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"The Borehole Has Given Us a Chance:" Health, Hygiene, and Human Development in Karamoja, Uganda

Laura E. Pugh

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“The Borehole Has Given Us a Chance:” Health,
Hygiene, and Human Development in Karamoja, Uganda

Laura Pugh
Submitted in partial requirement for Honors in Public Health
April 17, 2015

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Table of Abbreviations

ACTED	Agency for Technical Cooperation and Development
FAO	Food and Agricultural Organization
GIWEH	Global Institute of Water the Environment and Health
ICRC	International Committee of the Red Cross
IGAD	Intergovernmental Authority for Development
KALIP	Karamoja Livelihoods Programme
KIDP	Karamoja Integrated Development Program
KIDDP	Karamoja Integrated Development and Disarmament Program
LRA	Lord's Resistance Army
LPI	Livestock Policy Initiative
MDG	Millenium Development Goal
NDP	National Development Programme
NGO	Non-Governmental Organization
PRDP	Peace Recovery and Development Programme
UDNP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WFP	World Food Programme

Preface

Water is central to health, intertwined with every aspect of healthy living from hydration to hygiene to water-borne diseases. Millions of people throughout the world live without reliable access to clean water. Even when clean water is theoretically available, water provision may not adequately meet community's needs. In addition, the needs of communities with non-traditional lifestyles, including pastoralism, are often not met. After spending a summer doing research in Uganda, I returned full of questions about water provision and use, as well as the shortcomings of the public health community towards Karamoja, Uganda.

My driving concerns were to increase the breadth of literature on this understudied region by detailing water and hygiene behaviors in this area, to determine potential reasons that water development has been unsuccessful in Karamoja, and finally to suggest additional solutions to the water and health crises facing Karamoja today. I investigated these questions using four methods: with an extensive literature review and interviews with local international NGO water practitioners; with a survey questionnaire among young mothers in Karamoja; with focus groups among elderly women in the community; and with an analysis of the Ugandan Demographics and Health Survey.

The aims of the literature review and unstructured interviews was to develop an in-depth understanding of the state of the literature on water use in Karamoja, and the reasons it has fallen behind the rest of the country in terms of development. The survey questionnaire study aimed to provide descriptive statistics on use of improved and unimproved water, hygiene practices, and hygiene beliefs, and to investigate relationships between access to water, water behavior, and child morbidity outcomes. The focus groups aimed to clarify understanding of community perceptions of the borehole (the main improved water source) and the changes that has brought,

and better understanding community decision-making practices surrounding the borehole.

Finally, the study using the DHS data further explored the idea of Karamoja as an outlier in Uganda with unique development needs.

Overall, I found that health and hygiene in Karamoja is a story of contradictions. Mothers in Uganda place a high priority on their children's hygiene, and frequently conflate hygiene and health. However, the hygiene status of children is often low, and recommended hand washing practices are not carried out. Communities place a high importance on their boreholes, but often still use river water, and the boreholes are not all adequately maintained. Disease agents are so prevalent that it is difficult to imagine adequately protecting children in this context. However, important first steps to take include working to remove the institutionalized marginalization that has plagued the region and recognizing that the same solutions that work in sedentary agricultural societies may not fully translate to Karamoja. This set of studies aims to demonstrate why water development has not succeeded in Karamoja, what the typical behaviors and beliefs surrounding water use are, and what the international WASH community can do to improve Karamoja's outlook for the future.

Chapter I. Karamoja, Uganda: A Case Study in Water for Health and Development

INTRODUCTION

70% of the world's poorest people live in arid or semi-arid regions (Broca & Oram 1991). As the climate continues to shift, these regions will become increasingly vulnerable and at risk for problems of water security, food security, and conflict (Salim 2014). Uganda, one of the 49 'Least Developed Countries' in the world, already faces enormous challenges in water provision: just under 70% of its population currently has access to improved water sources, considered to be any protected well, borehole, tap, rainwater or piped facility. This figure varies enormously by region. Karamoja, the arid region to the northeast, fares the worst in terms of not only water access but also life expectancy, child mortality, and child nutrition status.

Karamoja is home to 1.4 million traditionally agro-pastoralist, semi-nomadic people (Avery 2014). Pastoralism has been greatly ignored as a viable livelihood strategy by international development organizations and national governments alike, despite being the

primary (and most well-suited) livelihood for many arid regions (Levine 2010, IGAD 2011). Projects to provide adequate water for agriculture, livestock, and people, have been haphazard and poorly maintained, and tend to focus their aims on promoting agriculture rather than livestock maintenance (Levine 2010). These policy and development errors, combined with periods of conflict in the region, have left Karamoja lagging far behind the rest of the country. Eighty-two percent of the population lives below the national poverty line (DHS 2011). Maternal mortality is among the highest in the world at 750/100000, and 15.3% of children die before their fifth birthday (DHS 2011). 45% of men and 58% of women have received no formal education (DHS 2011).

While substantial efforts have been made in many parts of the world to improve water quality and access for poor regions, Karamoja remains substantially underserved in terms of water provision. The region's remote location, history of civil conflict, and harsh climate have contributed to the lack of consistent development efforts in the region. This thesis is composed of three studies that address three main aims related to water access in hygiene in Karamoja region:

1. How does water intersect with the current development goals in the Karamoja region?
2. What are the main challenges to water provision in this region?
3. What are the recommendations for the government and development organizations to create sustainable water solutions in Karamoja?

Mismanagement of water is a key aspect preventing Karamoja's ability to develop. Inadequate supply and poor quality water is a major contributor to the livestock disease and death, child malnutrition, agricultural failure, and gender inequality that are holding Karamoja back. Furthermore, this paper demonstrates that cultural insensitivity and prejudice, combined with poor natural resource management, have created vast food and water insecurity.

International, national, and local actors need to make dramatic and rapid changes to their policies and activities in order to pull Karamoja out of current state of entrenched poverty and poor service provision.

This study was conducted by assessing a combination of regional project reports, government development initiatives, and literature about the region. The project reports were from UNICEF, ICRC, FAO, ACTED, Dan Church Aid, ASB, MercyCorps and the Ugandan Government. The author also interviewed five key informants: Nidal Salim (Global Institute for Water Environment and Health), Stephan Spang (International Committee of the Red Cross), Ivan Draganic (United Nations Development Program), Thomas Ameny (Food and Agricultural Organization Uganda), and Alastair Tailor (Karamoja Livelihoods Program) to gain a wide perspective on the future of global water provision and a specific understanding of project implementation in Karamoja. The conclusions presented in this paper are of the author alone.

WATER IN HEALTH AND DEVELOPMENT

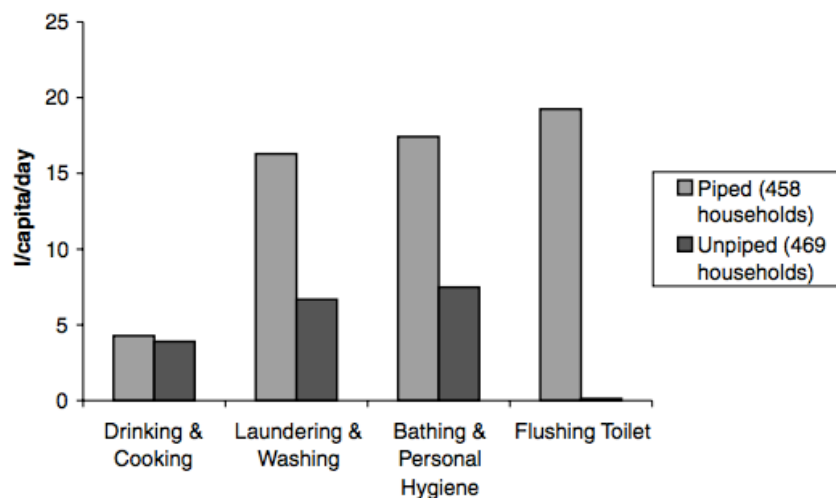
Water sustains the Earth. It allows rivers to flow, plants to grow, and cells to function. However, after 3.6 billion years of dependence on this singular molecule, Earth's inhabitants still do not get enough. 768 million people still lack sources of safe drinking water (WHO/UNICEF 2014), and women around the world spend an estimated 200 million hours each day fetching water from distant sources (United Nations 2013). The way the current generation responds to the problem of water will have incredible impacts on the health, environment, economic development, and security of the next.

Water and Health

Water is both essential to good health and a leading cause of poor health. Water maintains the healthy body by allowing food digestion, absorption and transportation of

nutrients, and elimination of toxins and wastes (Kleiner 1999). Adults in tropical climates need about 3 liters of water a day, and more if they are pregnant, active, or in the sun much of the day (Howard & Bartram 2003). Domestically, water is necessary for cooking, washing hands, bathing, cleaning the home, and laundry, not to mention its crucial role in agriculture and livestock production (Howard & Bartram 2003). In an analysis across developing countries in Sub-Saharan Africa, Howard & Bartram found that when water is limited, it is used first for drinking and cooking; therefore, providing excess water has the greatest impact on washing and hygiene behaviors (Figure 1).

Figure 1. Water use by category in piped and unpiped households (Howard & Bartram 2003)



Water is as dangerous as it is necessary, however, as one of the most common vectors for disease. In an age characterized by high-tech solutions and medical miracles, diarrhea kills 1.34 million children under 5 years old every year (Black et al. 2010). Diarrhea prevention relies on water in two capacities. Households need clean water to drink, but they also need enough water to fully carry out hygiene practices (including hand-washing, bathing, and cleaning) to avoid ingesting pathogens. As malnutrition is a factor in 45% of child deaths, diarrhea is even more

dangerous than direct mortality statistics suggest, due to its impact on absorption of nutrients among children (WHO 2013).

Diarrhea is far from the only disease associated with water. Deadly diseases such as campylobacteriosis, cholera, hepatitis A, hepatitis E, guinea worm, methaemoglobinaemia, and typhoid are all water-borne and can be contracted by drinking unclean water. In addition, toxin-based diseases like arsenicosis, cyanobacterial toxins, fluorosis, and lead poisoning can arise from drinking contaminated water (WHO 2013).

Inadequate access to clean water contributes to diseases of sanitation as well. When families struggle to carry enough water for themselves, or only have access to unclean water, they are unlikely to practice optimal hygiene (Figure 1, WHO 2003). In addition to childhood diarrhea, diseases of poor sanitation like hookworm, schistosomiasis, ascariasis, ringworm, scabies, trachoma, typhoid cause mortality and morbidity throughout the developing world (WHO 2001).

Finally, mosquito-borne diseases, notably malaria, dengue fever, and Japanese encephalitis, affect hundreds of millions of people a year (WHO 2001). Improper water storage near or in homes has been shown to provide additional breeding locations for disease-bearing insects (WHO 2001). Taken together, diseases of water, sanitation, and hygiene cause billions of years of healthy life lost every year.

Water and Security

As global water scarcity increases, so does the threat of water as a security issue. Although water has not been shown to directly cause international wars, its role within conflict settings cannot be ignored. Most notable, perhaps, is the conflict in Israel and Palestine over the Jordan River, but less explicit unrest over water issues is frequent as well (Wolf 1999). The most

prevalent form of international water tension occurs in fragile watersheds such as the Levant Region and the Nile River Basin; one country polluting or damming already scarce resources can have dramatic effects on the downstream and watershed countries (Salim 2014, Gleik 1993). Uganda is almost entirely dependent on the Nile for water, and is therefore a critical part of any Nile Basin negotiations (Gleik 1993).

Proper water resource management is necessary to prevent frustration over water from souring diplomatic relations between countries (Wolf 1999, Gleick 1993). In addition, water sources are increasingly of strategic importance during conflict. In Somalia, for example, one of the most prevalent offensive strategies is the destruction of motorized boreholes so that thousands of people are forced to move to a new location (Spang 2014). In the Karamoja region of Uganda where this paper focuses, the limited number of dams as water sources for livestock has become a source of tribal conflict (Taylor 2014).

Under International Human Rights Law, although access to water is considered a basic human right, quantity is not specified (Spang 2014, Hutton & Heller 2004). Providing water in emergency situations is one of the greatest and most expensive challenges facing humanitarian aid organizations today (Spang 2014, Webb & Iskandarani 1998). Preventing water from becoming both a cause and a weapon of conflict will require not only international focus and oversight, but also significant participation and cooperation by individual nations.

Water and Economic Development

Water has skyrocketed on the global development agenda in recent years, in large part because of its connection to health. The international community realizes that countries cannot grow their industries, educate their people, and successfully join the global economy without a healthy population. The poverty-poor-health cycle is vicious and pervasive in the developing

world. Unhealthy people are less able to learn, less productive, and therefore unable to rise out of the poverty that made them unhealthy in the first place. Aside from the incredible costs of direct mortality, children who are malnourished and stunted from diarrhea and environmental enteropathy are less likely to finish school, less healthy as adults, and earn less. In 2004, Hutton and Heller estimated that implementing water, sanitation, and hygiene interventions could eliminate up to 22,059 adult workdays lost per year due to diarrhea alone. More importantly, these interventions could lead to 1,863,335 more days' worth of children in school (Hutton & Heller 2004).

The second impact of water on development is on gender equality. Millennium Development Goal (MDG) 3 and other initiatives focus on the empowerment and education of women (United Nations 2013). Yet 40 billion hours are spent collecting water each year, the brunt of which is borne by women and girls (WHO 2010); this amounts to an estimated \$405 million dollars worth of time lost (Hutton & Heller 2004). Evidence from Ghana shows that average time spent collecting water has not decreased since 1993 (World Bank 2010).

Decreasing the distance to water allows women to spend more time on economic activities (Illahi & Grimard 2000) and may make girls more likely to stay in school (Koolwal & Van de Walle 2010, Nauges & Strand 2013). Reaching the rural girls across the developing world that are still not in school, and encouraging women to enter economically productive markets, will not be possible without full provision of water services.

Water and International Development Strategies

The most significant international strategy for development is the Millennium Development Goals, a set of eight broad objectives to achieve worldwide by 2015. Millennium Development Goal 7 is to “ensure environmental sustainability:” a sub-set of this goal is to halve

the proportion of people without access to drinking water (United Nations 2013). Globally, this goal has been achieved and is regarded as a success story; however, the progress has been driven primarily by India and China (United Nations 2013). Sub-Saharan Africa, on the other hand, is not expected to achieve this goal until 2033, and even this will only be achieved with improved efforts (Foster 2013). In fact, the number of sub-Saharan Africans without safe drinking water rose from 240 million in 1990 to 275 million in 2011 (Foster 2013). This can be attributed in part to decreases in assistance (both financially and technically) from traditional governments, and in part to inadequate capacities and political will within national governments (Gleck & Wilder 2012). Some economic analyses show that even the poorest national governments can afford to provide universal access to improved water sources if that becomes a top priority (Gleck & Wilder 2012).

On a regional level, the Nile River Basin is the area of Sub-Saharan Africa with the most fragile water conditions. This region consists of ten nations, all of which are at least partially arid and depend heavily on the Nile: Tanzania, Uganda, Rwanda, Burundi, Democratic Republic of the Congo, Kenya, Ethiopia, Eritrea, South Sudan, Sudan and Egypt (Oloo 2007). The region's resources have been traditionally poorly managed, with a distinct lack of formal oversight (Oloo 2007). In recent years, however, there has been increased multilateral partnership in the region to improve water management. The Nile Basin Initiative, adopted in 2000, is based in Uganda and aims to reduce tensions between the ten states and improve management of water resources in general and the Nile in particular (Oloo 2007). This management pertains primarily to agricultural use, which accounts for 70% of water use in the region (Oloo 2007).

