BRISTOL STOOL CHART VALIDATION STUDY

SIAYA, KENYA

By

FATUMO M.GULED

Bachelor of Arts, HEALTH: Science, Society and Policy

BRANDEIS UNIVERSITY, 2007

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Definition of TERMS

BSC- Bristol stool chart

MCH- Maternal and Child Health

WASH- Water Sanitation and Hygiene

WHO- World Health Organization

UNICEF- United Nations Children's Fund

Notes

1. Kiswahili and Dholuo words are written in Italics with a foot note explaining what they mean

2. Statements from participants are identified by a code

MM 1: The first Mother Interviewed

MM	Mama (a child's Mother)
1	The number given to that participant

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Abstract

Background: In the evaluation of Water, Sanitation, and Hygiene (WASH) intervention studies, researchers rely on mothers-report, a subjective outcome measure on whether their child has had diarrhea. Since this method is subjective there is a need for a more objective outcome measure. We are proposing the use of the Bristol Stool Chart (BSC). This is a scale of seven stool types that includes images and descriptions. The chart was developed and validated in Bristol, England to evaluate adult patients with irritable bowel syndrome but it has not been used as an outcome measure for WASH research in developing countries. ***Objective:*** This study assessed whether the chart can be used as an outcome measure instead of the alternative, mothers-report.***Methods:*** Mixed methods approach was used, using 99 surveys and 5 in-depth interviews. We assessed the ability of the mother to use the tool by asking mothers to rate their child's most recent stool and fake stool models on the chart. We measured the association between mothers' ability to use the chart and mother/child characteristics. Mother's ratings of three fake stools measured inter-rater reliability. In-depth individual interviews were used to understand mothers' perceptions of children's stools and stool types on the chart. ***Results:*** Mothers were able to rate the stools of children who were younger than three years old and still breastfeeding. In addition mothers were able to rate their children's stools who had come to the clinic for varied ailments. Specifically mothers were able to rate all the diarrhea cases on the chart as softer to watery stools, although the cases were very few. Mothers were able to consistently identify the three fake stools on the chart, establishing inter-rater reliability. Through in-depth interviews we learned that there are different types of diarrhea in this community and that the chart is well understood. ***Discussion:*** The chart can be used for children younger than three years old, weaned or those with diarrhea. ***Conclusion:*** In field settings the BSC can be used with mothers-report, this study has shown that it works well for certain children. If the tool will be used in this region one has to consider the varied types of diarrhea defined informally.

Table of Contents

List of figures

LITERATURE REVIEW

Diarrhea Burden

Diarrhea is a serious preventable public health crisis that accounts for 1.8 million deaths annually worldwide (WHO, 2005). The burden of disease disproportionately affects children who account for an estimated 68 percent of the global disease burden (Bartram, 2003). The morbidity and mortality associated with diarrheal diseases in resource poor settings is mostly attributed to drinking unsafe water and poor hygiene and sanitation practices (Prus-Unstun A., Bos R., Gore F., & Bartram J., 2008). The Joint Monitoring Program (JMP) for Water Supply and Sanitation organized by UNICEF/WHO estimates that 2.6 billion people worldwide lack improved sanitation and 884 million lack improved water source. The JMP classifies improved sanitation as flush or pour-flush toilet to piped sewer system, pit latrine or septic tank; a ventilated pit latrine (VIP); composting toilet or a pit latrine. Improved water supply is classified as at least 20 liters per capita per day from protected source within one kilometer of the users dwelling (WHO/UNICEF, 2008). In the African region diarrhea is the third leading cause of mortality in children under five (WHO, 2005).

Causes of diarrhea

The World Health Organization defines diarrhea as "the passage of 3 or more loose or liquid stools per day, or more frequently than is normal for the individual"(WHO, 2011). Various infectious agents cause diarrhea that include bacteria, protozoa and viruses. Transmission occurs through the "oral fecal route " which is direct transmission from one individual's feces to another individual's mouth either by ingesting fecal or water

contaminated with fecal matter (Keusch G.T, 2006). In high income countries diarrhea cases are rare mainly because most people have access to treated water supply, good personal and environmental hygiene however in middle and low income countries the diarrhea burden is immense mainly due to lack of water and sanitation facilities.

WASH Interventions

WASH intervention studies conducted in developing countries provide evidence that improving water, sanitation and hygiene reduces diarrhea mortality and morbidity. A meta-analysis published in 2005 (Fewtrell et al., 2005) reviewed the effectiveness of multiple interventions in diarrhea reduction, sanitation, hygiene, water supply and quality, and a combination of multiple interventions. Sanitation interventions provide a system that deals with disposing feces so they do not get back to humans for example building latrines and sewage systems. Hygiene interventions include providing education and promote behavior change such as hand washing using soap. Water supply interventions focus on overall community improvement or at the household level through improved water distribution, installation of hand pumps or water pipes connectors to a household. Water quality interventions involve water treatment to remove contaminants that cause illness either at the water source or at the household level (point of use) (Fewtrell & Colford, 2005).

There is a general consensus that hand washing with soap a popular hygiene intervention is very effective. A review of multiple studies that involved hand washing with soap as an intervention focus showed a reduction in diarrhea morbidity by 42 - 48%. Hand washing with soap is a relatively cheap intervention and multiple studies have shown consistent results in how much the intervention reduces diarrhea. Water quality

interventions that involve water treatment at the house hold level another relatively cost-effective intervention also shows a decrease in diarrhea by 30-40%, but the results for water quality studies show a wider variation across studies, the intervention is still effective in reducing diarrhea cases (Cairncross et al., 2010).

Studies indicate that interventions are effective however other researchers evaluated the methodology used in the studies and concluded that the results may be biased because some studies were not blinded, some were conducted for a short period of time and/ or use a subjective outcome measure that is self reported diarrhea(Schmidt and Cairncross 2009). Therefore identifying cost effective interventions that use research methodologies that can be applied across cultures is required.

The ability to measure the outcome of interest often times diarrhea in different settings is an important part of evaluation of the impact of the intervention. WASH interventions use diarrhea morbidity as a health outcome although it is a difficult health outcome to measure in field studies since it is caused by various pathogens and transmitted through various routes (Clasen, Roberts, Rabie, Schmidt, & Cairncross, 2006). Laboratory test for stool samples can be useful in identifying pathogens but the tests are expensive. In measuring intervention efficacy it is easier to inquire about diarrheal cases in children from the care taker typically the child's mother. Mothers-report is a subjective outcome measure therefore there is a need for a more objective measure of diarrhea that is feasible in field settings. We are proposing the Bristol stool chart as an outcome measure instead of mothers-report.

Bristol stool Chart (BSC)

The purpose of this research was to validate the Bristol Stool Chart (BSC) so it can function as a more objective health outcome measure, instead of mothers-report in WASH intervention studies. The Bristol Stool Chart is a scale of seven stool images and descriptions which was developed and validated in Bristol England for adults with irritable bowel syndrome. During that time clinicians understood very little about stool form therefore the scale was developed to assist clinicians in evaluating patients with irritable bowel syndrome that reported constipation. The first study that developed and used the scale aimed at understanding gut physiology by assessing intestinal transit time, timing and frequency of defecation and stool form in adult population. The scale had stool form descriptions from hardest stool *type1* hard lumps like nuts through type7 – a watery stool, entirely liquid without any solid pieces (Heaton et al., 1992). The same scale was later used to monitor changes in the functioning of the intestines for elderly population to evaluate whether stool form is a better predictor of intestinal transit time than how many times people had a bowel movement. This study validated the scale and concluded that stool form was a better method of evaluating changes in the function of the gut using the chart than looking at other more expensive measurements (Lewis & Heaton, 1997).

The chart was later adapted and validated into Spanish language. The purpose was to have a tool, in Spanish, that can be used to evaluate stool form and consistency in clinical practice and research (Pares et al., 2009). A recent study done in the United States reduced the original scale from 7 stool forms to five and validated the modified scale against stool photographs using pediatric gastroenterologists as raters. The scale

was reduced to five types of stool for ease so that children can easily rate their own stool using the scale. The purpose of the study was to develop a scale that can asses stool form in clinical and research settings. The study concluded that the modified Bristol stool scale (excluding types 5 and 3) was useful in assessing stool form in children and adults (Chumpitazi et al., 2010). The validation study conducted in Kenya used mothers as raters, translated the original chart to '*Kiswahili*[1]' and '*Dholuo*[2]' and added one extra stool type that represented watery stool with mucus and blood a common stool in the region.

BSC as an outcome measure

Typically water sanitation and hygiene intervention studies use diarrhea as the health outcome instead of mortality because it is difficult to study causes of mortality. Mortality is a relatively rare event compared to morbidity and mortality can be caused by multiple factors that are not directly associated with the intervention (Blum & Feachem, 1983). Diarrhea is a common infection therefore it is a better health outcome; however it needs to have a reliable objective measurement. Currently WASH Randomized control trials use a subjective outcome measure that is self reported gastro-intestinal symptoms which some researcher argue could be a biased estimate of the impact of the interventions for example in household water treatment results estimates (Schmidt & Cairncross, 2009).

The Bristol stool chart can potentially reduce systematic errors associated with courtesy and social-desirability bias In addition the chart may help reduce the confusion

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[1] Kiswahili- A language spoken in Eastern Africa countries Including (Kenya, Tanzania, Uganda, The Congo etc)

[2] Dholuo- A language spoken by the Luo people that live in Western Kenya around Lake Victoria

associated with the standard definition of diarrhea that is a mother remembering how many times a child passed stool, the stool form and for how long. The standard diarrhea definition is confusing since it inquires about frequency of the stool, and stool consistency compared to other stools within a specified time frame. The scale may also assist mothers in recalling diarrhea episodes since the chart has images.

The chart may reduce social desirability bias a systematic bias that stems from the participant knowing the "correct" answer and wanting to present him/herself in the best possible light. (Crosby, A.J, & L.F, 2006). The Bristol stool chart can reduce the courtesy bias, a source of error in un-blinded studies that occur when the participants in an intervention group overstate the effect of the intervention to please the person collecting data. Also the Bristol stool chart may also assist mothers in remembering stool form that happened days ago and how the stool looked like.

Pictorial superiority effect (done)

The simple images on the Bristol Stool Chart considered in this study could help mothers with remembering their child stool pattern and avoid the confusion associated with the standard definition of diarrhea which is usually read out to the mothers in field research. Pictures or images used in health education campaigns and in health communication, instead of handouts with just text, have shown to have a greater effect on recall, communication, attention and comprehension (Houts, Doak, Doak, & Loscalzo, 2006). A great deal of information can be captured in a simple image in the place of a lot of words that could be difficult or take a long time to comprehend. The images on the Bristol stool chart will summarize parts of the information contained in a few questions about children's fecal pattern.

Methodology for validating studies

The validity and reliability of an instrument has to be assessed before it is used as a research tool. A good research tool is both valid and reliable. First, a systematic approach is typically used to establish validity by reviewing literature for other validation studies, translating the instrument to the local language that will use the tool and reviewing the content translated for clarity by experts in the area of the topic. In addition it is advised to hold focus groups that will suggest the appropriate words commonly used in the population that will use the instrument.

A second step in the process of validating a research tool is designing methods that will collect data analyzable for different types of reliability estimates. Reliability is important because it is the ability to estimate measurement precision in the scores produced by the tool. Using human judgment can be difficult therefore one can decide which reliability tests to use in validating their instrument. There are four main types of reliability estimates depending on the tool and data collected which are;-inter-rater, parallel forms, internal consistency and test-retest reliability. Inter-rater or inter-observer reliability is the assessment of whether raters/observers give consistent estimation of the same phenomena under the same conditions. Parallel-forms reliability is the assessment of the results produced by two tests that are created in the same way from the same content domain. Internal consistency reliability is used to assess the consistency of the results across items within a test. Test-retest reliability examines measurements from the same observer at different time points and examines whether the measurements from different times such as a few days produced the same results using the same tool (Trochim & Donnelly, 2008).

In this study inter-rater or test-rest reliability would have been useful reliability estimates. We could not use test re-test reliability because locating a mother to rate the stools again would have been difficult since we did not collect identifiable information. We used inter-rater reliability and we estimated whether the Bristol Stool Chart produced the same results across multiple raters (Mothers). Furthermore, we designed this study to measure agreement between mothers, clinicians and researcher but we did not observe enough actual stools to rate and we were unable to measured kappa (statistical measure of inter-rater agreement).

MANUSCRIPT

Abstract

Background: In the evaluation of Water, Sanitation, and Hygiene (WASH) intervention studies, researchers rely on mothers-report, a subjective outcome measure on whether their child has had diarrhea. Since this method is subjective, there is a need for a more objective outcome measure. We are proposing the use of the Bristol stool chart, a scale of seven stool types that includes images and descriptions. The scale was developed and validated in Bristol, England to assist clinicians in evaluating and reporting constipation in adult patients with irritable bowel syndrome but it has not been used as an outcome measure for WASH research in developing countries. This study done at a district hospital in Kenya used three-dimensional stools in a potty and mothers as raters to validate the chart. We added one additional type on the chart and translated the descriptions to '*Kiswahili'* and '*Dholuo'* (the local languages). ***Objective:*** This study assessed whether the Bristol Stool Chart (BSC) can be used as an objective outcome measure instead of the alternative, mothers-report. ***Methods:*** We used a mixed methods approach, 99 surveys and 5 in-depth interviews. We assessed the ability of the mother to use the tool by asking mothers to rate their child's most recent stool using and fake stool models on the chart. We measured the association between mothers' ability to use the chart and characteristics collected in the surveys such as breastfeeding status, child age, child illnesses and mother's education. We measured inter-rater reliability by asking mothers to rate three different stool models against the chart. Data collected from 5 mothers with varied characteristics using in-depth individual interviews was used to understand mothers' and community perceptions of children's stools and to gauge mothers' perception of the stool types on BSC. ***Results:*** Mothers were able to rate the stools of children who were younger than three years old and still breastfeeding. In addition mothers were able to rate their children's stools who had come to the clinic for varied ailments. Specifically mothers were able to rate all the diarrhea cases on the chart as softer to watery stools, although the cases were very few. Different mothers were able to consistently identify the three fake stools on the chart, establishing inter-rater reliability. Key informant interviews taught us that there are different types of diarrhea in this community and that the chart is well understood by mothers. ***Discussion:*** The chart can be used for children younger than three years old, children who are being weaned, and children who have diarrhea. These are the children whose stool will be seen by their mothers. We have no way of knowing if the chart can measure the different types of diarrhea that mothers described during the in-depth interviews such as teething diarrhea, seasonal foods diarrhea or "Oriyanyanja". ***Conclusion:*** In field settings the Bristol stool chart can be used with mothers-report, this study has shown that it works well for children younger than three years old, weaning and possibly children with diarrhea. If the tool will be used in this region one has to consider the varied types of diarrhea present in this region. Another validation study with a large sample size is required.

