the study, have the right to withdraw from this study at any stage for any reason, and will not be required to explain my reasons for withdrawing. ☐

Data Collected: I understand that taking part in the project will include being interviewed and recorded (audio only). I understand that as part of the study, photos may be taken of my belongings and property, but that these will not contain myself or my family within these photographs. I will have a chance to review these images. ☐

Risks and Benefits of being in study: I understand that participation in this study contains no personal risk, but may take up to one hour to complete. I understand that there are no direct benefits of participating in this study: that there will be no change in services or financial gain as a result of participation. However, by participating in this study you will have a chance to share your experiences and contribute to the body of knowledge. ☐

Confidentiality and Anonymity: I understand that all the personal information I provide will be treated in strict confidence and will be kept anonymous and confidential to the researchers. ☐

Feedback/ Dissemination (Use of Data): I understand that anonymised data/quotes may be used in the research thesis and these will be distributed to academic and professional institutions. ☐

Understanding of the Informed Consent form: I have read (or had this page read to me) and understood the information sheet and this consent form. I have had an opportunity to ask questions about my participation. ☐

<u>Statement of consent</u>

I have read the above information or had the above information read to me. I have received answers to the questions I have asked. I consent to participate in this research. I am at least ..... years of age.

Name of participant: _____

Signature or thumbprint/mark of participant: _____ Date: _____

Name of person obtaining consent (Researcher): _____

Signature of person obtaining consent: _____ Date: _____

Witness of person in case person is Illiterate:

Name of Witness: _____

Signature or thumbprint/mark of witness: _____ Date: _____

Power dynamics prior to data collection:

- Consideration was given if this research was appropriate given these differences. A personal, self-examination was made of the researcher in relation to the study population. The researcher was identified as an American, white, educated, relatively wealthy male living within a stable context with no societal trauma. The study population was identified as displaced South Sudanese, impoverished, primarily female, with little education, and with potential trauma from past experiences. Due to the lack of research on IYCFM in emergencies and the lack of researchers with a reduced power dynamic, the decision was made to continue the research but with an increased awareness of potential research effects.
- Since the data would be collected outside and the researcher exclusively wears corrective glasses with transition lenses, eyeglasses were purchased within the UK without transitioning shades so that data was not collected in shaded glasses. Wearing sunglasses was perceived by the researcher to be inappropriately distancing for collecting data.
- Care was taken to follow proper process for gaining access to the camps through the Ugandan Office of Prime Minster (OPM). Proper procedure was followed upon arrival to the Arua district with introductory meetings with the district OPM administrator and the camp commandant.
- Female enumerators and interpreters were requested to best match the study participants; however, these were not available and a male enumerator and male interpreters were used throughout the data collection. Although this was a practical necessity, within this context it was acceptable for men and women to have conversations within home compounds and the willingness to share IYCFM information did not appear to be a sensitive, heavily gendered topic. Both men and women participated within the interviews and focus group discussions. Neither the researcher, enumerator, or public health promoter perceived any discomfort in discussing the topic within this particular context.

Power dynamics within piloting:

- Enumerator provided coaching on body language ques such as excessive eye contact common in American culture that might make some respondents nervous.
- An adjustment was made to the structure of the household visits to reduce power dynamics. This is described in the piloting experience below.
- It was noted that upon arrival the matriarch of the compound rushed to gather chairs for the researcher, enumerator, and translator while sitting herself on the lowest chair or the ground. A hierarchy of chairs based on their condition of repair was apparent within most interviews. After the first few pilot interviews, this was mentioned by the researcher. It was explained that this was a sign of respect for the researcher's status. Attempting to modify this practice was seen as distracting. The action taken was to explicitly recognize and humbly accept the nicest chair at each interview.

Power dynamics during data collection:

- Extensive care was taken to carefully explain the items listed within the informed consent. Explicit permission was gained to record audio and before each photo was taken to reinforce that the control was not with the researcher, but with the participants

- Male and female FGDs were kept separate to allow each to more openly express their opinion. In the household interviews where men participated, both opinions were collected if possible to allow both males and female caretakers to express their views on IYCFM within the household.
- Effort was made by the researcher and enumerator to quickly learn the terms used by the population for IYCFM products, for greetings, and for expressing gratitude. The use of English appeared to be a sign of education and power more common within men in the community. Although the use of English for the interviews was a practical necessity, the use of these local terms was an attempt to build trust and show interest.
- Humor was encouraged throughout the interviews to reduce stress both for the researchers and the interview participants. Questions that were seen as humorous but produced little usable results were kept within the interview structure. It was found that the topic of IYCFM was not only a non-sensitive topic, but one that could be quite funny to discuss. This was leveraged to make the interviews more fun when possible.
- Care was taken by the researcher to recognize power dynamics between himself, the enumerator, and the interpreters who were also refugees. Incorporating ideas by the enumerator within the research process, openly sharing information, taking honest suggestions, and sharing meals all were steps to ensuring that relationships within the research process were as balanced as possible and appropriate.

Power dynamics during dissemination:

- A dissemination plan was agreed with the local Refugee Welfare Council to allow the participating communities to review the work. It was noted in the FGDs that research within the camp has been largely extractive and communities have not had the chance to review research produced using their experiences. Allowing participating communities to review the dissertation was seen as a step to increase the level of participation in research beyond extraction.

II.3 Post Pilot Household Questionnaire and Interviews

Note: This is adapted from the WSP Sanitation Marketing Toolkit briefing entitled 'Management of Child Feces: Study Design and Measurement Tips' by Kathryn O' Connel (2015). It contains some text that is copied directly. This questionnaire is included here to show the actual data collection tool used during the interviews and is not meant to represent the researcher's original work. Credit for this interview questionnaire is to Kathryn O'Connel and has been heavily edited by the author to better meet the research objectives. [NUMBERS AND CROSSED OUT TEXT ADDED AFTER DATA COLLECTION]

Child Daily Activities and Demographics	
~~Interviewer to say:~~ **~~"Describe to me a typical day for [name], beginning with what happens when [name] wakes up in the morning, and then what happens in the afternoon, in evening time and through the night? I am interested to know what types of activities [name] does, what [name] eats and what clothes [name] wears."~~**	
Probes	**Response**
[SQ1-]How long have you been in Uganda (since leaving SS?)	
[SQ2]-What number is this child?	
[SQ3]-Child Age:	_____ Years _____ Months
[SQ4]-Development Stage (Check all that apply, starting from the top)	❑ Child can hold up head ❑ Child can sit up ❑ Child can crawl ❑ Child can walk ❑ Child can dress self
[SQ5]-Where does the child spend most of his/her time?	❑ Does [name] spend a lot of time on the ground either inside or outside? ❑ Carried by the caregiver? Other (Describe): _____
[SQ5]- What does the child mostly eat?	❑ Breast-feeding ❑ Bottle Fed ❑ Solid foods ❑ Other: _____

[SQ6]- What does the child wear for undergarments most of the time? [SQ7]- Different at night? (Put 'Nighttime' or other note if different during night or other time)	❑ None [With Clothes] ❑ None [No Clothes] ❑ Old Spare Cloths ❑ Disposable Nappies/ Diapers ❑ Cloth Nappies/ Diapers Other:_____
[SQ8]-Can your child control their bladder? Can your child control their bowel movements?	
[SQ9]-How many times a day does your child defecate? How many times a day does your child urinate?	Defecate: _____ Urinate: _____

Child Feces Management

Interviewer to say: ~~**"Tell me about the last time [name] defecated, beginning with when you first noticed this, and everything and anything you did in response to this. Please take a few minutes to think about this, and take your time as you describe this to me."**~~ **(Explained in informed consent)**
Can you show me the locations where these actions occurred?

Try to elicit information that answers the following questions. Broad probes include:
- "and then what happened?"
- "what did you do next?"
- "why did you do this?"
- "why didn't you do this?"

Probes	Response
Identification of Feces ● [SS1]-How did you notice the child had defecated? ● [SS2]-Where had the child defeated? (Directly on the ground in or outside the house? In a nappy or diaper? In a latrine? In multiple places?) [DEFECATION LOCATION] ● [SS3]-Who noticed that the child had defecated? (The caregiver, another sibling, or did the child indicate this?) ● [SS4]How long was after the child defecated before any action (or inaction) was taken to remove the feces? ● Were the feces solid or lose? Was it on the child's clothes or other surfaces? If so, where?	[NOTE: MODIFIED TO BETTER FIT WITHIN THESIS DOCUMENT]

Feces Management

[TRANSFER]

- [SS5]-Did you move the feces, or handle the feces? In what way? Or did someone else do this? — what did they do?
- With what was the feces handled with?

[STORAGE - IF USING CLOTHS]

- [SS6-]How long do you take to wash the used up clothes?

[STORAGE - IF USING POTTY]

- [SS7]-How long do you take to empty the potty? Do you ever wait to throw feces in the latrine? (Maybe at night)

[DISPOSAL]

- [SS8]-What places were the feces disposed? (Probe: latrine, garbage, buried, thrown outside, left there (not disposed of)) Have you ever heard of disposing of child feces in a latrine? Why or why not might you want to do that?

[CARETAKER ROLES]

- [SS9]-Who was involved in these steps? (Probe: anyone other than the caregiver?)

[POTTY SHARING - IF USING POTTY OR BASIN]

- [SS10]-If Potties - Do other people in the household use this potty? Maybe at night? Do any other households share this potty?

[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]

Handwashing and cleaning IF USING SPADE OR HOE: ● [SS11]-After disposing of the feces, was the spade or hoe washed afterwards? If so, how was it washed? Was the ground cleaned afterwards? IF USING POTTY: ● [SS12]-After disposing of the feces, was the potty cleaned afterwards? Where was the potty cleaned? If USING CLOTHS: ● [SS13]-Where were any soiled materials (e.g., cloths) disposed of? How were cloths cleaned? Were they stored before washing? Anal cleansing ● [SS14]-Was the child's bottom cleaned? (Probe: Did the child clean him or herself [i.e., rubbing his/her bottom on the ground)? How was the child's bottom cleaned? ● [SS15]-Explain how/why each cleaning step was taken. (Probe: and then what happened? Why did you next?) ● [SS16]-[IF RESPONDENT SAYS WATER FOR CLEANING: ASK:] Was water obtained to clean the child? From where was water obtained to clean the child? ● [SS17]-Where was the water disposed of? Handwashing ● [SS18]-After cleaning babies bottom, do you do anything else? If not, why? ● [SS19]-NOTE IF THERE IS NO RESPONSE THEN PROBE: Were the caregivers hands washed? If not why? What were the hands washed with? When were the hands washed? ● [SS20]-Was anything done to wash the child's hands? If not, why? What was done? What was used to wash the hands? When were the hands washed?	[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]

Barriers and Obstacles

Interviewer to say: ~~"Did you experience any obstacles / delays when you disposed of the your child's stool? Can you explain what these were?"~~
[SS21]-Do you experience any challenges managing your child's feces?

