Global Trends in Care Seeking for Children with Diarrhea: A Theoretically Grounded Exploration of Care Seeking Behavior Among the Countries of USAID's Demographic Health Surveys

By

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Bachelor of Arts
Grinnell College
2012

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Behavioral Sciences and Health Education
2014

Abstract

Global Trends in Care Seeking for Children with Diarrhea: A Theoretically Grounded Exploration of Care Seeking Behavior Among the Countries of USAID's Demographic Health Surveys

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Background and Objectives: This study provides a theoretically grounded foundation to exploring global care seeking trends for childhood diarrheal illnesses. In order to inform current global surveillance and intervention efforts, this study explored how different characteristics influenced any care seeking outside the home as well as care seeking at a medical facility.
Methods: Using data provided by the standard Demographic Health Surveys (DHS), this study provides the first step by exploring what individual and household characteristics are consistently influential in care seeking at a global level. All DHS datasets with measures of recent diarrheal illness were included in analysis. Predictor variables were justified and organized into a multivariate statistical model using Andersen's Health Behavior Model.
Results: Nearly 1.4 million children across 73 low- and middle-income countries were included in this study. Of these children, 16.5% had a diarrheal episode in the preceding two weeks. Fifty-three percent of these children were taken to some form of care outside the home, and 39.8% were taken to care at a medical facility. Overall, most predictor variables explored in this study were found to have some amount of influence on global care seeking practices for children with diarrhea. For both general care seeking as well as medical care seeking, a higher proportion of children with bloody stools and fever being taken to care. Globally, wealth had a positive relationship with care seeking, as did educational attainment of both the mother and father. Additionally, use of prenatal care was found to have a significant impact on care seeking, with prenatal care users being nearly twice as likely to seek care at a medical facility.
Conclusion: The results of this study indicate that medically based surveillance sites do capture a slightly biased sample of children with diarrheal illnesses. Childhood diarrheal surveillance should seek to adjust their observations of treated prevalence based on these uncovered influences in seeking medical care. Furthermore, these findings should be incorporated into future global care seeking intervention and policy efforts as well as provide a comparative structure from which to organize future diarrheal care seeking research.

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Acknowledgements

I would like to thank Dr. Richard Levinson, my thesis chair, and committee members Dr. Aron Hall and Dr. Ben Lopman for being a constant source of wisdom, support, and guidance throughout this process. I would also like to thank the Demographic Health Surveys and all their partnering agencies for putting in the years of fieldwork and technical expertise needed to produce such a detailed and comprehensive data source for researchers like me.

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I. INTRODUCTION

Diarrheal diseases remain a leading cause of morbidity and mortality for children in developing countries, accounting for over one million deaths per year for children less than five years of age [1-3]. Childhood death and illness due to diarrheal diseases is largely preventable, and global health researchers continue to promote a variety of strategies to reduce global incidence and severity. These international and country-specific policies and interventions to reduce diarrheal disease burden rely on surveillance research to provide an accurate picture of diarrheal prevalence in order to assess the effectiveness of current projects and understand where to target continued efforts.

In general, surveillance comes in two types: clinical and community. Clinically based surveillance samples from children who present with diarrheal symptoms at a medical facility where surveillance occurs. This form of surveillance offers many advantages, such as easy access to survey participants and trained staff and clinical equipment that can be used to monitor symptoms and identify the responsible pathogens. However, clinical surveillance has the potential to miss certain kinds of children depending on biases in care seeking behavior and as such current estimates remain imprecise [4]. Not only are children more likely to be taken to a medical facility if their diarrhea is believed to be more severe (thus meriting medical attention), but current research has found care seeking behaviors may be influenced by demographic characteristics, socioeconomics, health beliefs, and social norms. Therefore, clinically based

surveillance runs the risk of sampling from a population that does not accurately reflect the wider community.

Community based surveillance attempt to provide more accurate estimates of diarrheal illness by directly sampling from the community rather than through a hospital or clinic. While this form of surveillance is more representative of the population, it is often expensive, time consuming, and beyond the capacity of research teams for the low- and middle-income countries that have the greatest need for the most extensive and informative surveillance practices.

However, while the research community continues to debate best surveillance practices, many national and global organizations look to research data to inform policy and intervention decisions. Having baseline diarrheal prevalence as well as treatment and care seeking behaviors helps inform how to best use an organization's efforts and resources to reduce childhood diarrheal illness. A more organized, focused effort needs to be made by the research community to give these organizations the information they need to monitor progress, identify barriers, and in general to reach out to those children and families still in need.

This study provides an organized and theoretically grounded foundation to exploring global care seeking trends for childhood diarrheal illnesses. Using data provided by the standard Demographic Health Surveys (DHS), this study provides the first step by exploring what individual and household characteristics are consistently influential in care seeking at a global level. Potential influencing characteristics are justified and organized into a multivariate statistical model using Andersen's Health Behavior Model (Figure 1) which posits healthcare

utilization is influenced by three distinct constructs: *predisposing characteristics, enabling resources,* and perceptions of *need*. While theory is often absent from current research on care seeking and healthcare utilization for diarrheal illnesses, it has the ability to help facilitate comparisons across different research methods as well as validate and contextualize the relationships observed between influential characteristics and care seeking behavior. Theory also has the advantage of translating observed relationships into action as well as providing focus and direction for intervention efforts to improve and encourage care seeking. Overall, this study aims to inform adjustments in current clinical surveillance and development of global policy and intervention efforts as well as enhance global diarrheal disease research by providing a baseline understanding of the influences on care seeking and a structure for continued research. To this end, this study will look at the influences of theoretically supported characteristics on both care seeking behavior in general and care seeking behavior at a medical facility. The resulting research questions for this study are: (1) what are the care seeking rates for children with diarrhea among low- and middle-income countries, (2) what are the relationships between *predisposing characteristics, enabling resources*, and measures of *need* with general care seeking for children with diarrhea, and (3) what are the relationships between *predisposing characteristics, enabling resources*, and measures of *need* with medical care seeking for children with diarrhea?

II. LITERATURE REVIEW

Global Burden of Diarrhea

Diarrheal diseases continue to be a leading contributor in global childhood morbidity and mortality [5-7], accounting for over 1.3 million childhood deaths per year [2, 7]. Low- and middle-income countries continue to see a disproportionately high burden, where children experience an average of 2-3 diarrheal episodes a year [8]. The significant role diarrhea continues to play in global disease burden has warranted continued attention by the scientific community. In general, studies have relied primarily on hospital-based surveillance to assess local, national, and global trends in diarrheal prevalence to support and inform the development of vaccines and public health policies around diarrheal prevention and management [9, 10]. Additional community-based surveillance of diarrheal prevalence and care seeking behaviors are beginning to develop to (1) help adjust and contextualize hospital-based prevalence estimates, (2) develop ways of improving surveillance methodology, (3) inform intervention and education strategies for diarrheal care management and care seeking, and (4) gain a richer understanding of cultural and community-specific influences in care utilization for childhood illnesses.

Clinical Surveillance and the Lab

Often, surveillance studies use hospitals and clinics as recruitment sites because they provide easy access to patients and their stool samples. From these studies, researchers have been able to capture preliminary estimates of diarrheal prevalence in many low- and middle-income communities. In the wake of the rotavirus vaccine introduction, numerous studies have turned to laboratory-

accessible surveillance sites that possess the additional advantage of uncovering the relative burden of different diarrheal causing pathogens [7, 9, 11, 12].

However, despite the rise in refined, pathogen-specific surveillance, the overall burden of diarrheal disease remains elusive. Hospital surveillance can only provide burden estimates based on cases that prompt caretakers to seek medical attention. Therefore, these studies fail to capture complete burden estimates by missing those who do not seek care outside the home or who choose to seek care at other healthcare facilities outside of the surveillance locations. Such studies are open to potential biases that effect the decision to seek care outside the home and the type of care sought [4, 7].

Community-Based Surveillance

As a complement, researchers are beginning to design studies that survey beyond the hospital walls. When motivated and provided enough time and resources, researchers are designing large-scale prospective studies to try and capture those unreported cases and better characterize diarrheal burden [4, 13, 14]. However, these studies are rarely feasible, demanding a substantial amount of time and finances, and are particularly challenging in resource-poor countries with a less developed infrastructure. As a more feasible alternative, many retrospective studies have focused on characterizing the proportion of diarrheal incidence and care seeking through cross-sectional surveys and interviews [7, 15]. Many of these studies also address treatment-seeking behaviors in response to diarrheal illness, often focusing on the use of oral rehydration therapy as well as documenting or supporting interventions aimed to improve access and use of

diarrheal treatment [16, 17]. Overall, these community-based studies largely seek to understand the motivators to care seeking and the impact of traditional or non-western treatments as well as critique current burden estimates and inform more accurate surveillance techniques.

Current Findings

Varying Rates of Care Seeking

At their most basic, these community-based studies have revealed differences in care seeking proportions across communities in low- and middle-income countries (Table 1). For instance, in the Maradi Region of Niger, upwards of 70% sought outside care, but less than 10% of children were taken to the hospital [7]. This number is similar to the 11-13% who were seen in the public sector in the urban slums of Karachi, Pakistan [18], but it is by no means a global figure. One study in Malaysia found that 43.3% of those with diarrheal symptoms sought outside care [15]. In a large-scale case-control study in seven communities across Sub-Saharan African and South Asia participating in the Global Enteric Multicenter Study, 49.6% and 84.3% of respondents from Gambia and Mozambique respectively reported seeking care first at a health center, as compared to 15.8% and 13.2% of Indian and Bangladeshi respondents [4]. In the same study, 52.3% of respondents from Mali reported a traditional healer as their first point of care as compared to only 14.9% of Kenyan respondents and 0.7% of Pakistani respondents.

Source	Location	Any Care	Hospital/Clinic
Page (2011)	Maradi, Niger	70%	<10%
Zaidi (2006)	Karachi, Pakistan	--	11-13%
Tee (2011)	Malaysia	43.3%	---
Nasrin (2013)	Gambia	85%	49.6%
Nasrin (2013)	Mozambique	67%	84.3%
Nasrin (2013)	Bangladesh	87.5%	13.2%
Nasrin (2013)	India	72.8%	15.8%

Table 1. Summary table of care seeking rates described in previous research.