Introduction

There is evidence that many WASH interventions, such as hand washing with soap, effectively reduce diarrhea prevalence in children, and hence can prevent childhood mortality (Broschi-Pinto, F.Lanata, and, & Habte, 2006; Cairncross, et al., 2010).The majority of Water, Sanitation and Hygiene (WASH) studies in developing countries estimate the efficacy of their interventions by measuring diarrhea as a health outcome. A recent meta-analysis looked at thirty nine WASH studies that used reported diarrhea cases in non-high peak season as a health outcome (Fewtrell & Colford, 2005). Most WASH interventions use a consistent standard definition of diarrhea, which is determined by stool form ("looser than normal stools"), frequency ("three or more in a 24 hour period") and a specific recall period (e.g. "in the past 2 weeks") (WHO, 2011). In addition to the standard definition of diarrhea, there are informal ways of defining diarrhea depending on the culture. Informal definitions vary depending on common beliefs about the causes of diarrhea, which are mainly cultural (Pitts, McMaster, Hartmann, & Mausezahl, 1996). Variation in definitions of diarrhea can make it difficult for care-givers to describe diarrhea. It is also difficult for researchers to reliably assess diarrhea from verbal descriptions.

Currently there is a debate on the methodologies used in WASH efficacy studies, such as the subjectivity of collecting data on diarrhea prevalence, using mothers-reports (Schmidt & Cairncross, 2009). A more objective outcome measure is needed to minimize bias associated with the definition of diarrhea and self report in the evaluation of WASH interventions. We propose using the Bristol Stool Chart, a scale that was developed and validated in the United Kingdom (Lewis & Heaton, 1997). The scale/chart is useful

because it has images and description of a range of stool types along a spectrum from a hard stool (“type 1”) to a watery stool (“type 7”). In 2009 the scale was translated into Spanish and validated (Pares, et al., 2009). The chart was recently modified and validated as a tool that can be used by children to rate their own stool in the United States. Its inter-rater, intra-rater reliability and agreement were assessed against stool photographs and using physicians as raters and produced good reliability results (Chumpitazi, et al., 2010). Although these studies have concluded that the chart is useful for clinical and research purposes, it is also important to test its reliability on WASH efficacy studies in developing countries. In this thesis I used a mixed methods approach using surveys and in-depth key informant interviews to validate the chart in Kenya. In a hospital setting we measured mother’s ability to use the tool by asking them to rate their child’s most recent stool on the chart. We also measured inter-rater reliability by asking mothers to rate three different stool models on the chart. In-depth individual interviews allowed us to understand mother’s and community’s perceptions of children’s stools and to gauge mother’s perception of the stool types on BSC.

METHODS

Study objective

The objective of the study was to assess whether the Bristol Stool Chart (BSC) can be used as an objective outcome measure, by asking mothers to classify their child's most recent stool using the Bristol Stool Scale.

Specific Aims

1. To ensure mothers can precisely describe their children's fecal pattern using the Bristol Stool Chart

2. To measure inter-rater reliability by comparing multiple ratings of set of fake stool samples to assess whether or not different mothers view the same stool in the same way

3. To investigate whether the BSC correlate with the standard clinical definition of "three or more watery stools in a 24 hour period" by following up on the mother's assessment of the child's most recent stool and how it looked like using the BSC

4. To investigate the relationship between characteristics of the mother and child that is associated with the mother's ability to use BSC (e.g. mother's education, first time mother, breast feeding status)

5. To understand mothers perceptions of children's stools and the stools on the Bristol Stool Chart

Study Design

Study Site

Siaya District is one of the twelve districts of Nyanza province, located on the Equator in western Kenya, just north of Lake Victoria (see map in the appendix). The total area of the district is approximately 1,520 km squared (GOK, 2007). Most people in this region rely on subsistence farming as a source of income and food. The district hospital located at the heart of Siaya was the main recruitment site for this study. The hospital is designed to accommodate 360 beds but it is usually over capacity. The hospital was a convenient recruitment site because we had access to mothers and their children at the maternal and child health clinic (MCH) and the pediatric ward. The pediatric ward admits about 30 children per day during peak malaria season. Since the average stay is three days at times the facility is overburdened and two children may sleep in the same bed. Women and their children at the outpatient clinic and the inpatient pediatric ward were the most accessible study subjects. The wait time to see a clinician at the outpatient maternal and child health clinic was about two hours therefore we were able to identify eligible mothers without interfering with their care. All identified participants were consented verbally before the surveys and before the interviews

Image 1: Picture of a typical day at the maternal and child health clinic, Siaya District Hospital

were conducted. We used convenience sample in this project due to time and cost constrains. Also, it was expedient to recruit participants at the hospital since one of the study aims is to understand how BSC works for mothers whose child has had more than 3 looser stools than normal in the last 24 hours and these mothers are more likely to be at the clinic.

The first week of recruiting at the hospital was used to familiarize the researcher with daily and weekly schedule of the outpatient clinic, the clinic staff and women that came to the clinic and also pilot the study survey. A total of 115 mothers were consented to participate in the study during the eight weeks at the site. The 10 surveys completed the first week were not used in the final analysis because there were changes made to the survey. One mother left early during the survey therefore her information was also not used in the final survey analysis. A total of 99 surveys and 5 key informant interviews were used in the final analysis. At the end of each day of surveying, surveys were examined to see which age groups were lacking and the next day children of either older or younger age were recruited depending on how many children of a certain age have already been surveyed. Emory University (Atlanta, GA, USA) Institutional Review Board (IRB) and Kenya Medical Research Institute (Kisumu, Kenya) IRB approved the human research ethics for this study.

Sample population

Eligible study participants consisted of all women with children under 5 years old and their children. Mothers and their children were recruited while they were visiting the maternal and child health outpatient clinic or admitted in the inpatient children's unit at the Siaya district hospital in the months of June and July 2010. The outpatient clinic is

open on weekdays and on average 40 patients visit the outpatient clinic every day. Mondays and Fridays receive more patients than Tuesdays, Wednesdays and Thursdays. The reason some days are busy than other days could be because some specific days are assigned for growth monitoring or vaccination. Women brought their children in the outpatient clinic for annual vaccination, growth monitoring and if the child was ill.

Data collection

The original Bristol stool chart has 7 stool types with pictures and description in English. During our data collection we used translated descriptions of the original Bristol Stool Chart stool types into *Kiswahili* and *Dholuo* (see appendix V). We also added to the chart one more type (the 8th stool type), a watery bloody stool with mucus to differentiate dysentery from other types since dysentery was not represented on the chart. The researcher translated the stool descriptions and the surveys into Kiswahili and the research assistant translated them into Dholuo. A team of nurses were asked to translate back the stool descriptions to English and changes were made according to their suggestions.

We administered a survey that collected demographic information such as number of children, reason for visiting the clinic and mother's education level. We asked specific questions about the chart, such as which stool type was considered healthy and which one was unhealthy for younger children, for older children and for adults. We asked each participant to rate their child's most recent stool on the chart and rate the three fake stools (seen in images 2 and 3 below) on the chart.

During the first week we recognized that about 50% of mothers that attended the clinic preferred responding to the 25 minutes survey questions in their local language '*Dholuo'* a language spoken by people residing in western Kenya rather than in '*KiSwahili*' the Kenya national language. A trained research assistant translated the survey and the descriptions of the 8 stool types from '*Swahili'* to the local language '*Dholuo'*. The surveys were conducted in both '*Swahili'* and '*Dholuo'* by either the researcher or her assistant, respectively, depending on the language the mother preferred. The surveys were conducted at the waiting area of the outpatient clinic where mothers were waiting in line to be seen by either the nurse or the clinical officer.

Image 2: Stool models types two and five

The original goal of the study was to test the inter-rater reliability and agreement of the chart by comparing stools observed by three different raters, the mother, the clinician and the researcher however during data collection we observed few actual stool samples. Only ten different actual stool samples were obtained for observation and the observations were compared for each stool and rating on the Bristol stool chart by the child's mother, the researcher and any clinician available. We also asked mothers surveyed to rate three different fake stools made from curry, turmeric, wheat flour, coffee and water as seen in the images 2 and 3. These fake stool samples were recreated using the same recipe. I recorded the recipe

Image 3: Stool model type 7

(number of spoons) the first time I made the first stool samples and repeated the same recipe every day for the softer stools and every couple of days for the hard stool. Mothers were asked to match against the chart the sample that they thought closely resembled the fake stool presented to them in a potty.

In-Depth Interviews

In addition to the surveys in-depth individual interviews were used to understand how mothers with certain characteristics viewed the Bristol stool chart and perceptions of children's stools. These interviews were structured conversations guided by ten key questions. The ten questions were translated into Kiswahili by the researcher. The ten main questions asked about the mother's perception of each stool type, whether they represented a healthy or unhealthy stool, if they have ever seen that type before, what type of child passes that stool, for three different age groups categories between 6 months to a year old, a year to 3 years old and three to five years old). Interviews were conducted in '*Kiswahili'* by the researcher in a quiet room at the outpatient clinic or at the child's bed in the inpatient unit where the mother and her child stayed for overnight.

Interviews were used to help understand how the mothers interpreted the images and descriptions of the stool types on the Bristol stool chart. The interviews were recorded and they lasted between 25 to 35 minutes. Mothers who were comfortable being interviewed in Kiswahili were considered eligible participants. Out of the five mothers they had to have varied characteristics therefore once we identified mothers with any of the required characteristics for example mother with one child or certain level of education then we recruited another mother with a different characteristic until we had five total with every characteristic. Eligible mothers were any mothers that understood

'*Kiswahili*' well and with different demographic characteristics such as education and number of children. Varied characteristics about the mothers allowed us to understand the perception about the pictures and description of Bristol Stool from mothers who have had different experiences in that specific geographical area. Among all the five mothers who were interviewed four were from the urban Siaya area and one was from the rural part of Siaya. The mothers that were consented and interviewed had the following characteristics:- The first mother had one child and is in her first year at a university, two mothers completed primary education one had four children the other one had two children and two other mothers completed secondary education one had three children the other one had four children.

In-depth interviews limitations

One limitation to the qualitative part of this study was not using local language for some of the key informants interviewed. The gold standard for collecting qualitative data requires the interviewer to be fluent in the participant's preferred language. Qualitative data from our five key informant interviews were obtained from mothers who were comfortable speaking Kiswahili. Those women who preferred being interviewed in *Dholuo* almost half of the women that visited the clinic *were* not interviewed since we did not have a research assistant that was trained in collecting qualitative data and fluent in *Dholuo*. We omitted the perception of mothers who speak *Dholuo,* we have no way of knowing if their perception differs from the mothers we have interviewed.

An additional limitation was conducting interviews at a clinic setting was challenging due to the fact that clinicians do not tolerate traditional perceptions of childhood diarrhea and so some mothers may have been reluctant to explain for fear of

being overheard by a clinician. Although the interviews were conducted in a room with only the interviewer and the mother, oftentimes mothers would speak softly when describing a traditional belief about children stools. One mother said she has heard of traditional beliefs about stools but she doesn't believe in them. The way mothers responded to the questions about children's stools was influenced by the setting. In a clinic setting mothers were not entirely comfortable reporting their true belief of children stool types, their causes and treatments. The willingness to discuss possibly other types of stools could have been easier at different setting such as the participant's home. In addition other qualitative methods such as focus group discussion could have produced more insight to lay beliefs about diarrhea in children and interviews with clinicians.

Recruitment Challenges

The CDC/KEMRI and University of New Mexico were other partner institutions conducting a variety of research studies at the Maternal and child health clinic and the inpatient children's unit. Therefore there was mixed reaction towards participating in research studies; some mothers did not mind participating in research studies where as others did not feel comfortable participating in research studies. Given the circumstances at the outpatient clinic certain times when mothers were approached to participate in this study and they were not interested then anyone sitting next to the initial mother who refused to participate in the study will also refrain from participating. In such cases, we waited about half an hour until a new batch of mothers moved to the new line and we approached them again to ask their permission to participate in the study.

Analysis

All surveys were entered into Microsoft excel 2007 and descriptive statistical analysis was conducted using SAS version 9.2. Variability in rating the children's most recent stool against the Bristol stool chart was analyzed across five mother and child characteristics. Comparison in average child age, number of schooling years, number of children and breastfeeding status between correct and incorrect ratings of the 3D fake stools were performed using the student's t-test and chi-square tests. Both statistical tests were two sided with an alpha level of 0.05. The other statistical measure used was the phi coefficient which measured the degree of association between self reported diarrhea and rating the most recent stool as a type 7 on the Bristol stool chart. In addition phi coefficient was also used to measure the degree of association between rating both type 7 and 6 and reporting looser stool than normal

Results

Sample characteristics

Presented on **table 1** are the mother and child characteristics of the 99 responses from the mother about themselves and their child. Most of the women who completed the survey were young mothers with an average of 2 children per mother, the maximum number of children a mother had was eight and minimum was one child. The average age for the children surveyed was 29.9 months and average schooling years for the mother and spouse was 8 and 10 schooling years respectively. The most common reason for coming to the clinic was the child being ill and the most common illness reported was Fever/cough (59%). The clinic also provided family planning services, HIV testing to prevent mother to child transmission and antenatal care for pregnant women.

Presented on the pie chart below are the most common occupations mothers in this sample reported. **Chart 1** below show the distribution of the most reported occupations, most mothers worked at home as housewives (n=35) or were involved in subsistence farming (n=21). Three mothers were students, and 25 mothers had a small business.

Fifteen percent of mothers reported diarrhea as the illness that brought them to the clinic, however 43% of mothers reported their child has had looser stool than normal for more than 24 hours in the last seven days. Breastfeeding is classified as exclusive if the infant is receiving only breast milk with no additional foods or drinks not even water. Exclusive breastfeeding was estimated by asking mothers if they have given the child any form of drinks and any solid foods. Among the mothers surveyed none of them reported exclusive breastfeeding, one third of the children were breastfeeding with supplemental drinks or foods and two thirds were no longer breastfeeding.