Probes	Response
[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]	

Interviewer to say: [SS22]-"How were these barriers overcome (or not)?"
~~Interviewer to say: "If it had been possible, would you have disposed of the feces differently? Why? How so?"~~

Probes	Response

~~Do you think the current hygiene items are sufficient to help you manage the feces of your child? Are they appropriate for the age of your child?~~ [SS23]-Do you have sufficient water to wash your child after defecation?	[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]

Changes to child feces management

Interviewer to say: **"Thank you for telling me about what happened that last time your child defecated. Can you tell me about any other times or situations when your actions may be different from what you just described and why?"**

Probes	Response
● Are there certain times when the action is different? ○ [SS24]-How about when you are busy with cooking or chores? ■ If necessary, probe: Do you leave feces for a while? ○ [SS25]-What about the difference in day and night? ○ [SS26]-When one is travelling, in public or away from the home? ○ [SS27]-When it is rainy? ○ [SS28]-When the child is with another caregiver? ○ [SS29]-When the child is sick or with dairrhoea? ● ~~Do you do anything differently when your child has diarrhoea? [Note: Repeated question needs removing.]~~ ● Probe: How the actions are different in terms of the disposal, handling and cleaning of the child. ● Probe: Prompt the caregiver to explain why the actions different.	[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]

Interviewer to say: **"Can you help me understand how these management practices change as your child develops?"**

Probes	Response
Depending on the age of the child, modify these questions to either past tense or future tense. ● [SS30]-When your child is very young, do you manage their feces differently than now? How is it different? When do you stop doing this? ○ PROBE: When did you child stop using pampers or cloths? (NOTE: Don't suggest age) ● [SS31]-When your child gets a little older, will you manage their feces differently than now? What will change? When will this start? (Probe: Is it certain age, or when the child is able to do certain things, or when it starts eating different foods?) ● [SS32]-When do you think it is appropriate for your child to start using the latrine? ● [SS33]-When should children use a latrine by themselves without help for cleaning?	[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]

Interviewer to say: **[SS34]-"Can you describe how your displacement has changed your child feces management practices?"**	
Probes:	Response
• Probe: Why or why not? [IF CHILD IS OLD ENOUGH TO HAVE BEEN PRESENT DURING DISPLACEMENT] • [SS35]-When you first arrived was managing your child feces difficult? What made it difficult? • [SS36]-Has the war or your displacement changed your child's defecation pattern or ability to control defecation?	[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]

OBSERVATION CHECKS	
[SO1]- Is compound swept? ***[SO2] Are feces present?*** ***Ask to show place where each of these steps occur and the time it takes to walk between each spot (If not on plot)*** ***[SO12]Ask to see hoe/ scoop/ shovels/ potties.*** Are there residual feces/ flies visible on these enabling products? ***Ask to see latrine, hand washing facilities, washing locations, washing basins.*** ~~***IF SANITATION IS NOT ON PLOT: Record time to walk from defecation location to disposal location:***~~ **_____ [SO3]- Is Sanitation on Plot Y/N (Note, added after data collection. Sanitation was on plot for all households interviewed)**	[SO4]-Are children observed playing near defecation locations? [SO5]-What is the floor made of? (if defecated onto floor) [SO6]-Are feces currently present in the defecation locations? [SO7]-Are residual feces obviously present on tools after cleaning? [SO8] Handwashing facility Y/N? Note if soap [SO9] and water [SO10] are available in handwashing facilities: {SO11]-Are there flies visible at any of these locations?

Photograph: [NOTE: Ensure no people are present in photographs and consent to photograph has been given]

- **Evidence of defecation locations**
- **Evidence of enabling products (Including potties, scoops, washing bowls, nappies, etc.)**
- **Evidence of disposal locations (Including latrines)**
- **Evidence of cleaning locations**
- **Evidence of residual feces + flies in each location**

II.4 Focus Group Discussion Activities

Introduction: **"Thank you very much for talking with us today. We are interested in learning more about how families handle children's feces in your community, and your views will help us understand how we can help families care for their children. We are going to ask your ideas and opinions about how children's feces is handled and disposed of, and we want you to let us know what you think. There are no right or wrong answers, and you should feel free to say anything you like. Everything that we discuss today will be kept confidential, and will not be discussed with anyone outside of the study team. You do not have to answer any questions that you don't want to, but we would like to hear everyone's thoughts. Does anyone have any questions?"**

NOW READ - Participant Information and gain Informed Consent from Participants

Activity One: ***Describing feces management practices for children in different development stages***
In five smaller groups describe the typical process used to manage the feces of the child at the age shown on a photograph using any combination of drawing, writing, describing, demonstrating/ role playing.
After each, ask the whole focus group: Does anyone know of other ways that you have seen child feces managed at this age?

Purpose for participants: To share knowledge with a global community about local practices
Purpose for researcher: To understand the progression of sanitation practices used at different development stages
Data Collection Method: Pictures of cards + field notes + recording

Development Stage:	Who is involved?	Defecation Locations	Storage/ Transfer	Feces Disposal Locations	Post Disposal Hygiene Practices
Group 1: **Before baby can sit up**		[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]			
Group 2: **Child can sit up**					
Group 3: **Child can crawl**					
Group 4: **Child can walk**					
Group 5: **Child can dress self**					

Discussions based on answers.

Activities Two*: Barriers experienced in disposing of child feces properly + Potential Solutions*								
Purpose for participants: To express barriers which may be frustrating and creatively work towards potential solutions **Purpose for researcher:** To understand the main issues faced by caretakers ~~that prevent disposing child feces into latrines~~ while managing child feces **Data Collection Method:** Pictures of cards + field notes + recording								
Brainstorm barriers (Drawing + Writing on cards) What prevents you from disposing of child feces in latrines? (Rank the barriers)	Barrier 1	Barrier 2	Barrier 3	Barrier 4	Barrier 5	Barrier 6	Barrier 7	Barrier 8
Brainstorm Solutions (For each barrier) What are some of the solutions to helping dispose of feces in latrines? Note: Can have more than one solution per barrier	B.1 Solutions	B. 2 Solutions	B. 3 Solutions	B. 4 Solutions	B. 5 Solutions	B. 6 Solutions	B. 7 Solutions	B. 8 Solutions

Activity Three*: Open Discussion on Perceptions of NFI and Infrastructure Appropriateness*	
Purpose for participants: To express views and opinions on NFI kit items **Purpose for researcher:** To understand which NFI kit items are appropriate for this context **Data Collection Method:** Field Notes + Recording	
Questions:	**Field Notes:**
Do you find the current NFI kit contents help support your ability to manage their child's feces? Are they appropriate for the age of of your child? Why or why not?	[SPACE FOR THESE CELLS CONSOLIDATED TO SAVE SPACE]
What is good and bad about each of these? (Pass around each product and discuss each) ● Plastic Nappies ○ (pampers) ● Cloth Nappies ● Plastic Potties What do they see as the good points, what do they see as the bad points? When is it appropriate to use these?	
Are the latrines convenient for disposal of their child's feces? What makes them convenient? What makes them inconvenient? When is it appropriate for a child to start using a latrine?	
If water is used, how much water do you think you use per day to manage the child feces using their preferred method/ products? Do you feel the current water supply is sufficient for this need? If not, why not?	
Could you tell us some of the dangers that you know of mismanaging child feces? If yes, what are the dangers? If not, why not?	

II.5 Household Visit Piloting Experience

Since the questionnaire had not been previously tested prior to conducting the household interviews, one day was taken to pilot the questionnaire and make adjustments based on the following criteria. Because extensive changes were made to the questionnaire, this piloting experience is included here.

Questions considered during the piloting experience

a. Are questions relevant and/ or appropriate and/ or confusing?
b. Are questions leading respondents to a particular answer?
c. Any questions obviously missing?
d. Any issues with translation/ enumeration?
e. Any issues with structure/ formatting?
f. What is the time taken per interview? Has this been under or overestimated? Should informed consent be updated to match this time? Should the questionnaire be shortened?

Five household interviews with observations were conducted in family compounds in Ofua III. On the piloting day, a CEFORD public health promoter accompanied the data collection team and collected data while the researcher took notes on the data collection tools and the points above. At the end of the day, the enumerator, the researcher, and the accompanying public health promoter compared notes on the improvement of the data collection tools and made the following changes to the tools based on those notes.

Questions relevant/ appropriate/ confusing

- Removed question about the appropriateness of NFI for IYCFM as none had been provided.
- Changed the transport/ timing questions to simply note on the form if sanitation was on-plot. By the end of the pilot it was obvious that sanitation on-plot was nearly universal in the study population and the time to walk to the latrine was negligible.
- Removed question “Were any other actions/ steps considered that last time your child defecated, to dispose of the stool? If so, why were they taken?” This question was confusing to the enumerator, translator, and the respondents.
- Clarified which questions to ask in which situations to make the interview flow more easily for the enumerator. For example, on the page discussing cleaning questions of enabling product cleaning was split to have separate questions for potties, cloths, and scooping tools.
- Removed the question ‘What things would make it easier to manage the feces of your child?” This question was not needed as respondents were already listed off the things needed in previous questions.
- Expanded and clarified the questions on daily changes to child feces management as these were unclear in their original format and appeared to be significant in results.
- Clarified that questions on the changes brought on by displacement
- Simplified several questions to make wording easier to translate.
- Even though the question was confusing and did not produce any usable results, the data collection team decided to keep the question “How many times a day does your child urinate?” This question was

seen as an icebreaker question as it nearly always elicited a laugh and the response, ‘Too many times.’ Humor was seen as a useful tool for reducing power dynamics and the question was seen as a positive tool at creating a space conducive to more inclusive research, although it did not provide the intended data.

Are questions leading respondents to a particular answer?

- Remove specific probes on individual post anal cleaning hygiene practices. Within the pilot it became obvious that the hygiene promotion had informed families sufficiently on handwashing that any direct question on its practice was always met with an affirmative response. To better assess knowledge, it was simply asked if the caretaker ‘did anything else’ after washing the babies bottom.
- Develop probing method. It became apparent that indirect probes were needed to guide participants to the meaning of the question without guiding to answers.

Any questions obviously missing after the pilot?

- Question was added to clarify how long the respondent had been with Uganda as there was a mixture of lengths of time people were present within Uganda. This also allowed the researcher to compare to children’s age to know if questions on practices within South Sudan were appropriate for this family.
- Question was added on the ‘number’ that this child was within the set of siblings. It was found that it often wasn’t clear how many children were present and this allowed the researcher to know if the caretaker had children that were present within South Sudan and during the journey.

Any issues with translation/ enumeration?

- The researcher found the enumerator asked questions too quickly to successfully write down answers and to consider clarifying probing questions. It was discussed that the priority on the interviews was quality, not quantity and that writing responses fully would save time during transcription later.
- The researcher requested the enumerator ask questions in order to make it easier to process the written data later.
- The enumerator mentioned that the researcher was making too much eye contact and to allow respondents to respond by not looking too directly at them while they speak.

Any issues with structure/ format?

- Moved all pre-coded spot observations to the end of the interview to improve the flow and ensure greater accuracy. Continually pausing the direct line of questioning to fill out the pre-coded spot observation form was distracting and affecting the interview flow. For example, when the caretaker mentioned they used a hoe to scoop feces, they were originally asked to stop and retrieve the household hoe used for IYCFM rather than at the end of the interview after all hardware and infrastructure was discussed. This change was also made because the researcher felt the power dynamics of asking the participant to stand-up from the interview to walk across the compound and back to the researchers was inappropriate and might influence the results of questions answered later in the interview.