Influences on Care Seeking – Perceptions of Severity

When uncovering such diverse care-seeking rates across populations, the next question is why some do and some do not choose to seek specific kinds of care. Survey and interview research has also been used to explore this question. Many studies on childhood diarrhea focus on the care seeking decisions of mothers [3, 17, 19-21]. As the parent often in charge of childrearing, mothers are the ones who often make decisions about when to seek treatment and from what source. Many studies point to symptomology and, in particular, perceived severity as a key influence in motivating care seeking [21-23]. Studies in Sri Lanka and Nigeria have shown that perceiving or identifying diarrheal symptoms as high risk is often reported as a main reason for seeking care, while non-recognition of diarrheal severity was found to be a predominant reason for not seeking treatment [17, 22]. Goldman asnd Heuveline (2000) also reported care was more often sought for low parity children and children who are generally

perceived to have good health, which could easily be qualities that augment a caregivers perception of severity. It is important to note these findings, while prominent, lack consistency across communities in the literature. For example, Saha's [2] research in Gambia found severity symptoms including fever, vomiting, and signs of dehydration did not remain significant predictors of care seeking in larger multivariate models.

Influences on Care Seeking – the Child and the Household

Beyond perceptions of severity, other child and household factors were also found to bear influence on care seeking. Several studies found both the age of the sick child and number of children in the household influence health-seeking behavior [7, 15, 22]. Amarasiri de Silva's (2001) survey of Sri Lankan mothers, Tee's (2011) survey of a Malaysian population, and Taffa's [21] interviews with Nairobi mothers found caregivers were more likely to seek care for diarrheal episodes in young infants (less than 1 year) as opposed to older children, while caretakers in Mali and Burkina Faso were more likely to seek care for boys [3, 5]. Additionally, Page (2011) reported number of children in a Niger household had a positive correlation with care seeking. Again, others report contradictory findings, with several studies reporting no significant relationships between such variables [2, 24]. This variation implies different communities or cultures may rationalize care seeking in unique ways and validate the need for breadth as well as depth in care seeking research.

There has also been extensive research into the impact of demographic variables such as maternal education and socioeconomic status [6, 7, 17, 21].

Several studies have shown that poverty levels negatively impact care seeking outside the household [17, 21]. Other studies show a decrease in care seeking for higher socioeconomic status. In the Manhiça district of southern Mozambique, television-owning households, used here as a marker of higher socioeconomic status, were 78% less likely to utilize health services [25] and de Silva's (2001) research in Sri Lanka found similar rates of care seeking across all socioeconomic groups.

Studies in Western Kenya and Malawi both found formal education of mothers to increase rates of care seeking, likewise caregivers in Kolkata, India who completed primary school or higher were 15.5 times more likely to seek care outside the home [1, 26, 27]. Conversely, Page (2011) challenges the assumption by reporting no correlation between education and health seeking among mothers in rural Niger communities and Saha's (2013) survey results from caretakers in rural Gambia found no association between care seeking and a caregiver's educational attainment or socioeconomic status. While some researches have begun to argue that care seeking behavior can be evaluated independent of education or socioeconomic status [6], the extent to which these demographic characteristics influence care seeking behavior is still debated, making such arguments premature.

The literature has also found cultural beliefs and social norms about the cause and treatment of an illness to be significant in care seeking across multiple communities [6, 7, 28]. Cultural beliefs about the cause of an illness help define severity as well as what treatments to use and when to seek help. In some communities, such as central Thailand, some forms of diarrhea are not only

thought of as normal, but are considered markers in a child's growth and development [29]. A South African study found eleven different local kinds of diarrhea classifications which could be grouped into three overarching categories of causation: natural causes (such as teething), supernatural causes, and germs or dietary change [28]. These classifications dramatically impact care seeking behavior as indicators of severity and appropriate treatments differed based on the perceived cause.

Cultural beliefs also appear to influence not only when diarrheal episodes are considered dangerous, but also what resources caregivers turn to when they seek care outside the home. A study comparing Asian mothers across Asia and the United States found the majority of women first provided traditional treatments to their child and sought medical advice only after their traditional practices failed [30]. Similarly, Farag's (2013) study in Mali found that higher rates of care seeking from traditional healers were associated with increased perceptions of severity. In Guatemala, within a culture that reported higher rates of care-seeking behavior outside the home, mothers were still found to predominantly seek out relatives for advice, while only seeking other treatments in one-third of illnesses [31].

Theoretical Frameworks

Existing Behavior Models

Unfortunately, even though there is a growing body of information on diarrheal care seeking, there has been a persistent lack of effort to organize the information in a grounded and productive manner. While general care seeking behaviors have been characterized in the literature on a wide variety of health

topics, behavioral theory is rarely employed. However, recent studies are beginning to turn to several established behavior theories to organize their findings on general healthcare utilization. One study utilized the Theory of Planned Behavior (TPB) to inform their exploration of care-seeking behaviors in older USA-residing Mexicans and Mexican American communities [32]. Through their research, the authors found that normative beliefs centered on the benefits and perceived family and community support of traditional methods of treatment, with control beliefs revealing that the study participants saw traditional methods as more easily accessible and affordable. The authors concluded that utilizing TPB provided an empirical model that could better predict healthcare utilization within the Mexican and Mexican-American populations.

In care seeking research for diarrheal disease, many researchers use words and descriptors that directly call upon theoretical constructs (such as perceived severity, social norms). While the overall body of research continues to focus on a-theoretical observation, the Health Belief Model has occasionally been applied to relate variables of interest to care seeking behavior [4, 5]. Farag (2013) and Nasrin (2013) more explicitly utilize behavior theory in construction of predictor variables that measure care seeker perceptions, particularly of perceived severity and susceptibility. Nasrin's study spanning seven different countries uses a multivariate Health Belief Model to show that believing in effective diarrheal treatment measures resulted in higher rates of seeking care from a licensed provider. Similarly, Farag employs the Health Belief Model to contextualize the relationship between increased perceptions of severity (through both

symptomology and the caretakers association of symptoms with dehydration) and increased rates of care seeking from traditional healers in Mali [5].

Care Seeking Behavior Models

Unsatisfied with more general behavior theories, some researchers have developed theoretical frameworks specific to accessing healthcare. Lauver [33], developed a theory specific to care-seeking behaviors through her research on breast cancer screening. Through her research, she developed the Theory of Care-seeking Behavior based on three categories of psychosocial variables: affect, utility (expectations and values about outcomes), norms, and habits. Clinical and socio-demographic variables, the characteristics the majority of diarrheal care-seeking research have reported, are viewed as indirect influences under this theory. Instead, Lauver argues, they influence the theoretical variables (i.e. the psychosocial), which, in turn, influence care-seeking behavior.

While Lauver's theory shows promise, it has remained largely ignored since its formation over 20 years ago and places heavy emphasis on psychosocial variables that require a significant amount of additional time and resources to capture. Another theory used in exploring care seeking behavior has been Andersen's Health Behavior Theory (Figure 1). Developed in the 1960's, this theory was the first to specifically explore why people use health services [34].

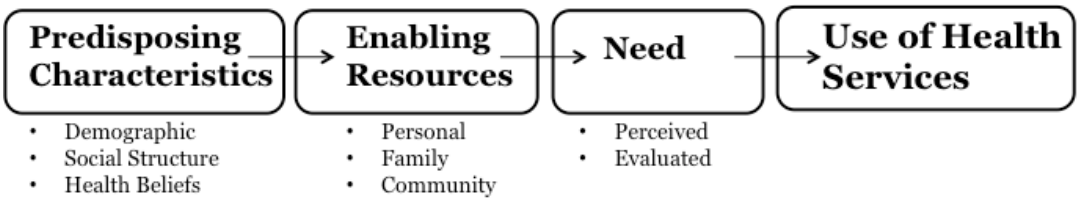

Figure 1. The basic model of Andersen's Health Behavior Theory.

At its core, Andersen's Health Behavior Model highlights three main domains that influence healthcare utilization: (1) predisposing characteristics, including demographics (such as age, sex, and ethnicity), social structural characteristics (education, occupation, and family size), and health beliefs and attitudes; (2) enabling resources which include measures of household income and socioeconomic status as well as distance from health care facilities, having health insurance, and the presence of available community resources like hospitals or clinics; and (3) need which can include perceptions of severity as well as clinical assessments. This theory has occasionally been used and adapted in health care utilization discussions in the previous decades, though it has yet to develop a significant presence in a global care-seeking environment [35]. In the 1990s, the model was adapted by Janardan Subedi (1989) through his work on hospital utilization in Nepal to include dimensions that reflect the impact of medical pluralism. This adapted model included an additional domain focusing on interpersonal factors that may influence care seeking behavior (such as identifying which household member makes decisions about healthcare, from whom individuals seek advice, etc.) as well as a pluralistic therapy domain that highlights the use of non-biomedical treatments and traditional healers as well as beliefs and perceptions surrounding their use.

Study Justification and Research Questions:

Differences in cultural beliefs contribute to the community-specific relationships many of the previously discussed variables can have on care seeking behavior. These culture-specific influences merit continued research, but such

extensive ethnographies require a considerable amount of time and are unable to help address the need for a more representative global burden estimate today. Pathogens and global health policies happen much faster than ethnographic, qualitative research, and important country and international actors are relying on current estimates to support and direct research and policy initiatives [7, 9, 13]. A standardized method of revealing key characteristics that impact diarrheal care seeking across a large breadth of low- and middle-income countries in an efficient manner can help improve understanding of healthcare seeking estimates used in international efforts to estimate disease burden as well as inform current policies, treatments, and interventions by providing a solid foundation from which to support the continued development of in-depth, country-specific research. Therefore, this project proposes the following questions: (1) what are the care seeking rates for children with diarrhea among low- and middle-income countries (2) what are the relationships between predisposing characteristics, enabling resources, and measures of need with care seeking outside the home for children with diarrhea, and (3) what are the relationships between these domains and care seeking specifically at a medical facility for children with diarrhea? These questions, explored through the guiding framework of Andersen's Health Behavior Model, will provide a standardized foundation to the discussion of care-seeking behaviors among children with diarrhea with positive implications for current policies and interventions as well as future research in care seeking behaviors for childhood illnesses in lower income countries.