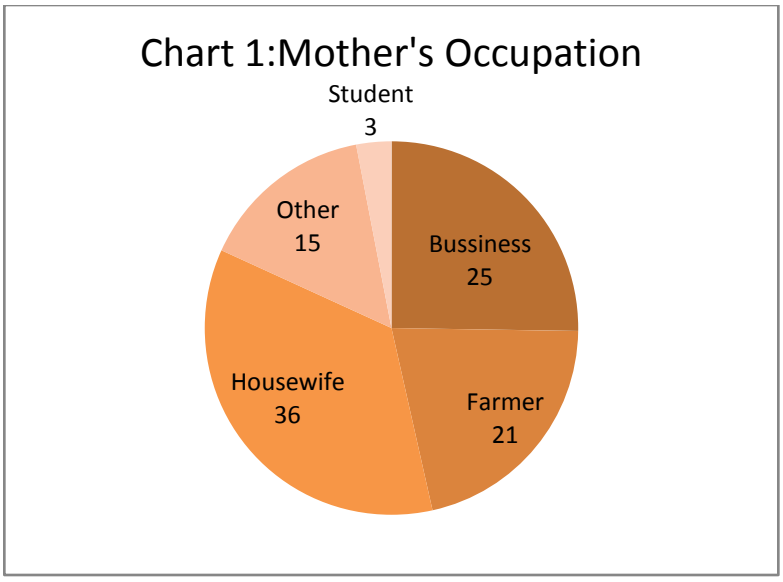
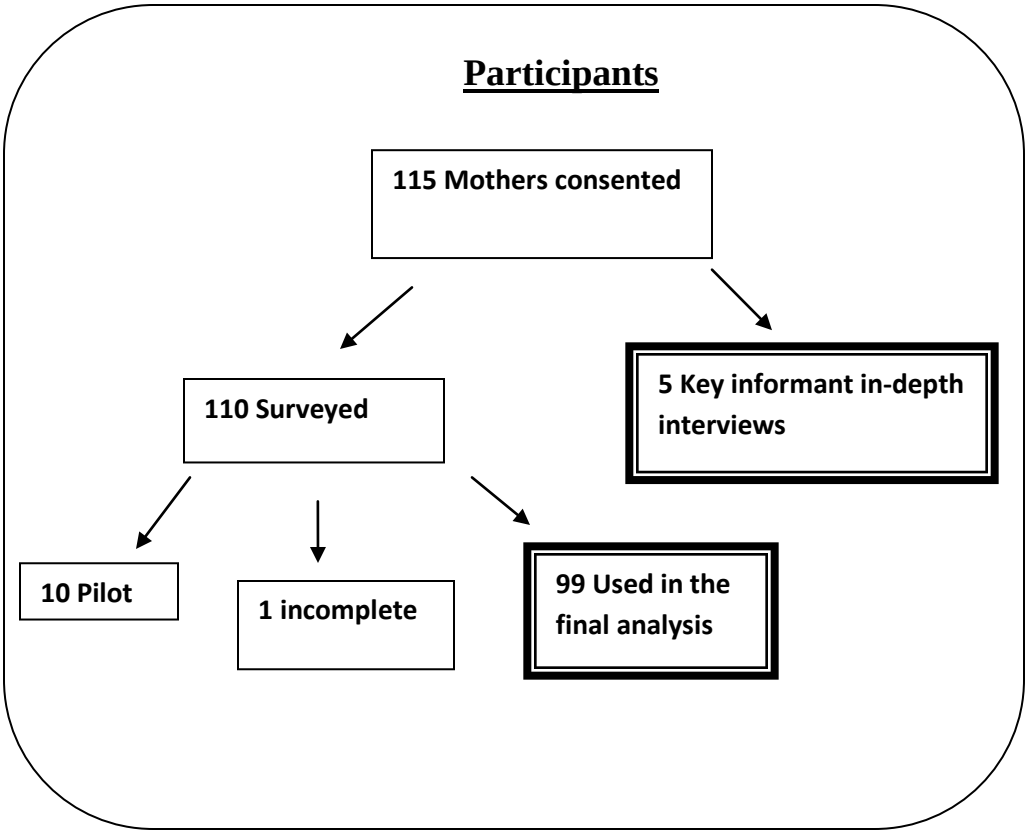


Chart 1:Mother's Occupation
Student
3
Other
15
Bussiness
25
Housewife
36
Farmer
21


Participants
115 Mothers consented
110 Surveyed
5 Key informant in-depth interviews
10 Pilot
1 incomplete
99 Used in the final analysis

Rating most recent stool on the Bristol Stool Chart

Out of all the 99 mothers surveyed 83 mothers rated their child's most recent stool on the Bristol stool chart, 15 mothers did not rate their child's most recent stool on the chart and one mother did not answer the rating question. Mothers that rated the stools on the chart (n=83) were asked to report the last time they saw the most recent stool, 29 reported seeing it the day before the survey , 48 the morning of the survey , 5 two or three days ago and 3 two weeks prior to the survey. Mothers that did not rate their child's most recent stool (n=15) reported that they either did not remember the last time they saw the stool (n=3), the stool the child had was not on the Bristol Stool Chart (n=2) or they did not know the last time the child passed stool (n=10)

Displayed on G**raph 1** are the frequencies of most recent stool ratings across the different types of stools on the Bristol stool chart. The most commonly rated stool types on the chart are type six (30), type seven (22), type four (11) and type five (9). None of the mothers rated their child's most recent stool as a type 8 (watery stool, with mucus and blood).

Variability in rating the most recent stool across five characteristics

Five characteristics that could have influenced mothers' ability to use the chart were examined according to mother's most recent stool ratings on the Bristol stool chart. The first characteristic examined for rating the most recent stool was the **number of schooling years** a mother completed as shown on **graph 2**. Number of schooling years was categorized into three groups (less than 8 years, completed 8 years and 8 or more

years)[3]. The first trend observed was ratings for the most commonly rated stool types on the chart (type 6 and 7). About a quarter of women that rated the most recent stool as a type 6 had less than 8 years of education, about half had exactly 8 years of education and a quarter had more than 8 years of education. Almost exactly similar variation was observed with women that rated the most recent stool as type 7. Secondly, looking at mothers that did not rate their child's stool, the results show that one mother who had more than eight schooling years did not rate the stool whereas most mothers that didn't see that stool had less than eight schooling years (8 out of 15) and 8 schooling years (6 out of 15). Mothers schooling years does not show any association with the way mothers rated their child's most recent stool.

The second characteristic examined was the **child's age** also categorized into three groups (younger than 1, between 1 and 3 and older than 3) shown on **graph 3**. Children's stools vary by age, every age marks a new development physically, and I used these categories because at about a year old most children are weaned and solid foods are introduced in their diet. Children develop physically and start becoming mobile (crawling and later walking) between 1 and 3 years old. Later at age 3 and above children become more independent and have improved their ability to run and play far from the care giver.

Looking at the most commonly rated types of stool (type 6 and 7) by age the results show that more rating for types six and seven are from younger children than older children. Looking at type six rating, there is a variation in rating between children younger than one and children between one and three years old. Out of the 30 children whose stool was rated as type six, 20 were between 1 and 3 years old, 8 were under a

[3] Eight years of education marks the end of primary education by taking a national exam and receiving the Kenyan certificate of primary education (KCPE)

year old and 2 children were older than three years old. Secondly, looking at type seven rating the results do not show that much variation between children younger than one (10 out of 11) and those between one and three (9 out of 11). This shows that children under three are the children that were having diarrhea or these children have softer stool because their diet changed or they are exposed other environmental factors that cause diarrhea.

Looking at rating results for older children the results show that their most recent stool were rated as the harder stools. Older children's stool rating were as type four (6 out of 11) and type five (5 out 9). Looking at mothers that didn't see their child's stool the results show that most mothers did not see the children's stools that are older than three.

The third characteristic examined was **breastfeeding status** shown on **graph 4**. Breastfeeding status was dichotomized into breastfeeding and not-breastfeeding at the time of the survey. First variation that was obvious was that most of the recent stools not rated by the mother were for children who were not breastfeeding (14 out of 15). Children who are not breastfeeding are most likely older and are either left with someone else to take care of them or have started walking and are not always close to their mother for the mother to see their stool. Secondly, looking at the ratings for children who are breastfeeding (30) our results show that most of their stools seen were rated as the softer stools that is type six (10) and type seven (13). Frequencies of children who are not breastfeeding (68) indicates a more spread out rating pattern across stool types, type 2 (4), type 3 (5) type four (9), type five (7), type six (20), type seven (9) and not rated (14). The ratings for breastfeeding children (30) increases towards the end of the chart types 2 (1), type 4 (2), type 5 (2), type 6 (10) and type 7 (13).

The fourth characteristic examined for variation in rating the most recent stool **is parity s**hown on **graph 5.** Parity is condensed into three groups (mother with one child, two children and three or more children). I divided parity into three groups to examine the pattern in rating by experiences of mothers with different number of children (parity). The most rated stool types for all three parities are type six (30) and type seven (22). Mothers with one child that rated their child's most recent stool was a type six 12, mother with 2 children was 10 and mother with 3 or more children was 7. Type seven was rated as follows 6 mothers had one child, 10 mothers had 2 children and 6 mothers have three or more children. The ratings of these two stools by parity are very similar. An interesting result was among the mothers who have not seen their child's most recent stool. The frequency of first time mothers who have not seen their child's most recent stool was (2 out of 15). Most mothers who have not seen their child's most recent are those with three or more children (10 out of 15). There does not seem to be a rating pattern associated with parity, maybe birth order of the child surveyed would have shown a pattern in rating

The last characteristic examined was specifically **child illness** displayed on **graph 6** instead of reason for visiting the clinic. Out of the three reasons (growth monitoring, Vaccination and child is illness) that brought a mother to the clinic Illness (74) was the most common reason. We categorized illness into four groups based on the most common ailment reported (cough, fever, diarrhea, malnutrition and other illness). Fever followed by cough was the most common ailments that brought them to the clinic. Other illness reported included injuries, anemia or kwashiorkor. First we looked at the variation of the most rated stools that is type 6 and type 7. For type seven the results show out of the 18 children whose most recent stool were rated as a type Seven 7 had fever, 1 had cough, 7

had diarrhea and 3 had other illness. For type six out of the 21 children whose stool was rated as a type six, 15 had fever, and 2 had cough, diarrhea and other illness respectively. Secondly, looking at diarrhea and how mothers rated children with this symptom across the stool types we can see that out of the 10 diarrhea cases reported, more than half (7) of the children's most recent stool was rated as a type Seven. Most recent stool of the rest of the children that had diarrhea were rated as a type five (1) and types six (2). Although we had very few diarrhea reported as a the reason for bringing the child to the clinic relative to fever the results show that most mothers rated these children's most recent stool as a type seven which is a watery stool representing diarrhea symptom.

Self-reported diarrhea (standard definition) and most recent stool

Results presented on **table 6** shows the correlation between a mother matching their child most recent stool as a seven on the chart and the mother self reporting their child having had a looser stool than normal more than three times in a 24 hour period during the last 7 days. In addition, I also looked at the correlation between matching a seven and six verses the other types and reporting diarrhea according to the standard definition. **Table 7** displays the results of a correlation measure between matching most recent stool with a six and 7 on the chart or not and diarrhea self report (standard definition). The results show little or no correlation between recent stool being a seven and self reporting looser stool than normal (phi coefficient of 0.1). The correlation between matching most recent stool as a seven and a six and reporting looser stool than normal had little to weak correlation with reporting looser stool than normal (phi

coefficient 0.3) the correlation coefficient was on the borderline towards a weak positive correlation.

Actual stool rating by mother, clinician and researcher

Ten actual stools were available for rating by the mother, a clinician and the researcher, displayed on **table 8**. The actual stools observed were rated as type one, type five, type six or type seven. Five out of the ten stools observed were rated the same way by all three raters (mother, clinician and researcher). Six out of the ten actual stools rated were rated the same way by at least two raters of the three raters (mother/clinician/researcher). Only two out of the ten actual stools rated were rated differently by each rater.

Rating fake stool models against the 8 types on the chart

All mothers were asked to match the fake stools against the Bristol stool chart. Mother and child characteristics are used to determine what influences a mother's ability to rate the fake stool correctly on the chart. The demographic characteristics used were the mother's schooling years, child age, number of children (parity) and breastfeeding status.

The association between mother and child characteristics and the way the mothers rated the three types of stool models (type 2, 5 and 7) against the BSC was measured using the student *t test*. I first looked at the associations between mother's characteristics and matching all three stool models and then any two of the 3D models correctly and incorrectly respectively. I decided to look at all three matching and any two matching because we had three stools and the chances of matching by chance all three or any two

was lower than matching any one correctly. Displayed on **table 2** are the results of the three t tests in which the same demographic characteristics mentioned above were compared between mothers who matched any three 3D models with their corresponding type on the chart and those who did not. The statistical test results show that there is no sufficient evidence that suggest a difference in all the three demographic characteristics between mothers who matched any two 3D models with the corresponding type on the chart and those who did not (p values 0.082, 0.676 and 0.297) respectively.

Displayed on t**able 3** are the results of the three t tests in which the mean child age, number of children and mother's schooling years was compared across mothers who matched any two 3D models with the intended corresponding type on the Bristol stool chart and those who matched the models with any other type on the chart. According to the results, at 5% confidence interval there is no sufficient evidence to conclude that there is a significant difference between the child's mean age between those who matched any two stool model with the corresponding type on the BSC (30.6 months) and those who did not (27.7 months) (*p value* 0.56). In addition there is also no sufficient evidence that suggests there is a significant difference between the average mother's schooling years and the average number of children for mothers who matched any two stool types with the corresponding type on the chart (8.5yrs)(2.5) and those who did not (8.3 yrs, 2.2) (*p values*= -0.38 and 0.349) respectively.

The final characteristic assessed was breastfeeding status. **Table 4** and **5** display the results of the association between breastfeeding status and matching any two and all three stool models with the corresponding type on the chart. The results show at 5% confidence interval there is no sufficient evidence to suggest that there is an association

between matching any two stool models with the corresponding type on the chart and breastfeeding ($\chi^2 = 1.45$, *p value* 0.22). Matching all three and breastfeeding also suggest there is no sufficient evidence to conclude that there is association between matching all three models with its corresponding image and description on chart and breastfeeding status ($\chi^2 = 3.8$, *p value* 0.05).