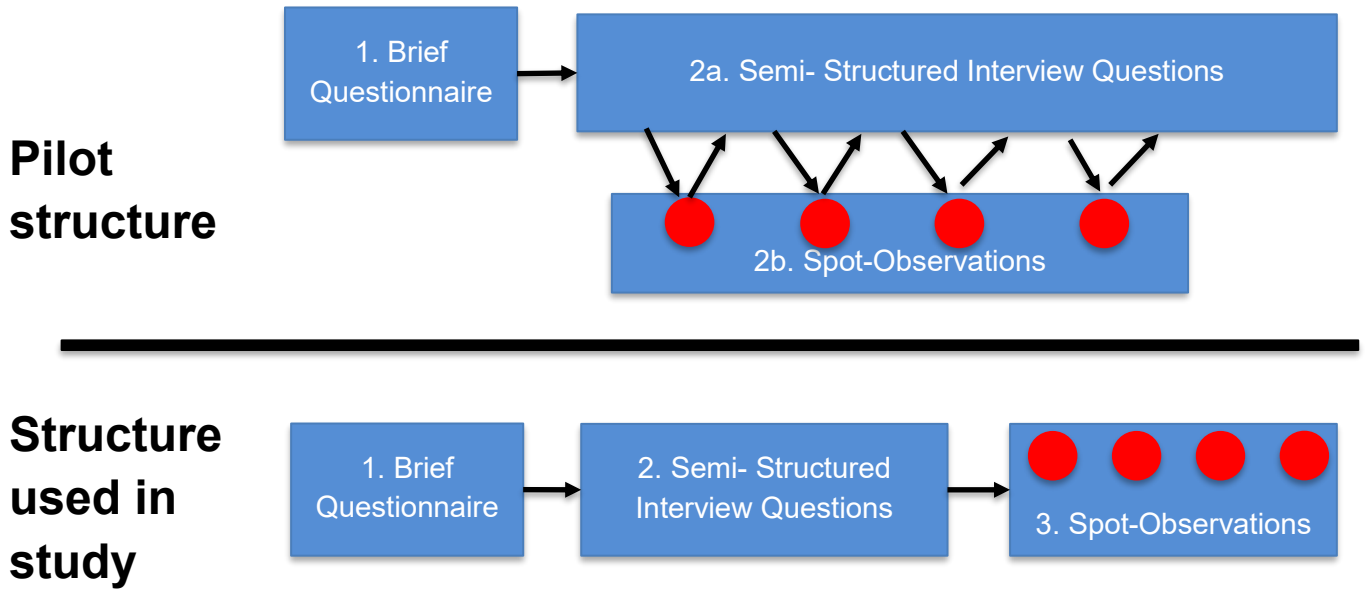


Figure 57 - Piloting structure vs structure used in study for household interviews

Notes after piloting to improve the interview tool if using again:

1. Clear that there is not enough room on the form for the questions on dynamic practices. (ie. More important than realized when form was prepared)
2. Enumerator added question: "How will this change how you manage your child's feces?" after Ofua III to all questionnaires. This was to replace "What are the solutions to these problems." Because the solution was always mentioned as 'provision of X thing (water, soap, potties, etc) that is missing from the household' this allowed the researchers to better understand how provision of X thing would change their ability to manage child feces.
3. Specifically, for families using OD + Scoop method, were asked what they do differently during diarrhea and if it is particularly difficult to manage?

FGD Activity 1 Piloting Experience

In general, a fun activity for both the researcher and participants. Discussions of baby poop were not taboo within these communities and were an entertaining concept for families to consider leading to plenty of laughter in each FGD. Bringing child sanitation products and discussing local names for these products was a useful icebreaker and way for participants to begin thinking through their experiences before the activity.

The second activity might be difficult to implement independently or first within a FGD. The first activity introduces concepts of IYCFM and allows families to consider the entire process of IYCFM. Without developing the context of the information caretakers may find it more difficult to brainstorm challenges and solutions.

Activity One – Development Stages

- Age categories generally clear amongst all FGDs and presented age appropriate sanitation solutions. In one sub group in one FGD, confusion lead the group to fill out their poster for the 'wrong' age group. This appeared to be an issue with the translation.

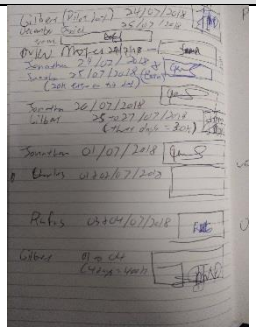
- Literacy was found to be an issue with this activity, requiring at least one literate person in each group to write the responses. Adaptations involving photos and
- Process steps were generally also intuitive to sub-groups, with any confusion generally coming from the concept of ‘storage’. Within the interviews it appeared that some families always immediately wash and only some families leave fecally contaminated objects to clean at more convenient times. Another word or phrase may be more easily understood to explain this process step.
- Clear explanation was provided for families to respond for how caretakers manage feces within their house, not how they want to do it or the ‘perfect way’. Within this context, people generally answered with seemingly riskier practices than within household interviews, perhaps because they could explain that this wasn’t their house, but how others managed within the community. This was not followed up as a component of this research, but was useful in comparing responses within the results. Having these FGDs in conjunction with the household interviews helped provide a more complete picture of the challenges faced with IYCFM.
- Note: Indicating ‘post-disposal hygiene practices’, may be leading participants to an answer. This was not meant to provide a useful indicator of actual practices, but to provide a more complete picture of the process.
- The presentations went well with each sub group and within each FGD, but this could be an issue if communities are less familiar with these presentations or if they are nervous presenting
- It was found that asking the question ‘Is this how it is done in your households?’ generally to the larger group after a sub-group presentation was not an effective tool as most caretakers agreed. But if this was explained at the beginning that it was ‘ok’ to disagree and express a different opinion, participants felt it was acceptable to express these opinions. Creating an environment where participants could disagree without arguing led to interesting conversations that revealed differences in opinions and gaps in hygiene promotion (such as disposal of wash water).
- This activity was very long, taking roughly an hour to an hour and a half; although participants were actively engaged the entire time and did not appear to find this excessive. This activity could be shortened by consolidating sub-groups. Suggesting more useful demarcations in sanitation development will require additional case studies as these appear to be highly contextual.
- Suggesting participants prioritize responses based on how common they are in the community might provide more useful responses. Participants naturally prioritized caretaker roles, but did not appear to rank the other categories of the poster activity.

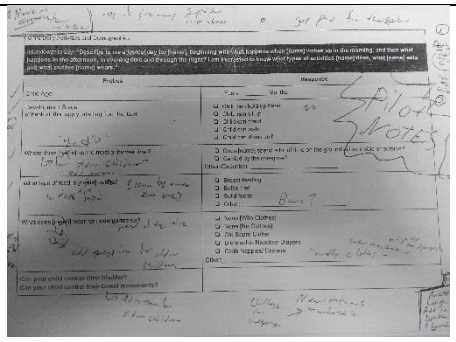
Activity Two

- This was an intuitive activity for all of the groups; although, clarification was needed to ensure caretakers understood that the challenges discussed were only their challenges for IYCFM and not general challenges with their displacement.
- The voting activity should be improved by using pocket chart voting. This method was not used due to time constraints given the length of the first activity. The researcher did not want to pre-code challenges onto envelopes.

II.6 Challenges and Opportunities During Research

Table 16 - Challenges in research

Challenge Encountered	Example (if applicable)	Action taken to overcome the challenge
Financial		
Payment of daily diesel, driver, enumerators, translators, lodging, mid-day meals for staff, and FGD supplies was limited by the personal funds of the researcher.	 *Figure 58- An informal log of payments to drivers, translators, and enumerators*	Funds restricted total data collection days within the camps and the schedule was set based on these funds. Days began early and went as late as was allowed by the camp rules (17:00) to maximize the data collected each day.
Data Collection		
Language barriers necessitated utilizing often untrained translators for most interviews. A different translator was used in each community.	Translator in one community occasionally would answer a question for a respondent without asking the participant.	Coaching for the translators was provided briefly in each community before collecting data. Longer training would have been appropriate, but was not practical due to time constraints. Additional coaching was provided as needed when the translators appeared to suggest answers for respondents rather than relay the question to the participants.
Researcher's accent		When the researchers American accent and speed of English became difficult for translator, the enumerator needed to 're-translate' English on a few occasions. In one community the translation was slower than others which meant less interviews were collected in that location.
Eliciting responses that reflected the actual experiences of the respondents, and not the response the participants thought was most desirable.	 *Figure 59 - A latrine with IYCFM spade ready for scooping. Handwashing station is present, but with no water or soap*	Asking follow up questions, such as 'is this how you normally do this?' or 'what if you cannot afford this item?' were used to help probe if the responses given reflected normal use. Observations, FGD, and other methodologies were used to help determine if the responses matched the actual practices.

Illiteracy of the respondents within interviews		A lengthy verbal consent was obtained explaining the items above, with a witness to sign for the respondent.
Illiteracy of the respondents within FGDs	 *Figure 60 - CEFORD public health promoter steps in to transcribe the FGD participant answers*	A lengthy verbal consent was provided to the FGDs. Because the first FGD activity requires at least one person from each sub-group to write responses, at least 5 literate people were needed in each FGD. This was not an issue during the first FGD with men. During the other FGDs the enumerator, public health promotor, driver, and researcher all assisted with writing the responses with careful coaching not to influence the responses.
Untested questionnaire	 *Figure 61 - Extensive notes from the pilot on the original questionnaire*	A pre-testing day was arranged, and six interviews were conducted with notes taken on which questions needed rewording, eliminated, or additional questions needed to clarify if certain questions were relevant to each participant. (See below)
FGD format was unable to be tested before it was conducted.		This was largely because time in the camps was limited and the FGD were organized locally by CEFORD hygiene promoters. This was mitigated by running all FGDs the same and taking notes as if the tool was under test as a pilot project for future users to take advantage of the tool.
FGD Disruptions in public locations		Multiple disruptions with uninvited participants, respondents dominating discussions, and older children interrupting the discussions. Having a skilled enumerator present was very valuable who was able to handle each issue in a respectful way.
Environmental / Logistical		

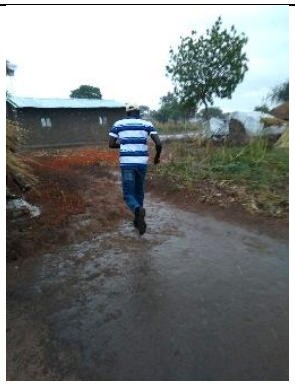
Rain delayed / cancelled fieldwork	 Gilbert, CEFORD Enumerator, runs through the rain.	Because interviews could only be conducted outside due to OPM regulations, rain events meant that the interview was cut short and a brisk run was required to return to shelter. Although, this is only occurred with the final interview, it meant that roughly 2 interviews were not completed while the data collection team waited for the rain to stop. The final FGD was delayed until the rain stopped which meant the second group of activities were cancelled to meet OPM camp work curfew. The first two FGDs were also delayed due to rain but were able to be completed in time.
Poor road conditions	 Vehicle stuck in mud	Hands on experience was gained in Ugandan vehicle recovery techniques. Fortunately, the only time the vehicle became stuck was on the last day after a large rain storm.
High heat cancelled field work		Data collection was cut short one day due to high heat affecting enumerator. Enumerator was taken to a shaded area and provided with water.
Remote location of Rhino camp meant personal transportation from Arua was difficult/ expensive to obtain for the research team.		Through WEDC connections at the Ministry of Water and Environment a driver and vehicle were provided for a small fee each day.
Limitations on the work conducted within Rhino Camp Settlement		Permission was gained from the Office of Prime Minister in Kampala and then presented to District level OPM offices and Rhino camp commandant. Researcher was accompaniment by enumerator and hygiene promoters who were familiar with camp restrictions.
Rapid location change from Ethiopia to Uganda		Research was originally planned for Ethiopia but was changed after logistics and permissions were in jeopardy.