Additionally, the Intergovernmental Authority for Development (IGAD) consists of eight countries: Djibouti, Eritrea, Ethiopia, Somalia, Sudan, South Sudan, Kenya, and Uganda.

Originally named IGADD, Intergovernmental Authority for Drought and Development, IGAD focuses on promoting development while mitigating environmental damage. Main outputs include weather monitoring and drought and disaster warnings, climate change monitoring, peace-building efforts, and economic cooperation initiatives (IGAD 1998). Since many groups in the Horn of Africa region are traditionally semi-nomadic pastoralists, IGAD began the Livestock Policy Initiative (LPI) in order to improve policy-making towards development in pastoral areas (IGAD 2011).

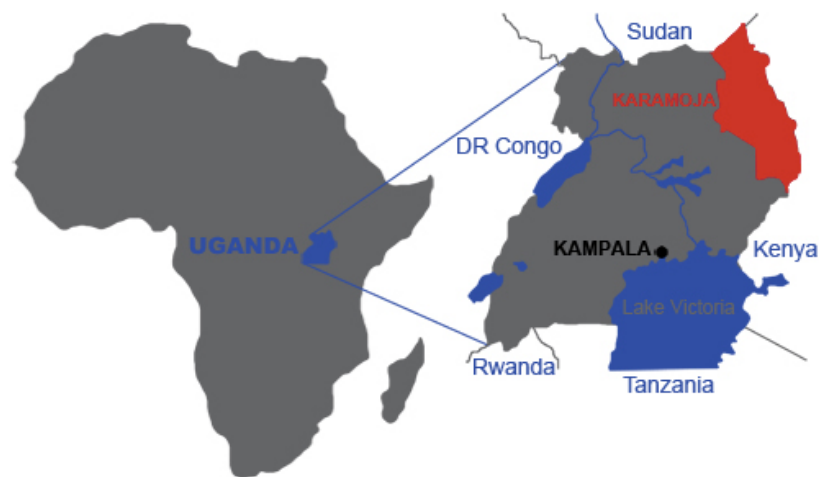
The main criticism of these intergovernmental partnerships and agreements is their inability to adequately address community-level factors (Oloo 2007). International frameworks and even national constitutions, although useful in initiating discussions, often do not impact development implementation on local levels (Gerlak & Wilder 2012). Although defining access to water as a human right is important, it does little to combat the realities of competition for resources and change the balance of power when it comes to unequal provision (Salim 2014, Gerlak & Wilder 2012). Water is such an integral and daily part of human life and culture that without community-tailored solutions, long-term change is impossible. Pastoral populations are particularly poorly served due to widespread prejudices and misunderstandings (Levine 2010). Using the example of the Karamoja Region, this paper argues that cultural insensitivity and prejudice, combined with poor natural resource management and lack of education, have created vast food and water insecurity.

As a result of its inextricable links to health, security, and economic productivity, water provision has become in and of itself an international development priority. However, many developing countries are falling short. The following study of the Karamoja region of Uganda demonstrates the adverse effects of poor water resource management. As a result of an

unpredictable rainfall pattern, poorly allocated government funds, and a history characterized by aid and instability, water provision is minimal, both for livelihoods and human consumption. The resulting inadequate access to water has contributed to the region's poor development through food insecurity, conflict, and high disease prevalence among animals and livestock.

KARAMOJA: REGIONAL PROFILE

Figure 2. Map of Uganda (SwissContact Germany 2012)



This paper focuses on the Karamoja region of Uganda, however, the agro-pastoralist, semi-nomadic lifestyle is prevalent in much of the Horn of Africa, and similar tribes live in Kenya and Sudan. Notably the Turkana in Kenya are a relatively well-studied population compared to the Karamojong due to greater stability in the region, but still maintain similar cultural practices. Up to 22 million people are estimated to be pastoralist or agro-pastoralist in the Horn of Africa, and 41% live in extreme poverty (World Bank 2014). The Karamoja Region, located in the northeastern corner of Uganda, is one of the least served regions in the world.

This marginalization extends to water as well. Across Uganda, 70% of people have access to improved water sources, whereas coverage is less than 50% in Karamoja (UNICEF 2013). The majority of residents travel over 30 minutes to fetch water. (DHS 2011). The most

common traditional livelihood is agro-pastoralism: raising livestock alongside supplementary agriculture (Levine 2010). These tribes are nomadic during the dry season, moving their herds in search of water (Levine 2010). Thus, economic, food, and water security are closely tied in Karamoja.

Climate

Karamoja, like most traditionally pastoralist areas, is semi-arid and receives small and unpredictable amounts of rain. The average yearly rainfall is between 400 and 700mm (Powell 2010, Republic of Uganda 2008). Karamoja experiences frequent droughts, with multi-year dry spells every decade or so (Powell 2010). Rainfall, when it does arrive, can be intense, causing flooding and disrupting transportation (Taylor 2014, Avery 2014, Hopp 2014). Karamoja is located on a plateau, and precipitation has a tendency to run off if not captured. The consequences of climate change on rainfall quantity are not clear, however, all studies indicate that rainfall patterns will be less predictable; thus, water solutions must be capable of handling both intense rainstorms and frequent dryness (Levine 2010, Powell 2010).

History of Development

The Karamoja region has been mistreated since Uganda's colonization. The British created close ties with the sedentary Baganda tribes, appointing those chiefs into leadership positions, while writing the non-hierarchical nomads to the north off as backwards and unpredictable (Kratli 2001). The British divide-and-rule strategy has left lasting impact and even today the Ugandan government underrepresents pastoralist interests and fails to meet their political needs (Cell 2012, Levine 2010). The majority of money for livelihood initiatives in Karamoja is spent on agriculture development, despite the fact that the region and its people are better suited for pastoralism (United Nations 2013, Levine 2010). The Ugandan government has

encouraged residents of Karamoja to turn to crop farming, fragmented traditional grazing land, and discouraging the free movements necessary for healthy livestock (Mburu 2001, Levine 2010, Taylor 2014).

Development workers in Karamoja today are hopeful. The government has become more receptive to supporting livestock production than previously, and improving security has enabled more investors and aid organizations to enter the area (Ameny 2014, Taylor 2014). However, best practices allowing pastoralism, small-scale farming, and sustainable alternative livelihoods to co-exist are far from realized. Community investment in interventions remains low, district governments are underfunded, and national policies have not had time to fully shift in response to new research. Water infrastructure is crucial for all development plans; the allocation of water to agriculture, livestock, or domestic use is a key indicator of priorities as well as a determining factor in the success of the intervention.

Security and pastoralism

Northern Uganda has faced significant insecurity, which contributes to and perpetuates its problems. The tribes of the Karamoja region (and neighboring Kenya and Sudan) have been armed since the early 1900s (Mburu 2001). However, widespread gun ownership did not occur until the political instability in the 1970s, after which arms trade with Kenya and Sudan skyrocketed (Mburu 2001). The state provided poor protection from security threats including the Lord's Resistance Army, and therefore many in Karamoja feel both a disconnect from the state and a need for guns for self-protection (Mburu 2001, Powell 2010). The most significant modern-day use of guns is for cattle rustling; neighboring tribes undertake sometimes-massive raids on each other's herds, which is the greatest source of wealth in the region (Powell 2010, Hopp 2014). Arms ownership has permeated the culture and become a means of physical and

economic security, as well as a status symbol (Powell 2010, Mburu 2001). Periodic efforts at disarmament have been generally unsuccessful due to aggressive tactics and failure to simultaneously disarm the tribes Kenya and Sudan, which frequently cross the Uganda border (Powell 2010, Mburu 2001).

Today, the security situation has greatly improved. The LRA has moved out of Uganda, and the Peace Development and Recovery Program (PRDP) and Karamoja Integrated Development and Disarmament Program (KIDDP) have largely succeeded in disarmament. Large-scale cattle rustling has nearly disappeared, although smaller-scale cattle theft still occurs (Taylor 2014). In 2012, the International Committee of the Red Cross left the area and declared it no longer a conflict area (Spang 2014).

The security problem, and the Ugandan government's response to it, has been devastating to the food security and water security of the region. The widespread violence caused the government to intensify efforts at encouraging agriculture over pastoralism in hopes of decreasing cattle raids (Taylor 2014). Due to the tribal violence, the government mandated putting livestock in guarded *kraals* (Levine 2010). The danger in certain 'no-man's-lands' also contributed to population pressure on safer areas. However, this practice caused rapid spread of disease, overgrazing of pastures, and inability to follow traditional nomadic routes, including those to water sources. Thus, during the early 2000s, livestock populations crashed (Taylor 2014).

Many families lost their livestock entirely due to the combination of raiding and disease and have converted to agriculture instead (Taylor 2014). Agriculture is both more water-intensive and water-dependent than pastoralism; whereas crops in Karamoja fail frequently, pasturelands are more resilient (Levine 2010). In fact, increased pressure to become sedentary

has been criticized for creating ‘artificial droughts’—conditions that are perceived as droughts but are simply part of the typical Karamoja climate (Levine 2010). Therefore, sustainable water solutions in Karamoja must address issues of the balance of livelihoods (agriculture, pastoralism, and supplemental activities) to ensure adequate water for production in addition to water for domestic use. Perhaps as a response to prior criticisms, the Ugandan government has increased its support of pastoralism, although the majority of funding in Karamoja still goes towards agricultural projects (Republic of Uganda 2008).

III. Karamoja and Water Development

Water stress is determined by the relationship between two variables: water availability and water use (Salim 2014). In Karamoja, the main factors in the use equation are agriculture, livestock production, and domestic use. Agriculture uses the most water by far, with livestock second. Karamoja’s population has doubled since 2000 and continues to grow; this change in population dramatically exacerbates existing problems. The total amount of water, geologically speaking, is adequate to support the current population unless agricultural use increases. Thus, the current challenge is bringing water safely to the people without lowering the water table. Although wide variation between districts exists, far less than half of people living in Karamoja have access to improved water (Avery 2014). The majority of Karamoja’s water is found in the ground, not in surface water (Avery 2014). Therefore, the water table is not regularly refilled, and according to some sources, it has already begun to drop. Providing adequate water, including that for production, for the entire existing population, will impact the water budget (Figure 3). Figure 3 demonstrates the existing ground water budget in different districts of Karamoja. It demonstrates both that there are currently relatively few stresses on the water table in Karamoja, making the impact of increased irrigation and population growth unclear. In

addition, the table demonstrates the estimated proportion of each district population who have access to improved water within a 30-minute trip; these numbers are still quite low compared to elsewhere in Uganda. With impending climate change and continued population increases, both hydrology and water practices must be closely monitored to keep well-intended development projects from drying out the region.

Figure 3. Water supply summary for Karamoja (Avery 2014)

District	Point water sources				WFP		Piped WS	Pop.	% Water Access
	Protected Spring	Shallow Well	Deep Borehole	Rain Tanks	Dams	Valley Tanks	PSP/Kiosk Tap Stand		
Nakapiripirit	6	32	224	9	2	7	21	244,900	33
Moroto	1	3	435	46	6	0	0	297,800	42
Kotido	0	1	224	37	33	4	4	204,600	33
Kaabong	0	18	227	0	1	1	1	345,300	21
Abim	3	13	143	29	4	0	0	47,490	86
Totals	10	67	1,253	121	46	12	26	1,140,090	

Notes: Data from Uganda Water Supply Atlas, Ministry of Water & Environment, 2010.²¹
WFP = Water for Production.

Water and Current Development Strategies

Given its development status, coupled with relative political stability over the past two decades, Uganda attracts significant international development attention in addition to nationally-directed strategies to improve infrastructure, education, and health. The overarching country development plan, the National Development Program (NDP, seeks to support economic growth and poverty eradication. For Karamoja, the development agenda is laid out through two programs: the Karamoja Integrated Development Program (KIDP) and the Peace, Recovery, and Development Plan (PRDP), which entered its second phase in 2012 (ISIS 2012). KIDP's primary aims are disarmament, improving basic social services, supporting alternative livelihoods such as energy and mining, stakeholder education, and improving monitoring and evaluation of interventions (Powell 2010). PRDP's main objectives are consolidating state authority, empowering communities, economic production, and peace building (ISIS 2012).

Water coincides with this agenda at essentially every point. Disarmament cannot succeed unless communities feel less need for their weapons; the limited number of water points and lack of good grazing locations frequently brings antagonistic tribes into close proximity (Taylor 2014). Improving production and food security is impossible without adequate water for both livestock and agriculture, necessitating construction of water tanks and irrigation systems. Lack of alternative sources of income during difficult or dry years independently contributes to water loss because many people turn to charcoal burning, destroying large sections of the forest and decreasing the land's ability to hold water (Spang 2014, Levine 2010). Households cannot become healthy and educated without nearby access to water for consumption and sanitation.

Water for Production

Figure 4. Water audit for Karamoja (Avery 2014)

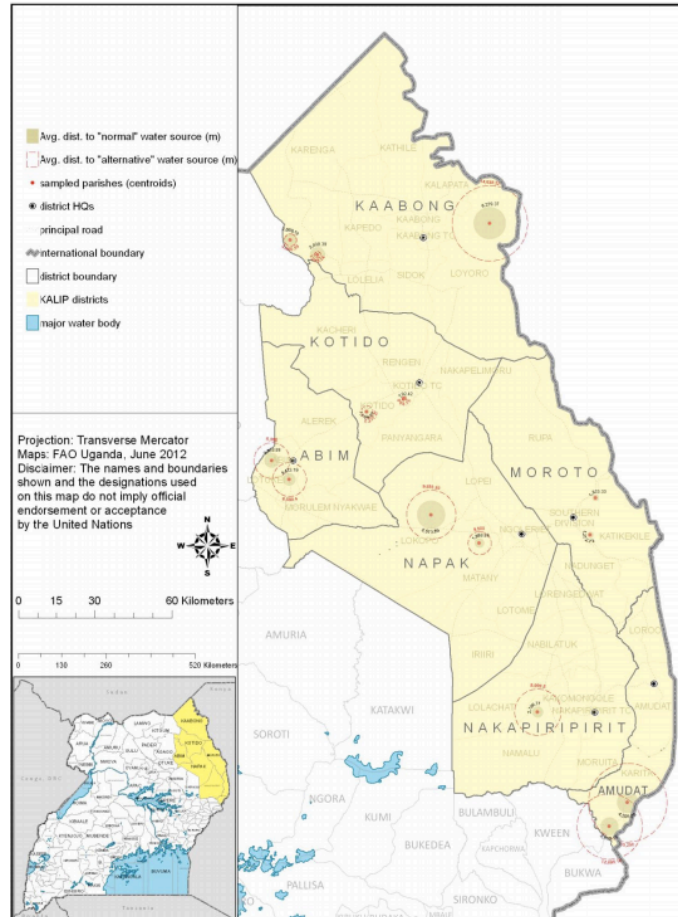
District ¹	Catchment	Surface Water ² MCM/yr	Ground Water MCM/yr	Run-off MCM/yr	Crop Water Demand MCM/yr
Kaabong ³	Aswa (50%)	-	27	205	0.67
Kaabong ³	L.Kyoga (50%)	-	27	205	0.67
Kotido ³	Aswa (50%)	-	36	678	1.76
Kotido ³	L.Kyoga (50%)	-	36	678	1.76
Moroto	L.Kyoga	2,387	34	313	10.43
Nakapiripirit	L.Kyoga	1,512	26	675	13.03
Abim	L.Kyoga	-	54	270	2.74

Water for production in Karamoja is critical. Although much less water intensive than crop agriculture, cattle need 15L of drinking water a day, and up to 100L if producing milk (Republic of Uganda 2008). The Karamoja Livelihoods Program reported that the infrastructure in need of the greatest attention was for water provision (Republic of Uganda 2008). Some surface water is present in Karamoja but often dries up in the dry season; therefore, adequate year-round water depends on storage (Figure 4, Avery 2014). Small-scale storage is done

primarily through valley tanks as well as some water ponds. Three large-scale dams provide year-round water (Taylor 2014).