3D stool model ranking across mothers

Three fake stool models made from water, flour, coffee, turmeric, and curry were shown to the mother in a potty. Matching fake stool was used to estimate matching consistency across all mothers. The three stool models were not shown to the mothers following any particular order so that mothers can pay attention to all the eight types before rating. The results are presented as they appear on the chart (hardest type to the softer, watery type). Displayed on **graph 7** are the results of mothers who matched 3D model type two with the 8 types on the chart. Mothers who matched this type with its corresponding type on the chart were 84.7 percent and less than 5% of the mothers matched this model with types 1, 4, 5, and 6 respectively and 5.15% matched this type with type three on the chart

Results presented on **graph 8** show the matching results of 3D model type 5. Mothers that matched type 5 stool model shown to them using a potty with its corresponding type (soft blubs with clear cut edges easy to pass) on the Bristol stool chart were 59.2% and mothers that matched it with type one (separate hard lumps like nuts, hard to pass) on the chart were 18.4%. The reason a high fraction of mothers were matching this type incorrectly could be because type five does look like type one. Mothers that matched type five model with type six on the chart were 11.2% and those

who matched it with type three on the chart were 7%. Less than 5% of the mothers matched this model with types 2 and 4 respectively.

Results displayed on **graph 9** shows the matching results for the last stool model which was watery stool which corresponded to the watery with no solid pieces type on the chart, 71.4 % of the mothers ranked this model with type seven (Watery no solid pieces) on the chart. Mothers that matched this type with the sixth type on the chart were 18% and those who matched this type with types 3, 4, 5 and 8 were less than 5% respectively.

Finally, displayed on **graph 10** are the percentages of mothers who matched all the 3D stool models, any two or any one with corresponding image and description on the BSC. Less than half of the mothers matched all three stool models correctly on the chart (37.7%). Eighty percent of mothers rated any two of the three stool models correctly on the chart and 96% rated any one of the three stool models correctly on the chart.

Nutrition

The types of food children eat partially determine the consistency of their stool; in this sample all children seem to be eating the same types of food. In this sample none of the children were exclusive breastfeeding therefore children were either mixed fed or not breastfeeding at all and eating normal foods. The most common drinks mother's reported giving their children were water (n=85), soda or tea (n=68), cow's milk (n=35), and *Uji* [4] (n=50). Almost all children were drinking water which means the water they are exposed to may cause looser stool than normal (diarrhea). The most common solid foods children had were *Ugali*[5] (n=75), Sukuma[6] (n=43), peas (n=47) and fish soup (n=37). Although this region has the highest HIV prevalence in Kenya formula feeds were not common, only 2 children were being given formula out of 99 children surveyed. Fifty five percent of mothers reported adding oils/fats in their children's food; another reason a child might have diarrhea or looser stool than normal. ORS was given to nine children, out of that one child had diarrhea, four had fever, one had malnutrition and 3 had some other illness. Only one child was not given anything to drink out of all children surveyed (n=99) and that child had fever.

[4] Uji- common porridge children drink when weaned made from maize flour and water
[5] Ugali- A staple food made from Maize flour and water
[6] Sukuma- A common green vegetable eaten with ugali in east Africa (Kale family)

Qualitative Results

Key informant interviews with five mothers on their perception of children's stools were analyzed separately. Two main themes about children's stool types, their causes and treatment were indentified from the transcripts: - 'common beliefs' and 'integration of modern and traditional medicine'.

Mother's perceptions of children's stool

Mothers interviewed indicated that children's stools vary by age of child, type of food the child is eating, and child health. Mothers indicated that the first stool a newborn passes is hard stool which is black in color that lasts for a couple of days; this was considered to be a normal stool. Mothers also indicated that once the child starts breastfeeding stool consistency and color changes and when a child is weaned color and consistency change again depending on what the child has started to east eating. Mothers stated that there is a difference in children's stool at three different stages of a child's life initially the child drinks breast milk, later after about six months children start drinking porridge and then they eventually transition to eating solid foods such as 'sima' '*ugali'* and "*omena*" (sardines). A mother with two children and 8 years of education described the changes in stools to the interviewer as follows

Interviewer: How does a new born baby's poop look like?
MM3: black

Interviewer: ok and then later how does it look like?
MM3: then it start looking like "maziwa mala[7]" they stick to each other

Interviewer: Oh Ok how about a 2 year old how does their poop look like
MM3: It is much harder than the stool when the baby is smaller

[7] Maziwa mala- butter milk or fermented cow's milk

Interviewer: What causes children's stools to be different?
MM3: A breast feeding baby's stool looks different and a stool of a child that eats food is also different

Interviewer: If a baby is having loose stool what causes that
MM3: children stomach diseases like worms
Common beliefs

Mothers mentioned multiple causes of diarrhea or loose stool in children under five years old. Dirty water, worms, environment, eating dirty things or food left out over night causes unhealthy watery or looser stool (diarrhea). Other causes of looser stool are seasonal foods for older children and teething for younger children who have started crawling. The foods that cause looser stool are "*maharage"* beans, roasted or boiled corn and "*waru"* sweet potatoes. Three out

of the five mothers interviewed mentioned there is loose stool due to teething, which happens to most children and mothers consider that a normal growing process and therefore is not a cause for concern. Mothers believe that loose stool caused by teething or a change of diet does not mean the child is unhealthy or ill but if the loose stool continues there are available home remedies commonly used in the community, typically known as herbal remedies.

Mothers primarily used color and consistency to describe stool. When asked to describe how stool changes in different stages during growth a mother of one child that attends a four year college said *"The stool colour changes from yellow to depending on what the child is eating"MM1*. The same mother when asked how stool that shows there is a problem with the child looks like she said, "*abnormal poop is stool which is watery (has water, a lot of water) and the green color with mucus and also bloody stool is bad*

”. Colour seems to be an important part of stool description. Colour also appears to be the way mothers determine whether it is a healthy stool or unhealthy stool. One mother with three children and secondary education described healthy and unhealthy stools to the interviewer as follows:

Interviewer: Can you tell me which stool colors are healthy and which ones are unhealthy
MM4: A little yellow and not too loose not too hard that is healthy normal stool, from 1 month to 8 months, unhealthy would be green with mucus and it becomes green after a while

Interviewer: What is that called?
MM4: I don't know the name is Swahili but it is called *"oriyanyanja"* in my language

The childhood diarrhea illness mentioned by the mother above known as '*oriyanyanja*' was described repeatedly across all respondents as a common cause of loose stool in children between one and five years old. 'o*riyanyanja*' was described as a looser stool than normal which is yellowish brown and foamy that becomes green after a while. Mothers did not know the name of the illness in Swahili or English that causes oriyanyanja and they believe it is a common childhood condition in western Kenya or *Luo* land. Later the research team heard that oriyanyanja translates to "amoebic dysentery'. Mothers interviewed stated they have seen it in their children but do not know the cause of '*oriyanyanja'*, they heard of the condition from older women in the community.

Integrating traditional and modern medicine

An interesting theme that emerged from the interviews is the integration of traditional and modern medicine in the treatment of childhood diarrhea. Mothers

mentioned using traditional/herbal remedies or had heard of someone using herbal remedies to treat childhood gastrointestinal illnesses. Mothers believed that traditional remedies found at home are as effective as modern medicine provided at the clinic; however traditional remedies were commonly used for specific illness found in their region.

All mothers interviewed described a common gastrointestinal illness that causes loose yellow stool that later turns *green* and sometimes has *foam or mucus.* These are symptoms of a type of diarrhea mothers called '*Oriyanyanja*' which they said is treated mainly by herbal medicine and a medicine known as *flagyl*[8]. The mothers explained that grandmothers typically know where to find the herbal medicine whereas *flagyl* was provided at a medical facility. One mother who had one child and 15 years of schooling was very comfortable discussing this condition; however other mothers were more hesitant in acknowledging that they believed in it or even know it exists. Later when the mother was prompted she would mention what she stated as 'heard' of the condition. The reason she possibly said 'heard' was because she did not want to appear as a mother that believed in this condition or used home remedies.

Another mother who had three children and 12 years of education admitted to knowing a condition with a local Lou name and a treatment. She said always brought the child to the clinic for treatment and heard about home remedies but does not use home remedies. This is how she explained the process to the interviewer:

Interviewer: A new born baby's stool, how does it look like?
MM5: It is black.

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[8] Flagyl- (metronidazole) is an oral synthetic antiprotozoal and antibacterial agent

Interviewer: How about from a month to six months?
MM5: Yellowish and sometimes green I don't know but there is an issue in Luo I forget the name in Luo, they say it's an infection and give you a medicine, but usually its yellowish

Interviewer: Ok so you said it is yellow in colour but how does it look like is it soft, hard, watery or in pieces
MM5: It is not hard unless the child is constipated

Interviewer: The illness you just told me what causes it, have you seen it in your children
MM5: Not this child but my other child a long time ago had it and then when my mother came she told me it was that infection, I forget the name I took her to the clinic they get a medication"

Later we inquired about 'oriyanyanja' from a female nurse, she acknowledged that some mothers used herbal medicine to treat a local illness however as a clinician at a clinic they discourage the use of herbal medicine. The clinician said often times herbal medicine exacerbates the diarrhea and mothers ultimately bring the child to the clinic after the child is severely dehydrated.

From these interviews, it appears that mothers will try a home remedy before they decide to take the child to a clinic because most mothers understand how their child's stool should look like. There may be several barriers that keep mothers from seeking health care from a health facility such as distance or not being able to leave other children by themselves at home. Since clinicians advise mothers to bring the child to the clinic and avoid using home remedies mothers will not admit to using home remedies once they have brought the child to the clinic.

Mother's perceptions of the Bristol Stool Chart

Another purpose of the interviews was to gauge the mothers' perception of the Bristol stool chart and its usefulness in measuring diarrhea in this community. All mothers interviewed were able to understand the images and descriptions of stools on the chart. Mothers were asked, "*what do you think about these pictures of stools?* Mothers thought the chart represented most of the stools they have ever seen except there is one stool that they have seen and does not appear on the chart which is a "green stool with mucus". When asked "*have you seen these types of stool before?*" The types of stool that mothers have seen before were type 2, 3, 5, 6 and 7. Mothers have seen some of these stools with their own children and with other children close to them (sister's, neighbor's child etc).

All mothers interviewed believed type 1 is a stool that is typically not common among children although they all said a child that is crawling and eats "*mchanga*" a Swahili word for dirt can have that stool. Across all five respondents *type 2* was considered to be a type of stool from a constipated child; *type 6* and *7* were classified as diarrhea; and *type 3* and *5* as normal stools depending on the age of the child and the food the child is eating. All mother's general idea of the types of stool on the chart were what we expected, the harder stools were consider not normal, the middle ones normal and the stool types towards the end of the chart not normal (types 6,7,8).

Healthy and Unhealthy Stool Types on the Chart

Displayed on **Graph 11** are the frequencies of the stool types that the surveyed mothers rated as healthy or unhealthy for younger children. Most mothers rated type eight (n=40), type seven (n=30) and type one (n=16) as un-healthy stools. And the stools rated as healthy were type four (n=27), type six (n=21), type five (n=17) and type three (n=17).

Mothers interviewed in-depth were also asked to which stools they thought were healthy or normal stools; most mothers said types 2, 3, 5 were normal stools. When asked which stools were unhealthy they said types 1, 6, 7 and 8, mothers also added that for children younger than six months type six was a normal stool. Type 4 on the chart was confusing to four of the five mothers interviewed. These mothers perceived type four as a worm associated stool passed if the child had worms. The description of Type 4 on the chart was 'like a sausage or snake, smooth and long' we translated into Kiswahili as follows '*laini ndefu kama nyoka'*. I believe the word 'nyoka' which means snake in Swahili in the description was similar to 'worm' and that was the source of the confusion. The last two types on the chart were perceived as an unhealthy stool for children and adults. Especially for type 8, mothers said for children of any age and adults the stool was unhealthy, it was viewed as a symptom of "*wadudu kwa tumbo*" micro organisms in the gut.

Discussion

Other studies and this study (similarities and differences)

Previous Bristol stool chart validation studies were primarily conducted in developed countries context. This project used a mixed methods approach to validate the Bristol stool chart as an outcome measure whereas the previous studies used primarily quantitative methods. One of the studies used photographs of stools instead of actual stools to validate the chart with clinicians as raters. Previous studies used test retest, inter-rater, intra-rater reliability and agreement methods to validate the chart (Chumpitazi, et al., 2010; Pares, et al., 2009). Initially our goal was to validate the tool against actual stool and fake stool models, however we did not observe enough actual stool as a result we relied on the fake stool models. Using mothers as raters we used inter-rater reliability method to validate the chart. Furthermore, mothers were asked to rate their child's most recent stool against the chart and we examined the association of their ability to rate the stools across several characteristics. Lastly we collected qualitative data through interviewing mothers to understand individual and community perception of children's stools in the context of this region.

Our sample and population in the province

Mothers that participated in this study were visiting the MCH clinic at the district hospital and these mothers most likely lived relatively closer to the semi urban part of Siaya district closer to the hospital. Due to limited resources this population was the most convenient sample population we could reach for this study. The 2008-09 Kenyan demographic and health survey data indicate that the fertility rate, education attainment,

child illnesses and other characteristics vary by province(KDHS, 2010). Looking at a few basic characteristics our sample and the population in the province also differ. Nyanza province where our study was conducted has one of the highest fertility rates (5.4 per woman) and our sample the average number of children per woman was 2. Education attainment for all women in this province based on the DHS is as follows 13.4 % have no education, 49.3% have some education and 17.4% completed Primary educations. In our sample 30% of women had some education, 41% completed primary education and 27% had secondary education or higher. In addition, the DHS data shows that 24.3 percent of children had fever and 16.2% had diarrhea in the province where as in our sample Fever was a common ailment (46 out of 75) and diarrhea cases were few (10 out of 75).

We demonstrated mother's ability to use the chart in rating their children's most recent stool on the chart by examining the association between ratings the stool types on the chart with mother's education, child age, breastfeeding status, parity, and reported child illness. An interesting pattern was observed in rated and un-rated children's most recent stool by age, breastfeeding status and child illness. Similar to the previous study (Chumpitazi, et al., 2010) we also demonstrated an inter-rater reliability using mothers ratings of fake stool samples against the chart while they used photographs rated by physicians. In general mothers consistently rated all three stool models the same way. I also showed consistency in fake stool ratings was not dependant on child age, breastfeeding status, mother's education or the number of children a mother had. Mothers with different characteristics understood the stool images and description on the chart in the same way.