Table 17 -Opportunities in research

Success/ Opportunity Encountered	Example	Why useful
Piloting was a very useful exercise in identifying gaps in the research methods	See piloting section for notes.	Allowed the remaining data collection to flow more easily and collect relevant information.
Sections of the interview overlapped in content	Eg. The section on 'challenges' and the section on 'changes in displacment' produced similar results with respondents discussing their coping strategies with the context.	This was useful as it was found that some found one set of questioning confusing, but the other clearer. Others had an opposite response so having both set of questions allowed the researcher more chances to understand coping mechanisms.
Having a two person data collection team with an enumerator asking questions and a researcher writing responses	Eg. The researcher would finish writing a question response while the enumerator asked the question to the respondent through the translator.	Allowed researcher more time to write, reducing transcription from audio. This also allowed the researcher to consider more in-depth probes and the co-interviewing process went very smoothly, allowing more interviews within a day. Also allowed researcher more time to consider the effectiveness of the research tools while the enumerator concentrated on implementation.
Positive, two-way communication between researcher and enumerator		Allowed the data collection to be more aware of issues such as too much eye contact (researcher), or asking too many probing questions (enumerator) leading to more successful data collection.
Having access to personal transport		Allowed the research team to maximize allowable time in the camps each day and to visit other locations such as the nursery school, health clinics, and markets.
Bringing local child sanitation products to FGDs	The participants found it very entertaining when the researcher (from USA) asked for the local words for the products.	Brought a sense of humor to FGDs, improving rapport and allowing the researcher, enumerator, and participants to have a more positive experience.
Strong local partners		CEFORD organization was a very accommodating, useful, and welcoming partner for organizing research within Rhino camp.

Appendix III – Companion Document to Results

Excerpt from Key Hygiene Messages – Oxfam Public Health Promotion

NOTE: THIS IS NOT COMPREHENSIVE OF THE HYGIENE PROMOTION DOCUMENT PROVIDED BY OXFAM AND HAS BEEN ABBREVIATED TO CONTAIN ONLY THE MESSAGES RELEVANT TO IYCFM.

Safe excreta disposal

This is hygienic disposal of human faeces including children faeces ensuring that all faeces are covered/ inaccessible by flies. Exposed faeces are a major cause in the spread of diseases (especially faecal-oral diseases). Covering faeces is the best method of stopping disease transmission

Methods of safe excreta:

Children's faeces can be more dangerous than adults' faeces as they are more likely to be contaminated.
Parents must be encouraged to remove and cover their children' faeces as soon as possible.

Proper latrine use/operation (Operation and Maintenance)

- All children faeces to be put in the latrine
- Children care takers to monitor children defecation site and clean as soon as they are used by small children
- Small children to be trained on use of defecation site and inform care taker after use or escorted and faeces removed immediately
- Children to be habit trained on hand washing after defecation
- Provide information to users on the importance of disposing faeces in latrines especially children's faeces

Solid waste management

- Discouraging children defecating and playing in the dumping area
- Discouraging mothers to through baby's faeces in the garbage pits

Use and maintenance of scoops and children potties.

- Always keep children pooties clean and stored in safe places.
- Always use children pooties for children to defecate.
- Always use scoops provided to throw children feaces to the latrine.

Management of children feaces.

- Always us a shovel to collect and throw children feaces in the pit latrine.

Excerpt from Key Hygiene Messages – Oxfam Public Health Promotion

NOTE: THIS IS NOT COMPREHENSIVE OF THE HYGIENE PROMOTION DOCUMENT PROVIDED BY OXFAM AND HAS BEEN ABBREVIATED TO CONTAIN ONLY THE MESSAGES RELEVANT TO IYCFM.

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- All children faeces to be put in the latrine
- Children care takers to monitor children defecation site and clean as soon as they are used by small children
- Small children to be trained on use of defecation site and inform care taker after use or escorted and faeces removed immediately
- Children to be habit trained on hand washing after defecation
- Provide information to users on the importance of disposing faeces in latrines especially children's faeces

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- Always use children pooties for children to defecate.
- Always use scoops provided to throw children feaces to the latrine.

Management of children feaces.

- Always us a shovel to collect and throw children feaces in the pit latrine.

Table 18 - Raw IYCFM process from household interviews

Age (mo.)	Communication	Defecation Location	Transfer Tool	Storage/ Delay Disposal	Disposal	Tool Cleaning	Bottom Clean	Anal Cleansing Disposal	Child Handwash	Caretaker Handwash
1	Crying	Cloths	Basin	Only night	Latrine	Clothes cleaned in basin	Cloths	Poured with clothes water	Washes babies hands	Wash hands
1.5	Crying + Nonverbal	Cloths	Basin	No	Latrine	N/A	Cloths or Wash in basin	Poured with clothes water	N/M	Wash hands
4	Nonverbal	Ground	Hoe	No	Latrine or buried	Dig in ground	Wash in basin	Poured with clothes water	N/M	Wash hands
6	Crying	Ground/ cloths	Hoe or spade	No	Latrine	Washes with the tippy tap	Cloth/ Wash in basin	N/M	N/M	Wash hands
8	Scheduling [Potty] and[No communication]	Potty/ Cloths	Potty	No	Latrine	Rinsed into latrine	Wash in basin	Poured into latrine	N/M	Wash hands
9	Nonverbal	Ground	Hoe	No	Latrine	Stick + disposed into latrine	Wash in basin	Pours to latrine	N/M	Wash hands
12	Nonverbal	Ground	Hoe or spade	Only night	Larine	Dig in ground	Wash in basin	Pours to bush	N/M	Wash hands
12	Non Verbal	Ground	Spade	Only night	Latrine	N/M	Wash in basin	N/M	N/M	Wash hands
13	Crying	Ground	Hoe	No	Latrine	Dig in ground	Wash in basin	Pours next to latrine	Washes babies hands	Wash hands
18	Non Verbal	Ground Specific Location	Hoe or spade	No	Latrine	Dig in ground	Wash in basin	Pours into bush	N/M	Wash hands
18	Verbal	Ground (day only)	Hoe or spade	No	Latrine	Not Collected [Interview terminated]			N/M	Wash hands
20	Verbal	Potty	Potty	No	Latrine	Washes potty with soap	Toilet paper/ cloths	N/M	N/M	Wash hands
24	Non Verbal + Verbal	Ground	Hoe or spade	Wait for water	Latrine	Rinses into latrine	Wash in basin	Into latrine	Washes babies hands	Wash hands
28	Verbal	Potty/ Ground	Potty/ Spade	No	Latrine	Potty: in latrine Spade: Dig in ground	Toilet paper	N/M	N/M	Wash hands
31	Verbal	Ground Specific Location	Spade	N/M	Latrine	Rinses outside latrine	Pour water	Outside Latrine	N/M	Wash hands
36	Verbal	Child latrine	N/A	N/A	N/A	N/A	Wash in basin	N/M	N/M	Wash hands
36	Non Verbal	Potty/ Ground	Potty or spade	No	Latrine	Piece of sack + dispose in latrine	Wash in basin	Latrine	NM	Wash hands
36	Non Verbal + Verbal	Ground Specific Location	Hoe or spade	N/A	Latrine	Piece of sack + dispose in latrine	Wash in basin	Latrine	N/M	Wash hands
48	Verbal	Latrine with help	N/A	N/A	N/A	N/A	Pour water	Latrine	N/M	Wash hands
48	Verbal	Latrine by self	N/A	N/A	N/A	N/A	Pour water	Outside Latrine	Washes babies hands	N/A

Table 19 - Defecation vs Tool cleaning and Anal cleaning disposal

Age (Mo.)	Defecation Location	Disposal Location	Tools Used	Tool Cleaning Location/ Method	Anal Cleansing	Anal Cleansing Disposal
1	Onto Clothes	Pours Into Latrine	N/A	Clothes in Basin to latrine	Cloths	Poured with clothes water
1.5	Onto Clothes	Pours into latrine	N/A	Clothes in Basin to latrine	Cloths or Wash in basin	Poured with clothes water
4	Onto ground [Held] Onto Clothes	Pours into latrine or bury	Hoe	Dig into ground	Wash in basin	Poured with clothes water
6	Onto ground [Held] Onto Clothes	Latrine	Hoe/ Spade	Wash at tippy tap	Cloth or Wash in basin	N/M
8	Into Potty [Held] Onto Clothes Onto ground	Latrine	Potty Hoe/ Spade	Rinse Hoe/Spade into latrine	Wash in basin	Poured into latrine
9	Onto ground [Held]	Latrine	Hoe	Push with small stick or dig into ground	Wash in basin	Pours to latrine
12	Onto ground [Held]	Latrine	Hoe/ Spade/ Cloths	Dig into ground	Wash in basin	Pours to bush
12	Onto ground	Latrine	Spade	N/M	Wash in basin	N/M
13	Onto ground	Latrine	Hoe	Dig into ground	Wash in basin	Pours next to latrine
18	Onto ground (specific location)	Latrine	Hoe/ Spade	Dig into ground	Wash in basin	Pours into bush
18	Onto ground (specific location)	Latrine	N/C [Interview terminated]	N/C [Interview terminated]	N/C [Interview terminated]	N/C [Interview terminated]
20	Into Potty	Latrine	Potty	Washes with soap (no disposal mentioned)	Toilet paper/ cloths	N/M
24	Onto ground	Latrine	Hoe/ Spade	Washes with water into latrine	Wash in basin	Into latrine
28	Into Potty	Latrine	Potty/ Spade	Washes potty into latrine, but dig spade into ground	Toilet paper	N/M
31	Onto ground (specific location)	Latrine	Spade	Washes near latrine	Wash with little water or wash in basin	Outside Latrine (sometimes)
36	Child Latrine	N/A	N/A	N/A	Wash in basin	N/M
36	Potty Onto ground	Latrine	Potty or Spade	Cleans with piece of small sack disposed in latrine	Wash in basin	Latrine
36	Onto ground (specific location)	Latrine	Hoe/ Spade	Cleaned with cloth/ stick and thrown in latrine	Wash in basin	Latrine
48	Into Latrine	N/A	N/A	N/A	Wash with little water	Latrine
48	Into Latrine	N/A	N/A	N/A	Washes self by pouring water	Outside Latrine