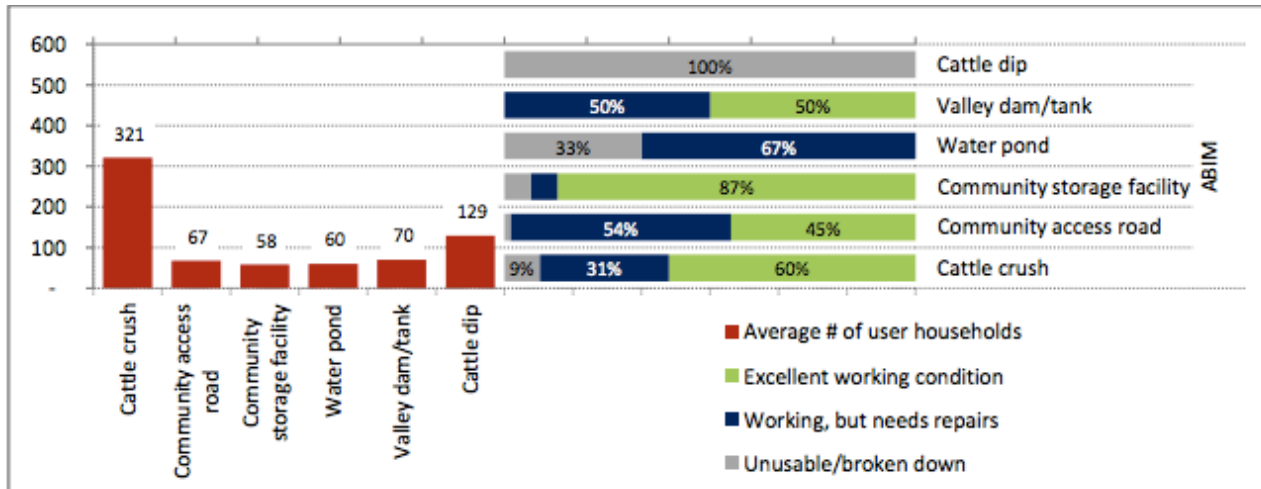
Figure 5. Average distance to water for livestock (Uganda 2008).

During dry seasons, many sources dry up, so herders may travel dozens of kilometers in search of water for their livestock (Figure 5, Republic of Uganda 2008). The government has constructed three large dams in Karamoja, which provide adequate quantities of water throughout dry spells, but bring many people and cattle into close contact, increasing the likelihood



of both livestock diseases and cultural clashes (Powell 2010, Taylor 2014). Many of the smaller ponds, tanks, and dams have dried out or filled with silt (Figure 6, Republic of Uganda 2008). With such limited options, the mobility shepherds rely on for their animals' health is drastically reduced (Levine 2010). In addition, almost every household in the region practices supplemental crop agriculture, which suffers from inadequate and unpredictable rainfall without irrigation (Levine 2010).

Figure 6. Number of user households and functionality of water source (Uganda 2008).



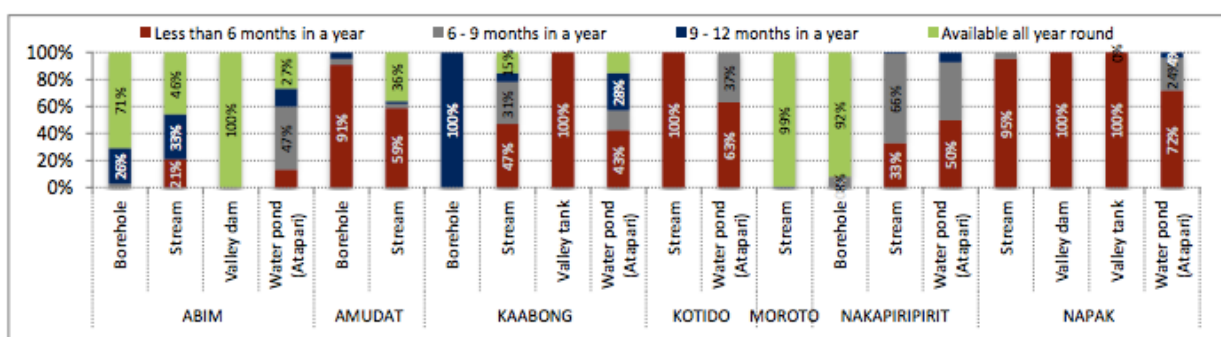
The main development program dealing with water provision is the Karamoja Livelihoods Development Program, or KALIP (Powell 2010). This program is carried out under supervision of the Ugandan Government but is funded by the European Union (Taylor 2014, Powell 2010). The national government partnered with three NGOs: MercyCorps, Arbeiter Samariter Bund (ASB), Dan Church Aid, and the UN’s Food and Agricultural Organization (FAO). The unifying goal of the project is to increase income for agro-pastoralists, while increasing local government capacities to maintain the changes (Powell 2010). To provide water for livestock, MercyCorps, ASB, and Dan Church Aid have constructed dams, water valley tanks, and ponds (Republic of Uganda 2008, Taylor 2014). The goal of the Uganda Ministry of Water and Environment is 21 new water valley tanks (three per district) by the end of 2014. In addition, the FAO is implementing 440 Agro-Pastoralist Field Schools (APFS) to educate farmers about optimal land and livestock management practices (Republic of Uganda 2008). The schools focus on water management techniques such as land contouring to utilize runoff, leaving certain areas uncultivated, installing drip irrigation at critical times and locations, and water harvesting in small dams and ponds (Ameny 2014).

Water for Domestic Use

Data on water for consumption is inadequate; although organizations keep close records of the projects they have completed, the extremely high rates of non-functionality have led to difficulties in estimating access to usable water (Hopp 2014, Taylor 2014). The majority of projects are focused on water for production rather than consumption, despite far from adequate access to clean drinking water (Ameny 2014). In 2010, there were 1253 boreholes in the region; that number, even if all were at full capacity, would yield approximately one borehole per 10,000 people. These water points are not evenly spaced; they naturally collect around high-populated areas such as Moroto Town rather than in the areas of greatest need. UNICEF is the main actor in drilling boreholes for safe drinking water (Taylor 2014).

Unfortunately, many of these wells are no longer functional; estimates show that as many as a two-thirds of boreholes are broken from overuse or provide salty water (Taylor 2014, Avery 2014). Whether the water is salty because the water table has lowered or because the wells were drilled in a poor location is unclear (Spang 2014, Salim 2014). Many boreholes only provide water for part of the year; in the dry season, wells may not be deep enough (Figure 7).

Figure 7. Availability of water sources throughout the year by district (Uganda 2008).



Overall, water for consumption is less well-researched than water for production in the area and needs to receive greater attention by development organizations, especially in light of

the high diarrhea mortality rates and negative effects on women associated with travelling long distances for water.

WATER USE AND PRACTICES IN KARAMOJA

Agriculture

The greatest strain on water in Karamoja comes from crop agriculture. The Government of Uganda has long promoted agriculture and settled lifestyles in Karamoja (Taylor 2014, Ameny 2014). After the security problems and severe cattle raids, some families lost all their cattle, making crop agriculture a forced reality (Taylor 2014, Ameny 2014). Thus, families practicing only agriculture are often the poorest (Levine 2010). In addition to facing the most water stress, poor agricultural households are typically the most impacted by climate change and the most food insecure (Levine 2010).

Figure 8. Water resource demand in Okok sub-catchment (Avery 2014)

Water Resource		Water Demand in Year 2010 and 2017		
Water Source	Available Water MCM/yr	Water Demand Category	2010 Demand MCM/yr	2017 Demand MCM/yr
Surface water	180	Domestic	4.83	6.35
Groundwater	306	Livestock	8.12	9.99
-	-	Irrigation	505	665
-	-	Industrial	0.0024	0.0048
TOTAL	486	TOTAL	518	671

Despite studies showing that in much of the Karamoja region, rainfall is too sporadic for consistent crop production, the government still prioritizes crop agriculture as a livelihood. The National Irrigation Plan is currently being developed, and has identified several areas in Karamoja to turn into large-scale agriculture projects. This would require enormous and expensive water and irrigation efforts and dramatically increase the total quantity of water used in Karamoja. Despite being necessary for grazing livestock, many rangelands in Karamoja are

seen as underutilized and in need of agricultural development (Avery 2014). Much of the population increase has occurred in the ‘green belt’ or agricultural areas of Uganda, including migration to these areas from elsewhere in the region (Ameny 2014). Unfortunately, studies have shown that the volume of increased irrigation needed to support even the existing agriculture would easily exceed available supply (Figure 8, Avery 2014). This, in turn, could strain other sectors such as water for livestock and domestic use (Figure 8, Avery 2014). The FAO and governmental groups are experimenting with quick-maturing or drought-resistant crops to increase reliability of agriculture, but effective measures to prevent agriculture from depleting the water table have not been adequately discussed or implemented (Ameny 2014).

Livestock

The second greatest use of water in Karamoja is for livestock. The traditional—and arguably most productive—form of livelihood in the Karamoja region is cattle production (Levine 2010). Cattle require approximately 15L of water a day, but this figure can be as high as 100L when the cattle are producing milk, a significant source of nutrition for the Karamojong. Traditionally, tribes moved with their cattle during the dry season to find water sources, and much of the population remains semi-nomadic. However, fragmentation of the land due to agriculture, settlements, and national park gazettement has reduced effectiveness of these nomadic routes and rendered watering cattle more difficult.

When provided with adequate water through storage tanks and water ponds, water for livestock is unlikely to create water stress in the region. A main challenge considerations in this area will include constricting enough small and mid-sized water sources to prevent large watering points from contributing to over-grazing of livestock. Additionally, these water points

must be well-designed to capture water efficiently; retain enough to avoid long journeys for water during the dry season; and be easy to manage by the community.

Alternative Livelihoods

In addition to increasing the effectiveness of crop agriculture and livestock production in Karamoja, development organizations are working to increase the viability of ‘alternative livelihoods’ (Republic of Uganda 2008). Economic and employment opportunities in the region are low; therefore, in bad harvest years families are often forced to turn to destructive coping mechanisms (Ameny 2014). Rather than truly replacing existing livelihoods, alternative livelihoods development aims to augment families’ earning but avoid unsustainable compensatory practices (FAO 2013).

The most common “negative” coping strategy is charcoal production, which involves cutting down and burning large stands of trees. This practice is extremely tree-intensive and has already led to the destruction of large amounts of forested land in Karamoja (Spang 2014). Trees hold in groundwater, reduce evaporation, mitigate wind, and effectively stave off desertification. Therefore, encouraging more constructive coping mechanisms such as honey production and cereal banking is important to preserve Karamoja’s landscape and water supply (Ameny 2014).

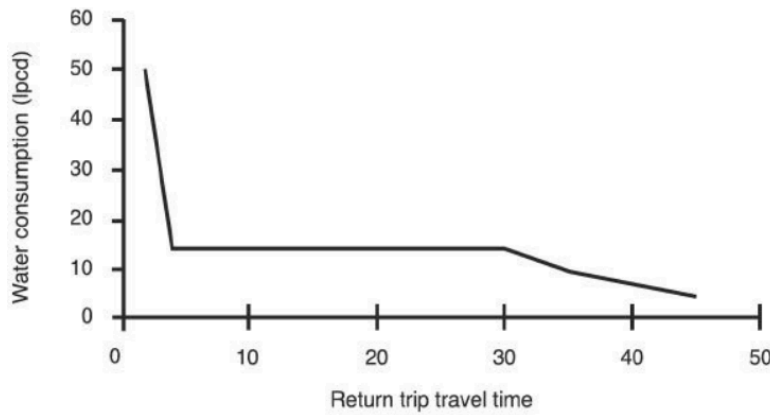
The alternative livelihood which receives the most attention from the Ugandan government, due to its high investment potential, is mineral mining (The Guardian 2014). Unmechanized artisanal mining has long been practiced by locals during the dry season, however, larger companies are now looking to move into the area. Mining is inherently extremely water-intensive and carries high risks of contaminating nearby sources (Human Rights Watch 2014). This problem is proliferating as larger companies move in and exploit limited water resources without community members’ consent. So far, mining companies have failed to inform

communities about the impact that the mining would have on their environment, specifically their water, and have formed no plans to mitigate these risks (Human Rights Watch 2014).

Domestic Use

Domestic water is by far the smallest quantity of water use in Karamoja. A Karamoja official estimated that people use around 5L of water a day (IRIN 2009). The minimum recommended water provision during humanitarian emergencies, on the other hand, is 20L per person per day (Spang 2014). Water consumption correlates directly with distance from water source; thus, the minimal water consumption highlights the inadequacy of access.

Figure 9. Water consumption compared to return trip (Mintz et al. 1995).



Although little data on water source and use is available for Karamoja, hygiene and hand-washing behaviors are extremely poorly practiced (DHS 2011). Salty borehole water and non-functional pumps have led to widespread use of non-improved water sources (Taylor 2014, Spang 2014, Salim 2014). With the focus on water for production, many communities now have convenient access to water valley tanks and ponds, and use these unimproved sources—intended for livestock—for hygiene and even consumption (Taylor 2014). Ponds, although preferred for taste and convenience, are dangerous sources because they are filled with polluted run-off (Oloya et al. 2008). Without also providing socially accepted sources of clean water, in adequate

quantities, close to people's homes, educational initiatives for safe water and proper hygiene have no chance of success.

RECOMMENDATIONS FOR STAKEHOLDERS

Water interventions in Karamoja still have a long way to go in order to effectively change the health and productivity of the region. International organizations, the national government, local governments, and NGOs all need to turn away from shortsighted relief and embrace the more challenging tasks of community involvement and environmental assessment to create true solutions for Karamoja rather than the Band-Aids it has received for years.

International Organizations

International humanitarian relief has been present in Karamoja since the 1980s. After three decades of food aid and relief projects, Karamoja is as destitute as ever. The international community has Karamoja on its radar, to be sure, but the way aid is targeted is not producing fruitful results. Much of this likely stems from treating Karamoja as a humanitarian emergency; since the civil war in the 1980s and the attacks of the LRA in the early 2000s, Karamoja has been seen internationally as an area of insecurity and crisis. With the best of intentions, the World Food Program has doled out food rations after every bad harvest and UNICEF has provided thousands of children with recovery feeding for malnutrition (UNICEF 2012). These short-term solutions, although doubtlessly saving lives at the time, have not been accompanied by enough sustainable change, economy building, or successful education initiatives, and have not ended the emergency-level rates of malnutrition (IRIN 2010). The World Food Program, the head of food aid to the region, gave food aid to 1 million people in Karamoja in 2009. Despite hopes to end the program in 2010, 155,000 people in particularly vulnerable households still depend on direct food aid as of 2013 (WFP 2010, WFP 2013).

After over forty years of attempted assistance, Karamoja is no short-term emergency; the only interventions that will truly change the trajectory of the region are educational, infrastructural, and social. The people of Karamoja need to take back responsibility for their lives and their community, and will not be able to do that without an increased sense of efficacy. Therefore, it will be the role of the international community to take the lead in encouraging actors to shift the budget from emergency relief to long-term efforts that will reduce the need for that aid. Current projects leave too little trust in the hands of the government; the KALIP project, for example, must refer to partners in the EU for major decisions. This can cause severe delays, particularly when work must be done in a particular season to be effective (Taylor 2014).