Our study was strengthened by the qualitative methodology that provided insight on general community specific and individual perceptions of an important but sensitive issue such as stool form which is often not discussed in-depth. Through in depth interviews with mothers identified as key informants we were able to gather information about common beliefs associated with children's stools, and the interaction between modern and traditional remedies. We also gained new knowledge about types of diarrhea in the context of this region. Qualitative methodology has not been used in the previous validation studies, this method was necessary because it answered a question that surveys were not able to answer. Guided open ended questions provided an understanding of how mothers perceived stool form, cause and treatment of certain stool types and whether the BSC can be used to measure these stool types.

Results synthesis and Limitations

Breastfeeding status and child age are closely linked characteristics. I expected recent stool rating results for these two characteristics to have a similar pattern that aligns with the general development of an infants and children. It is important to note that none of the children surveyed were exclusively breastfeeding, every child was at least given water or cow's milk therefore we could not examine variation in rating for children who are exclusively breastfed. First, it was observed that most children whose stools were not rated on the chart were three years or older similarly most children whose stools were not rated on the chart were no longer breastfeeding. Typically children who are not breastfeeding anymore are much older therefore rating variation should show this pattern.

Another interesting trend was observed in the ratings for the children who are breastfeeding. Rating across the chart by breastfeeding status shows that children's stools

who are breastfeeding are rated as the softer stools. In general children who are breastfeeding should have softer stools and not the hard stools; if a lot more mothers had rated stools from these children as harder stools then the BSC would not be useful in this group. Ratings by age also showed an expected pattern; children older than three had harder stool types than the soft stool types. The stool ratings pattern indicates an association between the ability of the mother to rate her child's stool according to child age and breastfeeding status. It is valuable to know that mothers are rating the most recent stool with the expected types on the chart based on the child's age and breastfeeding status independently and that the patterns are similar between these two characteristics.

During the study design we hoped to see more diarrhea cases however at the field during data collection diarrhea cases reported were very few (10 reported cases). The ten cases reported were all rated on the chart as type five, six and seven. Since all ten cases (although very few) were rated, none of the mothers reported them as unseen indicating that mothers know when their child is ill (has looser stool than normal). This verifies our hypothesis that the Bristol stool chart is a relatively easy tool to use for mothers especially if the child has diarrhea because the mother will notice if her child has diarrhea. Researchers have to decided which type on the chart is diarrhea aligned with the standard diarrhea definition.

We were able to demonstrate inter-rater reliability using fake stools given that scores produced by mothers in rating stool models presented to them in a potty were consistent. The few diversions from correct matching observed could be due to the stool models themselves and not the raters. The stool models used were made early in the

morning therefore by the later afternoon the watery stool may have dried and looked more like a type six rather than a type seven. Other diversions may have been caused by close similarities in stool types on the chart. For example type two and type three which are next to each other on the chart. Types two was one of the stool models made and sometimes mothers rated it as a type three. A few mothers (5%) rated the stool model as a type 3 on the chart instead of type two. One of the reasons a previous validation study reduced the chart to five types which were very different from each other instead of seven types was to reduce confusion so children can be able to rate their own stool (Chumpitazi, et al., 2010).

More than half rated type 5 the same way although this stool model seemed more confusing than the other two models and took mothers a longer time to rate it. Often times mothers would ask is this a soft stool of a hard stool. One of the reasons type 5 was difficult to rate was its close similarity with type 1 consequently about 20% of mothers rated it as a type 1 instead of type 5. The third stool model which was intended to be a watery stool was also a slightly difficult stool to rate, about 20% of mothers rated it as a type 6 where as 70% rated it as a type 7. On the Bristol stool chart type 6 and type 7 closely resemble each other especially if mothers focused on the images or mothers who rated it in the morning when it was just made rated it as a seven where as mothers who rated it later in the day saw it as a type six. It is important in this case to also look at the descriptions because type 7 is described as '*entirely liquid'* stool and a type 6 is a '*mushy stool'*. Mothers could have not read the description and rated based on the images only. As we administered the survey we sometimes had to read the descriptions to mothers that took a long time to rate the stools on the chart therefore as researchers we have to

consider illiterate mothers when using the chart in the field. I collected data on education attainment. Every mother in our sample reported had some education but we do not have information on their literacy.

I have shown that the chart does produce consistent results and the consistency is not associated with the child's age, number of children, her level of education or whether the child was breastfeeding. Mothers were able to easily use the chart independent of their demographic characteristic. There could be other secondary factors which were not assed that contribute to consistency in some mothers seeing the models a certain way and others seeing it differently for example the number of times a child is brought to the clinic, the child's birth order or the use of home remedies. Other factors could be distance to the health facility or time that it takes a mother to get to a health facility.

The Bristol stool chart cannot be used to define diarrhea based on the standard definition by using only type seven. The results showed little or no correlation between rating a type seven only on the chart and self reporting diarrhea according to the standard definition. This could be due to reporting error caused by confusion in the definition, the child could have had 3 or more looser stools than normal within 24 hours in the last seven days but their most recent stool was rated a type six or a type five instead of a type seven. Furthermore, correlation measure between reporting a type seven and a type six with standard definition of diarrhea showed a weak positive correlation. There is a possibility that mothers thought type six and type seven were representing the same type of stool.

Although Bristol stool chart is more objective than mothers-report, a possible drawback to consider when using the chart as an outcome measure is the likelihood of it becoming another self report after a long period of time. Mothers in this study were able

to identify healthy verses unhealthy stool types for children on the chart. Therefore the chart could create bias in intervention evaluation once everyone gets accustomed to being asked question regarding stools using the chart. Participants may eventually know what they should be reporting especially for the intervention arm, especially if the intervention is not blinded.

All mothers five interviewed in-depth described stools that were of concern and stools that were normal based on their experience with children and being in the community. The mothers recognized that watery stool was a problem and mentioned multiple reasons a child would have watery stool. Treatment for watery stool depends on the cause. Mothers added that both modern and traditional remedies are generally effective. The Bristol stool chart was clear to the key informants and they were able to distinguish stools that suggest a child is constipated, suffering from diarrhea or suggest the child is normal. Also mothers were able to tell the last two stools (type seven and eight) showed a symptom of a gastrointestinal problem.

The interviews gave insight on how Bristol stool chart can be used in this setting with a few modifications such as including other forms of diarrhea. I think the best way would be to remove one type that is a hard stool and ad one type that represents ‘oriyanyanja’. We were able to understand a diarrhea type known as ‘oriyanyanja’ because the first mother interviewed had mentioned and we prompted other mothers to further understand this type of diarrhea. Three other mothers also mentioned it and one mother had to be prompted more to describe this stool.

Conclusion

The Chart works well for children younger than three years old and those going through the weaning process. Hence, the chart may not work well in measuring stool pattern for children older than three years since mothers may not see older children's stools, unless the child has severe diarrhea and the care giver notices. Also we do not know if the BSC can measure the different types of diarrhea described by mothers for example teething diarrhea, '*Oriyanyanja'* diarrhea, dirty water diarrhea, bad food diarrhea, seasonal foods diarrhea. A limitation to this study is using a convenience sample to validate the chart. Mothers who visit the clinic either live close to the clinic or have minimum barriers that prevent them from seeking care from a health facility such as this one. The population that will use the tool may have different characteristics such education attainment. In addition, the tool may be used in household based surveys that will reach mothers that have different health seeking behavior than those we have seen at the clinic during this validation study. Mothers that participated in this study were able to distinguish healthy verses unhealthy stools on the chart therefore the chart could create bias in evaluation studies once everyone knows what they should be reporting especially for the intervention arm.

General Recommendations

Currently the Bristol Stool chart has potential could be used as an outcome measure in addition to mothers-report. Another study with a larger sample is required to confirm validity and reliability of the chart. There are a few things that I think should be included in another validation study such as dietary recall specific to that population, mother's literacy, and birth order of the child surveyed. We have established that the tool

works well for children younger than three and those going through weaning which is a gradual process between the ages of six months up to three years. Another validation study does not have to include children older than three unless they are children with diarrhea because I have also shown that the tool works well for children whose mother believe they have diarrhea (although the diarrhea cases were few and possibly severe since they were brought to the hospital). If one decides to use the tool now in the region where the study was conducted, I would recommend adding a stool type that resembles the description of "*Oriyanyanja*". Every mother interviewed in-depth described this type of diarrhea as a common illness most children experience in this region. This is the only addition that I believe is important and could be skipped if not included on the chart.

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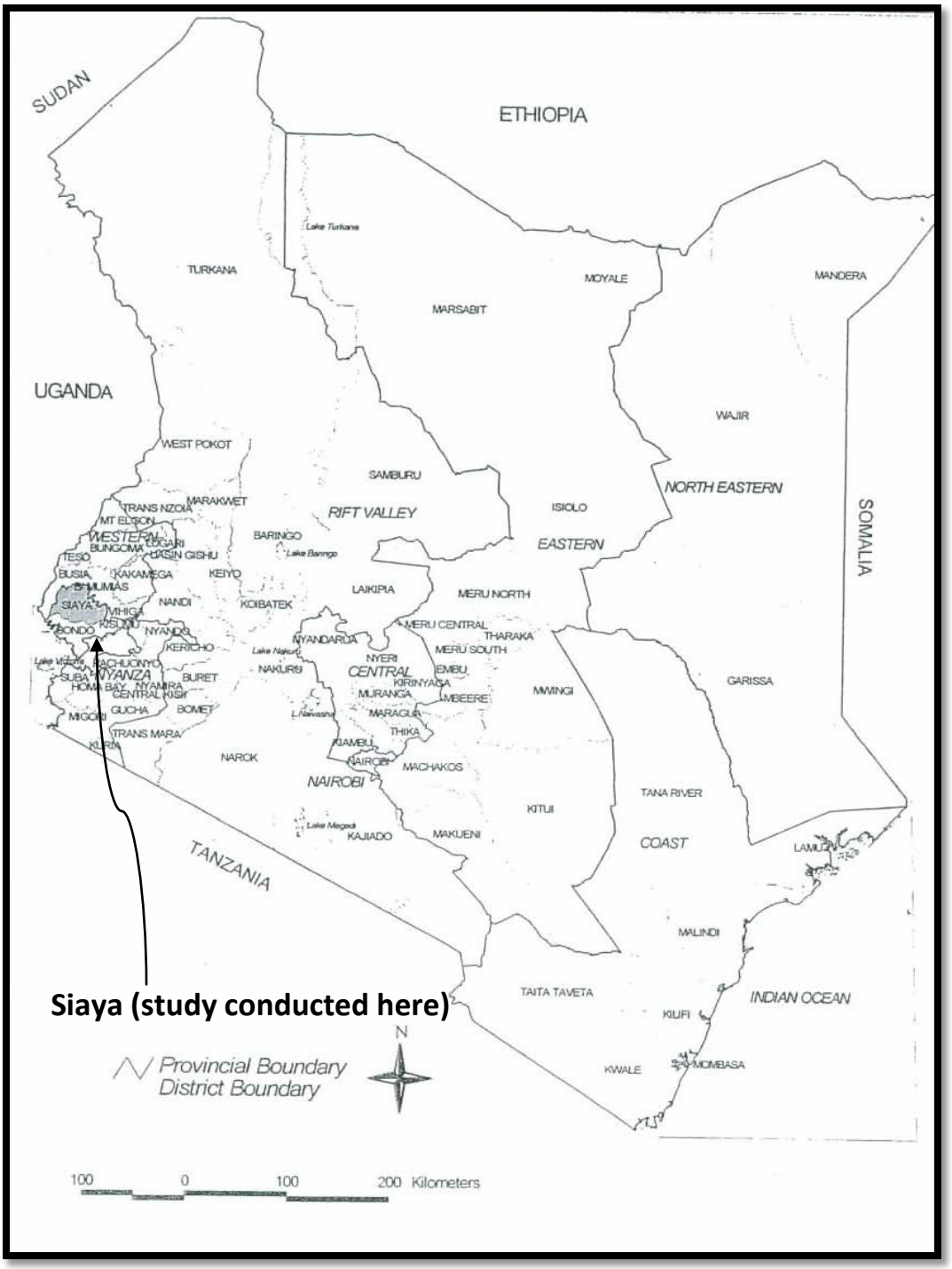
Appendix I:MAP

[9]MAP of KENYA



[9] Map from "Siaya district development plan " Ministry of finance and planning.