III. METHODS

DHS Instrument

In order to explore globally relevant care seeking behaviors, this study used data provided in the standard Demographic Health Surveys (DHS)*. Funded by the U.S. Agency for International Development (USAID), the DHS are nationally representative household surveys distributed globally and provide a wide range of data on health behaviors and health status. Each standard DHS begins with a household-based questionnaire capturing household-level characteristics. Through this survey, fieldworkers identify eligible men and women of each household to complete the respective men's and women's specific questionnaires. The women's questionnaire includes items regarding the health status, health behaviors, and demographic characteristics of the woman and her husband or partner as well as all of her children under five years of age. Since this study focuses on child illness and maternal behavior, all predictors were taken from the household and women's questionnaires.

Data Collection Procedures

The DHS are always conducted in-country by a sole implementing organization that can be governmental, non-governmental, or private. All DHS surveys and procedures are submitted to in-country institutional review boards prior to data collection. Organization staff and fieldworkers are then trained to conduct the surveys in person at the participants' households. DHS-based staff

* All DHS-specific methods mentioned in this work come from the detail provided in the literature found through the DHS website. For more information on DHS background, survey content, protocol, data cleaning and dissemination, visit www.measuredhs.com.

provide technical and logistical support throughout the process, helping to ensure data is translatable across countries and survey years. Household and individual survey weights are calculated for each woman who participated in the women's questionnaire to help guarantee an accurate representation of their country. After data is collected, DHS and in-country staff clean, standardize, and organize the data into specific datasets designed for different units of analysis (i.e. household, household member, men, women, children, etc.). As this project's unit of analysis is children with recent diarrhea, the children's recode dataset was the most relevant. This dataset provides one record for every child under the age of five of an interviewed woman. The dataset includes data on prenatal and postnatal care, immunizations, and childhood health as well as data for the mother, her partners, and the household.

Accessing DHS Data for Independent Analysis

From survey preparation to data processing and dissemination, the data collection process ranges an average of 18-20 months for the DHS and in-country staff. Once data has been organized into its datasets, it is available for any third party researcher to access through the DHS. In order to access DHS data, third-party researchers must submit a brief proposal outlining their research objectives and requesting datasets by country. Data requests are usually approved and released to the third party researchers within 24 hours.

Compiling DHS Datasets for Analysis

This study requested all available children's recode datasets from all DHS participating countries. In total, there were 206 children's recode datasets across

73 countries. Each dataset was first checked to see if responses were recorded for the question: "Has [child's name] had diarrhea in the last 2 weeks?" While most datasets provided "yes" and "no" responses to this question, some older datasets (those from years before 1997) contained a more detailed response, with response options including "yes, in the last 24 hours" as well as "yes, in the last 2 weeks," and "no." These datasets were recoded to combine the 24-hour and 2-week responses to match the dichotomous yes/no responses of the later datasets.

All children in each dataset were identified by their mother's case identification number and a birth history number. The mother's case identification number was generated by DHS staff and is a combination of three individual identification numbers: a geographic cluster number, a household number, and a household member number. When necessary, these identification variables were used to combine the standard children's recode dataset with two other datasets: one containing wealth index measures and another containing HIV biomarker data.

The wealth index measure was kept in a separate dataset until around 1997-2003. Whenever a wealth index dataset was provided separately from the children's dataset, the two were matched and combined using the household's identification number. Similarly, all data on the mother's HIV status was reported in a separate dataset. All HIV datasets were combined with their corresponding children's dataset using the mother's case identification number.

Once all children's recode datasets had been combined with their corresponding wealth index or HIV status datasets, all the predictor variables used in this model were checked to make sure the response options were the

same across each dataset. All datasets for a given country were then combined and an additional variable was created to identify dataset country. Finally, compiled datasets from all countries were compiled into the final, completed dataset.

Study Population and Sample Size

The standard DHS surveys provide large sample sizes, typically between 5,000 and 30,000 households per country, and all eligible women in every participating household were surveyed. In general, women were eligible if they were between the ages of 15 and 49, however some countries used slightly different eligibility requirements, such as marital status or an expanded age range. Each eligible woman provided information on every child they had within the last five years. Women who had multiple children with diarrhea were included twice so as to capture the different behaviors for each child's particular demographic and illness characteristics. The country-specific sample size of all children under five years from these surveys ranged from 1,041 in Comoros to 128,995 in India with a median sample size of 12,043 in Cote d'Ivoire. Across all 73 countries, the total number of children captured was 1,391,481 (Figure 3). For this study, our unit of analysis was children who had experienced an episode of diarrhea in the preceding two weeks, reducing the overall sample size to 227,746. Here, country-specific sample sizes ranged from 83 in Albania to 15130 from India, with a median sample size of 2457 from Burundi.

Measures

Outcome Measures

The two outcome measures of interest are seeking care from any source and seeking medically based care. The former was assessed through the question "Did you seek advice or treatment for the diarrhea from any source?" Responses of "yes" and "no" were recorded into a treatment variable in the DHS dataset marking whether or not care was sought in any form. Additionally, those who responded "yes" were then asked, "Where did you seek advice or treatment?" There were several response categories standard across countries such as "government hospital," "private hospital or clinic," "pharmacy," "private doctor," and "other," as well as many country-specific public and private sector categories. The DHS standardized and recoded these responses and created useful care-seeking variables in the final datasets. To assess medical care seeking, we used a DHS-generated variable that marked if a child was taken to a medical facility. This variable includes children taken to all public sector and private medical facilities except for Pharmacy.

Predictor Variables

The predictor variables selected for these analyses were chosen based on literature support, researcher interest, and theoretical inquiry. Community-specific ethnographic research has explored the relationship between care seeking and the child's sex, age, birth order, and presence of additional symptoms such as fever and bloody stool. In relation to the proposed theoretical model, Andersen's Health Behavior Model, the variables can be classified under one of

the three main constructs: *predisposing characteristics*, *enabling resources*, and *need*.

Measures of Predisposing Characteristics

Among the *predisposing characteristics*, child's sex [2, 3, 5, 24], child's age [2, 15, 21, 22], birth order [7], and mother's education level [1, 2, 7, 26, 27] have been explored in previous research. The DHS dataset includes a birth order measure where one indicates the first-born child, as well as a birth index measure that is the reverse of birth order (a one indicates the most recent birth). Cross-referencing both these measures, two new variables were created. The first variable measured birth order in three distinct categories: firstborn, middle, and lastborn, with those revealed to be an only child classified as firstborn. The second variable created was a dichotomous measure indicating whether the child was an only child or had siblings. Maternal education was assessed through two consecutive questions. First, the women were asked, "Have you ever attended school?" Those who responded affirmatively were then asked, "What is the highest level of school you attended: primary, secondary, or higher?" Similarly, Paternal education was assessed through the questions "Did your (last) (husband/partner) ever attend school?" and "What was the highest level of school he attended: primary, secondary, or higher?" Responses to both questions for the woman and her partner were then coded into one variable for each person, indicating highest level of education attended: none, primary, secondary, and higher. Finally, the use of prenatal care for each child was assessed using a yes/no dichotomous response to the question "Did you see anyone for antenatal care for this pregnancy?" A follow up question did assess the type of prenatal

care used, but this study focused only on whether the mother sought any care, regardless of source.

Measures of Enabling Resources

In this model, *enabling resources* include variables related to wealth and distance to a healthcare facility. A wealth index measure was added to the DHS after 1988 and is measured as a composite of a household's cumulative living standard: ownership of assets such as televisions and bicycles, water access, sanitation facilities, and household building materials. Wealth index is recorded as a numeric value on a continuous scale and recoded as a categorical variable as quintiles: "Poorest," "Poorer," "Middle," "Richer," and "Richest." While distance to a medical facility was never discussed in relation to the child's health, the DHS does include a question assessing the mother's perceived barrier of distance in seeking medical care for herself. The woman is asked "When you are sick and want to get medical advice or treatment, is each of the following a big problem or not?" With "distance to the health facility" being one of the factors proposed, women responded with either "a big problem," "not a big problem," or "no problem." The answer choices were combined to form a dichotomous variable with distance either being "a big problem" or "not a big problem," with "not a big problem" being a combination of the original answer and "no problem."

Measures of Need

Finally, perceptions of *need* in this model include the presence of two additional symptoms recorded by the DHS: bloody stool and fever. After the women responded to the question "Has [child's name] had diarrhea in the last 2 weeks?" a follow up question was posed: "Was there any blood in the stool?"

Fever was also asked as an additional symptom occurring within the same time period: “Has [child’s name] been ill with a fever at any time in the last 2 weeks?”

HIV Status and Care Seeking

While HIV status of the caregiver or mother has not been explicitly looked at in relation to care seeking for children with diarrheal illnesses, research has showed how fear of stigma and experienced discrimination by medical providers has had a negative impact on HIV positive mother’s accessing healthcare for themselves and their potentially HIV-positive children [36-38]. Because the DHS has begun to provide HIV biomarker data on mothers as well as their care seeking behavior for their children, it offers a first glimpse into the impact HIV status can have on care seeking for children’s diarrhea and particularly HIV status’s influence in relation to other care seeking influences

Starting in 2001, several countries began collecting HIV blood tests as part of the implementation of the standard DHS. A subset of women interviewed through the standard DHS were invited to participate in a voluntary HIV testing procedure. The protocol was approved by the ethical review board of each country. Blood samples were collected from each participating woman through a finger prick and analyzed using an ELISA laboratory test.

Stages of Analyses

The analyses for this study were performed in SPSS in three steps. First, global and country-specific rates of care seeking were captured. Both rates for any care seeking outside the home as well as care seeking at a medical facility

were calculated as proportions of all children with a reported diarrheal illness in the preceding two weeks.

Next, we explored whether there is a relationship between the predictor variables and any source of care seeking outside the home. Bivariate analysis were performed to assess the individual relationships between the predictor variables and general care seeking with the outcome measure being a yes/no response to the question "Did you seek advice or treatment for the diarrhea from any source?" All variables that were found to be significant through bivariate analysis were included in the final multivariate model. All variables were entered hierarchically into the final multivariate model in groups based on their theoretical domain. The country identification variable was entered first to hold as a constant, and subsequently the predisposing characteristics, enabling resources, and measures of need were entered into the model according to the diagram laid out in Figure 2.