This also means greater focus on water quantity infrastructure, education, and maintenance (Spang 2014). International organizations such as UNICEF are often the coordinating bodies for multi-actor interventions. As such, they must pay greater attention to mapping existing water sources and planning the water use for the future based on hydrology, soil characteristics, and geology (Salim 2014).

The role of the international community in climate change is crucial. As the earth's temperatures rise, the rains in Karamoja are likely to become yet more unpredictable (Levine 2010, Avery 2014). The international community must continue to put pressure on individual governments to take more drastic measures toward mitigating climate change. They must provide experts and assistance to low-income countries, which are likely to be the most affected, to better understand the changes taking place and create policies that mitigate the impacts and focus on the future rather than the present.

The global development community is preparing to transfer to the Post-2015 Development Agenda that will replace the eight MDGs this coming year. Having more specific

attention paid to water, instead of intertwining it within other MDGs, may bring it more to the forefront of donors' priorities (Salim 2014). For example, GIWEH, working with the government of Switzerland, proposes four water targets: universal access to water, sanitation, and hygiene; increasing water productivity for growth while respecting ecosystem requirements; managing wastewater to protect water resources and aquatic ecosystems; and increasing resilience to water related disasters (Mirzoeva and Salim 2014). Focusing on water access as a basic human right and a goal in itself, instead of vaguely intertwined among other targets, and recognizing the importance of environmentally sustainable water, will allow the development community to move towards true water security rather than short-term solutions.

National Government

The first and most important step that the Ugandan government can take to benefit the people of Karamoja is change the national attitude toward the region. Karamoja has so long been viewed as a source of frustration and failure that national discourse treats the region as a problem to be dealt with rather than an area to uplift or a source of economic opportunity (Levine 2010). However, if Karamoja is given full opportunity to develop, it could both finally become self-sufficient and export its livestock products to the rest of the country. Although less than 10% of the human population, Karamoja holds 20% of the cattle, 16% of the goats, and 49% of the sheep in the country; these resources could be used for trade both within Uganda and with surrounding countries (Avery 2014).

The government is gradually giving more support to livestock health, such as mass animal vaccinations and valley tank implementation (Ameny 2014, Taylor 2014). However, as late as the National Development Plan of 2010, the Ugandan Government still prioritized agricultural development over livestock support (Republic of Uganda 2010). Water for

agriculture causes as much as 90% of the water usage in Karamoja; with water tables already dropping, increasing the area of land in need of irrigation and the number of people reliant on adequate rainfall is dangerous and counter-productive (Levine 2010, Avery 2014). In addition, drip irrigation schemes are often destroyed by bush fires, trampled, or otherwise destroyed (Avery 2014). Shifting funding priorities away from expensive and often experimental irrigation projects and towards sustainable watering points for both humans and livestock, and keeping agricultural interventions at the small scale where it is traditionally practiced, will be both more water efficient and culturally acceptable (Levine 2010).

Uganda also participates in several regional partnerships. The Intergovernmental Authority on Development (IGAD) consists of ten countries facing many of the same challenges as Uganda, including large pastoralist populations. This group already has a focus on climate change monitoring, however, the actions taken have been limited. Using this partnership to develop concrete regional policies in regards to best practices for water use would both stave off future conflict and allow these countries to benefit from each other's knowledge. Uganda has signed to the IGAD treaty to protect pastoralists, however, these changes have not yet been reflected in specific action and legislation supporting pastoralism (Ameny 2014). The Horn of Africa Pastoral Network was created in 2009 to increase communication and cooperation between Horn of Africa countries and offer advice on improving policies and best practices (HoAPN 2010). Uganda has, improved relationships with neighboring pastoralists from Kenya by allowing more free movement across borders and creating joint animal vaccination programs and cross-border water structures (Ameny 2014). Partnerships like these, if used to their full potential, could impact the quality of policies and encourage use of scientific and expert knowledge when devising development plans.

As of 2014, the national government still had no regional water management plan for Karamoja. This is particularly dangerous because even small-scale projects in an area as fragile as Karamoja can have significant consequences over time (Republic of Uganda 2008, Avery 2014). A regional water management plan is currently being drafted, which will hopefully create a more cohesive vision and less haphazard implementation process. As the population rises and demand increases, boreholes and watering areas will need to be created more strategically with hydrology in mind.

No project should be begun without first carrying out an environmental impact report. Unfortunately, reports show that Environmental Impact Assessments, while expected by the Department of Water and Resource Management, are not taken seriously and often bypassed altogether (Avery 2014). Taking EIAs more seriously would hold CSOs and NGOs accountable for their projects and ensure that they are thought through prior to implementation. Different NGOs produce different quality work and have different priorities; it is up to the government to provide coordination and ensure that all NGOs follow certain standards in regards to both quality control and environmental protection (Taylor 2014). The national government should prevent private, unregulated well drilling and keep close records of the water projects that are undertaken and their impact on the water budget of the region (Salim 2014).

Both national and international projects need to focus on infrastructure. During the rainy season roads are often impassable, cutting Karamoja off from the rest of the country (Taylor 2014). This severely inhibits communication as well as economic activity. Maintenance of major roads both within Karamoja and to the surrounding regions will dramatically increase its ability to develop.

Local Government

The foremost reason for the failure of water projects in Karamoja has been the lack of community-level investment. Local governments in most districts fail to complete their expected functions. Workers complain of lack of funding, understaffing, and logistical problems. Ideally, the local governments, as leaders of the community, would be the main source of guidance for water development (Draganic 2014). However, as district offices cannot complete their existing tasks, much less increase their capacities, they need increased support and intensive capacity building efforts. Local governments should eventually take full responsibility for water resource management by controlling placement and quantity of water sources and taking charge of monitoring of the systems to ensure functionality. This will require decentralization and significant support from the national government (Draganic 2014, Salim 2014).

There is also a lack of community-level investment in assets. Public goods are often not seen as the community's responsibility to fix and instead people expect outsiders to come fix things like broken boreholes or silted tanks (Taylor 2014). Local leaders will have a huge role in the coming years in shaking the problem of aid dependency and encouraging citizens and communities to invest in their own resources.

Non-Governmental Organizations

The first goal of NGOs should be to support the local government's priorities. The water interventions that have had the greatest impact have worked closely with the district governments. Increasing functionality of water provision is the third direct objective (behind support for crop agriculture and livestock) in the Karamoja Food Security Action plan for 2009-2014 (Office of the Prime Minister 2009). Therefore, NGOs should focus as much as possible on financially supporting and helping to implement government-instigated projects, rather than acting independently.

With development agendas focusing more on water, and with the increasingly stable security situation over the past few years, NGOs providing water interventions have proliferated. However, the focus has often been on quantity over quality; organizations, in attempts to save money, are using ineffective designs and low quality materials (Avery 2014). Boreholes break down shortly after construction or provide salty water; drip irrigation schemes melt in bush fires; valley tanks fill with silt (Avery 2014). NGOs must use their resources more wisely by consulting experts on location, design, and materials instead of implementing wide-scale but ineffective interventions.

Secondly, the main aspiration of NGOs should be to provide interventions that benefit community both wants and needs. Projects are carried out without nearly adequate community involvement and sensitization. Boreholes are frequently destroyed by vandalism because community members see ox carts as more important than boreholes and take screw and bolts from the pumps. Community members use livestock ponds for bathing and even drinking despite provision of boreholes. Having legitimate involvement in every construction process will allow communities to both see how projects are done (and how to fix them later) and create a sense of ownership, which is often lacking in Karamoja (Avery 2014).

In addition to direct community involvement, education of women about water use, storage, and hygiene will greatly increase the potential impact of water-for-consumption interventions. Excess water has not traditionally been available in homes; therefore, hand-washing and other hygiene practices are rarely practiced (UNICEF 2009). These behaviors need to be ingrained in cultural norms through extended and intentional education programs to allow water quantity to lead to decreases in diarrheal and other water-borne diseases. Formal

educational attainment in Karamoja is extremely low particularly among girls, so NGOs must take on some responsibility for community-based education (UNICEF 2009).

The final and perhaps most important failure of NGOs in the past has been inadequate maintenance strategies. Although most projects include some provision of monitoring and evaluation, most of the maintenance plans are in name only. Often, NGOs complete a project, record everything that has been done and to what extent their original plans were completed, and then move on (Taylor 2014). Most of the time, there are no funds allocated to maintenance; projects are handed over succinctly to the communities. However, many communities in Karamoja do not have the capacity, and certainly not the funds, to maintain their own infrastructure. Fully successful maintenance strategies may include leaving behind paid personnel and additional parts or funding to buy replacements as needed. As mentioned above, better-designed projects that are less easy to vandalize, break less easily, and truly involve the community will have more success in maintenance. Specific and targeted efforts to build community and local government capacities will hopefully increase self-sufficiency in the future. In the meantime, NGOs must take greater responsibilities for their own projects and plan beyond construction in their budgets and strategies.

CONCLUSIONS

This study has found that traditional aid strategies have not succeeded in Karamoja due to its unique history, livelihood strategy, and climate. More than half of the population of Karamoja lacks year-round access to clean, potable water. This has severe implications on health, educational attainment, gender equality, food security, and economic production. Inefficient water use for agriculture has lowered the water table, hurting water for production and domestic water alike. Currently, water provision projects are implemented on a reactive,

emergency basis (Avery 2014). These projects are often shortsighted, poorly constructed, and done without full community involvement (Avery 2014).

As the population continues to rise and climate change makes rains less predictable, a unified water plan for the area is necessary. National and international policies must become more sensitive to pastoralist issues instead of encouraging settlement and crop agriculture in drought-prone areas. Communities, in turn, must learn to be environmentally sustainable with water use, and to take responsibility for their water infrastructure, and local governments must have the funds, staffing, and capacity to support the communities. Water for production should focus first on water for livestock production and second on the irrigation of existing small-scale agriculture. Domestic water projects should focus on reducing distance to water for consumption and hygiene and education about hygiene and water safety.

This study of Karamoja has several limitations. The most significant is in regards to the limited data on the Karamoja region; the conditions of infrastructure change so quickly that assessing what communities truly have access to at any given time can be difficult. Until improved maintenance strategies are implemented and continuous monitoring of all water sources occurs, full understanding of the water situation is difficult. More research needs to be undertaken in the area of water for domestic use. Although many communities have access to boreholes, barriers to use (such as poor taste or low quality) are not well understood in the literature. Increased community involvement is central to the success of water interventions, so locals' relationship with development projects, with the government, and with NGOs, and their capacity for self-sufficient projects, should be investigated and enhanced.

The problem in Karamoja is not inherent inability of the people to care for themselves, but failure of existing structures to allow them to do so. Water interventions could decrease the

high morbidity from both diarrhea and malnutrition, increase gender equality, and promote economic development and food security. If Uganda ever hopes to lift Karamoja out of poverty, effective and comprehensive water provision is the place to start.

Chapter II. “Long Time Ago We Were Not Near to Water:” Culture and Perceptions of the Borehole

INTRODUCTION

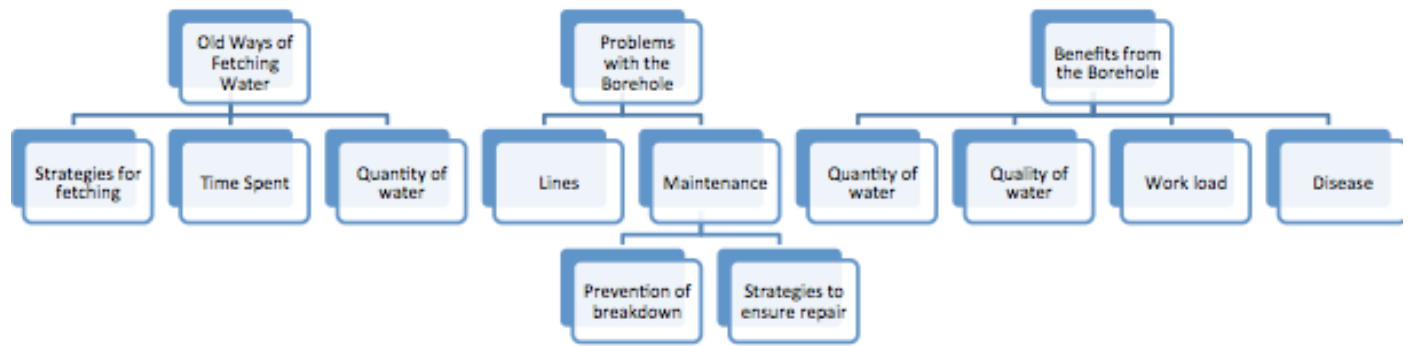
The focus group discussions were beneficial in further exploring the perceptions of the community towards clean water sources, their understanding of changes over time, and the changing cultural norms surrounding decision making, including decisions around maintenance of the borehole. Bokora society is gerontocratic, and therefore old women are in a well-respected position and have an important influence the decision-making in their communities. Decision-make is consensus-based; therefore, there was a tendency for all of the women to come to an agreement on a topic rather than argue opposing positions. We encouraged all women to speak out and asked for specific women’s opinions in the event that they were not speaking out, however, this cultural norm of consensus is an important consideration when analyzing the results of the focus groups.

METHODS

Two focus groups (n=18) were conducted among elderly women within two communities, Naakale and Kopetatum, to compare between current practices and traditional practices, and investigate cultural norms around borehole maintenance. Naakale has had a borehole near the village for several years, whereas Kopetatum just recently had a borehole installed. Both villages are long-standing with similar cultural practices. Translators from the communities mobilized the women both the two days before and morning day of the focus group to ensure maximum participation. Each group had 9 grandmothers and great-grandmothers participate. This demographic was chosen because women are typically the water carriers for their families, so these elderly women have seen and experienced firsthand the changes in water practices over the last 50 years. In addition, Karamojong society is gerontocratic, so understanding these women's and their husbands' expectations and thought processes provides a window into the ways in which decisions get made, specifically around borehole use, protection, and maintenance. The focus group questions focused on water and hygiene now compared to in the past, the impact of the borehole on the community, and the processes by which the communities intended to keep the borehole maintained and functioning.

The focus groups among old women were translated and transcribed by two native speakers of Karamajong. They were analyzed and coded by the principle investigator. The answers were coded in terms of three major themes of the questionnaire, which are old ways of water collection and use, benefits of the borehole, new problems which have arisen with the borehole, problems with using the river, and maintenance of the borehole. Within each original category, sub-categories were deductively defined based on participant responses. The node tree demonstrating the organization of the results of the analysis are demonstrated in Figure 10.

Figure 10. Node tree: Framework for Focus Group Analysis



RESULTS



Jerrycans



Borehole



Clay carrying pot

Former norms for water collection

The old women participating in the focus groups grew up before jerrycans and boreholes were introduced into the community. The women described their strategies for fetching water. In addition to characterizing differences, women often referenced the impacts it had on their time and the quantity of water available.

In general, women molded pots out of clay or carved out large gourds and used them to collect water wherever it might gather. In the wet season, this was typically a small river or

pond; in the dry season, it was likely to be stagnant collected water. Women described a sense of urgency when the rains came to immediately collect available water.

“We could fetch stagnant water from a big hole.” -Kopetatum

“Long time when boreholes had not been drilled, we used to fetch water from the river but nowadays you just go with a jerrycan to the borehole.” -Nakaale

“When the pumpkin grows we get and we make a water container.” -Kopetatum

“Then when the clouds are ready to fall when it starts drizzling like this we could run and fetch from the roads the stagnant water. The one which water can flow on ground.” -Kopetatum

“When it reaches rainy season, it rains. We again go to the holes and rivers.” -Kopetatum

“When it starts raining like this we again run to the rocks and we start fetching water before it disappears.” -Kopetatum

Women seem to recognize that their water sources in those days were not safe from disease agents, and described their strategies to combat their unclean water. One woman described boiling the water, and two mentioned distilling, or straining the water through a cloth to remove the particles.