Appendix II: Tables and Bar Graphs

Table 1- Sample Population Characteristics (N=99)

Continuous Characteristics	**Mean(SD)**	**Min**	**Max**
Child Age (Months)	29.97 (1.7)	1	60
Mothers schooling yrs	8.4 (0.22)	1	15
Number of children	2.4 (0.15)	1	8
Spouse schooling yrs	10 (3.1)	3	16

Categorical Characteristics	**N**	**(%)**
Mothers education- Some primary	31	(31.31)
Completed Primary	41	(41.41)
Secondary or higher	27	(27.27)
Child age: Less than 12 months	24	(24.24)
12-36 months	43	(43.43)
Above 36 months	32	(32.32)
Parity : 1 child	27	(27.27)
2 children	36	(36.36)
3 children or more	36	(36.36)
Breastfeeding: Supplemental	30	(30.6)
Exclusive	0	(0.00)
Male Child	49	(51.6)
Reason at Clinic: Child ill	81	(82.6)
Vaccination	3	(3.06)
Growth Monitoring	4	(4.08)
Other	10	(10.2)
Child Illness: Diarrhea	10	(13.3)
Fever/Cough	53	(70.7)
Malnutrition	2	(2.7)
Other illness	10	(13.3)
Child had loose stool last 7 days	40	(43.5)
Spouse Occupation : Business	13	(13.3)
Farmer	20	(20.20)
Driver	7	(7.07)
Day worker	5	(5.05)
Other	39	(39.4)
NA	12	(12.1)

Table 2: Matching All three 3D models by child's age, mothers schooling years and number of children among matchers who participated in matching fake stool on the chart (n=98)

		All 3 Matching				
		n	mean	95% CI (mean)	t statistic	*p - value*
Child age (months)	Incorrect Correct	61 37	27.6 33.9	22.9 – 32.4 28.5 – 39.3	-1.76	0.082
Mother schooling years	Incorrect Correct	61 37	8.5 8.2	7.9 – 9.0 7.4 – 9.1	0.42	0.676
number of children	Incorrect Correct	61 37	2.3 2.7	2.03 – 2.6 2.1 – 3.2	-1.05	0.297

Table 3: Matching any two 3D models by child's age, mothers schooling years and Number of children among mothers who participated in matching fake stool on the chart (n=98)

		Any 2 Matching				
		n	mean	95% CI (mean)	t statistic	*p value*
Child age (months)	Incorrect Correct	19 79	27.7 30.6	18.4 - 37.03 6.7 - 34.5	-0.59	0.56
Mother schooling years	Incorrect correct	19 79	8.3 8.5	7.2 - 9.2 7.9 - 8.9	0.7	-0.38
number of children	Incorrect Correct	19 79	2.2 2.5	1.7 -2.7 2.1-- 2.8	-0.95	0.349

Table 4: Matching all three 3D stool models with corresponding picture and description on the Bristol stool chart and breast feeding status (n=98)

		Breastfeeding		Total
		No	Yes	
Matching All three Fake stools with Its corresponding image on chart	Yes	38	23	**61**
	No	30	7	**37**
Total		**68**	**30**	**98**

Chi sq = 3.8 df=1, *p value* 0.05

Table 5: Matching any two 3D Model with corresponding picture and description on chart and breastfeeding status (n=98)

		Breastfeeding		Total
		No	Yes	
Matching Any two Fake stools with Its corresponding image on chart	No	11	8	**19**
	Yes	57	22	**79**
Total		**68**	**30**	**98**

Chi sq 1.45, df =1 *p* value 0.22

Table 6: Reported type seven as the most recent stool and Self-reported 3 or more looser stool than normal in a 24 hour period during the last 7 days (n=80)

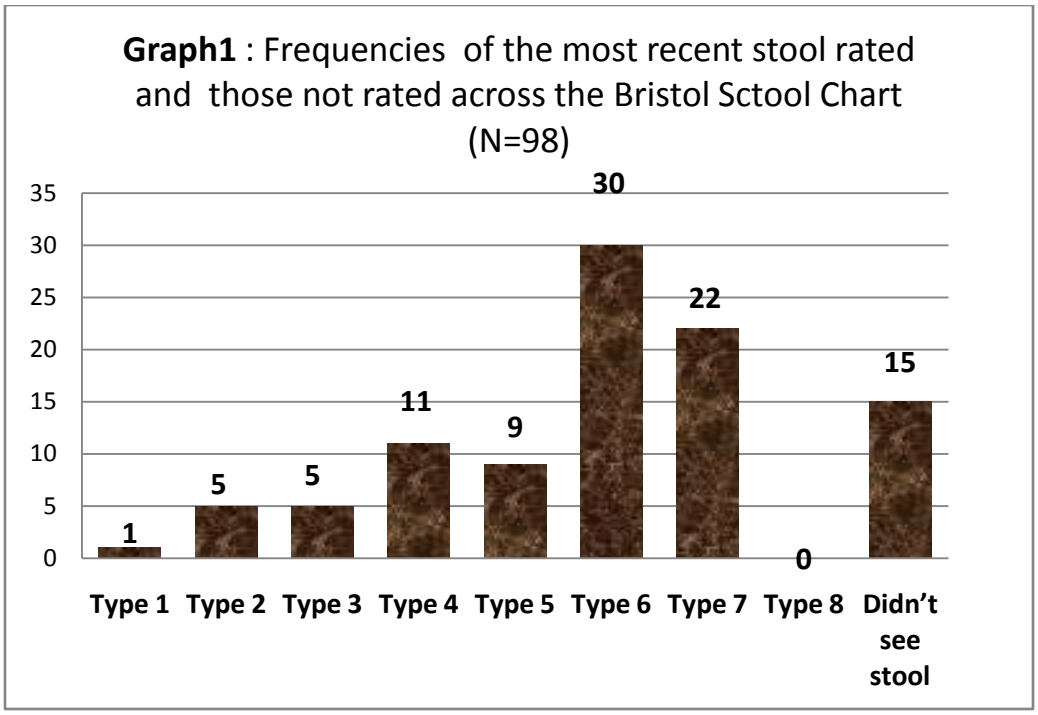
		Self reported 3 or more loose stool than normal		Total
		Yes	No	
Reported a 7 As most recent stool	Yes	12	9	**21**
	No	24	35	**59**
Total		**36**	**44**	**80**

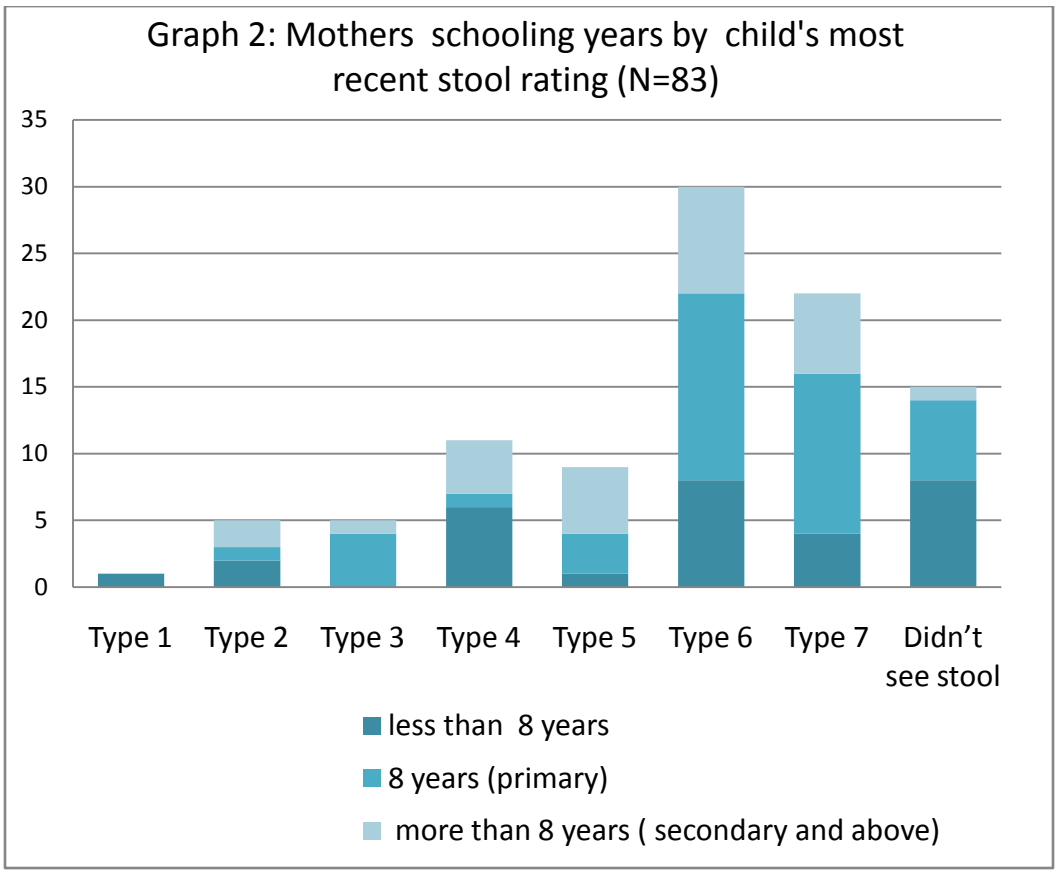
phi coefficient = 0.1

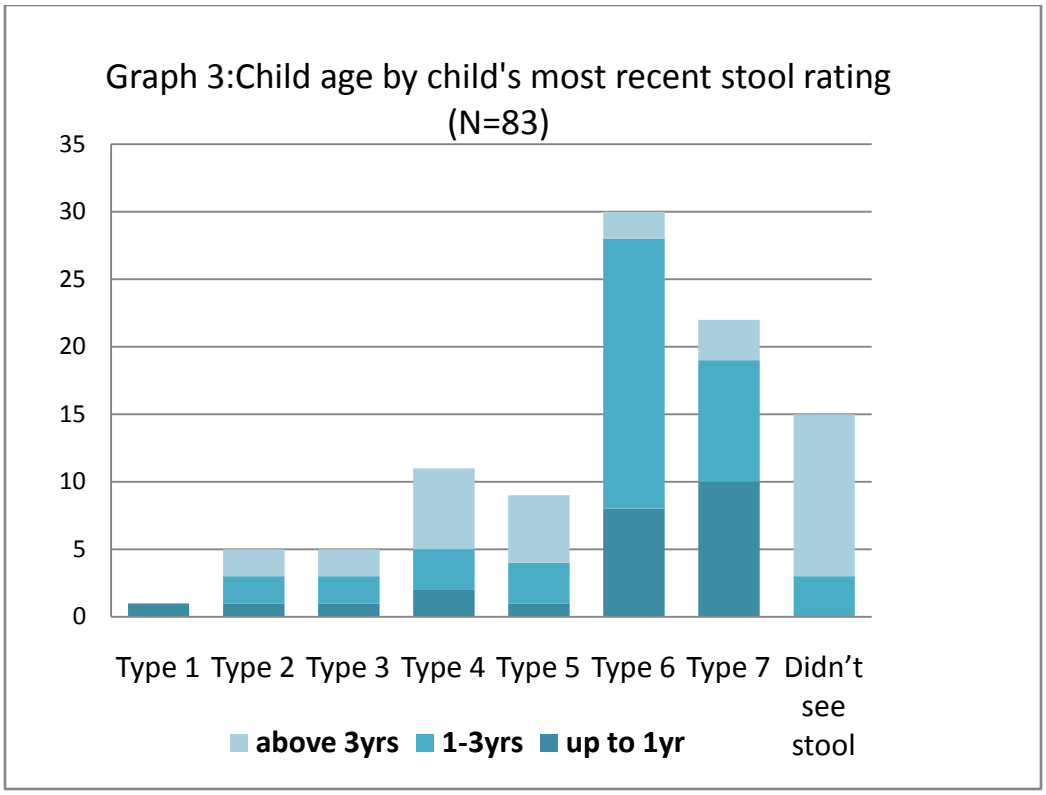
Table7: Reported type seven and 6 as the most recent stool and Self-reported 3 or more looser stool than normal in a 24 hour period during the last 7 days (n=80)				
		Self reported 3 or more loose stool than normal		Total
		Yes	No	
Reported a type 7 + 6 as most recent stool	Yes	28	23	**51**
	No	8	21	**29**
Total		**36**	**44**	**80**