Table 20 - Child Development Markers vs IYCFM strategies

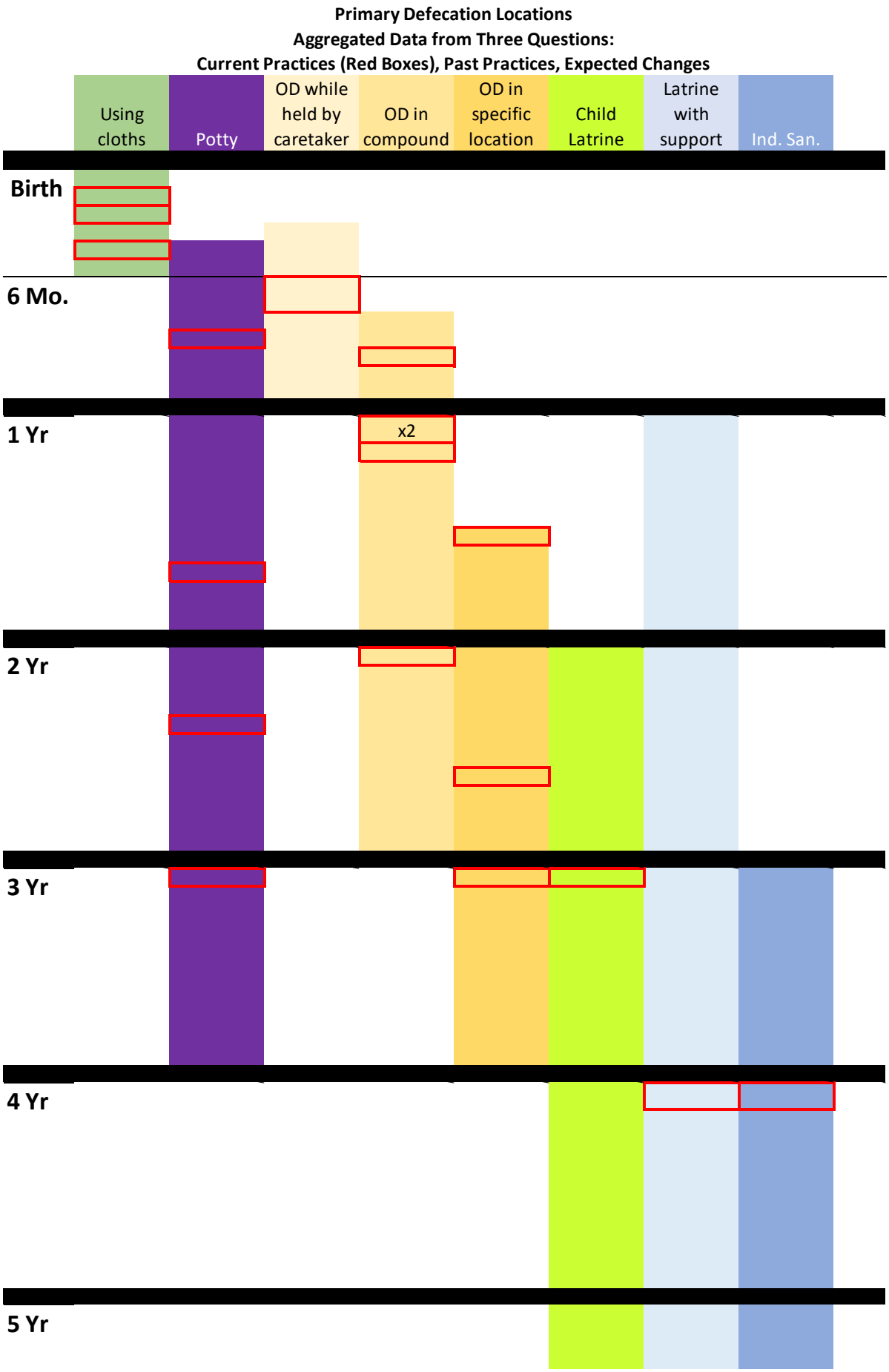
Child Development						IYCFM Strategies	
Age (Mo.)	**Independence**	**Primary time spent**	**Reported Bowel Control**	**Communication of defecation need**	**Child Diet**	**Defecation Locations**	**Anal Cleansing**
1	Not holding up head	On Bed	No	Crying	Breastfeeding	Onto Clothes	Cloths
1.5	Holding head	On Bed	No	Crying + Nonverbal	Breastfeeding	Onto Clothes	Cloths or Wash in basin
4	Holding head	On Bed	No	Nonverbal	Breastfeeding	Onto ground [Held] Onto Clothes	Wash in basin
6	Crawling	Outside	Yes	Crying	Breastfeeding + Solid foods	Onto ground [Held] Onto Clothes	Cloth or Wash in basin
8	Crawling	Outside	Yes	Scheduling [Potty] and[No communication]	Breastfeeding + Solid foods	Into Potty [Held] Onto Clothes/ OD	Wash in basin
9	Crawling	Outside	Yes	Nonverbal	Breastfeeding + Solid foods	Onto ground [Held]	Wash in basin
12	Crawling	Outside	Somewhat	Nonverbal	Breastfeeding + Solid foods	Onto ground [Held]	Wash in basin
12	Walking	Outside	Yes	Non Verbal	Breastfeeding + Solid foods	Onto ground	Wash in basin
13	Walking	Outside	No	Crying	Breastfeeding + Solid foods	Onto ground	Wash in basin
18	Walking	Outside	No	Non Verbal	Breastfeeding + Solid foods	OD (specific location)	Wash in basin
18	Walking	Outside	Yes	Verbal	Breastfeeding + Solid foods	OD (specific location)	N/C [Interview terminated]
20	Walking	Outside	Yes	Verbal	Breastfeeding + Solid foods	Into Potty	Toilet paper/ cloths
24	Walking	Outside	Sometimes	Non Verbal + Verbal	Breastfeeding + Solid foods	Onto ground	Wash in basin
28	Dressing Self	Outside	Yes	Verbal	Solid foods	Into Potty	Toilet paper
31	Walk	Outside	Yes	Verbal	Solid foods	Onto ground (specific location)	Wash with little water or wash in basin
36	Walk	Nursery School	Yes	Verbal	Solid foods	Child Latrine	Wash in basin
36	Walk	Outside	Yes	Non Verbal	Solid foods	Potty/ OD	Wash in basin
36	Dressing Self	Outside	Yes	Non Verbal + Verbal	Solid foods	Onto ground (specific location)	Wash in basin
48	Dressing Self	Outside	Yes	Verbal	Solid foods	Into Latrine	Wash with little water
48	Dressing Self	School	Yes	Verbal	Solid foods	Into Latrine	Washes self by pouring water

Table 21 Who is involved with IYCFM in FGDs

Who is involved with IYCFM?				
	Men Ofua III	Women Ofua III	Old Women Ariaze	Women Ariwa
Children Who Cannot Yet Sit - up	1. Mother 2. Father 3. Baby sitter	1. Mother 2. Sister 3. Brother 4. Grandmother	1. Mothers 2. Fathers (in absence of mothers) 3. A girl above 10 years of age 4. A boy above 8 years of age 5. Old mothers 6. Aunt	1. Mother 2. Aunt 3. Grandmothers 4. Babysitter (helper)
Sitting, not crawling	1. Mother 2. Sister 3. Brother 4. Grandmother	1. Mother 2. Sisters 3. Grandmother, father and brothers 4. Baby sitters and the stepmother if available	1. Mother 2. Father 3. Grandmother	1. Mother 2. Father 3. 'Baby sitter' 4. Grandmother 5. Sister 6. Brother 7. Aunt
Crawling, not walking	1. Mother 2, 'caretaker' 3. Sisters 4. Father 5. Brothers 6. Grandmother	1. Mother and father 2. Sister 3. Brother 4. Grandmother	1. Mothers 2. Grandmothers 3. A girl in the absence of the mother or grandmother 4. Fathers can help in the absence of the above people	1. Mother 2. Father 3. Elder Sister
Walking, not dressing	1. Father and Mother 2. Grandmother 3. Brother/ sister	1. Mother 2. Father 3. Grandmother 4. Baby sitter 5. Sister in law 6. Brother 7. Grandfather 8. Aunt 9. Uncle	1. Mother 2. Caretaker of the child 3. Father 4. Grandmother and old daughters	1. Mother 2. Father 3. Sister 4. Brother 5. Grand Mother 6. Aunts 7. Uncle 8. Neighbor
Walking and dressing	1. Mother 2. Father 3. Sister 4. Brother 5. Aunt 6. Grandmother 7. Grandfather 8. Baby sitter 9. Anyone at home 10 Friends Himself (unranked)	1. Mother 2. Sister 3. Father 4. Grandmother 5. Brother	1. Mother 2. Father/ sisters 3. Brothers	1. Himself 2. Mother 3. Father 4. Sisters 5. Brothers 6. Uncles 7. Everybody in the house

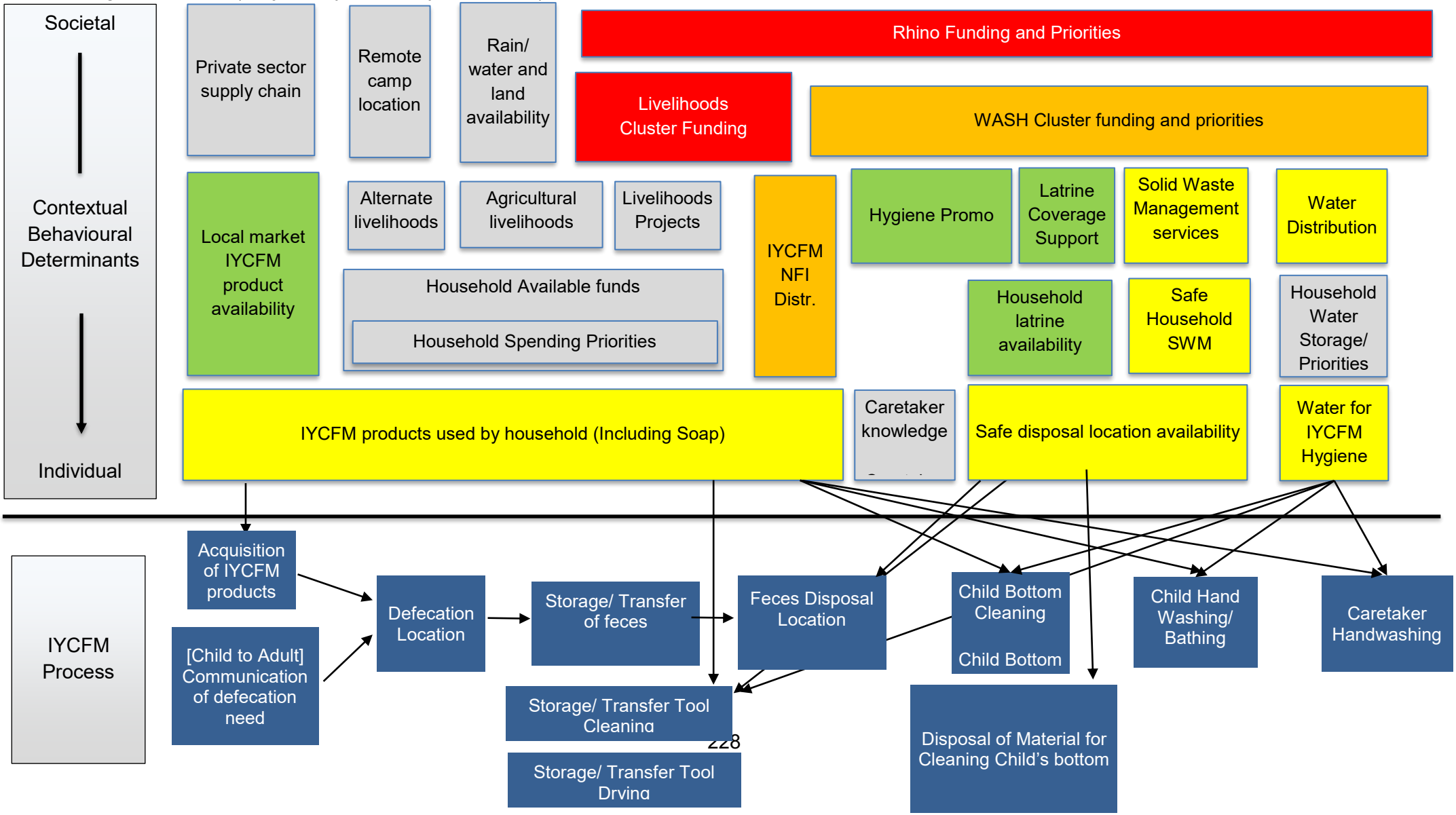
Table 22 below shows the simplified timeline of progression for IYCFM practices. This was created by aggregating the information provided in household interviews with the minimum and maximum age described for each practice. The red boxes again represent the age and the current practice for the interview respondents.