The final analysis operated under a similar structure, using the outcome variable that captures care seeking specifically at a medical facility. Here as well, bivariate analyses were performed first and all variables were theoretically grouped and included in the final model along with the country-specific measure as a constant.

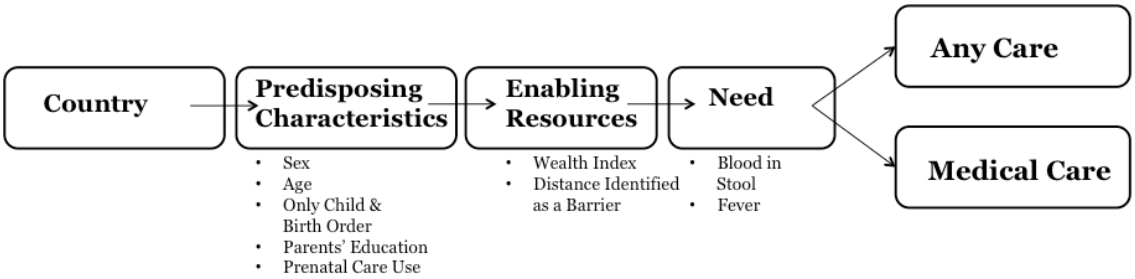

Figure 2. DHS Predictor variables by each domain of Andersen's Health Behavior Theory.

IV. RESULTS

For this project, we queried the DHS for all available datasets from all DHS participating countries on October 21st, 2013. In total, 206 datasets from 73 countries provided data on recent diarrheal episodes in children. Datasets were collected from sites as early as 1984 and as recent as 2013. The earliest phase of the DHS, surveys administered between 1984-1989 did not contain appropriate data on medical healthcare seeking and were thus not included in the calculations for care seeking rates and the medical and general care seeking models. This reduced the number of datasets used in care-seeking analyses to 185 and the number of countries to sixty-seven.

Diarrheal Prevalence and Care Seeking Rates by Country

Of the nearly 1.4 million children captured across all datasets, 16.5% had a diarrheal episode in the preceding two weeks (Figure 3). Country-specific prevalence of diarrhea can be found in Table 2, and ranged from 4.43% in Maldives to 34.77% in Yemen. Of those that had a diarrheal episode in the previous two weeks, 53.0% report seeking care of any kind, ranging from 26.99% in Ethiopia to 84.57% in Maldives. Proportion of care seeking

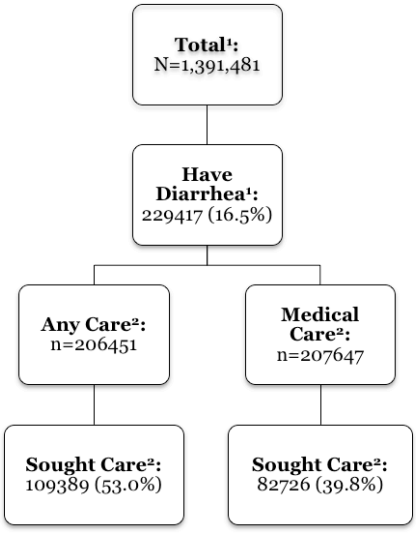

Figure 3. Diarrheal prevalence and care seeking rates across all datasets. ¹Datasets included: 206, countries represented: 73. ²Datasets included: 185, countries represented: 67.

outside the home was not found to be significantly related to diarrheal prevalence (R^2=0.08) (Figure 4a). Additionally, 39.8% of children with a recent diarrheal episode were taken to care at a medical facility, ranging from 15.82% in Mali to 84.57% in Maldives. Likewise, diarrheal prevalence accounted for only 15% of the difference in a country's proportion of care seeking at a medical facility (R^2=0.15) (Figure 4b). Again, a breakdown of care seeking rates for each country can be found in Table 2.

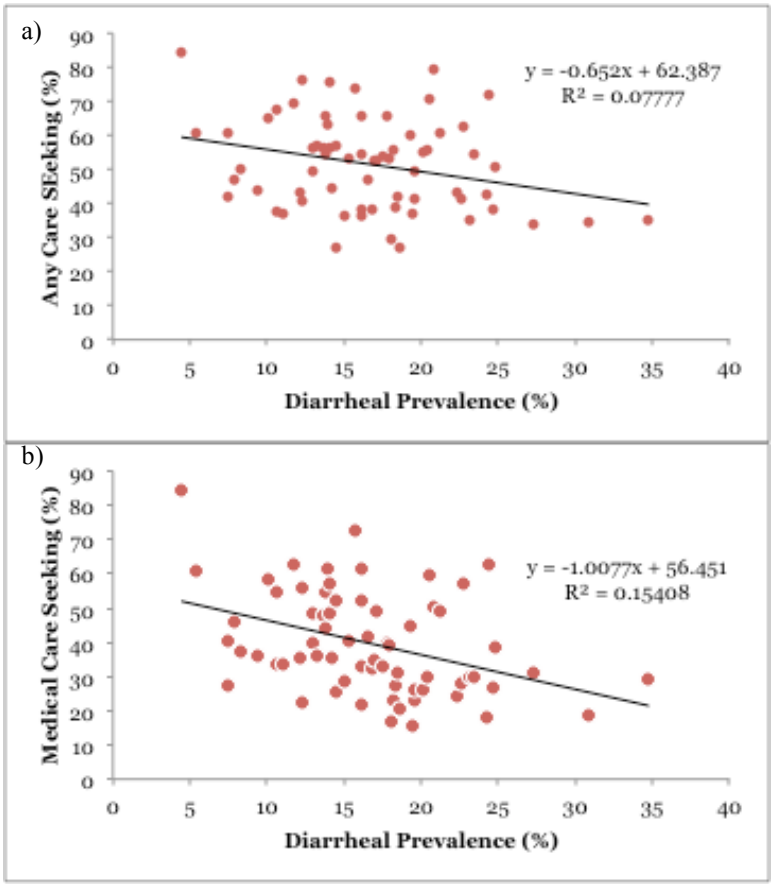

Figure 4. a) Relationship between country-specific diarrheal prevalence and care seeking from any source. b) Relationship between country-specific diarrheal prevalence and medical care seeking.

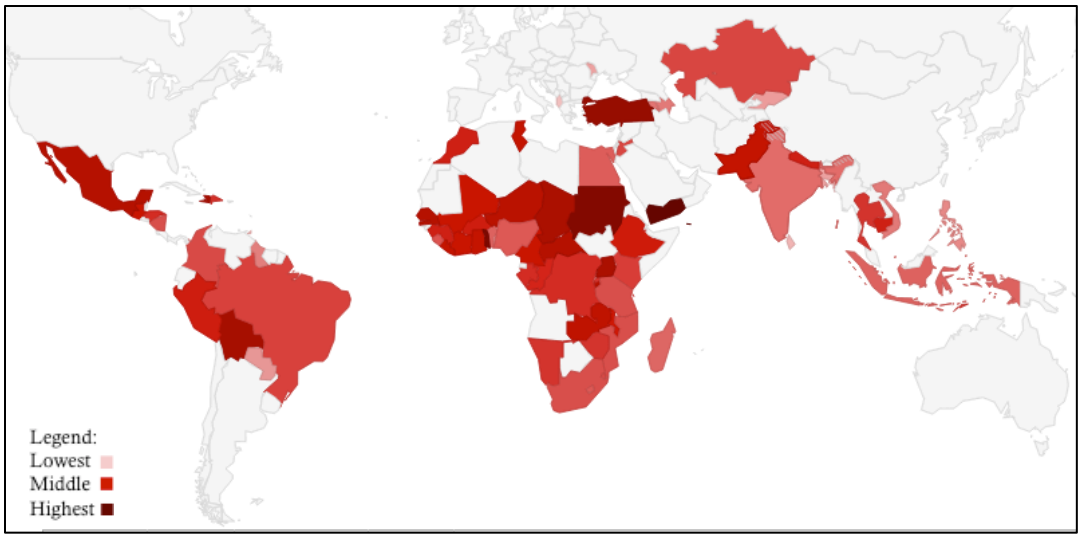

Figure 5. Global map representing diarrheal prevalence across all countries included in the study. Shading indicates degree of relative prevalence, with darker color representing higher prevalence rates. For country specific numbers see Table 2. Image created in Google Drive®