“Then we boil so that it doesn’t smell so that we stay with it.” -Kopetatum

“Then we drink the dirt settles down the container and they start distilling.” -Kopetatum

“Dry season when the rain falls we fetch water and we put in the pots. Then we distill we distill [strain through cloth]. We use for staying for some time. This very water is the one we are using for sometime, also use for drinking alcohol.” -Kopetatum

Women also discussed the impacts that the water scarcity had on their consumption.

After spending an entire day to collect pots of water, they might not travel to get additional water for days.

“Then we get water from that river... We could stay with this water for five days.” -Kopetatum

“The water used not to be there. Thirst.” -Kopetatum

“Water was not flowing, during dry season we dug the holes.” -Nakaale

One of the primary strategies for getting water in the dry season, which is still used today in communities lacking access to boreholes during the dry season, is digging into the riverbed until water is found. The women described:

“We remove the soil then fresh water comes.” -Kopetatum

“Then it transport when it reaches dry season, then we go and we dig the hole and we remove soil and we get fresh water from down.” -Nakaale

“People like pumping [from the borehole] because it is easy. It is not like long ago where they would dig the ground. They could dig the ground like this until the water comes out from down. They get heaps of soil like this.” -Kopetatum

“Even though you are carrying your child you enter inside the hole.” -Kopetatum

“The borehole is like when you are digging the hole there are four people, men. They will gather women and say women of the home all come and we get the cows, we dig and dig and dig and we come back home that day when water has not come.” -Kopetatum

The time that it used to take for women to travel collecting water, particularly during dry season, was a recurring theme among the groups. Women described having to walk to the mountains to find streams and ponds there rather than in the drier flatlands. Eventually, as boreholes began to be put in, women would walk long distances for well water rather than for standing ponds.

“When it becomes dry season water gets disappeared, then we start fetching from far places.” -Kopetatum

“We could leave at evening hours...going to fetch from Loteleleit.” -Kopetatum

“When at night when the star raises we go to Nabilatuk to fetch water.” -Kopetatum

“It was far where we used to go and fetch from. It was two times and coming back and then we drink. When rain season comes then water becomes common or abundant.” -Kopetatum

“Long time ago we were not near to water, water was too far from homes. We could go to fetch long distances. Like from here up to Lolacat. We could leave at night and carry the calabashes and pots then we bring water and we put down. Then we drink that one water when the sun comes here when it reaches 2:00pm then we leave and we bring again water and we put here.” -Kopetatum

“Long time, the borehole of Apaopota is the one we used to fetch up to even evening hours and also til the moon goes down.” -Kopetatum

Alcohol preparation is a type of water use with huge cultural significance. Local beer, prepared from sorghum, is historically ubiquitous at group gatherings, prepared and given out or sold by the women. Follows is a detailed description of the process of beer preparation and the access to water it requires.

“We could go three times you get your flour with hands even though it reaches evening you grind and your yeast when the sun is like this you go for your flour and yeast then water from the river then you mix when it is not enough you go for more. You could put the grinding stone and you start grinding when you finish you go for water and mix and when the sun come here you go again and again when you bring for cooking. When it becomes ready we cover when time for taking comes, it can even reach ten times. When you’re still going back to the borehole fetching water which people use. When you prepare alcohol for your husband or for your in-law put it to a drum, they have not yet come by that time, a pot of this size. Pots even though they are ten and what water could be filled in we sing up to morning, when the children are fetching water others grinding while playing all night.” -Nakaale

Benefits from the Borehole

In addition to detailing their past strategies for water collection, women described the positive changes that they experienced with the addition of boreholes to their villages. The discussed the boreholes’ popularity over the river. The two benefits noted most often were the convenience: having to travel less far and not needing to dig for water during the dry season; and disease prevention.

“Nowadays boreholes have come. We no longer fetch from the river. Only bathing.” -Kopetatum

“No one still steps to the river.” -Nakaale

“The borehole water is the clean one.” -Nakaale

“The borehole is very near when you need to bathe. Long ago we used to fetch from the river before drilling the boreholes but nowadays we all fetch from the boreholes.” -Kopetatum

“We used to drink from the rivers and borehole of Ngingalom up to when we went to the closer one for the school when you feel like. You go to the borehole, you go to school, if not you go and dig the river and you remove the first water then the clean one will come from the sand. Now we have left that because the boreholes have come.” -Kopetatum

“Even for the other one from the home of Ngingalom when the river becomes full it became impossible to pass and fetch water and coming back. That is why they drilled this borehole.” -Kopetatum

“The borehole has given us a chance, it prevents diseases.” -Nakaale

All of the women identified the river with potential contamination and dirtiness, describing the fact that it is only fit for bathing due to maggots, contamination, and diseases.

Women were afraid of insects such as maggots (a general term for germs/dirt/dirty things in the water), leeches, and frog eggs in their water.

“There are maggots.” -Kopetatum

“What we call maggots and the eggs of the frogs.” -Kopetatum

“There are leeches those long worms when you go they bite. They take blood and when you try to remove the blood comes out.” -Nakaale

The old women were concerned about diarrhea (“cholera” is used generally), which is likely due both to education and the experience of a cholera epidemic in 2010, as well as generally the effects that the dirt off other people’s bodies could have if ingested.

“They said that leave water for the river it contains cholera.” -Nakaale

“Again this water you use fetching people are still bathing. You will fetch and drink and later you will get cholera. Mother it is good for environment to be clean.” -Nakaale

“The river, people bathe also, cows also, then when you go again you start fetching you drink, so you get also some cough, diarrhea.” -Nakaale

“Somebody will go and bathe while for you, you will be fetching water from the other side not knowing that somebody is bathing.” -Nakaale

“From where the water flows they go there and start washing clothes, then you start taking and you will suffer from cholera.” -Nakaale

“It is very short from the river, it is bad, what the river transports is bad, because it comes whoever will fall sick will come and contaminate water then when you go you take and start bathing with cholera, and you will take that water and you will feel pain in your throat.” -Nakaale

“You will take and fall sick, like one will come and defecate into the river, when he/she is already sick. Then when you take you fall sick automatically.” -Nakaale

“We are tired of this [river] water. The moment you taste you fall sick. Now I tell you, help us the borehole and you repair only that.” -Nakaale

The final concern about the river is the distance over which it can carry rotten animals or other contaminants. One woman mentioned feces specifically, although it was unclear as to whether she was concerned about human or animal excrement.

“The river can transport even some animal when it dies even when it rots.” -Kopetatum

“It can transport even feces.” -Kopetatum

“The river water can become bad like when feces are thrown, the dead and the dirty water will be in the river and it makes water not to be taken.” -Nakaale

“The river can transport even some animal when it dies even when it rots.” -Kopetatum

The sense of disgust expressed for river water might be partially biased based on an incident that had occurred in the community in which a woman had died of HIV and her family reportedly placed her body in the river because they were unable to afford a burial. Due to fear generated by this incident and general stigmatization of HIV, the river was particularly offensive to women at the time of interview.

“Yes I went last month to Tokora hospital there were some three people who were brought from Kaiku and when those people died they threw them in the river. I was also there with my child who was sick. That is why I was saying the river water is never safe. So we became happy when the God Jesus and our leader drilled for us the borehole, then I said it was better for the borehole to be there.” -Nakaale

“The river erodes everything. Like some [dead] body whom it will carry it will bring. Even snakes it transports. Even AIDS patient can urinate in the river.” -Kopetatum

“The river water is never safe in the way that they bring even the AIDS patient and they throw him/her there, even for TB also comes and bathes and coughs while spitting into the water and putting mucus.” -Nakaale

“The river called Nalyakat from Tokora is bad because they throw the dead people and whatever to the river then they make others to drink bad water.” -Nakaale

One important distinction was the interpretation of livestock and their drinking habits. Women specifically mentioned when discussion old patterns of behavior that they would drink from the river like the animals. Then, when the boreholes arrived, they shared this too with the livestock. This is an important representation of the cultural importance of the cattle; rather than

using the improved water source to distinguish themselves from their livestock, they shared their improved conditions with their animals.

“Because that is the borehole, we no longer dig the hole. Even the animals are using the borehole.” -Kopetatum

“What has made people to relax from digging the ground digging the ground.” -Kopetatum

“It’s only the animals go to drink water from the river.” -Nakaale

“Like in the past, we would fetch water from the rivers where animals could drink and also nowadays we get from boreholes.” -Nakaale

Problems with the Borehole

One of the most interesting findings of the focus group discussions was the prevalence of the idea that the need for boreholes is a recent development. Women felt that although they are grateful for the boreholes and feel that they are necessary in modern times, that the water they drank as children did not cause as many problems as it would now. Several women voiced the view that although boreholes were not always necessary, nowadays they are not even enough to stop the diseases.

“There were maggots. There were no diseases. Sometime back the diseases came. Long ago they could distill the maggots and start drinking but nowadays they have said that there are diseases. The disease is nowadays cholera. It becomes the moment you take, you fall sick.” -Kopetatum

“It was like that but nowadays water is abundant. Likewise to boreholes but long time ago we could take this water there was no disease which was common from people. We didn’t know about health centers even the young children were given local medicine to drink.” -Kopetatum

“But one time back the immunization was introduced. They said bring the young children to the hospitals but there is too much sickness.” -Kopetatum

“Even nowadays there is abundant water from the boreholes, there is too much sickness. Every day they are taking a child to the clinic. It was not there during our days.” -Kopetatum

“The sickness was less. Because it is rampant now, the government brought near the borehole. Everything is near now even the drugs for the young children. It has brought we no longer take the local ones it is only modern ones.” -Kopetatum

“Nowadays there are many diseases, like AIDS, gonorrhoea, if somebody urinated into the river from the other side it is easy for you to get infected if you take his water of the river.” -Nakaale

A common challenge to borehole users is that long lines form during the dry season.

When small streams and rivers dry up, women who typically use natural water sources for some or most of their water need to travel instead to the borehole.

“What about during dry season could the lines from the borehole be long? That time when there is shortage of water.” -Kopetatum

“Lines are many from the borehole during dry season. The line from the borehole could stay up to evening.” -Kopetatum

“We shall still follow like that even though it reaches evening, no one will flake and leave theirs. The other one will put and the other one will also put her jerrycan, the line is like the way we are standing.” -Kopetatum

During these circumstances, the volume of jerrycan that a household owns becomes particularly important; if you are only able to get through the line once or twice in a day, the quantity of water you can carry in one trip could become a limiting factor.

“It is according to the size of the jerrycans if you have a big jerrycan you will fetch enough water and if you are committed you can even go back for another turn or round.” -Kopetatum

“When you are following the line, the line is long when you still go back. When you go, you will have to put your jerrycan behind theirs while they also be going forward.” -Kopetatum

“They are many [in the line], they can even reach ten, thirty, and twenty.” -Nakaale

Often, boreholes become rusty over time and parts are not replaced. Typically, the water is red or brownish in the morning and clears as water is pumped through; however this is a potential limitation on the hours available for water collection. Women did not view this as a serious problem with the borehole, and rather as an inconvenience that could be avoided.

“There is morning rust.” -Nakaale

“When we collect soil and we set there, it will be muddy even where we get the dirty water had entered inside the borehole and it is smelly.” -Nakaale

“Mothers, when you fetch water in the morning, what spoiled the water of the borehole? They had got water when it is spoiled. They had got water when it is yellow.” -Nakaale

“When it is day time the water becomes OK.” -Nakaale

One important problem with the borehole is lack of maintenance. Participants described the cement surrounding the borehole cracking, and being faced with the challenge of collecting water from a broken borehole, which would be more likely to have “worms,” or visible debris, in the water. The word “spoiled” was most commonly used to describe a borehole which had become cracked or otherwise nonfunctional.

“Only rusting, if there are no worms.” -Nakaale

“The time of repairing the borehole the cement was not fixed very well.” -Nakaale

“From the beginning here, and even the cement had fell down.” -Nakaale

“It is broken and it is appearing bad.” -Nakaale

Due to problems in borehole management and repair previously noted in Karamoja, the women in the focus group were also asked to describe the processes by which they prevent the borehole from breaking as well as the pathways they would take to repair the borehole in the event that it breaks. The primary maintenance strategy upon which the women agreed was to assign a watchperson over the borehole, to stay at the borehole and ensure that it is not abused, parts are not taken or broken, and that the surrounding area is kept clean.

“We shall first sit, we first sit and then we say let’s get a person so and so to be seeing the borehole and we all choose and all people agree in all their hearts that we put so and so, so that all people will come and fetch while sweeping the borehole and trimming as well.” -Kopetatum

In terms of day-to-day upkeep and care of the borehole, the women stated that the ideal would be to have a community member as the “in charge” who would regularly provide cleaning, upkeep, and protection of the borehole. However, neither of the focus group communities had implemented that strategy, due to financial constraints.

“There is no one in charge, no one was got to become the in charge.” -Nakaale

“You bring stones and put, after that you bring the sun. Now also the in charge wants to be paid.” -Nakaale

“We want the other borehole to be repaired, after that we put some one in charge to keep it clean.” -Nakaale

“Who will be paying the person who will be appointed? None in this poverty.” -Nakaale

“Then when their leader accepts that they will repair then they will get the in-charge now.” -Nakaale

In addition, the women noted that it is the responsibility of the youth to wash the cement and keep the borehole clean. Hygiene surrounding the borehole may be particularly important considering the frequency of livestock use; although a currently uninvestigated pathway, livestock feces and saliva on the borehole could serve as an early opportunity for contamination of improved water.

“We shall wash, we shall sweep.” -Kopetatum

“Who will wash, is it you? You or is it youth? It is youth.” -Kopetatum

In the event that the borehole does become “spoiled,” or broken, the women agreed that it would likely be necessary to collect money, and that this would be done on a household-by-household basis. They were also clear that their first priority would be to consult the government local chairman.

“We shall say when it gets spoiled. We shall say all the homes should collect money.” -Kopetatum

“What if the borehole gets spoiled, will the men also do something? They will tell other elders to collect money for somebody to repair the borehole.” -Kopetatum

“This the men (elders) to be in charge.” -Kopetatum

“Every woman should get money and gives to the old men.” -Kopetatum

“What about if the money is needed for repairing the borehole, will it be one person to get the money? Everybody.” -Nakaale

“What about when you go where will you go to the very first person or to the chairman first to ask what to be done? We are supposed to first go to the chairman.” -Nakaale

When asked what would happen in more complicated situations (if people refused to give money, or if the community could not decide how to go about the repair), the old women

emphasized the importance of the borehole to them. They noted that if it became broken, they and the old men would do everything they could to keep the borehole.

“What if the old men refuse to sit together, what would be the next step? They will not refuse. Because it is the very water we drink. What has made people to relax from digging the ground digging the ground.” -Kopetatum

“What if all people refuse to pay. What will you do? They will pay. Who will not pay? He who doesn't eat, doesn't drink water. There is no one to chase but he/she will also look for money when she get she pays.” -Kopetatum

“There is the answer here. If the borehole gets spoiled and the mechanic refuses to come to repair, and the people agree to collect money like and use for repairing our borehole to whom shall we collect to.” -Nakaale

“They will say lets go back to the very mechanic who repaired last time to help with the borehole. They go and borrow that they help us once more.” -Nakaale

“You the old people should go and awake other old men so that they go to the government to the very one who repaired again.” -Nakaale

The women had positive views overall of their local government representative, the chairman. The chairman is typically appointed to a small region, covering a few villages, and is responsible for bringing the community's concerns to district officials and dealing with outsiders as well. They felt confident that he would intervene and get the government to repair a broken borehole. Women discussed the collaboration between the old men (elders) and the chairman; they said that if a borehole was broken, the old men would reach out to the chairman, who would suggest to them an amount of money that would be needed to the borehole. It would then be the responsibility of the elder men to collect that money from the households in their manyattas.