Table 22 - Simplified Progression of IYCFM practices as children develop



Rhino Case Study Contextual IYCFM Behavioral Determinants

The contextual factors are discussed in the contextual factors section. The impact of these items on behaviors is discussed within the results narrative.
Grey = Identified, but not researched or qualified
Red = critically stressed (subjectively ranked by researcher)
Orange = stressed (subjectively ranked by researcher)
Yellow = poor (subjectively ranked by researcher)
Green = good or better (subjectively ranked by researcher)



IYCFM Process steps and related risks investigated within case study

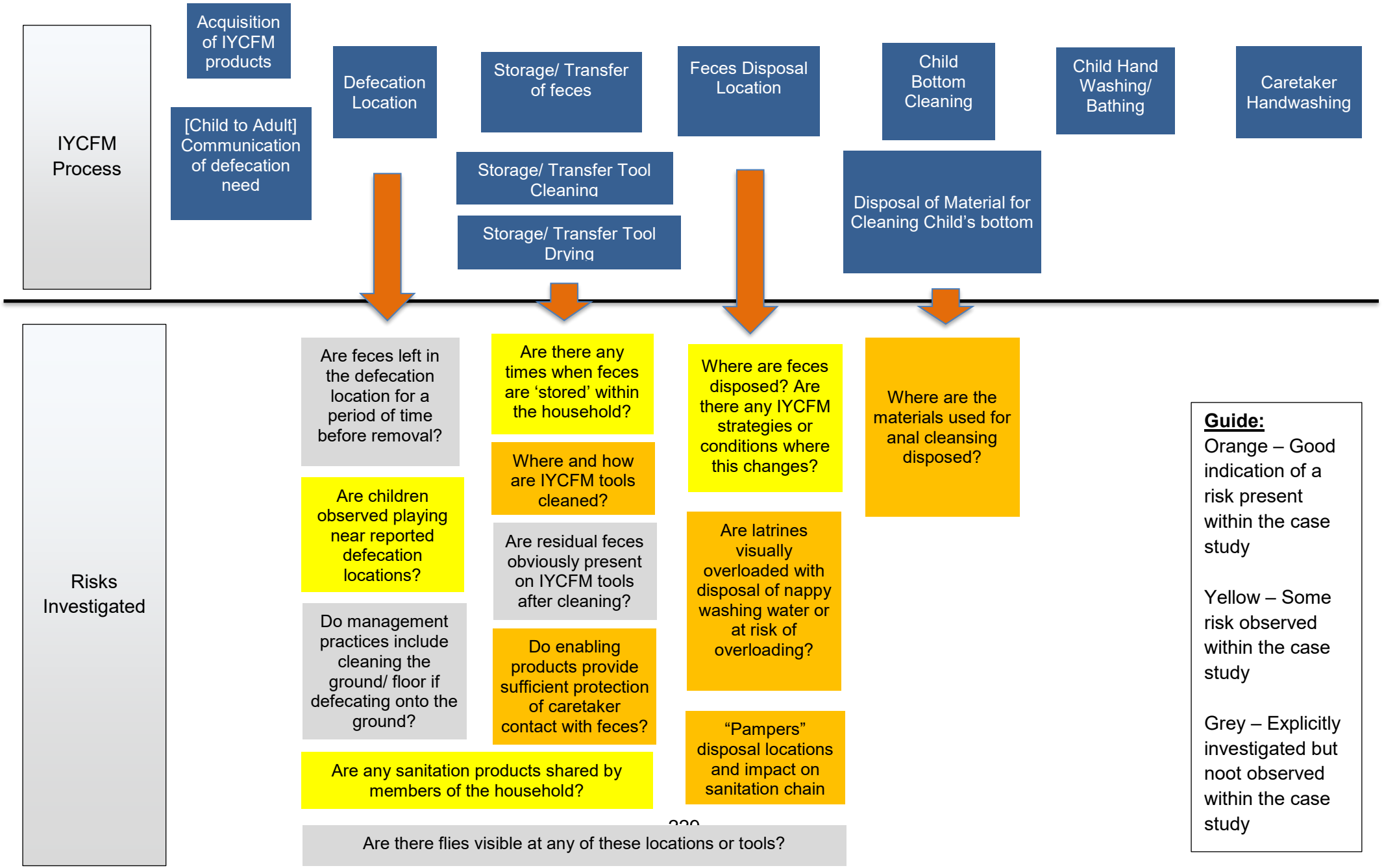


Table 23 - Comparison of reported and observed risks between IYCFM strategies

Comparison of Reported and Observed Risks Between IYCFM Strategies Within Case Study					
Process Step	**Cloths / Diapers**	**Potty**	**Scooping**	**Child Latrines**	**"Big Latrines"**
Defecation Location	• Washing cloths without soap reported to lead to 'itching' • Poor quality cloths may not sufficiently contain feces, increasing the risk of children playing with feces.	Sharing of potties between households may be a source of exposure.	• Potential for insufficient scooping, particularly with diarrhea • Potential for missing child feces, particularly if child is not home • Children playing in defecation areas • Children eating soil in defecation areas • Likely insufficient removal if used in rocky areas or tough soils • Nighttime and rain practices vary significantly and may have additional risks	• Potential for feces on slab if not used or cleaned properly leading to increase in flies in the compound • Potential flooding during rain leading to fecal exposure in compound • Use as solid waste pit may influence emptying options • Note: Defecation location is the same as disposal location	• Potential for feces on slab if not used or cleaned properly • Note: Defecation location is the same as disposal location
Storage/ Transfer	Contaminated cloths stored in home at night and when water is not available	Potties with feces stored at night	None observed		
Storage/ Transfer product cleaning	Significant hand contact with fecally contaminated material	Potential for cleaning outside latrine	Potential for cleaning outside latrine		
Disposal	• Wash water most likely of all methods to be disposed outside of latrine, especially for families using cloths during diarrheal episodes and normally use potties or scoops. • If disposed in latrine, wash water potentially leading to latrine subsidence in poor soils • Disposable diapers likely to influence latrine life and future latrine emptying options	None observed	None observed (Soil volumes may lead to premature latrine fill)		
Child cleaning/ hand wash	• Significant caretaker hand contact with child feces during child bathing • Wash water disposal potentially leading to latrine subsidence • Potential for bottom cleaning outside of latrines				
Caretaker hand wash	Low rates of sufficient handwashing facilities likely exacerbating risks after significant hand contact with child feces				

Appendix IV –Companion Document for Case Study Boundaries and Future Case Study Recommendations

It is recommended that, if possible, future IYCFM case studies with limited resources narrow down scope to a few key areas. The broad take on IYCFM within this case study may not be practical within tighter time frames and led to a considerably longer, more involved study than intended. Adding questions onto the questionnaire to explore other issues would likely cause interview lengths to be impractically long for both caretakers and researchers. During this study it was found that although an indication of practices could be provided for many things, the large scope meant that some research questions remained largely unanswered. The boundaries for this case study are defined here. Future case study recommendations are largely built upon expanding the boundaries of this case study and in defining future case studies for useful comparison. In order to improve future case studies, a brief recommendation is made for potential future objectives for this research aim that were not included within this research before making individual recommendations for each research objective included within this research. Specific research questions are included within each section and a brief discussion of improvements on methodology is included below.

IV.1 Case Study Boundaries

This study did not delve deeper into psychosocial themes in IYCFM other than those raised within the answers. This was due to multiple reasons. First, the size of the interview questionnaire was approaching the reasonable limit of a one-hour interview. Next, the professional background of the researcher is more closely oriented towards technical and logistical issues. Finally, within the literature, multiple studies have attempted to explore psychosocial determinants, but there are very few studies which look into the technical and contextual factors. Based on this literature gap, this study removed the previously included objectives and questions assessing psychosocial behavioral determinants:

- Do caretakers consider their current methods as unsafe?
- Do caretakers understand the risks associated with child feces?
- Do caretakers consider their current methods as inconvenient?
- Do caretakers have views on infant sanitation that are unknown or require significant hygiene promotion?

More robust tools were not used due to time and funding constraints to perform studies on: full market analysis, willingness to pay, ability to pay, and household spending priorities.

Health and medical outcomes of the practices identified were not explored within this study.

Case study boundaries for community comparisons:

- A comparison of other camps within Uganda was not feasible within this case study as these necessitate additional approvals from the Ugandan Office of Prime Minister.
- A comparison of South Sudanese vs refugees from Democratic Republic of Congo within Rhino was not possible with this case study due to funding and timing constraints.

- A direct comparison of acute vs stable contexts was not possible with this case study. There were some communities within Rhino with new arrivals coming from South Sudan (Rhino extension). Comparing these communities was not possible due to funding and timing constraints, although this may have been a useful comparison given the apparent impact of extended hygiene promotion on IYCFM practices. To provide direction for future research, a question was included within the semi-structured interviews to collect experiences during initial settlement within Rhino.
- Mentioned several times within the interviews, initial processing and transit centers might have also provided a useful comparison for the case study. These were not compared due to access issues along with the funding and timing constraints of the case study.
- A comparison of host communities to the refugee population was not possible due to funding and timing constraints. The host communities have access to more livelihood generating activities, but have had less hygiene promotion. Comparing these contextual factors as well as cultural differences may have been useful given the results of the case study. This may have provided useful information regarding behavioral determinants.

Case study boundaries within methodologies and participants

- Within each household, only one child was the focus of the interview, since completing the questionnaire for multiple children would have taken a prohibitively long time to conduct the interview.
- Within the study communities, the hygiene promoters cited that there are ‘model homes’ which meet specific criteria for hygiene within their compounds. A comparison between these ‘model homes’ and those that do not meet the criteria was not possible with the small number of qualitative interviews.
- FGDs with health workers and hygiene promoters were considered to compare if the messages were internalized by the staff promoting them. This information was collected in the impromptu unstructured interviews with a hygiene promoter and through opportunistic observations. Because FGDs took significant resources to organize and facilitate, additional FGDs were not feasible due to funding and time constraints.

IV.2 Future objectives to improve future case studies with a similar research aim

The original objectives set for the study contained contextual, technological, and psychosocial behavioral determinants. However; with limited funds for field work, the questions focused on understand the range of practices as the primary objective and the psychosocial behavioral determinants were dropped completely.

Because the study did not examine psychosocial determinants in depth in parallel with contextual and technological issues, some results have limited explanatory value. For example, while children may anecdotally ‘fear the dark’, specific fears that children had influencing their nighttime defecation locations were not explored within this context. It was also not explored if caretakers themselves had reasons for not going outside. Similar studies by Reed et al. (2018) examined some factors influencing nighttime latrine usage within other communities within Rhino for adults and found than nearly 70% of female community members were prevented from using sanitation facilities at night due to poor lighting The conditions leading to this behavior may not be

present within more secure areas. Additional case studies on IYCFM may benefit from a stronger psychosocial perspective to inform these behaviors.

IV.3 Additional steps to help address contextual behavioral determinants in future case studies

There are some limitations when attempting to understand the contextual influences on practices, particularly with the limited depth of information. Other contextual factors may have gone unaddressed since the study was limited to the original research questions and the challenges mentioned by caretakers and key interview informants. Future case studies with more resources may choose to focus exclusively on contextual factors with a grounded theory approach openly exploring each issue as it reveals itself during research. Two issues are suggested here that would have improved the descriptive ability of the contextual information and provided more solid results: A stronger knowledge assessment and comparison with pre-hygiene promotion practices in acute emergency phase and a stronger assessment of household priorities along with ATP and WTP for IYCFM products.

Future case studies may find benefit in examining IYCFM practices through time as an emergency develops between acute and stabilized phases to see how context effects these practices. Additionally, examining specific practices such as tool cleaning before and after hygiene promotion interventions may help identify how this promotion impacts behaviors beyond disposal. For example, the practice of completely bathing children may have been a relatively new practice developed from new parental understandings of the risk of child feces.