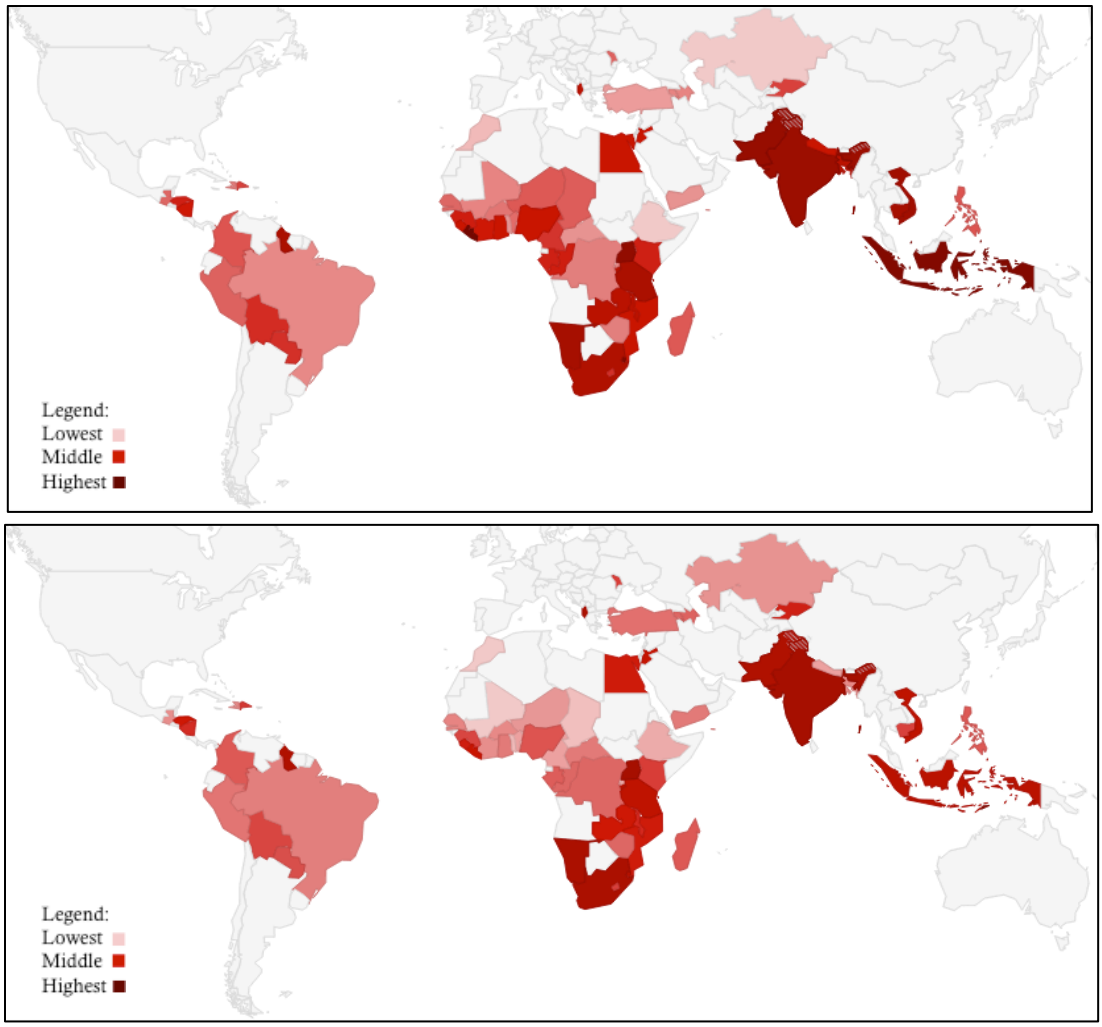

Figure 6. Global maps representing general (top) and medical (bottom) care seeking rates across all countries. Darker colors represent higher care seeking rates. For country specific numbers see Table 2. Images created in Google Drive®

Table 2. Diarrheal prevalence and care seeking rates by country.

Country	Total Children Surveyed (% with diarrhea)	Any Care (%)	Medical Care(%)
Albania	1541 (5.39)	50 (60.98)	50 (60.98)
Armenia	4492 (11.02)	183 (37.12)	164 (33.27)
Azerbaijan	2170 (10.65)	86 (37.39)	78 (33.77)
Bangladesh	36129 (7.48)	1628 (60.50)	730 (27.13)
Benin	21606 (12.25)	1070 (40.73)	595 (22.57)
Bolivia	32299 (24.75)	3295 (50.53)	2534 (38.79)
Brazil	10779 (15.03)	390 (36.18)	311 (28.85)
Burkina Faso	33802 (18.32)	2411 (39.04)	1674 (27.11)
Burundi	10830 (22.69)	1156 (62.32)	1065 (57.41)
Cambodia	22264 (17.81)	2589 (65.53)	1567 (39.63)
Cameroon	22547 (19.52)	2160 (49.33)	1004 (22.92)
Central African Republic	2515 (23.14)	203 (34.94)	174 (30.00)
Chad	11383 (24.19)	1170 (42.90)	494 (18.12)
Colombia	44096 (14.19)	2551 (44.31)	2039 (35.39)
Comoros	1041 (23.44)	130 (54.39)	71 (29.71)
Republic of the Congo	11969 (17.49)	1119 (53.54)	693 (33.13)
Dem. Republic of the Congo	7841 (16.75)	497 (38.14)	428 (32.60)
Cote d'Ivoire	12043 (20.13)	1327 (54.81)	639 (26.39)
Dominican Republic	32370 (16.50)	1808 (47.08)	1608 (41.74)
Egypt	52942 (12.91)	3868 (56.62)	3296 (48.24)
Ethipia	31508 (18.54)	1572 (26.99)	1213 (20.82)
Gabon	8005 (16.96)	702 (52.39)	467 (34.85)
Ghana	14463 (20.42)	1099 (55.51)	591 (29.83)
Guatemala	12785 (19.58)	740 (41.46)	465 (26.05)
Guinea	16832 (17.97)	1594 (53.20)	1171 (39.09)
Guyana	1786 (10.02)	117 (65.36)	105 (58.66)
Haiti	20280 (24.68)	1899 (38.06)	1347 (26.98)
Honduras	19637 (17.02)	1751 (52.39)	1649 (49.34)
India	128995 (11.73)	10440 (69.18)	9448 (62.61)
Indonesia	90763 (12.25)	8424 (76.08)	6168 (55.69)
Jordan	39007 (14.53)	3226 (56.97)	2959 (52.24)
Kazakstan	2104 (14.45)	82 (27.06)	78 (25.74)
Kenya	25956 (15.27)	1651 (52.98)	1267 (40.64)
Kyrgyzstan	5047 (7.91)	187 (46.98)	184 (46.23)
Lesotho	6324 (13.00)	405 (49.63)	327 (40.02)
Liberia	4880 (20.78)	794 (79.64)	499 (50.10)
Madagascar	25807 (12.15)	1357 (43.55)	1109 (35.59)
Malawi	41624 (19.26)	4801 (60.20)	3577 (44.85)
Maldives	3677 (4.43)	137 (84.57)	137 (84.57)

Country	Total Children Surveyed (% with diarrhea)	Any Care (%)	Medical Care(%)
Mali	31080 (19.45)	1858 (36.95)	797 (15.82)
Mexico	5293 (22.82)	n/a	n/a
Moldova	1560 (7.50)	49 (41.88)	47 (40.17)
Morocco	16128 (18.07)	383 (29.44)	215 (16.54)
Mozambique	23655 (14.04)	1859 (56.28)	1596 (48.31)
Namibia	10945 (16.16)	1159 (65.89)	1080 (61.26)
Nepal	20791 (18.15)	1722 (55.64)	873 (23.16)
Nicaragua	13667 (13.84)	1025 (54.55)	832 (44.28)
Niger	30447 (22.33)	2901 (43.23)	1640 (24.17)
Nigeria	39860 (13.26)	2964 (56.72)	1890 (36.17)
Pakistan	25138 (20.49)	3633 (70.75)	3051 (59.37)
Paraguay	3772 (8.24)	152 (49.84)	114 (37.25)
Peru	37132 (18.45)	2480 (41.95)	1822 (30.81)
The Philippines	28438 (9.39)	1165 (43.93)	949 (35.78)
Rwanda	28063 (16.08)	1639 (36.58)	990 (22.05)
Sao Tome and Principe	1716 (16.08)	148 (54.41)	142 (52.21)
Senegal	34562 (22.62)	2627 (41.14)	1774 (27.78)
Sierra Leone	4976 (13.59)	374 (56.24)	318 (47.75)
South Africa	4504 (13.92)	381 (62.98)	371 (61.42)
Sri Lanka	3837 (6.07)	n/a)	n/a
Sudan	5989 (30.19)	n/a	n/a
Swaziland	2432 (14.10)	259 (75.51)	195 (56.85)
Tanzania	30759 (13.84)	2532 (65.49)	2316 (54.92)
Thailand	3436 (15.98)	n/a	n/a
Timor-Leste	9292 (15.65)	1069 (73.72)	1051 (72.43)
Togo	6388 (30.79)	395 (34.47)	212 (18.52)
Trinidad and Tobago	1836 (6.15)	n/a	n/a
Tunisia	4246 (20.63)	n/a	n/a
Turkey	6775 (27.32)	621 (33.60)	573 (31.02)
Uganda	30461 (24.32)	4550 (71.78)	3966 (62.51)
Viet nam	3067 (10.63)	219 (67.38)	178 (54.77)
Yemen	6600 (34.77)	795 (35.11)	666 (29.42)
Zambia	22551 (21.23)	2905 (60.93)	2355 (49.38)
Zimbabwe	17946 (16.11)	857 (37.99)	741 (32.82)

Any Care Seeking

All measures of predisposing characteristics, enabling resources, and need were found to be significantly associated with care seeking at a conservative p<.05 (Table 3) and were therefore included in an overall multivariate logistic regression model. A country variable was also included to be held as a constant and to ensure relationships accurately reflect the overall population.

Results of the regression model reveal that many of the variables remained significantly associated with care seeking behavior. Among the *predisposing characteristics*, 53.6% of male children were taken to care, while 52.3% of female children were taken to care (aOR=1.088; p<.001). Compared to infants under the age of one, of which 52.2% were taken to care, 56.2% (aOR=1.282; p<.001) and 52.6% (aOR=1.089; p=.004) of one and two year olds respectively were taken to care. There was no significant difference between care seeking rates for infants under one year and 3-5 year olds (p=.147).

Within the multivariate model, birth order (whether the child was a firstborn, middle child, or lastborn) was no longer significantly related to care seeking (p=.110), though 57.1% of only child were taken to care, compared to only 52.7% of those with siblings (aOR=1.832; p=.043).

Among predisposing characteristics of the parents, both maternal and paternal education were related to care seeking behavior. Higher rates of care seeking corresponded with each increase in education level. Compared to children of mothers with no formal education, of which 46.9% were taken to care, 55.0% of children from mother's with a primary school education were taken to care (aOR=1.089; p=.005), while 59.5% of children from mothers who attended

secondary school (aOR=1.182; p<.001) and 62.2% of children from mothers with higher education (aOR=1.160; p<.001) were taken to care. Paternal education showed a similar relationship to care seeking. Compared to 44.7% of children from fathers without any formal education being taken to care, 54.1% of children from fathers with a primary school education (aOR=1.139; p<.001), 58.9% of children from fathers with a secondary education (aOR=1.169; p<.001), and 62.2% of children from fathers with higher education taken to care (aOR=1.232; p<.001).

Additionally, the use of prenatal care was found to have a significant relationship with care seeking for a diarrheal episode. Mothers who report using prenatal care of any kind (doctor, nurse, traditional birth attendant, etc.) were more likely to seek care, with 56.5% of those children taken to care compared to only 39.4% of mothers without prenatal care (aOR=1.586; p<.001).

Both measures of *enabling resources* also maintained strong relationships with care seeking behavior. Overall, there appears to be a significant positive association between wealth index and care seeking behavior, with a higher percentage of children being taken to care with each increase in wealth index quintile. Compared to those in the lowest quintile of wealth, of which 48.7% of children were taken to care, 51.2% of children from the second-lowest quintile were taken to care (aOR=1.085; p=.006), 53.5% of children in the middle quintile (aOR=1.136; p<.001) and 56.0% of children in the second-highest (1.122; p=.001) quintiles were taken to care. Finally, 60.5% of children from the wealthiest quintile were taken to care (aOR=1.586; p<.001). With respect to distance to a healthcare facility, women who reported distance as a big problem were less

likely to seek care, taking only 51.2% of their children to care outside the home (aOR=0.858; p<.001).