“If things become impossible, we all go saying we do not have money I do not have money you go to somebody let's go to the chairman so that he goes somewhere else.” -Kopetatum

“They will manage, we shall go and tell chairman that the borehole is spoiled help us. We are going to get money and give it to chairman.” -Kopetatum

“What if the chairman is refusing the elders again. He will not refuse because it is his work.”

“What about if they say they are repairing the borehole, who will get the money? All the people who drink from this borehole.” -Kopetatum

“Who will tell you that you get the money? It is the chairman. Old men will get up and say get.”

“Then mothers that, whenever the borehole gets spoiled, how much money shall we get per family? Tell us. It becomes much. Because somebody will get one thousand shillings and another one five hundred shillings.” -Kopetatum

“Each person will get how much money from her family? Then you put together.” -Kopetatum

“You first listen when the borehole gets spoiled this home is made together with that one every family will have to get one thousand shillings from their home and other homes every family one thousand shillings.” -Kopetatum

“It is the old men to go and talk to and say help us once more we have nowhere to go and fetch from water our borehole has got spoiled.” -Nakaale

One woman stated that if the old men refused to sit and discuss the matter together, that no further movement would be possible and the borehole would simply remain broken.

“What about if the old men are not to sit. What will happen to the borehole. Nothing. Then it stays and becomes old.” -Nakaale

Another, however, disagreed, arguing that if the men refused to sit and come to a decision that the women would be able to take matters into their own hand and find a mechanic or a government worker who would be able to help.

“Even us the old mamas will arise and go to the one who repaired last time.” -Kopetatum

The women specified that typically, although it would be the elder men’s and local chairman’s responsibility to ensure that the borehole got fixed, it would be up to individual women to find or gather the money. This reflects the role of women in Bokora society, in which women are typically in charge of the manyatta. They perform most agriculture, and do additional work to find supplemental money.

“Even though one man has five wives, even he will have to pay five thousand shillings.” -Kopetatum

“Is it men to get this money or is it ladies? Women. Every woman from her family.” -Kopetatum

Although several women expressed the opinion that due to the extreme importance of clean water, the community would rally together to do whatever it took to restore a broken

borehole, many women also stated that their personal poverty was too great and that others, and the government in particular, is responsible for ensuring that the boreholes remain functional.

“Will it not be like getting money, then people will have to get. This issue should be presented to the government because as per now we are helpless.” -Nakaale

“Like long time ago also, when they could say that the borehole is spoiled, then the people present who were said to be overseers are supposed to pay. I do not know that group whether they paid. We get what money?” -Nakaale

“I tell you that the government is supposed to help us now. The hunger is affecting us. Where shall we get money from? Yes where shall we get from when we staff like this? Like now we have awoken our heart here now.” -Nakaale

“We go back to the government who helped us even the last time.” -Nakaale

Children were an additional concern because often they go to the borehole independently of their parents and are found bathing and playing in the borehole. The ways in which the old women discussed dealing with young children potentially causing damage provides further insight into the disciplines and overarching community structures. In particular, there is a community-based approach to childcare. It is acceptable for someone who is not the child’s parent to discipline and even administer corporal punishment to a misbehaving child.

Additionally, it is common for older children to discipline and teach their younger siblings.

“They get, only the small ones are the ones which do not hear.” -Kopetatum

“Some child hardens his/her head. But those who are wise will hear and understand but those youngsters never.” -Kopetatum

“Some remember. No one will come to teach like when your children are orphans it is only God to teach them or the bigger ones will teach them that do this and that.” -Kopetatum

“Like when she goes to jump jump around with the borehole. Jumping and splashing mud around the borehole. Well our people have authority when they get them from the borehole or the river doing what will make them get drowned and tell them not to repeat that one more so that it doesn’t make you to get drowned.” -Kopetatum

“Like if she is big headed and the pedestrians also say so then you will discipline. If she runs you send the elder children to catch him/her or you report to the father when he comes late in the evening.” -Kopetatum

“That what if the child does it one more time being big headed, your disciplining she/his is not getting, what will be done to this daughter or son? There is nothing apart from disciplining if she/he accepts he accept and if not you give up. She/he will even die when you discipline regularly.” -Kopetatum

“Like when a child becomes undisciplined at home, when she/he goes out and she/he starts jumping from the borehole saying kuku-kuku-kuku then they will have to discipline. Then when she/he come back home you again discipline. That young child will not do it again.”

“What if you get a girl jumping while pumping the borehole, what will you do? We shall cane her properly.” -Kopetatum

“Anyone who finds her doing that should cane and they say do not do it anymore. If it gets broken who will repair.” -Kopetatum

“Not your sister or cousin is the only one to cane you but anyone who finds you.” -Nakaale

“She will also be punished then reported to her mother that she should do it no longer.” -Nakaale

Finally, women were asked to discuss the ways in which they teach their children and grandchildren about hygiene and water collection. The old women still have a lot of power in the community and reflect hygiene and behavioral norms, incorporating both how they were raised and modern practices. Old women were particularly adamant about teaching their young children to clean the jerrycan and wash their hands while at the borehole. This may explain the finding from the survey that women who used the borehole as their primary water source reported higher rates of hand washing than women who used the river. Water collection was also closely tied to direct needs for cooking; the old women did not describe collecting water specifically for hygiene. This finding was supported by the structured observation, in which very little water was stored in the compound. Women typically cleaned themselves and their children (with the exception of infants) while at the water source rather than in their homes.

“I will tell that you go and fetch water, you go and bathe, you go and fetch once more for cooking food.” -Kopetatum

“When she goes there to the borehole, washes the jerrycan and the hands also then she fetches the water.” -Kopetatum

“When you go to fetch water, you first wash your hands and your face and then you fetch in a jerrycan.” -Kopetatum

“When you fetch water you first wash the jerrycan, you put water then in the jerrycan.” -
Kopetatum

“And cleanliness, sweeping and trimming the grass and bathing well. Then cooking. Then you wash the plates. Then we start serving serving serving.” -Kopetatum

“We tell them that do not contaminate water when you fetch so that we take when it is clean.”
“I tell them that be fetching water for drinking, do not play in water, when you come you bathe and you be smearing where we sleep.” -Nakaale

“Just like when you get them when they leave contaminated water you get sick and discipline.” -
Nakaale

“Tell her that, children can go to the borehole to fetch no wasting time then go and look for vegetables, firewood, grind the sorghum and cook food and fetch water for bathing.” -Nakaale

“We teach them that sweep the compound, wash the face, get a tooth brush, get plates and wash.”
-Nakaale

“We tell the child go find fetch water in the jerrycan before you wash your hands so that they be clean and you cook food in a clean pot and then we eat then you sweep the compound. The case of your body you first wash your hands.” -Nakaale

The old women of Nakaale and Kopetatum villages highly value their access to boreholes, and provided a unique insight into traditional water collection practices, how this has changed since the arrival of boreholes, and community structures and attitudes regarding borehole maintenance and the community's relationship with the government and water-focused NGOs.

Discussion

The results from the focus group discussions echo and add to results found in previous studies in Uganda. Unfortunately, no available published studies focused on changes in water collection over time in Karamoja or a similar culture. Therefore, these women's description of their experience is unique. Their descriptions of walking long hours to collect water, collecting stagnant water in puddles before it disappeared, and using clay pots and hollowed pumpkins provide a vivid picture into the traditional Karamojong lifestyle. The shortened time to reach the borehole compared to their former water collection strategies is consistent with the Drawers of Water Studies, in which water consumption among rural households in Uganda was found to

have increased by 50% in the past 40 years (White et al. 1972, Thompson et al. 2002), as well as meta-analyses which connect distance to water to water consumption (Howard & Bartram 2003). The main traditional way to collect water during the dry season is to dig into the riverbed until water arrives, which is still practiced today. Although the women in this group expressed a preference against it, communities without a convenient borehole or whose borehole is out of service still regularly dig into the river to form their own wells.

Importantly, despite expressing gratitude that the boreholes are now present, and demonstrating a clear preference for borehole water for drinking, the women also felt that in the past, such safety precautions were less necessary. They expressed the view that although now improved water, hygiene, and medical services are important, it is only with modernization itself that they have become necessary (Mogensen 2000). This is consistent both with Karamoja's history itself: colonization, independence, climate change, and modernization of the country have all contributed to humanitarian crises in the region in recent history. The perception that diseases in general were simply less prevalent when these women drank stagnant and unimproved river water coincides with a time in history when the region was less plagued by outbreaks of violence, explicit government discrimination, and famine. This phenomenon is described in "False Teeth:" children's disease, diarrhea in particular, has become associated with social and spiritual causes (Mogensen 2000). In modern times; many cultures within Uganda have adopted the concept of "False Teeth," the idea of a disease brought on by external causes and bad circumstances rather than by germs or some concrete vector (Mogensen 2000). The remedy for this ailment is removal of children's teeth, a common practice and public health concern in Karamoja, which indicates that the idea of an increase in disease associated with modernization and political changes is heavily present modern Karamojong culture.

The women's discussion also highlighted the role of alcohol production in daily life. Women described their feelings that water was no good without sorghum to make it into beer, and described in detail the gatherings they had in younger days, when beer was more abundant. Alcohol has important cultural significance in Karamoja, both as a staple at group gatherings and as an economically important product for Karamojong women (Dancause 2010). My study introduces the point, unlike previous studies, that the proportion of household water used for alcohol production may be high in this context and should be taken into consideration when addressing total water needs.

Women were very appreciative of their access to clean water, and vehemently expressed their disdain for use of river water. Based on unpublished survey data, river water is still commonly used, but women used borehole water for drinking in the majority of cases. In addition to the cleanliness, women appreciated the convenience of the borehole; newly constructed boreholes are often closer to their homes than the river particularly as smaller streams dry up in the dry season. The two main perceived benefits of the borehole were decreased diarrhea and increased convenience in water collection.

On the other hand, barriers to borehole use included long lines during the dry season, failure to fix rusty parts (which causes the water to look dirty when first pumped), and failure to fix functionally broken boreholes. Previous studies on water supplies in Karamoja have found fault with water management and upkeep practices (Avery 2014, Taylor 2014). The conclusion of many NGO practitioners and researchers is that boreholes are installed with the intention of community upkeep, but that the communities fail to take matters into their own hands, and NGOs do not allocate monitoring and repair funds, resulting in a high prevalence of broken water sources (Avery 2014). The results of the focus groups add somewhat more nuance to this

assessment; although communities do have intentions and even plans in place to be able to protect the borehole from disrepair and vandalism, these plans have not materialized in either focus group community. Both communities agreed that their desired course of action would be to install a borehole watchman responsible for cleaning, weeding, and protecting the borehole, but neither community felt able to pay for such a person. In addition, there does remain a strong sense that if the borehole breaks, it is the responsibility of the person who built it, whether it is the government or an NGO, to fix it. In the short-term at least, borehole installers may need to deal with this cultural barrier rather than attempt to fix it, and simply pay greater attention to ensure that their boreholes remain operational. NGOs who are interested in building community capacity to care for the borehole should account for the potential need to fund an individual rather than expecting the community to collectively maintain the borehole.

Throughout the focus groups, women stressed the importance of clean water. Their true gratitude for the boreholes, and their distain for drinking river water, demonstrated some level of knowledge about disease transmission through unimproved water. They made clear that the water was critical to themselves, their children, and their livestock. Therefore, further interventions in the area should focus on how to access clean water or make your water clean and how to avoid contamination. Non-educational interventions should focus on making clean water the convenient choice rather than only the intellectual one.

Chapter III: Water Use, Health Beliefs, Behaviors, and Child Morbidity in Karamoja: A Mixed-Methods Study

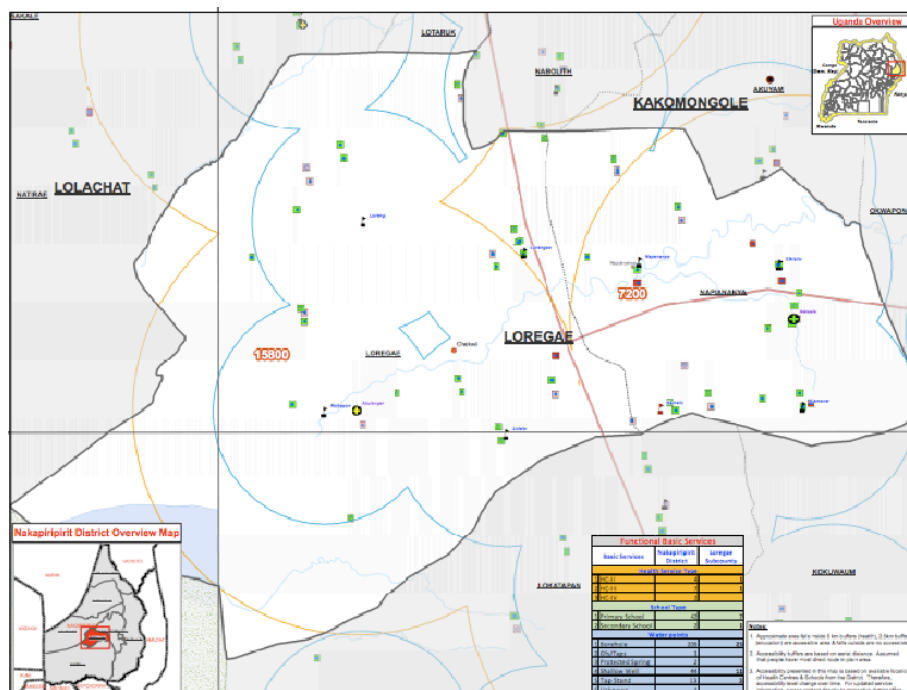
INTRODUCTION

Inadequate hand-washing and hygiene behaviors are a root cause of many of the most preventable infectious diseases in low-income countries (WHO, UNICEF 2014). More than 14,000 children still die each year from diarrhea in Uganda (Clinton Foundation 2012). This study examines the determinants of poor adherence to hand washing and hygiene guidelines and aims to understand whether mothers' failure to perform these essential child survival behaviors is primarily due to physical lack of access to water or to behavioral factors, and how these behaviors impact child morbidity. WASH interventions aim to improve health by reducing water-borne and fecally transmitted diseases by improving safe water access and waste disposal facilities, and by improving hygiene practices through behavior change strategies. Water quantity

has been shown to be more important than water quality in reducing child morbidity, therefore, access both to clean water and to adequate quantities are crucial (Fewtrell and Colford 2005).

This study was conducted in Nakapiripirit District, Karamoja Region, in northeastern Uganda. Due to longstanding political and economic marginalization, Karamoja lags behind the rest of Uganda in health and development indicators, especially those associated with hygiene (UDHS 2011). The majority of people live in rural villages in traditional compounds made of mud and wood. No running water is available, so the highest level of improved water source is a borehole. Latrines are not found in homes, so open defecation is common. Eighty-two percent of the population lives below the national poverty line (UDHS 2011). Fifteen percent of children die before their fifth birthday, and 45% of men and 58% of women have received no formal education (DHS 2011). While 70% of Ugandans have access to improved water sources, coverage is less than 50% in Karamoja (UNICEF 2012). Over half of residents travel over 30 minutes to fetch water (UDHS 2011).