A large gap exists in assessing the local economic situation. This could be a valuable component for future case studies to better understand how economic restrictions influence IYCFM. Lack of assessment for household willingness to pay and ability to pay for consumables such as soap was a major limitation to this study to compare with the reported financial barriers reported by caretakers. Higher level financial constraints also limited the descriptive ability of the contextual information. For example, the availability of household funds appeared to be impacted by a number of non-assessed factors including agricultural livelihoods, livelihood projects from the livelihoods cluster, and any other potential livelihoods within Rhino. Although key informant interviews indicated that the livelihoods cluster was critically underfunded and several livelihoods projects were seen under disrepair, assessments of the complete economic situation within the case study communities was out of scope.

Specific contextual questions to address in future case studies:

- If agricultural or latrine building tools are not provided in an emergency how do IYCFM practices change?

- What effect do the contextual factors have on IYCFM practices? Would the practices described within this case study be different with less hygiene promotion, more or less water stress, greater access to products and livelihoods, in an acute emergency, in an epidemic vs displacement, in a higher income context, outside of Sub-Saharan African, in areas with communal but not on plot sanitation?

- To what extent are disposables growing in usage across Sub-Saharan Africa? What are the current and future potential impacts of insufficient solid waste on the sanitation chain in areas where these are used extensively, but are disposed within latrines? What are the current and potential future environmental and public health impacts if these are openly disposed? What research has the private sector conducted that might provide insight to this issue?

- How will the humanitarian community ethically balance IYCFM provision between emergencies in high income contexts and lower income contexts, especially if communities are requesting similar products? Does a double standard exist in resource allocation and provision that needs to be directly addressed?

- What are the best methods for IYCFM product delivery in an emergency? What support can be provided to local market actors to ensure they have consistent supply of the products needed by caretakers for IYCFM? In situations with a large market presence and IYCFM NFI is provided, what effect does this have on local market actors? How viable are voucher systems within this context?

IV.4 Additional steps to help understand IYCFM processes in future case studies

Based on the results of the literature review and the results of the study, two other process steps may be useful to consider in future case studies: acquisition of IYCFM products and drying IYCFM products after washing. These were included within the results section as these were mentioned by caretakers when describing their process for IYCFM.

By explicitly including questions of acquiring IYCFM products, future research could better understand household purchasing roles, IYCFM household spending priority (WTP), barriers to purchase (including ATP), etc. Inclusion of acquisition as a process step would emphasize that sanitation for children requires products when children cannot yet use latrines. This might also reveal conflicting household spending priorities as barriers to IYCFM products.

While drying IYCFM products may not appear to be a critical step within the IYCFM process, its inclusion may emphasize that a location to dry cloths is a necessity. This process step may have a larger influence on IYCFM practices in conditions outside of this case study such as: high density locations with limited space, limited cloths per caretaker, rainy seasons requiring indoors drying, and high humidity with long drying times. During this study potties were also washed with water after each use and placed in the sun to dry. The effect of this practice is discussed below on the technological analysis.

Specific IYCFM process questions to address in future case studies:

- How can public health teams quickly assess and code current IYCFM practices and adapt programming to reduce risk?

IV.5 Additional steps to help address child development in future case studies

The later training ages described in Appendix I and within this study may imply that some studies, including the MICS global survey, are likely missing many children who are not using latrines and therefore require their feces to be managed with methods other than 'adult sanitation'. Due to a near complete lack of qualitative data, anthropological studies describing these sanitation transitions and the challenges faced by caretakers and children within a variety of contexts may provide useful information at making latrines more friendly for children during this time. Better understanding the local boundaries of these sanitation changes will likely be a useful tool for setting the inclusion criteria of IYCFM studies, particularly for qualitative studies. Quantitative studies may examine practices globally to find the best ages that capture the variety of IYCFM practices present around the world.

Specific child development and IYCFM questions to address in future case studies:

- If IYCFM product acquisition improves (inside or outside of an emergency) for very young children (those too young to use potties or open defecate), and this made IYCFM more convenient for caretakers, would this this incentivize families to postpone training? What would the implications of this delayed training have on NFI or hygiene promotion?

- How can programs best address the wide variation of developmentally based sanitation practices from birth to independent sanitation? To what extent should these programs attempt to match the sanitation advice provided by pediatricians within high income, non-emergency contexts?

- How can we best deliver messaging to engineers that children of different ages have different developmental abilities that will dictate which sanitation provisions are appropriate for use?

IV.6 Additional steps to help address variances in practices in future case studies

A limitation to this analysis is that the relative occurrence of changing conditions has not been assessed. Rain may be easily predicted with the Ugandan rainy season. While 'nighttime' obviously occurs daily, children may only rarely defecate at night, especially later in their development. 'Ability to control bowels' was a question posed to caretaker, however, differentiation between daytime and nighttime continence was not assessed as a component of this research. This may be a useful differentiator for both the changing conditions and for child development to examine in future studies. Other conditions have an even less obvious occurrence such as how often caretakers take children on a journey. Future case studies may discuss with caretakers how often these occur.

When considering that the case study communities were using assisted infant toilet training techniques, diarrheal occurrence may have a reduced impact on families who 'potty train' at much later ages and use disposable IYCFM products until children are much older (see literature review 2.3). Additional case studies in

communities using delayed training techniques may provide a useful basis for comparison of diarrheal impacts on IYCFM strategies for children of different ages.

Future case studies could consider other conditions, for example, between communities with different soil conditions. This could show challenges and risks of scooping in areas where fecally contaminated soil occurs. Additionally, future case studies may examine changing conditions from a grounded theory approach looking to identify other conditions which modify caretaker practice.

Specific IYCFM variations questions to address in future case studies:

- How can we develop our understanding of variations in caretaker's practices within a given household and the risks involved?

- Within a cholera context, how are caretakers practicing IYCFM? Similar to this study, are children previously using other sanitation technologies such as potties or scoops using cloths during cholera? How do water needs increase for IYCFM washing during cholera? If there is a large increase of wash water disposal in latrines during this time is this creating any additional risks? How practical is it to adapt hygiene promotion around IYCFM to address different variations in different contexts?

IV.7 Additional steps to help address caretaker roles in future case studies

It was difficult to triangulate caretaker roles within the methodologies used and the results were inconclusive as to the full extent that household members are assisting with IYCFM and at which stages of a child's development these occur. Longer, structured observations focusing on this topic may produce more accurate results. Future case studies may focus exclusively on secondary caretaker roles and how these change as children develop. Additionally, knowledge transfer on sanitation practices through household members may be an interesting topic of future study, particularly in areas where hygiene promotion activities target only heads of households. Future case studies may also focus on household priorities and if these are significant barriers to IYCFM products.

Specific IYCFM caretaker role questions to address in future case studies:

- What risks are present for small children assisting with IYCFM of smaller children?

- How is knowledge transferred throughout the household if a primary caregiver is given a message, but other family members are contributing significantly to child care? What are the risks to children who are assisting with IYCFM of younger siblings if insufficiently trained?

IV.8 Additional steps to help address risks in future case studies

There were several risks within the original research questions that did not appear to be present within this context during the time of the study. These may be present within other contexts or within this context during different conditions (such as rainy season).

- Flies were not seen in any of the defecation locations or near IYCFM tools.

- Each household interview presented IYCFM tools as a component of the spot observations. IYCFM tools appeared to be cleaned sufficiently so there were no residual feces spotted during spot observations.

Given that risk is comprised of both likelihood and impact, neither of these are quantified within this study. This study did not look at the conditions under which tools are cleaned, the frequency of this practice, or suggest estimates for the quantity of feces entering the home environment. Additional qualitative and quantitative studies examining each of these risks in a range of contexts can provide additional evidence of risks beyond safe disposal for each IYCFM strategy that need to be considered.

Similar to the initial review in section 1.3 attempting to place IYCFM practices within a broader global context, this research originally included an objective to understand IYCFM risks in relation to other risks within the home environment, represented by figure 65 below.

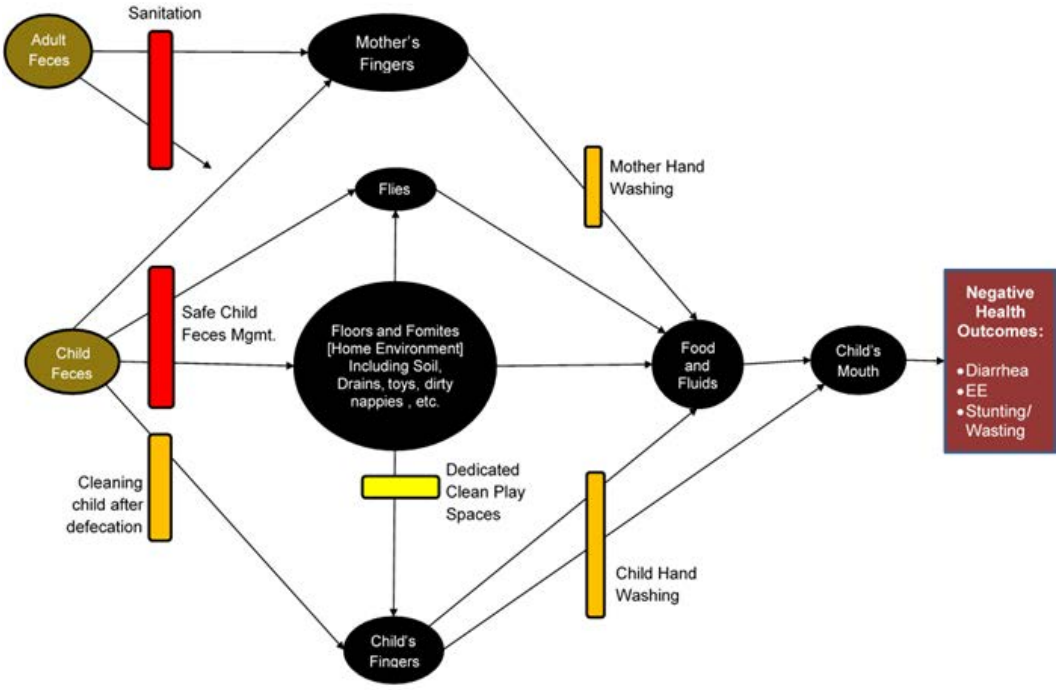


Figure 62 – Simplified F-Diagram adapted to match risks and barriers identified within original literature review objectives. Only IYCFM and post-disposal hygiene have been included within the study.

The intention of this review was to better place IYCFM within a priority of household interventions. However, attempting to assess multiple non-IYCFM related risks was not seen as feasible additions to the case study scope due to the skills of the researcher, time constraints, and resource constraints. For these reasons, this literature was not included in the review nor in the data collection as it would not support the research objectives. Future studies could focus on exploring all aspects of household exposure and risk to children to better place IYCFM within a set of humanitarian priorities.

Dedicated case studies focusing on latrine subsidence are needed to better understand this risk. Physical science studies should be conducted to better understand latrine subsidence comparing volumes of wash water in varying soil conditions for various latrine pit designs.

Specific risk related research questions for future case studies:

- Why did some families choose to build child latrines despite the discouragement of the public health teams? Where did this latrine design come from? If this was learned from camps within South Sudan, how can responses better coordinate messaging on IYCFM?