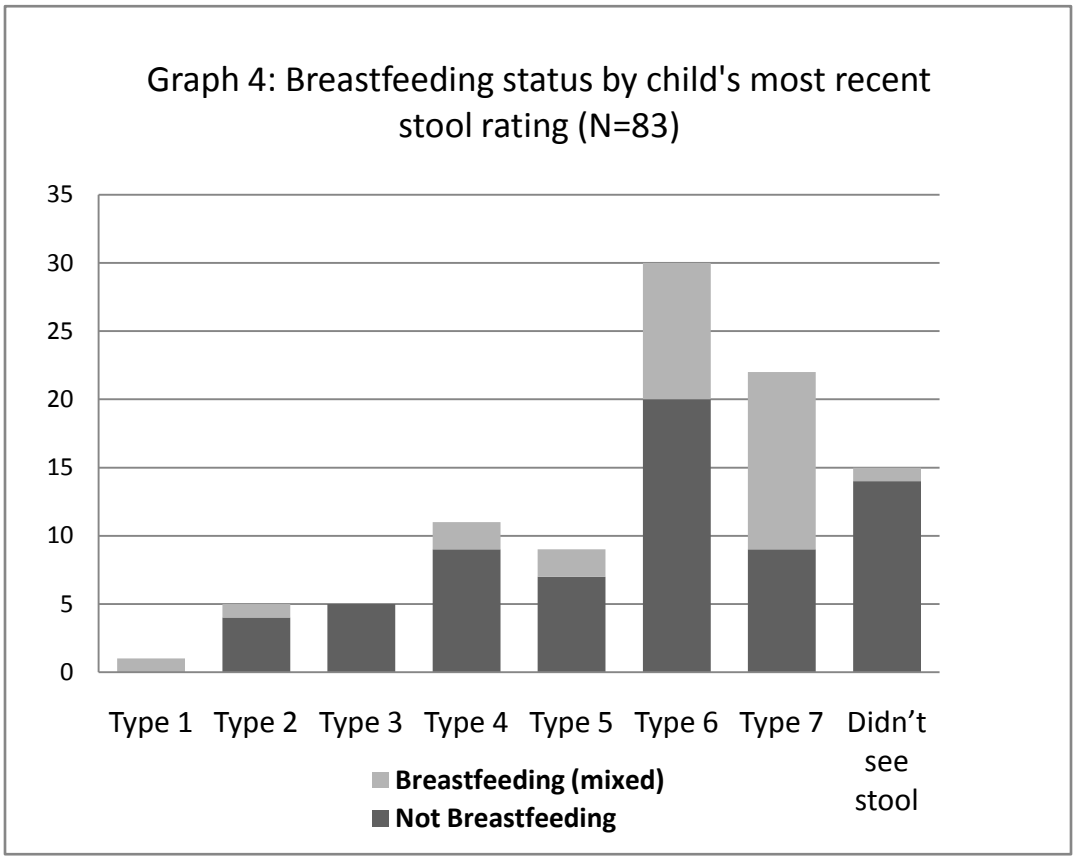
Phi coefficient = 0.3

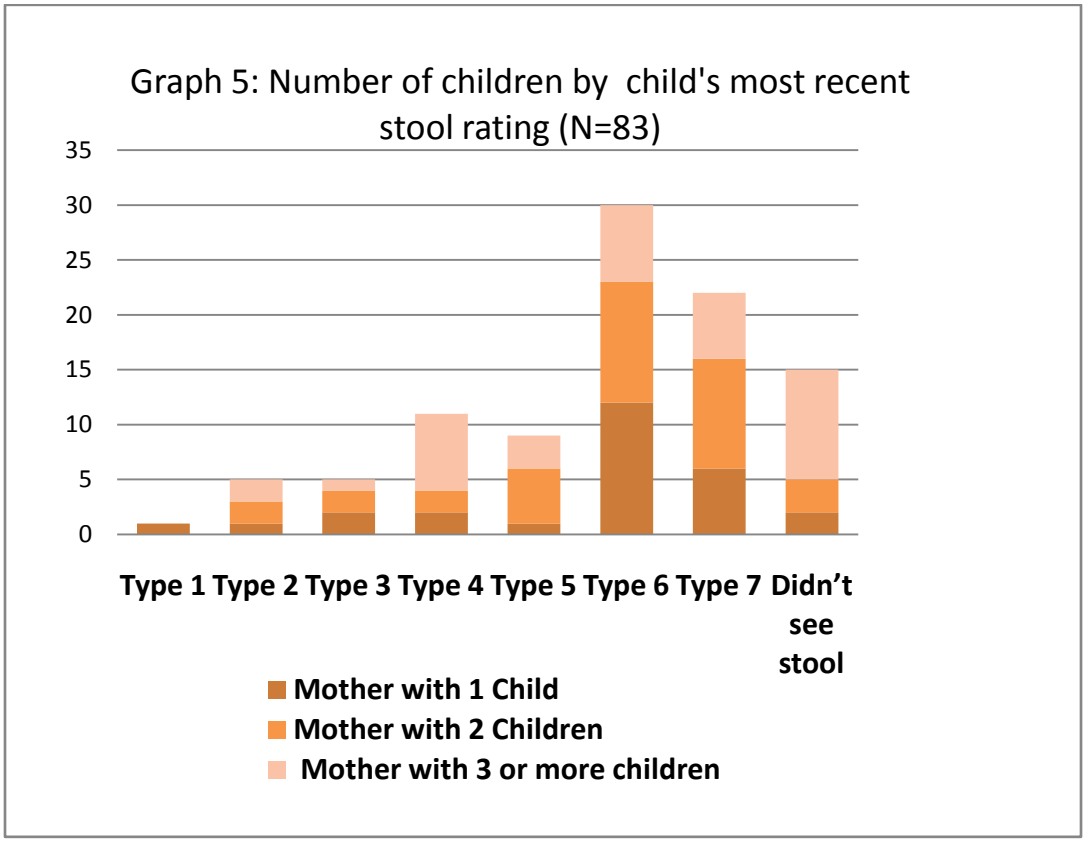
Table 8: Actual stools rated and participants characteristics (n=10)						
Reason at Clinic	**Child Age in Months**	**Stool Observed**	**Mothers schooling years**	**Mother**	**Clinician**	**Researcher**
Anemia	8	A	7 yrs	1	6	7
Pneumonia	2	B	8 yrs	**7**	**7**	**7**
Vaccination	2	C	8yrs	6	6	6
Malnutrition	9	D	8 yrs	6	6	7
Diarrhea	6	E	8 yrs	7	6	6
Pneumonia	9	F	8 yrs	7	6	7
Cough/Malaria	12	G	8 yrs	6	6	6
Malaria	7	H	8 yrs	5	6	7
Other reason	22	I	7 yrs	6	6	6
Malaria	7	J	8 yrs	6	6	6

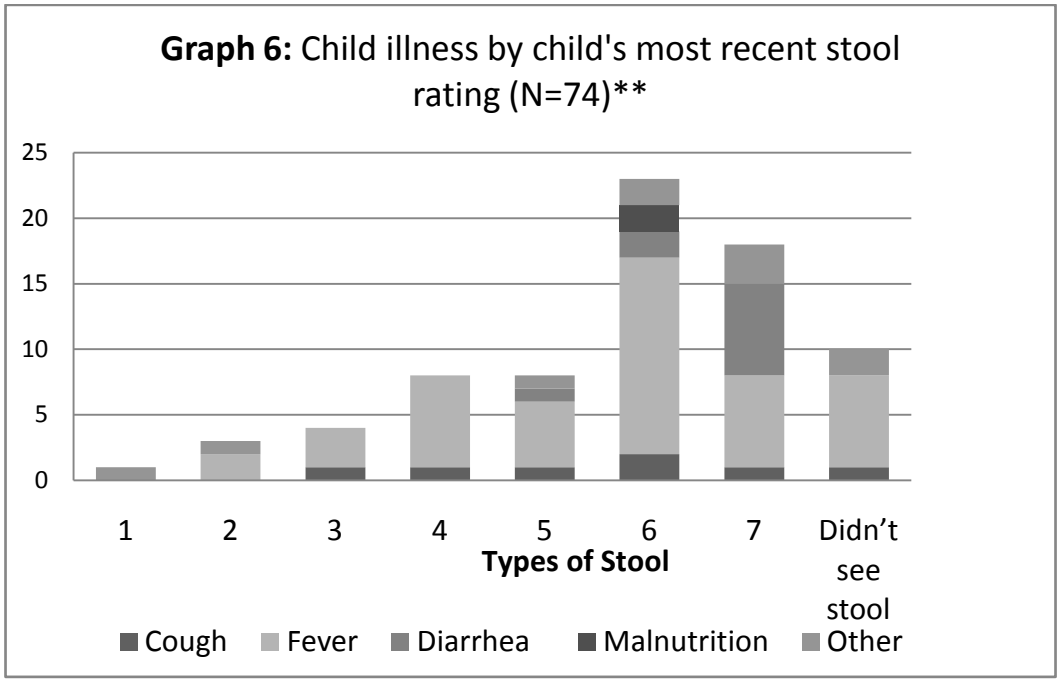

Graph1 : Frequencies of the most recent stool rated and those not rated across the Bristol Sctool Chart (N=98)
35
30
25
20
15
10
5
0
1
5
5
11
9
30
22
0
15
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6
Type 7
Type 8
Didn't see stool


Graph 2: Mothers schooling years by child's most recent stool rating (N=83)
35
30
25
20
15
10
5
0
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6
Type 7
Didn't see stool
less than 8 years
8 years (primary)
more than 8 years (secondary and above)


Graph 3:Child age by child's most recent stool rating (N=83)
35
30
25
20
15
10
5
0
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6
Type 7
Didn't see stool
above 3yrs
1-3yrs
up to 1yr

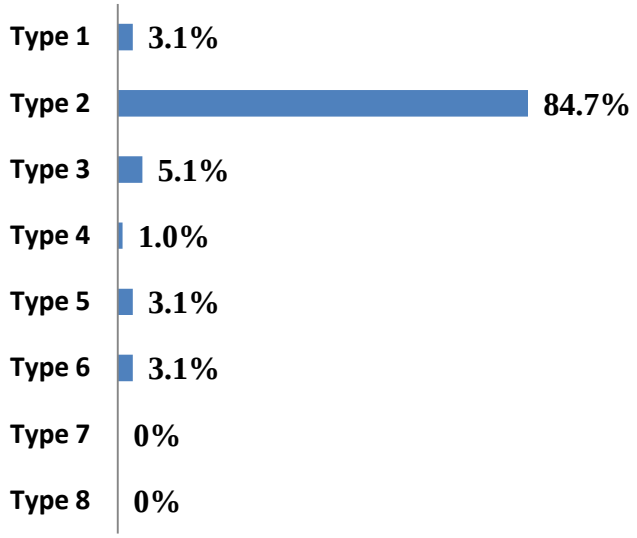

Graph 4: Breastfeeding status by child's most recent stool rating (N=83)
35
30
25
20
15
10
5
0
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6
Type 7
Didn't see stool
Breastfeeding (mixed)
Not Breastfeeding



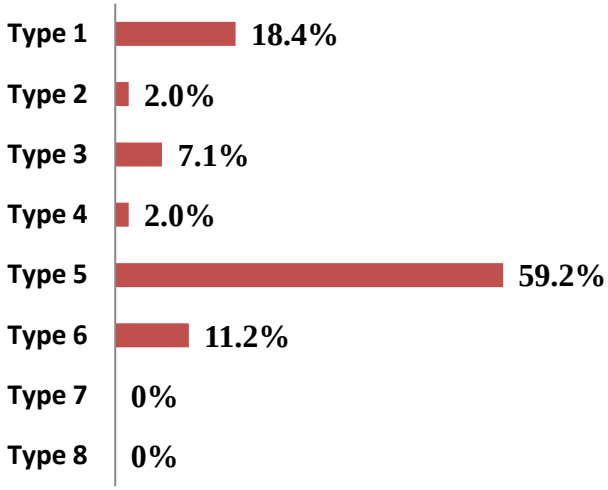


** Illness (n=74) was examined instead of reason at clinic (n=83); other reasons at clinic were vaccination and growth monitoring

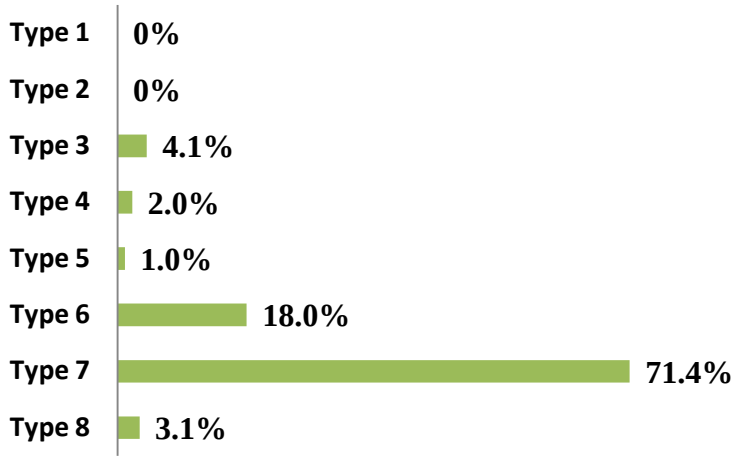
Graph 7 : Type 2 stool model rating by the mother on the BSC



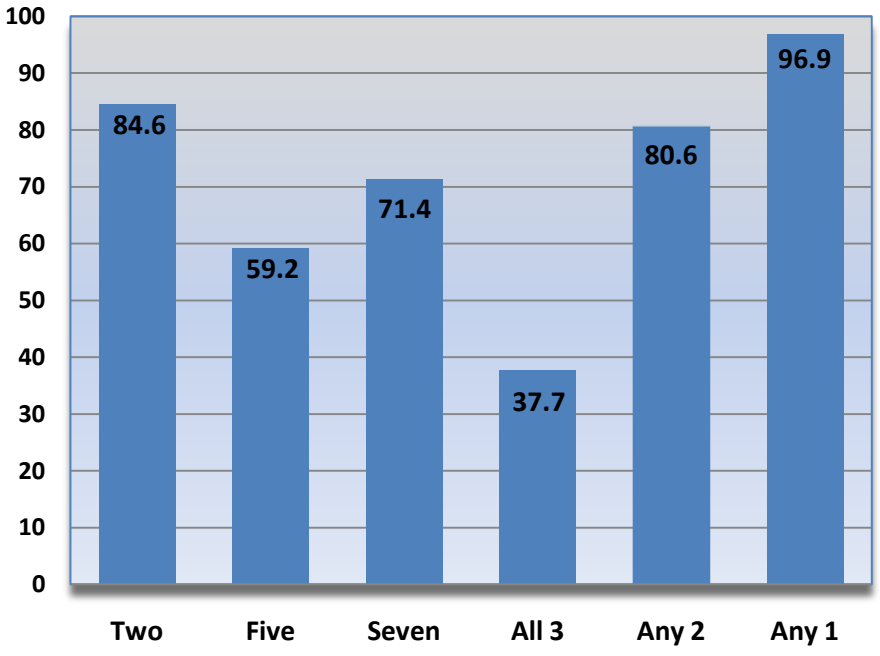
Graph 8: Type 5 stool model rating by the mother on the BSC

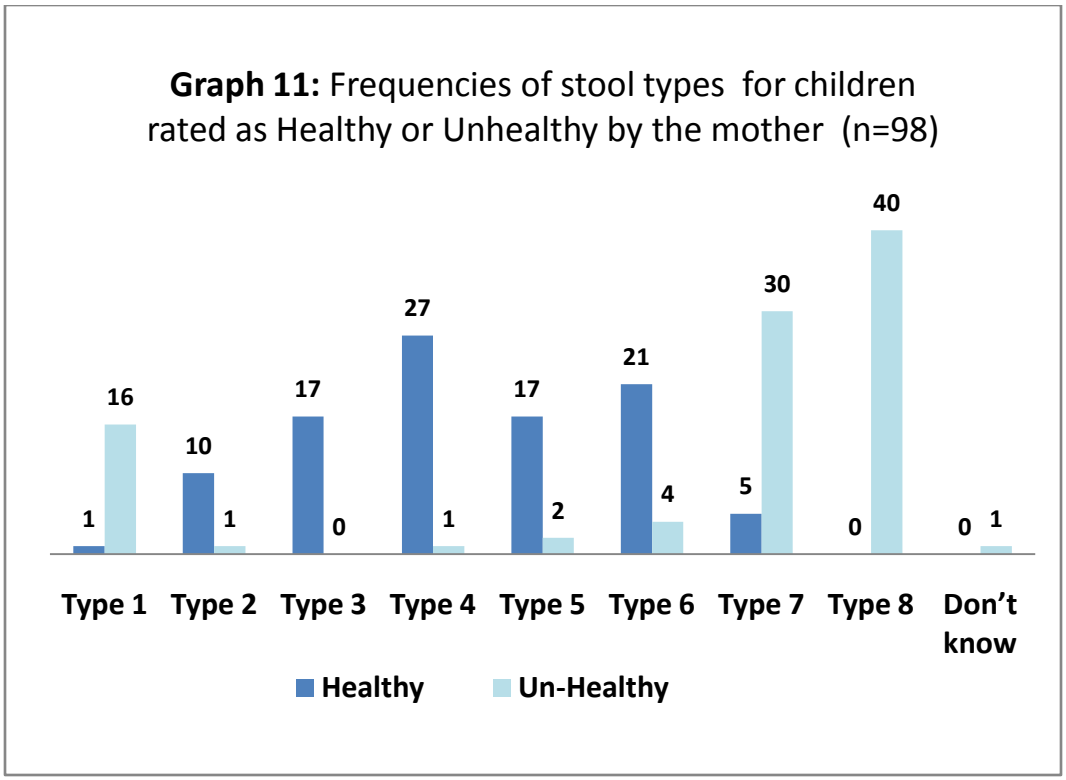


Graph 9: Type 7 stool model rating by the mother on the BSC



Graph 10: Percent of Mothers who matched 3D Stool model with corresponding image on the chart (n=98)




Graph 11: Frequencies of stool types for children rated as Healthy or Unhealthy by the mother (n=98)
1
16
10
1
17
0
27
1
17
2
21
4
5
30
0
40
0
1
Type 1
Type 2
Type 3
Type 4
Type 5
Type 6
Type 7
Type 8
Don't know
Healthy
Un-Healthy