Figure 11 Map of Borehole locations in Loregae Subcounty, Nakapiripirit District, Karamoja



METHODS

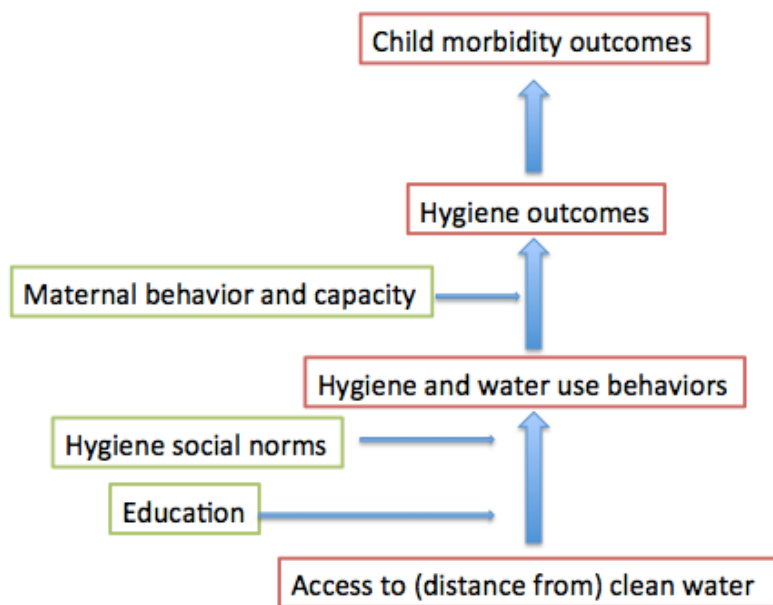
Conceptual framework

The study question was derived from the following conceptual framework (Figure 12); I hypothesized that:

1. Women with closer proximity to a source of clean water, or a borehole, would be more likely to use borehole water for daily tasks.
2. Women with closer access to a water source would use more total water.
3. Women who use more total water are like to have children with fewer morbidity outcomes.

I hypothesized that the relationships between proximity to water and relative proximity to water would be mediated by maternal levels of health knowledge, social support, and time constraints.

Figure 12. Conceptual framework



Study site and population

The study was conducted in several villages in Loregae sub-county, Nakapiripirit District Uganda. All participants are women over the age of 18 with at least one child under the age of

24 months. The most common livelihood is agro-pastoralism: raising livestock alongside supplementary agriculture (Levine 2010). Women are responsible for the agriculture while men typically tend to the livestock if the family owns any. The majority of participants live in rural villages in traditional compounds made of mud and wood.

The majority of villages have access to a borehole, a deep well that provides safe drinking water, within a mile of their home. However, during the dry season lines become long and time-intensive, and during the wet season the nearby rivers and streams become more convenient than the longer walk to the borehole. Individual villages vary widely in their proximity both boreholes and rivers. The community asks often for more boreholes to be installed closer to their homes; however, available research suggests that increases in water use and health outcomes only come at two critical points: when moving the borehole from very far to very close (within 200 meters) or when switching from a community source to a tap in the individual's yard or home.

According to the semi-pastoralist traditions, women are primarily responsible for all aspects of domestic life in addition to subsistence farming. According to 2007 data, life expectancy at birth is 47.7 years, three years lower than the Uganda average; therefore, in addition to their own children, women often care for the children of deceased or handicapped relatives and neighbors (OCHA 2009). Due to the lack of opportunity in the region and the decline of traditional livelihoods, men rarely fully provide for their families. Therefore, women work in subsistence activities such as gathering and selling firewood, making and selling charcoal, breaking rocks on the mountain, and working in others' gardens when money is lacking for food or basic items. These time and energy stresses add to the difficulty of gathering adequate amounts of clean water.

The traditional method of obtaining water consisted of filling clay pots and hollowed out gourds with water when the rains came, and travelling to mountain streams during the dry season. Aid groups have constructed several boreholes in the area in recent years. There is no running water or electrical power, so the only sources of improved water are the boreholes. Unimproved water is gathered from local streams and rivers that are only present during the wet season. Chlorine is not widely available; the two ways locals clean their unimproved water are by boiling it or straining it through a cloth.

Data collection

Participants (n=56) were recruited from a total of seven villages (Alamachar, Apercorait, Nariko, Nakasien, Moru Athia, Nakaale, and Nakingol) within Loregae sub-district. Women with a child under two years of age were eligible for the study. The translator went in advance to each village to let women know what day we would come. The PI and translator travelled together by foot to reach remote locations. Upon arrival, the translator mobilized again to let women know we had arrived. In each village, we interviewed all eligible women present on the day of arrival. Therefore, the samples were collected clustered by village.

Data was collected through a 25-minute survey questionnaire detailing demographic data, hygiene behavior, water use, and child health indicators. If women did not know their own age, they were asked to guess in relation to my translator who was about 24 years old, around the mean age of women in the study. Women also were asked about their age in relation to significant events in the community. Women typically lose track of their children's' ages as well when they grow older. Due to the lack of overall accuracy in determining ages, age at first pregnancy was split into a simple three-category variable: young pregnancy, average pregnancy, or late pregnancy. According to community members, a young pregnancy would be 18 or

younger, and a late pregnancy after about 24. The health centers in the area give health and immunization cards to each child who comes in, so many mothers had their child's date of birth recorded on their card. For questions about hygiene practices and causes of disease, participants were asked to free-list their responses in order to prevent bias; all answers listed more than once were included in analysis. Each questionnaire was conducted through a local translator fluent in Ngakaramojong and English and trained in the study methods.

Analytic method

Survey data was coded into numerical variables and analyzed through logistic regressions in STATA Statistical Software. We report the results from two models, both of which control for vulnerabilities among women: controlling for young pregnancy (pregnancy younger than 18 years of age) and lack of support from the husband (measured as whether he contributed financially to the family), and controlling for young pregnancy and a large family (greater than 5 children in a household). Under these models, confounding was reduced and appeared more accurately represent the data. Due to the small sample size, the number of variables to be controlled for had to remain small to prevent confidence intervals from widening, however, based on the context these models are expected to accurately represent social vulnerability among women. Additional models considered included maternal education, which provided too little variability to be useful, and number of co wives, which has uncertain and conflicting effects due to the practice of wealthier men taking additional wives but the earlier wives potentially being treated unequally or poorly.

Ethical considerations

A consent form was translated to each participant, after which they signed their willingness to participate. The study was approved by the Uganda Council for Science and

Technology as well as the William and Mary Protection of Human Subjects Committee (PHSC-2014-03-10-9403-sbickes).

Results

Study subjects

Table 1 summarizes the demographic characteristics of the study sample. Education among participants is low, with 70% of the sample never having gone to school, and only 7% attending secondary education or higher. The age of children ranged 0-24 months. Paternal and maternal education are both extremely low, with 46% of fathers and 69% of mothers never receiving any formal education. Household size is large and 30% of households have 5 or more birth children, in addition to an average of 1.25 non-biological dependents per household. Overall, there was little variation between study subjects because they are all from similarly low-income households in a very marginalized region of Uganda. Additionally, all participants were selected from villages in close proximity to one another and therefore have generally similar cultural beliefs and hygiene and child care practices. However, there was some variation in the implementation of these beliefs based on differences between individual families and differences in village location relative to the nearest water source, although 64% reside more than 500m from the nearest water source. The differences manifested themselves primarily in the total quantity of water used within a household.

TABLE 1 Demographic characteristic of study participants (n=56)

	Number (%)
Child age in months	
0-6	21 (37.5%)
6-12	22
12-24	13
Percent still breastfed	51 (96%)
Child male	23 (41%)
Child female	33 (59%)
Maternal age	
18-24	19 (33.9%)
25-30	20 (35.7%)
31-36	5 (8.9%)
37-42	7 (12.5%)
>42	5 (8.9%)
Highest Paternal Education mean years (SE)	
None	26 (46.43%)
Some primary	12 (21.43%)
Some secondary	18 (32.14%)
Highest Maternal Education,	
None	39 (69.64%)
Some primary	13 (23.22%)
Secondary or higher	4 (7.14%)
Building Materials of home	
Percent with tin roof	5 (8.93%)
Percent with mud walls, no cement or bricks	54 (96.43%)
Number of birth children	
One	12 (21.43%)
2 to 4	27 (48.21%)
5 or more	17 (30.36%)
Number of non-biological dependents, mean	1.25
> 500m from water source	35/55 (64%)
Percent > 3000m from health facility	19/56 (34%)
Caregiver marital status (%)	
Married, no co-wives	30 (53.57%)
Married, 1-5 co-wives	26 (46.43%)
Primary Means of money for food (%)	
Garden only	32.15
Garden and additional subsistence strategies	62.5%
Salaried position	5.3%

¹ Unless otherwise noted, reported values are Number (%).

² Anthropometric indices were calculated using the new WHO growth standards (WHO Multicentre Growth Reference Study Group, 2005).

Hand washing Practices

See Table 2 for hand washing practices. Mothers were given a hand washing score out of four for their response to an open-ended question of when they wash their hands. Their responses are

reported according to the two critical transmission events: eating and cooking, and after the two critical contamination events: defecation or sweeping the compound. 83% of women reported washing their hands for either 1 or 2 of these potentially triggers. The most common cause for hand washing was cooking, followed by eating. This suggests that women are more likely to use hand washing to prevent potential food contamination rather than as a reaction to becoming dirty. All women reported washing their hands the previous day, at a minimum of two times per day. Mothers reported washing their an average of twice per day. In contrast to maternal hand washing, child washing was not associated with specific events, but rather was carried out more habitually; when estimating the number of times per day, women referred to times of day, such as once in the morning and once in the evening, rather than events that cause the child to need to be washed.

TABLE 2 Frequency of self-reported maternal hygiene practices (n=56)

	Number (SE)
Maternal hand washing for critical events (eat, cook, defecation, sweep)	
0/4	2 (3.57%)
1/4	17 (30.4%)
2/4	30 (52.6%)
3/4	6 (10.7%)
4/4	1 (1.79%)
Maternal hand washing frequency (per day)	
2-4 times	55.4%
5-7 times	23.2%
Over 7	21.4%
Child washing frequency (per day)	
1	10 (17.9%)
2	37 (66.1%)
3	9 (16.1%)

¹ Unless otherwise noted, reported values are Number (%).

Compound hygiene practices

Compound hygiene practices were assessed based on observations taken by the interviewer at the time of the survey (Table 3). Typically, chickens and ducks freely roamed the

compound and their feces were present on the ground in 68% of the compound yards. Livestock (cattle and goats) are often kept in small pens within the compounds at night and grazed during the day, but sick or vulnerable animals are taken into the main compound yard to be looked after. Livestock feces were found in 22% of the compounds. For many families, chicken and livestock feces were swept away on a daily basis, but the freedom of chickens and ducks made the compound difficult to keep continuously clean. Although many families had partitions for goats and cattle, none had a way to partition chickens and ducks, who roamed freely within the compound and occasionally entered inside the homes as well.

Notably, no homes had soap at the time of their interview. Although hand washing and child washing occurs frequently, it virtually never occurs without soap, with the exception of free soap handed out by the hospital when children are delivered.

TABLE 3 Observed environmental hazards/problems/risks in caregiver compound (n=56)¹

	Number (SE)
Water stored openly in yard	8 (15.1%)
Chicken feces present	37 (68.52%)
Livestock feces present	12 (22.22%)
Mother's hands visibly dirty	18 (32.73%)
Child's hands visibly dirty	5 (11.36%)
Plate-drying rack present	17 (32.69%)
Partition for chickens (if owned)	0 (0%)
Partition for goats (if owned)	15.69%
Partition for cows (if owned)	24%
Soap present	0 (0%)

¹ Unless otherwise noted, reported values are Number (%).

Common health beliefs

Women were asked to free-list the following: reasons that their child might become sick, ways to keep their child healthy, and diseases that can be prevented by washing their child (Table 4). The most common answer for the reason that their child might become sick was that that were not bathed enough (75%), followed by not being fed well (39%) and not using a mosquito net (32%). Clearly, hygiene is seen as an extremely important component of health.

General elements of attentive child care such as “Not paying close attention” (10.7%) and “leaving them to become dirty” (5.35%) are also considered important. In order to keep their child healthy, again the most frequently cited answer was to bathe the child often (83%), followed by feeding them well (66%). 23% also mentioned the importance of keeping the environment clean.

When asked what diseases are preventable by washing their child often, 85.7% identified diarrhea, followed by eye problems (62.5%) and skin rashes (55.4%). All three of these are significant health problems caused by poor water quality and hygiene practices. Diarrhea is a major cause of young child death, and trachoma is declining but still a significant public health problem that can be cured simply by increasing the frequency with which child’s faces are washed. 10.7% of women incorrectly cited malaria as a problem that could be avoided with washing the child frequently enough; although malaria is a large problem, using a net should be emphasized as the primary prevention method for malaria rather than simply washing the child well. Although 85% correctly identified diarrhea, 15% of women did not associate hygiene with diarrhea, meaning there is still room for hygiene education in the community. In addition to diarrhea, education about washing children’s faces to prevent trachoma would be beneficial. Only 8.93% of women mentioned ‘jiggers,’ a common parasite that lives in the soil and enters children through their feet and hands. If the dirt is not frequently washed off these areas, children are more likely to get severe jigger infestations that can become infected and lead to damage and disability in the hands and feet. Education of proper prevention and treatment of jiggers, including keeping children in shoes and washing their hands and feet from dirt frequently, could have a huge impact on this public health problem.

TABLE 4 Common health beliefs (n=56)¹

	Number(Percent)
Reasons given for child becoming sick	
Not bathed	42 (75%)
Not fed well	22 (39.3%)
Not using mosquito net	18 (32.1%)
Not clothed well	8 (14.2%)
Eating soil	7 (12.5%)
Not paid enough attention	6 (10.7%)
Sleep somewhere dirty	6 (10.7%)
Nails not clipped	5 (8.92%)
Too cold	4 (7.12%)
Too much dust	3 (5.6%)
Left to become angry	3 (5.6%)
Not breastfed	3 (5.6%)
Reasons given for how to keep a child healthy	
Bathe	47 (83.9%)
Eat well	37 (66.1%)
Use a mosquito net	16 (28.6%)
Take to the clinic	15 (28.8%)
Clothe well	13 (23.2%)
Keep environment clean	7 (23.5%)
Clean nails	6 (10.7%)
Breastfeed	5 (8.9%)
Pay the child attention	5 (8.9%)
Diseases to be prevented by washing the child	
Diarrhea	48 (85.7%)
Eye problems	35 (62.5%)
Rash	31 (55.4%)
Vomiting	13 (23.2%)
Cough	12 (21.4%)
Jiggers	5 (8.93%)
Malaria	6 (10.7%)
Other	17 (30.4%)

¹ Unless otherwise noted, reported values are Number (%).

Logistic regression models

Survey results were further analyzed using logistic regression models in STATA Data Analysis and Statistical Software. Although no statistically significant results were found due to the reasons previously discussed, the data do provide some interesting implications.

Child morbidity

We measured child morbidity based on 7-day and 24-hour incidence reports by the mother of the young child. If a household's closest water source was the river as opposed to the

borehole, the odds ratio (95% CI) was 1.44 (-0.23, 3.17), 0.37 (-1.16, 1.90), 1.01 (-0.40, 2.41), and 0.94 (-.82, 2.70) for 7-day diarrhea incidence, 7-day fever incidence, 24-hour rash incidence, and 24-hour eye irritation incidence, respectively (Table 5). Although not statistically significant, this trend indicates that the distance to the closest water source might matter less than the relative distance between an improved water source and the river for child morbidity.