- Does disposal into a latrine after open defecation provide sufficient protection to be considered safe? Does this significantly change the fecal coliform count within soils where children are playing and potentially eating dirt? Should the definition of 'safe disposal' be updated to 'safe management' and include aspects of the IYCFM process beyond disposal? How would this be measured and monitored?

- What impact do disposable diapers have on latrine emptying? If disposal of these products within latrines necessitates manual emptying, should this be considered safe disposal? If not, are there convenient solutions other than robust solid waste management used in high-income contexts?
- What are the risks for cleaning of residual feces on IYCFM tools? Are these relative between the technologies?

- Are there best practices for cleaning children's bottoms that can minimize risk, cost, and household water stress in an emergency?

- Are there significant variations in the order of operations? If so, does the order of operations provide any risks? For example, if after defecation the caretaker washes a child's bottom then washes her hands but then removes feces and washes the tool? Does this change under any varying conditions?

- To what extent does the lack of lighting at night introduce risk into the IYCFM process?

- What are the priorities for sanitation in an emergency? Should vulnerable groups be prioritized? Should sanitation be prioritized on relative size of sub-populations? For example, if children under-5 make up 25-30% of a displaced population, 4/5 of those may not currently use latrines. If 24% of a population are unable to use latrines, and do not have any sanitation provision, should the only indicator for sanitation be access to a latrine? Has this been a conscious decision or one of necessity? What are the most useful indicators for these populations to determine risk and safety? Can this be a combination of product, disposal infrastructure, and knowledge? Can lessons be adapted from MHM? Can lessons be adapted from studies of adult incontinence? How practical are these assessments within different stages of an emergency?

IV.9 Additional steps to help address technology themes in future case studies

With few case studies considering technology themes, appropriate questions beyond technological risks were difficult to prepare prior to conducting the study. These constraints meant that several of the original questions

prepared for technological suitability were not able to be answered within this case study. Preparing technology suitability research questions without a familiarity with the study area required assumptions to be made about the technologies in use. Only after arrival to the case study area were these able to be assessed for relevance. Technology themes discovered during the study were difficult to explore based on resource constraints and priority of answering the pre-defined research objectives. Future case studies would benefit from using a grounded theory approach and focusing solely on technology themes to explore these topics on site.

The distances to disposal facilities was not mentioned in either the FGDs or household interviews as a factor to disposal. This is likely because each home within the case study had a latrine on plot, although this was not confirmed within the interviews. Additional case studies in areas with varying latrine coverage such as communal latrines or acute emergencies with no latrine coverage will need to be conducted to better understand the impact of these items.

Communal solid waste management services were not available within Rhino and were not assessed as a component of this research. Case studies in emergency situations with these services (such as displacement within higher income contexts), may provide more useful information on the suitability and influence of these services for managing disposable diapers. Household solid waste pits were not assessed for their ability to manage these products as it was assumed that these were not viable disposal locations. Future research may choose to challenge this assumption.

The general question for challenges did not reveal any technical challenges, focusing on financial barriers to purchasing IYCFM products such as soap, cloths, and potties, mentioned in the contextual information above. Specific questions relating to observed or reported technical challenges may be a more effective method at understanding these issues than general questions of challenges.

A technical review of the differences in water provision between these communities was not a component of this research due to time and budget constraints. Further case studies could better understand how differences in water supply affect caretaker's ability to manage child feces. Additionally, while the question was asked if water was sufficient to manage child's feces, reported volumes were inconsistently reported and varied widely. Future case studies may focus on this aspect of IYCFM to better understand these water needs and provide more accurate estimates of water needed for each IYCFM strategy. Structured observations with physical measurement may be a more reliable method at understanding water usage.

Physical science studies should be conducted to better understand the volumes of soil moved into latrines due to scooping and the effect this has on latrine life. Future public health teams may find value in assessing local latrine infrastructure before suggesting scoops as the potential intervention.

Figure 63 - Potty Comparison

While seemingly trivial, it is worth noting that low quality potties may not last and if distributed for IYCFM purposes, may be unusable after a period of time that is not currently well known. Further qualitative and physical science studies may examine this issue to determine a practical design life for potties and decide if this has an impact on

NFI distribution, particularly in extended displacement. Previous research on the mechanics of plastic degradation in UV light could also be applied to this situation to better understand the relative durability of different plastic potty designs. Figure 66 to the right shows a comparison of potties. On left: the potty design available within Rhino. On right: A higher quality potty made of thick plastic available within Arua.

With our current lack of research on cloth diaper and reusable diapers in emergency contexts, the risks of this inadequate distribution and the subsequent coping strategies are not well known. Further case studies in these environments could help provide information on this topic.

Examining convenience factors with time studies of IYCFM practices may produce information showing how some IYCFM strategies are more or less convenient than others. While this was mentioned as a behavioral determinant in Appendix I above, this was considered non-feasible within this case study. This information may help hygiene promotion activities better address the concerns of caretakers while still reaching public health goals.

Specific IYCFM technology questions to address in future case studies:

- For families who use OD + scooping methods, what volume of dirt is moved into the latrine? Does this have any significant influence on the life of the latrine?

- Under which sets of environmental conditions are scoops or potties more appropriate for distribution? Should public health teams consider soil types, population densities, rainfall, latrine type etc in addition to user preferences? If pour flush toilets are used, should scoops be automatically ruled out? Under rocky conditions should scoops be automatically ruled out?

- To what extent will wash water disposal in latrines affect the integrity of the pit in a variety of different soil conditions? Are there inexpensive, appropriate latrine linings to make latrines more appropriate for wash water disposal in areas with collapsible soils? Are there any soak-away designs for this water that would provide sufficient protection from flies and fecal contamination? If not, are there any innovations that could be made to conveniently handle fecally contaminated wash water in resource constrained environments? How will wash water disposal work in emergencies with high population to latrine ratios?

- Do hardware interventions work in acute emergencies? How well do communal based solutions work for young children? Are there distance limitations? How can communal based solutions account for lack of continence?

- Are there best practices for child latrines that can be better adapted to a variety of contexts? What contextual factors need to be considered in their design? How does ‘big latrine’ design affect use by children of different ages? How can latrines be designed to make them more accessible to children of younger ages? Should the goal of engineering latrines for children be the adoption of these technologies by children as young as possible? To what extent should engineering attempt to facilitate modifications in children’s sanitation progression during development in order to meet public health objectives?

- How can humanitarians respond to the introduction of disposables into an emergency context if there are insufficient resources to safely handle these products? Are there solutions such as communal incineration that might be more appropriate for child sanitation solid waste? Has this been piloted anywhere? What are the implications for their improper disposal in extended displacements with limited land for new latrines?

- In Kerine Deniels 2004 paper, it is recommended that children are taken to defecation trenches within acute emergencies. Has this ever been assessed? How effective is this practice for children of different ages, particularly those unable to control their bowels?

- Should disposable diapers be considered a sanitation product? Should cloths be considered a sanitation product? Should laundry detergent, *omo*, be considered a sanitation product? Should wash basins be considered a sanitation product? If these are necessary for safe sanitation for young children, should this influence provision?

IV.10 Additional steps to help improve IYCFM research methodology in future case studies

There are potential biases defining IYCFM practices within the case study. The significant hygiene promotion within the communities may have led some caretakers to overemphasize practices that they perceived as positive. The use of local hygiene promoters as translators may have also induced caretakers to provide responses they perceived would portray themselves positively. For example, bathing after each defecation event appeared to be a preferred practice and this may explain its reported prevalence. Similarly, many households reported pamper usage, but later admitted to using cloths demonstrating that there was an effort to display a behavior that was not financially possible for many caretakers within the case study.

Hawthorne effects from the white, western researcher may have introduced a hopefulness into the research that incentivized caretakers to amplify challenges, even though it was emphasized within the informed consent that the researcher was not affiliated with any NGO and the research would not lead to a change in service levels or NFI provision.

Another potential biasing element of the study is due to the sampling strategy. The study attempted to find an even distribution of caretakers from birth until independent sanitation. While this allowed for a broad view of the case study communities, it did not allow for a depth of information within any of the specific IYCFM strategies, particularly for cloth usage in the first six months. This indicates that qualitative data saturation for any given IYCFM strategy was likely not reached. Fully reaching saturation for each IYCFM strategy would not have been feasible with the project budget and timeline. Future case studies may find it useful to conduct a preliminary study to identify the range of IYCFM strategies within a community before focusing on one particular IYCFM strategy to gain deeper knowledge on these practices.

The comparison between the coping strategies and relative risks may have some inaccuracies given there were different numbers of caretakers using each technology within the case study, allowing for large differences in the depth of information to be collected on each IYCFM strategy. For example, although about a fifth of families either planned to use a child latrine or had used one in the past, only one family was found to currently use child latrines within the case study. Nearly half of all respondents were using scoops, which could account for some of the coping strategy variety. To better understand these comparisons, another case study should be conducted intentionally collecting similar sample sizes for each IYCFM strategy.

Results regarding displacements may have been impacted by several potential confounding factors. For example, the proposed use of pampers within South Sudan may have been heavily influenced by a desire to both appear modern while also showing that these preferred IYCFM tools were lacking. Additional case studies within South Sudan may provide a better comparison of changes.

While the results on secondary caretakers are presented as reported, there may be factors affecting its reliability. This could be explained by the fact that children do not spend much time away from their mothers during the first few years, although the amount of time that children spend with secondary caretakers was not assessed within this study due to time constraints. Without longer structured observations, these claims were difficult to triangulate. This information was collected to help compare to the FGD results on secondary caretakers to provide evidence for expanded hygiene promotion beyond the head of households. While the FGDs showed there were many people involved with IYCFM within the household, the differences in these practices remain largely inconclusive. the other conditions assessed are largely outside of a caretakers control, these may be perceived by caretakers as reflecting on the care provided to their children.

Similar to the results for IYCFM behaviors, the questions used to assess risks may have been answered by caretakers in a way that portrayed themselves positively. For example, it was clear within the handwashing questions that caretakers were keen to demonstrate that they washed hands after IYCFM, even stating that they used ash when soap was not available. However, the spot observations showed that few handwashing facilities were in fully operable condition. While this result was easily triangulated with spot observations, other practices, such as disposal of child bottom cleaning material, were not able to be confirmed with spot observations. Future case studies with more resources could use longer structured observations to better triangulate these results.

While the semi-structured interviews were supplemented with spot observations, FGDs, and incidental observations to verify the household interview results, longer structured observations could provide a more robust verification that was not possible within the budget for this research. Note: Appendix II discusses piloting of FGDs and household visits.

IV.11 Suggestions for future case study contexts

With the disjointed themes and no previous case studies within the literature, identifying typical or extreme case studies were difficult. The practicalities of this research also limited the options for case studies to very specific

locations meaning this case study is neither extreme nor necessarily typical. This section outlines the components for future case study researchers to consider when selecting either extreme or typical cases.

Based on the results of this case study, future case studies should look for extremes in water availability, product availability, population density, high diarrheal incidence, large numbers of displaced children, and weather patterns requiring children to remain indoors

- Acute displacement to better understand practices for children of different ages when disposal locations are not yet available, when water for hygiene is severely restricted, and when no IYCFM products are available.
    - High density camps in settings where caretakers are more used to allowing children to open defecate.
    - High income emergencies where caretakers typically use disposable products and delayed training techniques.
    - Epidemics with large diarrheal incidences to assess changing IYCFM practices in a location with an active
    - Camp settings during rainy or monsoon seasons to observe how practices change between caretakers using different CFM practices.
    - Conditions with extreme water stress to observe how caretakers manage washing and hygiene.

      Thanks for reading, Jake Pitts, wash.humanitarianengineer@gmail.com