Appendix III: Summary sheet, Key informant In-depth interviews

Objective: To understand how mothers perceive children's fecal pattern and the images and descriptions of stools on the Bristol stool chart

Participants:
Mama1 - 1 child and15 schooling years
Mama2 - 4 children and 8 schooling years
Mama3 – 2 children and 8 schooling years
Mama4 - 3 children and 12 schooling years
Mama5 – 4 children and 12 schooling years

Introduction	
Objective:	To obtain consent and provide information about the research and the research procedure
Introduction of researcher	Hi Mama My name is Fatumo Guled Thank you for agreeing to participate in this research project, I appreciate your time
Introducing the research procedure	I understand it may be uncomfortable to discuss children's stool but this is a normal experience among humans and it is an important part of children's health, therefore we want to be able to understand how mothers perceive stool types that are normal and those that are not normal for young children
Confidentiality	The information you give me will not have your name or your child's name. this information will be used for this research project only and I will not share it with anyone else

Verbal consent Permission to use recorder Permission to discuss children poop	We will be recording this information because it is important that I capture all the information from you, this is a recording device that will record our voice. We would like to collect information that will assist us in the process and hopefully we can learn ways of reducing childhood diarrhea. Do I have your permission?
Part I	
Objective:	To build rapport, get to know the Mother and her children
Demographic information about participant and child	number of children, number of schooling years and experience with children's stool
General Information about children's stool Probe:	Can you tell about children's stools, do they always look the same What child would have _____ stool That stool is common in which children
Causes	What do you think causes the stools you described How do you go about resolving this _____
Probe:	Could you tell me more about _____
Part II	
Objective:	To understand how mothers perceive the stool types on **The Bristol stool Chart**
Images on the Bristol stool Chart	Have you seen these **stool types** before
Each type on the chart **type 1 to type 8**	Have you seen type ____ before, which child would have this stool

Each type on the chart **type 1 to type 8**	does this stool say anything about the child's health is this a healthy or unhealthy type of stool For children under 12 months For children who are 1 - 3 years old For older children
Probe:	Why would you say _____
Conclusion	
Objective:	To collect any more information the mother would like to share about children's stool types
Closing questions	Do you think these images represent all the stools you have seen, should we add or remove certain types of stool. Do you have anything else to add Thank you for your time mama here as an appreciation gift (soap and water-guard) Explain how to use water-guard if she has not used it before

Appendix IV: Survey

IPA WASH Project

BSC-Survey

1) Participant ID number/namba ya mshiki |__|__|__|__|__|__|

Fill in this information at the beginning of the interview:

2) Date of interview: *tarehe ya mahojiano* (dd/mm/yyyy) |__|__|/|__|__|/|__|__|__|__|

3) Data Entry Date: |__|__|/|__|__|/|__|__|__|__|

4) Comments on data entry: *maelezo mengine*

SECTION A: INTRODUCTION

Read the following paragraph to the respondent in Kiswahili, Luhya, or Luo whichever they understand better, and ask if they agree to participate. Present the respondent with a Kiswahili copy of the statement while reading.

Read: "Hello. **BSC validation study Consent form - English Version**

Read: "Hello. How are you? I am (name) from IPA, the non-governmental development organization, in Busia Town. Do you have time to talk to me for about 20 minutes about your child's health for a research project I am conducting? I am not a clinician and I cannot answer any medical questions about you or your child's health. I know you are here for medical reasons and I hope you get help and your child feels better. The reason I am here is to ask mama's to help us know when children are sick with diarrhea (*kuharisha)* and we are testing this chart to see if it is easy for mamas like yourself to use. You do not need to talk to me if you do not want to. And if there is any question you do not want to answer, that will be fine. If you do want to talk with me, I will keep everything that you tell me entirely private and confidential, and will not talk to other people about what you have said. I do not need to know your name or your family's names, and I will not tell anyone that you have talked to me. Your answers will in no way affect you or your child's medical treatment at this clinic. Also it will not affect the assistance that IPA might provide to your community or your family. If you have any problems, or if you feel uncomfortable answering any question, you should feel free to stop talking with me at any time.

If you have any questions about this, you can ask me I will be around in the next three months or you can contact me or Clair Null by going to the IPA office in Busia town and they will help you get in touch with myself and Clair Null. I am a student and Clair Null is a Professor at Emory University in the United States and we are in charge of this research project. All your answers will be kept private. We would appreciate your assistance in answering some questions for the next 20 minutes, but participation is voluntary and there is no need to answer any questions if you don't want to. I will ask you detailed questions about you and your children. We will be asking question about the child's *kuharisha* and we know it is not polite to ask questions about poop because it is uncomfortable however we need to be able to tell if this chart can help mamas identify if their child is sick with *kuharisha* . Another reason we are conducting this research is to find a better way that is less uncomfortable to talk about "*kuharisha kwa mtoto"*. All children make messes sometimes and we want to see if this chart is a good way to make sure the children are healthy, you don't have to be embarrassed mama because of the questions we ask. May we have your permission to ask these questions, and would you be willing to participate?" When it is your turn to see the medical doctor we will stop and you can go ahead.

1. **Consent given?** ***(1=Yes, 2=No)*** *Idhini imetolewa ndio/hapana/ duoko ina ichiwo (eei dawe)* |_____|

2. **If respondent DOES NOT GIVE CONSENT:** Why? _____

   *Mshiriki hajatoa Idhini, sababu*_____
   Ka Ng'ama 1) Penjo Okoduoko: Nam'go_____

3. Time start interview: *(24-hr clock; HH:MM)* |__|__|:|__|__|
   Saa ya kuanza mahojiano (masaa 24 saa:dakika)
   Sama Ichake penjo: (saa dakika

4. Why are you at the clinic today *mama*?

   (a.) Child ill describe _____
   (b.) Vaccination
   (c.) Growth Monitoring

Mama kwanini upo katika kiliniki leo/ Ango Momiyo ibiro e Klinik kawuono mama?

   a) Mototo Mgonjwaa/ her mar tuo mar nyathi _____
   b) *Chanjo/*
   c) *Kutazama ukuwaji wa mtoto/ Pimo dongo mar nyathi*

5. What is this Child's Age |_____|
   Umri wa mtoto ni / Nyathini en jahigui adi |_____|

6. Child gender |M| |F|
   Jinsia ya mtoto/ Nyathi en mawuoyi kose manyako mvulana / msichana

7. How many children do you have? |_____|
   Una watoto wangapi? Ingi Nyithindo adi?

8. What was the number of schooling years you completed? |_____|
   Umeenda shule kwa muda wa miaka mingapi?
   Isomo Nyaka e klass adi?

9. What the number of schooling years your spouse completed? |_____|
   Mzee wako amesoma shule kwa muda wa miaka mingapi?
   Jaodi osomo nyaka e klass adi?

10. What is your occupation? |_____|
   Kazi yako ni nini? Himo tich mana/itiyo tich mana?

11. What is your spouse's occupation? |_____|
   Kazi ya mzee wako ni nini? Jaodi tiyo tich mana?

12. Yesterday did your child have any of the following drinks
   Jana ulimpatia mtoto kitu kama/ To be nyoro nyathini no madha achiel kuom gigi
   a) Breast milk Y N *Maziwa ya mama/ cha thuno*
   b) Water, gripe water, sugar Y N *maji, sukari, maji ya gripe kwaajili ya kuharisha/pi skari*
   c) Animal Milks Y N *maziwa ya ngombe, mbuzi/ cha thiang'*
   d) Formula Y N *fomula /fomula*
   e) Yogurt Y N *maziwa lala/ chak mapoto*
   f) Juice, tea, soda Y N *juisi, soda, chai*
   g) ORS Y N
   h) Any other drinks- specify _____Y N *maji ya aina yoyote/gin agina moro mimadho (full nyinge) Y N*
   i) Home remedy in liquid form *dawa za maji maji za miti shamba/chieo moro amora ma ilosoe ot mau ka pi? Y N*
   j) Child did not take any drink yesterday *mtoto hajapatiwa kitu chochocte cha maji maji jana/ Nyathi ok no madho giu moro amora nyoro Y N*

13. Yesterday did your child eat any of the following whether pureed, mashed, solid or in any other preparation / *Jana mtoto alikula kitu chochote cha aina hii / Kuom gik ma adhi kuanogi en mane manyathini ne achamo nyoro:-*
   a) Uji or other porridges *Uji, aina yoyote ya uji/ Nyuka* ***Y N***
   b) Ugali, Rice, potatoes,bread, chapatti, mandazi *Ugali wali, viazi, mkate ,chapatti ,mandazi/kuon,mchel,erabuon,mkate,chapti,mandasi* ***Y N***
   c) Peas, beans, grams, nuts *maharage,karanga,njegere/ peas,oganda,olaya,nas* ***Y N***
   d) Fruits *matunda/ Olemo* ***Y N***
   e) Leafy green vegetables such as sukuma, spinach, managu, or other / *A lot moro amora kaka; skuma ,boo,spinach* Y N
   f) Any other vegetables such as cabbage, butternut, carrot, tomatoes etc *A lot moro ma opogre kak ; kabichi,karat,nyanya* Y N
   g) Eggs *mayai/Tong* Y N
   h) Meat, fish, liver, gizzard *nyama,samaki,maini, figo* Y N
   i) Child did not eat any foods yesterday *mtoto hajakula chakula yoyote jana/nyathi ok ne ochamo chiemo moro amora nyoro* Y N

14. Yesterday did your child have any oils or margarine (i.e. Kimbo) either alone or in food? Y N
   Jana motto alikula mafuta ya aina yotote kama kimbo kwenye chakula ama peke yake? Ndio /hapana

To be nyathi hochamo mo moro amora kaka kimbo kata bluband? ***Y N***

15. When was your child's last poop? _____
Mara ya mwisho mtoto kupata choo ni lini? Nyathini hodhi oko mogik saa adi? _____

16. Did you see it? Y N
Uliona choo cha mtoto? To be na ineno Oko no? ***Y N***

17. When was the last poop you saw? _____
Mara ya mwisho kuona choo cha mtoto ni lini/Oko ma ogik mana ineno ne eh saa adi _____

18. Here are some 3 fake stools and could you match them to the stools on the BSC

Nyis min nyathi mfano mag minyaga ata kasto inyese ni mado opimgi gi minyaga mane BSC

(use same random stools with other mothers)

Type 2	1	2	3	4	5	6	7	8
Type 5	1	2	3	4	5	6	7	8
Type 7	1	2	3	4	5	6	7	8

19. Which picture closely resembles your child's most recent stool, (if stool available for observation ask mother if it is okay for you and clinician to observe the stool and also respond)
En picha mane ma odwa chal gi mnyaga mar nyathini ma nyochag ka mnyaga nitie to nyis mama ka ber mondo in ja klinik kod mama mondo urang mnyaga no

Mother response Circle one Types of stool	1	2	4	4	5	6	7	8
Clinician response	1	2	3	4	5	6	7	8
My response	1	2	3	4	5	6	7	8

20. Thinking about your young children (those under 2 years): Does the chart have all the types of stool your children have had? Y/ N *Katika choo chochote cha mtoto uliyowahi ona, hizi hapa ziko na yote ile umewahi ona? Ka iparo kuom nyithindi (man piny mar highi ariyo) be BSC nyiso minyaga magisegapedogo kuom ndao ma okalo?* ***Y N***

21. If the answer is **No** to question 20- ask to show you by drawing or describe the type missing

Kama mama akisema hapana/ mwambia akuonyeshe ambazo hazipo katika BSC/Kaduoko en dawer; nyis mama mondo ogor kata o pim kaka minyaga ne chal

22. Which of the stool types shown on this chart are healthy for children under two years old? (list all)

Wewe mama unafikiri choo ipi katika hizi picha haina shida kwa mtoto chini ya miaka mbili/ En Minyaga mana kuom ma onyisgo ma nyiso ni nyathi man ebuo higni ariyo ngima? (kutau duto)

_____

23. Are there any stool types shown on this chart that would make you think your child is sick?

    Katika hizi picha kuna picha amabayo kama mtoto akiwa na choo hii utapata wasiwasi kama mtoto ni mgojwa? Nitie Minyaga moroamora manyiso ni nyathi tuo kuom ma otang'ni go?

24. Which of the stool types shown on this chart are healthy for older children?

    Katika hizi picha zinazoonyeswa hapa, picha ipi ni haina shida kwa watoto wakubwa? /En Mnyaga mane mannyiso ni nyathi maduang' mgima?

25. What stool color is healthy/ not of concern and what color is of condern/shows a child is sick?

    Choo cha rangi gani haina shida? / En kido/rangi mane mar minyaga mane BSC waber gi n'ama duong'

    Choo cha rangi gani kinashida/ huonyesha mtoto mgonjwa?

26. Which of the stool types shown on this chart are healthy for adults?

    Katika hizi picha Choo gani haina shida kwa watu wakubwa kama mimi na wewe?/ En kido manemar minyaga manyiso ni ng'amo duong'

27. In the past 7 days has your child had 3 or more watery stool that is looser than normal in a period of 24 hrs? *Kuaniza siku saba ziliz piata mtoto wako alipata choo cha majimaji, maji zaidi ya kawaida zaidi ya mara tatu kwa muda wa masaa 24/ Kuom ndalo obiriyo ma osekalo be Nyathini osebedo kadhi oko mangapi kata odiewo kuom ndala adek kuom sache 24?*

28. Do you think this is normal for your child? *Unadhani hii ni kawaida/ To be iparo ni ma ber kod nyathini*

Appendix V: Bristol Stool Chart

Bristol Stool Chart

Aina Kido	1		Ngumu Kutoka Minyaga Matek to Oluowore Matido tido
Aina Kido	2		Madonge donge Yameshikamana Minyaga Machal gi mitura, Omakre omakre
Aina Kido	3		Kama soseji iko na kraks juu Chal gi mutura Kata sosag to tek ahinya
Aina Kido	4		kama Soseg ndefu kama Nyoka Rep rep to bor Kathuol
Aina Kido	5		Laini inatoka moja moja Oluore MAtindo tindo to rep rep
Aina Kido	6		Choo Chepesi Rep rep Ahinya to otimo pi
Aina Kido	7		Choo cha maji maji, hamna ugumu Otimo pi Mang'eny
Aina Kido	8		Makamasi/damu Minyaga Matindo remo kod othwinyo