Both measures of *need* were found to have a strong relationship with care seeking behavior. Sixty three percent of children with bloody stool in their diarrhea were taken to care compared to 55.5% of children without bloody stool (aOR=1.629; p<.001) and 57.0% of children with a fever during the same period were taken to care while only 48.7% of children without fever were taken to care (aOR=1.621; p<.001).

Table 3. Results of the predictor variables and general care seeking. All results are weighted and survey country was held as a constant in the full model.

Any Care Seeking (n)	Bivariate Models				Full Model		
	Sought Care (%)	**Odds Ratio**	**C.I. 95%**	**p-value**	**aOR**	**C.I. 95%**	**p-value**
Predisposing Characteristics							
Sex (206451)							
Male	58243 (53.6)	1.055	1.037-1.073	<.001	1.088	1.045-1.132	<.001
Female	51146 (52.3)	*Ref*			*Ref*		
Age (206450)							<.001
<1 year	29352 (52.2)	*Ref*					
1 year	37985 (56.2)	1.173	1.147-1.199	<.001	1.282	1.221-1.346	<.001
2 years	22338 (52.6)	1.014	0.989-1.040	.268	1.089	1.027-1.155	.004
3-5 years	19713 (49.1)	0.883	0.861-0.906	<.001	0.952	0.892-1.017	.147
Birth Order (206451)							.110
Firstborn	28148 (56.3)	*Ref*					
Middle	11609 (47.8)	0.713	0.692-0.735	<.001	1.832	1.021-3.287	.043
Lastborn	69632 (52.7)	0.865	0.847-0.883	<.001	1.489	0.671-3.307	.328
Siblings (206451)							
Only Child	23526 (57.1)	1.231	1.204-1.258	<.001	1.830	1.019-3.287	.043
Has Siblings	85863 (52.0)	*Ref*					

Any Care Seeking (n)		**Bivariate Models**			**Full Model**		
Maternal Education (205581)							<.001
None	38079 (46.9)	*Ref*					
Primary	40997 (55.0)	1.382	1.355-1.410	<.001	1.089	1.026-1.155	.005
Secondary	25577 (59.5)	1.664	1.626-1.704	<.001	1.182	1.097-1.274	<.001
Higher	4274 (62.2)	1.866	1.774-1.963	<.001	1.160	1.016-1.323	.028
Paternal Education (194850)							<.001
None	26981 (44.7)	*Ref*					
Primary	37286 (54.1)	1.458	1.427-1.491	<.001	1.139	1.071-1.211	<.001
Secondary	32066 (58.9)	1.774	1.733-1.816	<.001	1.169	1.090-1.254	<.001
Higher	7044 (62.5)	2.059	1.976-2.146	<.001	1.232	1.103-1.376	<.001
Prenatal Care (178877**)**							
Some Care	79277 (56.5)	2.002	1.956-1.048	<.001	1.586	1.480-1.700	<.001
No Care	15210 (39.4)	*Ref*					
Enabling Resources							
Wealth Index (192782)							<.001
Poorest	24110 (48.7)	*Ref*					
Poorer	22242 (51.2)	1.102	1.074-1.131	<.001	1.085	1.024-1.151	.006
Middle	21319 (53.5)	1.208	1.177-1.241	<.001	1.136	1.068-1.207	<.001
Richer	19698 (56.0)	1.339	1.303-1.377	<.001	1.122	1.051-1.198	.001
Richest	14994 (60.5)	1.609	1.560-1.660	<.001	1.586	1.480-1.700	<.001
Distance (111233)							
Big Problem	25109 (51.2)	0.772	0.754-0.790	<.001	0.868	0.831-0.905	<.001
Not a Big Problem	35784 (57.6)	*Ref*					
Need							
Blood in Stool (140499)							
Yes	13280 (63.0)	1.367	1.326-1.409	<.001	1.629	1.527-1.738	<.001
No	66266 (55.5)	*Ref*					
Fever (199536)							
Yes	60176 (57.0)	1.400	1.375-1.425	<.001	1.621	1.556-1.689	<.001
No	45768 (48.7)	*Ref*					

Medical Care Seeking

Similar patterns were observed when the predictor variables were used to predict medical care seeking. Likewise, all measures of each theoretical construct were found to be significantly associated with care seeking a $p<.05$ (Table 4) and were included in an overall multivariate logistic regression model. Again, the country variable was included to ensure relationships accurately reflect medical care seeking across the population.

In the final model, many of the variables remained significantly associated with medical care seeking. Among the *predisposing characteristics*, 40.5% of male children were taken to care, while 39.2% of female children were taken to care (aOR=1.077; $p<.001$).

Compared to infants under the age of one, of which 40.6% were taken to a medical facility, 43.0% (aOR=1.184; $p<.001$) of one year olds were taken to a medical facility. Children 3-5 years of age were least likely to be taken to a medical facility, with only 35.0% (aOR=0.862; $p=<.001$). Here, there was no significant difference between care seeking rates for infants under one year and two year olds ($p=.673$).

Within the multivariate model, 44.3% of only children were taken to a medical facility compared to only 38.7% of children with siblings (aOR=2.384; $p=.005$). Compared to 43.5% of firstborn children, 34.0% of middle children (aOR=2.523; $p=.003$) and 39.5% of lastborn children (aOR=2.532; $p=.026$) were taken to a medical facility.

Again, higher rates of medical care seeking corresponded with each increase in education level. Compared to children of mothers with no formal

education, of which only 32.1% were taken to medically based care, 41.7% of children from mother's with a primary school education were taken to a medical facility (aOR=1.116; p<.001), while 49.0% of children from mothers who attended secondary school (aOR=1.258; p<.001) and 53.9% of children from mothers with higher education (aOR=1.164; p=.021) were taken to a medical facility. Similarly, compared to only 29.4% of children from fathers without any formal education, 41.0% of children from fathers with a primary school education (aOR=1.152; p<.001), 47.2% of children from fathers with a secondary school education (aOR=1.197; p<.001), and 52.8% of children from fathers with higher education (aOR=1.277; p<.001) were taken to care at a medical facility.

As with overall care seeking, the use of prenatal care was again found to have a strong relationship with medical care seeking. Mothers who report using prenatal care of any kind were nearly twice as likely to seek care at a medical facility, with 44.3% of their children taken to medical care compared to 23.0% of children from mothers without prenatal care (aOR=1.930; p<.001).

Among the *enabling resources*, relative wealth also maintained a significant relationship with medical care seeking behavior, again with a higher percentage of children being taken to medical facilities with each successive wealth index quintile. While 35.0% of children from the lowest quintile of wealth were taken to a medical facility, 37.6% of children from the second-lowest quintile (aOR=1.069; p=.025), 40.2% of children from the middle (aOR=1.109; p=.001), 42.8% of children from the second-highest quintile (aOR=1.062; p=.067), and 49.2% of children from the wealthiest quintile (aOR= 1.246 p<.001) were taken to care at a medical facility. Additionally, only 38.4% of children from

mothers who reported distance as a big problem were taken to medical care compared to 54.9% of children from mothers who did not see distance as a significant problem to accessing healthcare (aOR=0.856; p<.001).

Again, both measures of *need* had strong relationships with care seeking at a medical facility. Of children with bloody stool in their diarrhea 47.7% were taken to a medical facility compared to 43.1% of children without bloody stool (aOR=1.539; p<.001) and 43.3% of children with a fever were taken to a medical facility compared to only 36.1% of children without a fever (aOR=1.622; p<.001).

Table 4. Results of the predictor variables and care seeking at a medical facility. All results are weighted and survey country was held as a constant in the full model.

	Bivariate Models				Full Model		
Medical Care Seeking (n)	**Sought Care (%)**	**Odds Ratio**	**C.I. 95%**	**p-value**	**aOR**	**C.I. 95%**	**p-value**
Predisposing Characteristics							
Sex (207647)							
Male	44208 (40.5)	1.056	1.037-1.075	<.001	1.077	1.036-1.120	<.001
Female	38517 (39.2)	*Ref*					
Age (207648)							<.001
<1 year	22997 (40.6)	*Ref*					
1 year	29244 (43.0)	1.102	1.077-1.127	<.001	1.184	1.129-1.242	<.001
2 years	16393 (38.3)	0.909	0.886-0.933	<.001	0.988	0.932-1.046	.673
3-5 years	14092 (35.0)	0.788	0.768-0.809	<.001	0.862	0.808-0.921	<.001
Birth Order (207648)							.011
Firstborn	21879 (43.5)	*Ref*					
Middle	8291 (34.0)	0.670	0.649-0.691	<.001	2.523	1.374-4.635	.003
Lastborn	52556 (39.5)	0.848	0.830-0.866	<.001	2.532	1.120-5.727	.026
Siblings (207648)							
Only Child	18370 (44.3)	1.261	1.234-1.289	<.001	2.384	1.297-4.383	.005
Has Siblings	64356 (38.7)	*Ref*					

Medical Care Seeking (n)		**Bivariate Models**			**Full Model**		
Maternal Education (206778)							<.001
None	26253 (32.1)	*Ref*					
Primary	31299 (41.7)	1.519	1.488-1.551	<.001	1.116	1.054-1.183	<.001
Secondary	21080 (49.0)	2.035	1.987-2.085	<.001	1.258	1.170-1.354	<.001
Higher	3701 (53.9)	2.475	2.355-2.601	<.001	1.164	1.023-1.324	.021
Paternal Education (195687)							<.001
None	17862 (29.4)	*Ref*					
Primary	28358 (41.0)	1.669	1.631-1.708	<.001	1.152	1.084-1.224	<.001
Secondary	25773 (47.2)	2.146	2.095-2.199	<.001	1.197	1.118-1.282	<.001
Higher	5975 (52.8)	2.686	2.579-2.798	<.001	1.277	1.147-1.422	<.001
Prenatal Care (179955)							
Some Care	62416 (44.3)	2.670	2.602-2.740	<.001	1.930	1.798-2.070	<.001
No Care	8273 (23.0)	*Ref*					
Enabling Resources							
Wealth Index (193979)							<.001
Poorest	17499 (35.0)	*Ref*					
Poorer	16460 (37.6)	1.119	1.090-1.150	<.001	1.069	1.008-1.133	.025
Middle	16131(40.2)	1.247	1.214-1.282	<.001	1.109	1.044-1.178	.001
Richer	15168 (42.8)	1.390	1.352-1.429	<.001	1.062	0.996-1.133	.067
Richest	12256 (49.2)	1.794	1.739-1.850	<.001	1.246	1.154-1.345	<.001
Distances (111383)							
Big Problem	18861 (38.4)	0.735	0.718-0.753	<.001	0.856	0.821-0.893	<.001
Not a Big Problem	28540 (45.9)	*Ref*					
Need							
Blood in Stool (141194)							
Yes	10122 (47.7)	1.205	1.171-1.241	<.001	1.539	1.448-1.635	<.001
No	51727 (43.1)	*Ref*					
Fever (200729)							
Yes	46021 (43.3)	1.356	1.332-1.381	<.001	1.622	1.558-1.689	<.001
No	34089 (36.1)	*Ref*					

HIV Status and Care Seeking

A subset of 17,836 women across 22 countries was tested for HIV as an extra component of the standard DHS (Table 5). Of those who were tested for HIV, HIV positive women were 25.9% more likely to seek care of any kind for a child with diarrhea (OR=1.259; p=.001) and 41.8% more likely to seek care at a medical facility (OR=1.418; p<.001). However, when holding the other variables of this analysis as constants, the relationship between HIV status and care seeking at any source (aOR=0.917, 95%C.I.=0.747-1.126, p=.407) or a medical facility (aOR=1.005, 95%C.I.=0.821-1.229, p=.963) disappeared.

HIV Status of the Mother and Care Seeking				
	Sought Care (%)	**Odds Ratio**	**C.I. 95%**	**p-value**
Any Care Seeking				
HIV Status (17716)				
HIV Negative	8313 (49.4)	*Ref*		
HIV Positive	489 (55.1)	1.259	1.099-1.442	.001
Medical Care Seeking				
HIV Status (17747)				
HIV Negative	5961 (35.4)	*Ref*		
HIV Positive	387 (43.7)	1.418	1.237-1.625	<.001

Table 5. Results of two bivariate analyses comparing HIV status and care seeking from any source and care seeking at a medical facility.

V. DISCUSSION

Summary of Key Findings

This study provides a theoretically grounded look at characteristics that impact care-seeking behaviors for children with diarrhea across a large number of low- and middle-income countries. While much of the current literature explores care-seeking influences in a single country, this study demonstrates

several key characteristics that have an influence on care seeking rates at a more global level.

Overall, most predictor variables explored in this study were found to have some amount of influence on global care seeking practices for children with diarrhea. For both general care seeking as well as medical care seeking, measures of need had a significant influence on care seeking behavior, with a higher proportion of children with bloody stools and fever being taken to care. Globally, wealth had a positive impact on care seeking, with higher rates of care seeking occurring in each subsequent wealth index quintile. This relationship was found for both general care seeking and medical care seeking, though the relationship between wealth status and care seeking was steeper for care at a medical facility. Most measures of predisposing characteristics had a significant influence on care seeking behavior, though the mother's HIV status had no significant influence when placed in a model with all other predictor variables. Interestingly, both maternal and paternal education were found to be significantly associated with care seeking even when the partner's education level was held as a constant. Additionally, use of prenatal care was found to have a significant impact on care seeking, with prenatal care users being nearly twice as likely to seek care at a medical facility.

The results of the multivariate model for medically based care seeking indicate that medically based surveillance sites do capture a slightly biased sample of children with diarrheal illnesses. Childhood diarrheal surveillance should seek to adjust their observations of treated prevalence based on these uncovered influences in seeking medical care. Since the variables included in this

study have a similar impact on general and medically based care seeking, expanded surveillance locations may not correct for biases in who presents their child to a healthcare facility, though these findings would suggest that intervention and educational efforts aimed at improving general care seeking rates will also help improve the frequency of medical care seeking as well.

Connections to Previous Research

Many of our findings support the work of past researchers who looked at these relationships in individual countries and help smooth out differences observed between them. For example, while studies have disputed the impact of caregiver education and socioeconomic status on care seeking behavior [2, 7], our study shows the larger trend across low- and middle-income countries is that increases in both maternal and paternal education as well as household wealth have a positive relationship with general care seeking outside the home and care seeking at medical facilities. This study found significant, cross-national impact of characteristics with disputed relationships to care seeking such as age and sex of the sick child [2, 24]. On a global scale, male children and one year olds are more likely to be taken to care. Similarly, our findings support trends observed in other country-specific research that caregivers are more likely to seek care for children with additional markers of severity such as bloody stool and fever [2, 17, 21, 23].

Informing Current Global Efforts

While results for individual countries and geographic regions may still vary, our study provides a first look at the impact these measures have at the

global level. As such, these findings can help contextualize and enhance global diarrheal surveillance and international-level policy and intervention efforts. The impact this study can have on global surveillance is twofold. First, while community-wide surveillance is often beyond the time and financial resources of researchers in low-income countries, hospital and clinic-based surveillance is much more feasible. Second, understanding the biases in children represented in medically based surveillance can allow for an adjustment in extrapolating surveillance data to the wider international community. This is particularly significant for immutable demographic differences such as age and sex of the child as well as barriers such as low socioeconomic status and distances to facilities. This study in particular would suggest that medically based surveillance needs to correct for a larger number of girls, older children, and children of lower socioeconomic status households at greater distance from the surveillance sites.

Beyond demographic representations in current surveillance, this study shows that accessing currently established community-based international datasets can be useful in advancing not just our understandings of global diarrhea burdens but also areas to target in current policy measures and intervention efforts. Based on our results, intervention work may want to focus on educational efforts targeting more mutable predisposing characteristics or perceptions of need that impact care seeking decisions. For example, encouraging the use of treatment even if the child does not have bloody stool or a concurrent fever, or seeking care for children even when diarrhea is presented at an older age or during perhaps more normalized times such as weaning or

teething. Global interventions may look to alleviate less mutable predisposing characteristics such as sex and age by depicting older children and girls in intervention materials to help encourage higher rates of care seeking for those demographics.

Similarly, interventions may need to be targeted to particular populations such as families with both low maternal and paternal education. Such interventions could provide additional support to parents without formal education through creative means that translate easier across education status such as pictures, skits, community health worker outreach, and other verbal or visual messaging campaigns. Policies should also seek to enhance beneficial enabling resources and ease burdens that come from a lack of such resources. Through our particular findings, that would include providing additional support for households or communities that are a burdensome distance from healthcare facilities and working to reduce gaps in healthcare utilization for families with a lower wealth status. Policy and intervention efforts can also reach beyond the topic of diarrhea. While studies have looked at the impact of maternal interventions on concurrent improvements in prenatal care rates and warning signs or treatment needs of diarrheal diseases [39], studies have yet to explicitly address the role prenatal care can have on care seeking for diarrheal illnesses later in the child's life. In this study, the use of prenatal care had a significant impact on the likelihood of accessing care for childhood diarrhea, which could reflect the importance of familiarity, comfort, and trust in utilizing care for their children regardless of the illness. This finding could suggest that focusing on other predisposing characteristics such as health beliefs and social norms in care

utilization may be important in improving care seeking rates. Interventions and policies that encourage the use of prenatal care as well as other general infant and child care could help change the cultural norms of healthcare use and the beliefs about care seeking in general and resulting in improved rates of diarrheal care seeking as well.

This study also shows the value and applicability of current organized, cross-national population surveys. Projects such as the DHS absorb the majority of the time and costs needed to produce high quality, nationally representative data that is comparable across time and different countries. By accessing datasets from such well-established organizations, researchers can explore and interpret diarrhea care seeking and treatment behaviors in numerous broad or specific locations at no cost and within a very short period of time. These organizations provide an invaluable resource. Such easily accessible data has the potential to provide essential insight into global diarrheal burden and care behaviors, which can provide immediate support and guidance for current global health policies and intervention as well as providing a great foundation for future research.

Introduction of Theoretical Structure

While there has been a widening body of research on diarrheal care seeking in low- and middle-income countries, efforts have largely been atheoretical and unorganized. Though some exploration has begun to use behavior theory to create measures of health beliefs [4, 5], future research will benefit from the structure and justification behavior theory can afford in a larger

model. Andersen's Health Behavior Theory is particularly applicable for diarrheal care seeking and versatile enough to work within the parameters of whatever global or country-specific questions a researcher may pose. Through our study, we see that while enabling resources have a modest influence on care seeking behavior, measures of *need* and certain *predisposing characteristics* had fairly strong associations with both general and medical care seeking behaviors. Future research may want to see if these trends hold true in specific countries as well as expand their focus by looking at other variables within those constructs. Exploring the impact of other predisposing characteristics such as health beliefs and cultural norms, or other measures of need such as dehydration will allow for a more robust understanding of care seeking behavior and continue to help intervention and policy measures target the most significant influences.

Limitations

There are several limitations to this study worth discussing. First, though the DHS is a robust instrument, the section devoted specifically to recent diarrheal episodes in children was limited to basic symptoms and treatment decisions. Through the survey there were no measures to reasonably reflect more abstract psychological and social influences such as perceptions and norms around diarrhea, when care outside the home is necessary, and what choice of care provider is appropriate. This limited the current study to only exploring sociodemographic predisposing characteristics, many of which are difficult (education) or impossible (sex, age) to change. Perceptions and beliefs are significantly more mutable and therefore can be good targets for care seeking

interventions. Additionally, previous research has already highlighted how some demographic characteristics such as a child's age can impact perceptions of severity and diarrhea norms [28, 29]. Future studies should attempt to uncover the interaction between these predisposing characteristics and how this interaction relates to the overall theoretical model. Understanding such relationships will help to further refine intervention efforts to alter norms and perceptions to enhance care seeking.

As a study that focused on the influences in care seeking across numerous countries, this study sacrificed minutia for variables that can translate across most countries. Though this study controlled for country in the overall model, differences in healthcare systems within each country could play a role in decisions about care seeking and influence the relationship between predictor measures and care seeking decisions, particularly for things influencing access such as wealth and other enabling resources. There are, however, some minutia captured in the DHS that could not be used in a multi-country survey but that would potentially be beneficial in future country-specific analyses. The DHS have measures of ethnicity, religion, and other country- and culture-specific demographic variables (for example, whether the husband has multiple wives). These measures could not be used in this study because they were not globally translatable, but they may be important to care seeking decision-making for the families in those particular areas and thus merit exploration in future research that can inform those country-specific interventions.

Additionally, while the complete, multi-country dataset spans all months of the year, each individual survey was administered in each country over a brief

period of one to four months. Traditional hospital and community-based surveillance research for diarrheal prevalence aim for survey periods of one year at minimum to account for seasonal variations in diarrheal prevalence. Since this study did not take seasonality into account, true prevalence rates may be slightly different for some countries included in the analysis. This is a particular challenge in a multi-country study, since seasons corresponding to high or low diarrheal prevalence may be at different times for different countries (for example, those above, below, or near the equator). Issues of seasonality may also impact care seeking behaviors since diarrhea could be perceived as more or less severe during different seasons, and families may have access to different resources or perceive barriers such as distance and transportation differently depending on the season.

Future Research

This study provides a solid foundation from which a wide breadth of future research on diarrheal care seeking can be pursued. The most immediate next step is to identify factors related to care seeking for each of the sixty-seven countries. While this project focused on exploring what factors have a significant influence on care seeking behavior at a global level, it is important to take the additional step to capture such relationships at a country-specific level. By developing an organized theory-driven structure from a compiled, multi-country dataset, exploration at the country-level will be standardized, allowing for reliable comparisons to global, regional, and cross-country trends. Country-specific findings on medical care seeking influences can help adjust country-based

diarrheal surveillance estimates, while country-specific findings on medical and general care seeking can help inform in-country programs, including the potential to adopt and adapt preexisting interventions to address their country's specific care seeking influences.

In addition, future research may wish to explore other potential influences on care seeking behavior that are theoretically justified and applicable to continued care seeking intervention efforts. For example, a first look at vaccination compliance through the multivariate model presented in this study found that children who had received at least one vaccine were more likely to be taken to any care (aOR=1.423, 95%C.I.=1.302-1.555, p<.001) as well as a medical facility (aOR=1.558, 95%C.I.=1.423-1.706, p<.001). The DHS provides a great deal of detail on infant and childhood vaccination compliance, and looking at vaccination compliance in greater detail can help uncover what vaccination campaigns or interventions may be a source to encourage general and diarrheal-specific care seeking efforts. The ability to get certain vaccines, such as for Polio, may point to the presence of important enabling resources and community infrastructure that supports vaccination campaigns while postnatal vaccines may proxy more predisposing characteristics such as norms and expectations regarding the use of medical facilities. Further research into connections between diarrheal care seeking and vaccination rates, as well as other variables relevant to healthcare utilization and public health programs can help encourage synergistic and resource-efficient intervention efforts for childhood health.

In order to better understand potential biases in clinical based surveillance and to inform general care seeking programs, this study chose to explore what

factors influence medically based care seeking and what factors prompt any care seeking outside the home. Depending on the objectives of future research, influences on non-medically based care seeking should be explored. As previous literature has shown, the choice to seek out culturally traditional or non-clinical care can be influenced by perceptions of severity as well as cultural norms and beliefs about the cause of the diarrheal illness [5, 28-31]. An initial look through the dataset used in this study seems to support past research. When looking at the predictor variables in relation to those who did not seek care at a medical facility, both measures of need (blood in stool and presence of fever) yielding an increased likelihood of non-medical care seeking (APPENDIX I). Interestingly, while most other measures were not significantly associated with nonmedical care seeking in the multivariate model, the child's age and family's wealth index were found to have significant influence. Similar to medical care seeking, nonmedical care seeking increased across each wealth index quintile, but the child's age revealed an opposite trend, with nonmedical care seeking increasing in likelihood for older children (APPENDIX I). Future research should refine this initial exploration, identifying what kinds of nonmedical care seeking can be observed at a global level (for example, is "traditional healer" a classification that translates well across countries for global analysis), and identify potential influences to such care seeking decisions based on the current literature and theoretical justifications that are within the scope of the DHS.

Such research will provide important additional insight into global care seeking intervention efforts as well as reveal the impact of a pluralist healthcare environment. Future research should expand on Subedi's (1989) exploration of

medical pluralism and care seeking behavior. Understanding how parents navigate a pluralist healthcare environment will help inform where diarrheal treatment information and resources would be most beneficial and what sort of partnerships to pursue between medical and nonmedical facilities, both for surveillance and interventions.

Finally, this leads to the additional need to research decisions that result in the delay of care seeking. As diarrhea is a common childhood illness, medical attention is not always immediate. Though the DHS does not capture data on illness duration and frequency prior to seeking care, future research should seek to gain this knowledge through other data sources. Delay in curative treatment can have a significant impact on the overall burden of diarrheal illnesses and understanding care seeking behavior should include an understanding of not just where care is sought but when care is deemed necessary. In this way future intervention efforts can be tailored to encourage prompt treatment before the illness becomes a greater burden to the family and the healthcare system. Incorporating and expanding upon the findings of this study will help strengthen the global response to the continued threat of diarrheal illnesses to infant and childhood health in low- and middle-income countries.

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APPENDIX I: Multivariate Logistic Regression Output for Non-Medical Care Seeking

	Full Model		
Non-Medical Care Seeking			
	aOR	**C.I. 95%**	**p-value**
Predisposing Characteristics			
Sex			
Male	1.073	1.002-1.150	.045
Female	*Ref*		
Age	*Ref*		<.001
<1 year			
1 year	1.403	1.287-1.529	<.001
2 years	1.352	1.222-1.495	<.001
3-5 years	1.282	1.145-1.435	<.001
Birth Order			.309
Firstborn	*Ref*		
Middle	0.245	0.040-1.518	.131
Lastborn	0.669	0.275-1.628	.376
Siblings			
Only Child	0.741	0.304-1.806	.510
Has Siblings			
Maternal Education			.320
None	*Ref*		
Primary	1.014	0.919-1.118	.833
Secondary	0.986	0.867-1.122	.833
Higher	1.223	0.949-1.577	.119
Paternal Education			.651
None	*Ref*		
Primary	1.065	0.961-1.179	.229
Secondary	1.065	0.947-1.198	.290
Higher	1.064	0.870-1.300	.547
Prenatal Care			
Some Care	0.922	0.825-1.027	.142
No Care	*Ref*		
Enabling Resources			
Wealth Index			.001
Poorest	*Ref*		
Poorer	1.122	1.014-1.241	.026
Middle	1.177	1.058-1.309	.003
Richer	1.266	1.130-1.417	<.001
Richest	1.199	1.044-1.377	.010
Distance			
Big Problem	0.945	0.878-1.016	.127
Not a Big Problem	*Ref*		
Need			
Blood in Stool	*Ref*		
Yes	1.432	1.292-1.589	<.001
No			
Fever	*Ref*		
Yes	1.294	1.206-1.389	<.001
No			

APPENDIX II: Questions from the Demographic Health Surveys

Questions were asked for each child under the age of 5 years.
Questions numbers taken from Phase 6 (2008-2013) DHS Questionnaire

Question Number		
104	Have you ever attended school?	YES..... 1 NO 2
105	What is the highest level of school you attended: primary, secondary, or higher? (1)	PRIMARY ..... 1 SECONDARY ..... 2 HIGHER 3
211	Now I would like to record the names of all your births, whether still alive or not, starting with the first one you had. RECORD NAMES OF ALL THE BIRTHS IN 212. RECORD TWINS AND TRIPLETS ON SEPARATE ROWS. (IF THERE ARE MORE THAN 12 BIRTHS, USE AN ADDITIONAL QUESTIONNAIRE, STARTING WITH THE SECOND ROW).	
213	Is (NAME) a boy or a girl?	Boy……1 Girl……..2
215	In what month and year was (NAME) born? PROBE: When is his/her birthday?	
217	IF ALIVE: How old was (NAME) at his/her last birthday?	RECORD AGE IN COMPLETED YEARS
408	Did you see anyone for antenatal care for this pregnancy?	Yes……1 No……..2
514	Has (NAME) had diarrhea in the last 2 weeks? (8)	Yes……..1 No……..2 Don't Know……8
515	Was there any blood in the stools?	Yes……..……1 No……2 Don't Know……8
518	Did you seek any advice or treatment for the diarrhea from any source?	Yes……1 No……..2
519	Where did you seek advice or treatment? (9) Anywhere else?	PUBLIC SECTOR GOVT HOSPITAL……A

	PROBE TO IDENTIFY EACH TYPE OF SOURCE. IF UNABLE TO DETERMINE IF PUBLIC OR PRIVATE SECTOR , WRITE THE NAME OF THE PLACE. _____ (Name of place(s))	GOVT HEALTH CENTER …….. B GOVT HEALTHPOST …….. C MOBILE CLINIC ……..D FIELDWORKER ……..E OTHER PUBLIC SECTOR _____…….F (SPECIFY) PRIVATE MEDICAL SECTOR PVT. HOSPITAL/ CLINIC……. G PHARMACY……..H PVTDOCTOR……I MOBILE CLINIC ……J FIELDWORKER ……..K OTHER PRIVATE MED. SECTOR _____…….L (SPECIFY) OTHER SOURCE SHOP ……M TRADITIONAL PRACTITIONER ……..N MARKET ……O Other _____ ……X (SPECIFY)
525	Has (NAME) been ill with a fever at any time in the last 2 weeks?	Yes……1 No……2 Don't Know……8
803	Did your (last) (husband/partner) ever attend school?	YES…… 1 NO …… 2
804	What was the highest level of school he attended: primary, secondary, or higher? **(1)**	PRIMARY …… 1 SECONDARY …… 2 HIGHER …… 3 DON'TKNOW …… 8
1008	Many different factors can prevent women from	

	getting medical advice or treatment for themselves. When you are sick and want to get medical advice or treatment, is each of the following a big problem or not? …….. The distance to the health facility?	BIG PROBLEM……1 NOT A BIG PROBLEM……2 NO PROBLEM……3