Households with a water source closer than 300 meters had higher hand washing frequency among mothers (4.6 versus 3.6 times per day, one-tailed test $p=.0376$) but not among children (3.00 versus 2.89, $p=0.33$). When the closest household water source was the borehole compared to the river, the frequency of hand washing was higher among children (3.4 versus 2.8 times per day, $p .0231$) but not among mothers (4.22 versus 4.37, $p=0.60$). Having the closest water source 300m or more from the home was also associated with elevated odds ratios: 7-day fever: 0.72 (0.89, 2.32); 24-hour rash: 0.73 (-0.53, 1.98), 24-hour diarrhea: 0.47 (-1.30, 2.24), and 24-hour eye irritation incidence: 1.90 (0.19, 3.62). The only significant result among all regressions was the increased odds of eye irritation with greater water distance. Karamoja is one of the few regions of the world which still faces a significant burden of trachoma, an entirely preventable eye infection which can lead to blindness, and which has been found to associate highly with low quantity of water use. Therefore, the above associations could be mediated by the total quantity of water used per day; greater water use is associated specifically with reductions in trachoma incidence, as well as increased frequency of hand washing and bathing. Typically, after food and hydration needs are met, additional water is used for household hygiene. In this sample, low water use was not associated with increased diarrhea or rash, but was associated at a near-significant level with 24-hour eye rash 1.39 (-0.12, 2.90).

TABLE 5 Fixed-effects logistic regression results of water access and water use behaviors according to child morbidity characteristics (n=56)*

	Number (95%CI)
7-day diarrhea	
Closest water is river	1.44 (-0.23, 3.17)
Water more than 300m away	-0.78 (-2.14, 0.57)
Low water use	-0.04 (-1.23, 1.16)
Ever drink from river	0.16 (-0.99, 1.32)
Environmental score	0.19 (0.77, 0.39)
Few jerrycans	-0.034 (-1.27, 1.20)
7 day fever	
Closest water is river	0.37 (-1.16, 1.90)
Water more than 300m away	0.72 (0.89, 2.32)
Low water use	0.10 (-1.21, 1.40)
Ever drink from river	-1.25 (-2.72, 0.22)
Environmental score	0.50 (-0.21, 1.20)
Few jerrycans	0.23 (-1.07, 1.54)
Rash 24 hour	
Closest water is river	1.01 (-0.40, 2.41)
Water more than 300m away	0.73(-0.53, 1.98)
Low water use	-0.28 (-1.48, 0.92)
Ever drink from river	0.56 (-0.62, 1.74)
Environmental score	0.15 (-0.53, 0.84)
Few jerrycans	0.49 (-0.73, 1.72)
Diarrhea 24 hour	
Water more than 300m away	0.47 (-1.30, 2.24)
Low water use	-0.49 (-2.29, 1.31)
Ever drink from river	1.15 (-0.66, 2.30)
Environmental score	0.16 (-0.75 1.07)
Few jerrycans	0.42 (-1.31, 2.16)
Eyes 24 hour	
Closest water is river	0.94 (-.82, 2.70)
Water more than 300m away**	1.90 (0.19, 3.62)
Low water use	1.39 (-0.12, 2.90)
Environmental score	1.00 (-0.23, 2.24)
Few jerrycans	1.57 (-.063, 3.21)
Mom hand washing score	
Low water use	0.27 (-4.47, 5.01)
Few jerrycans	1.56 (-3.98, 7.10)
Environmental score	-0.33 (-2.74, 2.09)

*Logistic regression models control for young pregnancy and no husband support

**Significant at P=.05

One unexpected finding was that families sometimes felt constrained by the number of jerrycans with which they were able to carry and store water. Several mothers mentioned that they only had a watering can or 10L jerrycan to carry water and therefore had to collect water as

they used it rather than fetching greater quantities at one time. The mean water use per person was 10.9L (SE 1.1), and 82.1% (46/56) of households consumed less than 20L per person. Larger households did not account for greater water needs: households with more than 5 children had the same total water usage as households with fewer than 5 children (64.82L versus 64.11L, $p=0.53$). This may be due to the fact that large households had the same number of jerrycans as smaller households (30.7L versus 26.8L, $p=0.74$).

Finally, child morbidity was assessed in relation to the women’s environmental hygiene score, a score out of 7 based on select characteristics from Table 3: chicken feces present, livestock feces present, mother’s hands visibly dirty, partition for livestock, and presence of soap. Higher child morbidity was associated with poor environmental hygiene scores: 7-day fever (OR 1.56), 24-hour rash (OR 1.17), 24-hour diarrhea (OR 1.17), 24-hour eye irritation (OR 1.82).

Environmental risk factors

Having water farther than 300m away was associated nearly significantly with higher likelihood of using little water 1.46 (-.012, 2.93), having a poor environmental score (OR 1.74), the mother’s hands being dirty (OR 3.19), and the child’s hands being dirty (OR 1.76).

TABLE 6 Odds ratios (95%) of environmental risk factors (n=56)*

	Number (95%CI)
Low water use	
Water more than 300 meters	1.46 (-.012, 2.93)
Closest water is river	-0.12 (-1.49, 1.25)
Mom primary water fetcher	-0.63 (-2.0, 0.76)
Mom’s hands dirty	
Water more than 300 meters	1.17 (-0.092, 2.42)
Low water use	-1.55 (-3.55, 0.45)
Few jerrycans	-.10 (-1.38, 1.17)
Child’s hands dirty	
Low water use	-1.93 (-4.60, 0.74)
Few Jerrycans	0.12 (-1.95, 2.19)

*Logistic results: controlling for large family and no husband support

Overall, women consider hygiene to be a crucial aspect of childcare and health. They are limited by inability to keep their compound environment clean, having inadequate volume of jerrycans for collection and storage, and living either physically or relatively removed from sources of clean water.

DISCUSSION

Due to its history of violence and underdevelopment, few studies have been done on Karamoja specifically, especially in recent years. The majority of studies that have come out of the region focus on peace building efforts between tribes to reduce raids, or the tense relations between the military presence and the locals. Our study was limited in statistical power due to a modest sample size and lack of variation between participants. Thus, statistical comparisons did not yield significant results. However, our findings provide insight into future directions in WASH programming in this region.

Water and Sanitation Access

Although specific studies of hygiene and water use are lacking, reports from the government and development organizations corroborate the findings of this study. A study by the Government of Uganda in 2007 found although most of the households could and did access boreholes, distance was one of the major challenges identified by the communities leading to household members using water (8.9L) which is far below the recommended amount of 11 liters of water per person per day. 60% of households reported using the bush as the main source of fecal matter disposal (Gov. of Uganda 2012).

The OCHA report from 2008-2009 states that that hygiene practices are lacking due to lack of water and soap, and open defecation is practiced in the absence of community latrines

(OHCA). Although we did not study latrine use, the lack of a facility further exacerbates the possibilities of fecal-oral contamination, particularly if hands are not being washed immediately, as this study indicates.

Access to clean water and soap is unreliable in rural homesteads across the district, and the lack of hygiene exposes very young children chronically to multiple secondary infections, such as scabies and worms, further reducing their resistance to acute infections (Wiebusch 2002). A 2014 study awaiting publication corroborating our findings that women associate hand washing with cooking and eating rather than sources of contamination and defecation: Only 10% of mothers reported washing their hands after defecation, while 60% reported washing their hands specifically pertaining to eating or cooking (Hopp 2014).

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The effect of climate-change-induced drought and desertification cannot be overestimated in Karamoja (OCHA). Traditionally, this has been analyzed primarily in terms of the effect on food security, a constantly looming problem in the region. However, a renewed analysis of the impact of these changes on household water security and hygiene is necessary as well. Based on the findings of the present study, households already do not use enough total

water to satisfy their basic hydration and hygiene needs, and boreholes regularly malfunction, causing people to revert to using the river or having to walk farther to alternate boreholes.

Government spending and development profiles also support my assertion that WASH interventions should become a greater focus in Karamoja, implemented alongside water for production interventions. Valley tanks and ponds are constructed for livestock, and irrigation systems are set up for agriculture, but without functional boreholes installed alongside them, people resort to dangerously sharing this water with their animals (Taylor 2014). In 2009, OCHA requested 4,657,836 UGH for WASH interventions and was rewarded 9,20,934, 19% of the original request. In contrast, 52,640,291 UGH was requested for food interventions, and 47,520,030 was rewarded, 90% of the request. Although food insecurity remains a debilitating problem in Nakapiripirit district, sustainability of health and development cannot happen without adequate water and sanitation either. Increasing water access, hygiene education, and sanitation facilities could dramatically reduce morbidity among Karamojong children and increase the effectiveness of the food interventions in themselves. According to 2009 data, only 40% of people in Karamoja had consistent access to safe water (UNICEF 2010). This number is unacceptably low and is contributing to poor hygiene practices and child morbidity. The malnutrition rate in Nakapiripirit District is 14%; many of these children are likely exposed to unsafe water as well.

Hand washing practices

Our finding that adequate hand washing corroborates what has been found in similar cultures and surrounding locations. In South Sudan, hand-washing rates, particularly with soap, are extremely low (Shrestha 2012). We note not only that hand washing rates are low overall, but that they are particularly low after defecation. For example, in 2010 only 20% of people in

South Sudan were found to wash their hands after defecation (Shrestha 2012). This corroborates our finding that mothers report washing their hands most after cooking and eating, and rarely washed their hands after contamination events such as defecation. This finding could be particularly important because it demonstrates a lack of disgust involved in the cause of hand washing. Disgust serves as an important psychological motivator, particularly in promoting hand washing after defecation (Aunger et al. 2010, Curtis 2004, Curtis 2007). Although women understood the importance of hand washing, the tendency to do so only before cooking or eating may mean that there is still a lack of understanding among women about disease spread and a lack of disgust in the community. In addition, washing hands before cooking and eating may simply reflect the fact that women are washing the vegetables and pots to cook rather than washing their hands specifically.

Effective interventions that promote hand washing have been shown to reduce diarrhea episodes by about one-third (Ejemot et al.) 2009. Providing clean water in low-income areas has been shown to reduce diarrhea by about one-third (Fewtrell 2005). Karamoja is not expected to receive household-level water facilities in the near future, therefore, creative solutions are needed to improve individual storage ability and water cleanliness. Point-of-use water quality interventions have not been widely used in this area, despite being shown to be effective.

Child washing was typically associated with times during the day rather than with specific triggers; mothers typically reported washing their child 'in the morning' or 'in the evening' rather than due to a particular cause. Associates with eating and cooking may also be coincidental and due to the time of day at which it was committed rather than the mothers associating cooking and eating with potential contamination points (Aunger 2010).

Soap use was found to be extremely low, which is corroborated by data from the greater Karamoja area (UDHS 2012). The lack of soap we found is again emphasized in the DHS report for Karamoja. Among households where a place for washing hands was observed, a mere 1.6% had both soap and water; 10.1% had water alone, and 88% had no soap or water present (DHS 2011). Other than the soap given to mothers after giving birth in a health facility, soap was absent from homes. Alternatives for soap, such as ash, are not regularly used either (UDHS 2012). Providing women with alternatives to soap that may be readily available and zero-cost could encourage better hand washing practices. Strong evidence to suggest that ‘rubbing agents’ are essential in hand washing, and that ash and mud may be nearly as effective as soap in lowering diarrhea disease risk (Hoque & Briend 1991).

Figure 13. Hand contamination with fecal coliforms following hand washing with different agents (Hoque and Briend 1991)

	Number of contaminated hands (%)	P-values against control
Control*	12 (60)	
Water	8 (40)	NS
Soap	4 (20)	<0.01
Ash	3 (15)	<0.01
Mud	4 (20)	<0.01

*women did not wash their hands.

Diarrhea incidence per child-year by mothers’ hand washing practices (Bloomfield and Nash 2009)

	Intervention area			Control area		
	N	Mean	SD	N	Mean	SD
Use ash/mud	215	3.0	2.6*	108	3.9	3.6
Use water only	174	4.0	2.9	282	4.1	3.2

*P=<0.01 for use of mud/ash compared with use of water only

Although the above studies treated mud and ash together in assessing diarrhea morbidity, there is evidence that ash is the preferable hand-washing agent due to its sterility (Bloomfield and Nash 2009). In Karamoja, sanitation practices are low and risk is very high of the soil being contaminated through both livestock and human feces. Ash, unlike mud or soil, is sanitary. Burning wood to make charcoal is a widely practiced livelihood, making ash from fires readily available at zero cost to most households.

Compound Hygiene Practices

Due to the typical agro-pastoralist livelihood of participants, livestock feces were commonly found in households. However, recent meta-analyses have demonstrated a significant association between exposure to domestic animals and child diarrheal risk and suggests that exposure to both domestic poultry and livestock constitute a diarrheal risk factor (Zambrano 2014). This finding was corroborated by this study, in which poor compound hygiene (including livestock feces present) was associated with increased diarrheal risk. There are, however, studies which find no association between the presence of livestock and diarrheal risk, possibly due to the nutritional benefits of the livestock (Thiem 2012).

Common health beliefs

Our study was unique in reporting health and hygiene beliefs and motivations for hygiene practices among this population, and therefore we are unable to provide comparative literature for similar populations. With the exception of motivations for hand washing, there is little evidence of motivations for health behavior in comparable populations. In addition, our study design was unique in asking women to list the reasons that their child might be sick or remain healthy, and determining which diseases they associated with hygiene problems. The majority of studies investigating women's health knowledge measure their understanding of causes of

diarrhea in particular and how to treat it, but no studies have investigated what range of diseases women associate with poor hygiene practices and to what degree they feel their own actions can control their child's health.

Storage containers

The OCHA report also confirms our finding that storage containers are a limiting factor for families, stating that “storage containers are shared within manyattas since they are unaffordable by a single family.” This study found that many families do not own nearly the volume of jerrycans that would be necessary to supply their water needs, and that families who shared jerry cans (did not own many of their own) generally had lower total water use.

Limitations

Several characteristics of the study setting limited our data collection. First, there is little concept of time, particularly not in a way that would translate well to minutes or hours; thus, participants could not accurately predict how long it takes them to collect water. Instead, we used a GPS measurement of distance along the typical path that women take to from each village to each water source. This is helpful in allowing accurate comparison and mapping of distances between villages, however, does not account for other factors such as difficult terrain or steep slope that could alter the time and energy spent collecting water each time. The different interpretation of time passage also impacted participants' ability to guess the frequency and precise timing of activities. Therefore, the survey focused on what people did during the past 24 hours (one day) and the researchers interpreted those results to be true for the typical day.

Differentiating wealth is difficult in this context. Wealth has traditionally been measured in cattle; however, with a history of violent raids accompanied by government-enforced disarmament, individuals are often unwilling to honestly report the number of cattle they own. In

fact, asking this loaded question has strained relationships between locals and other NGOs. With the exception of one schoolteacher and one missionary employee, all participants had extremely similar subsistence strategies. Women are traditionally responsible for ‘gardening,’ or farm labor. Traditionally, men would be in charge of the cattle herds, complementing women’s provision of plants with meat, milk, and blood. However, as the total number of cattle in the area declines, in more and more resource-constrained households are turning to alternative subsistence strategies, including hiring themselves out to work in others’ gardens, collecting sticks to sell to people building homes, and cutting down trees to burn for charcoal. These strategies are typically only used when money is directly needed by the family. Therefore, the woman who works only in the garden is likely to be from a wealthier household than a woman who consistently burns charcoal.

In terms of education, the literacy rates are so low that it would not make a practical cut-off point. Instead, we used education level; since so few children attend any formal school at all, we found ‘no education’ versus even ‘some primary’ to be the most meaningful cutoff.

Although attendance in school does not always indicate literacy, attending school at all indicates at least some level of individual or familial interest in education. Even so, nearly 70% of women had received less than one year of school and could not sign their own names. This lack of variability in the sample made education a difficult variable to investigate.

CONCLUSIONS

Study findings suggest that the most effective WASH interventions to carry out in the Karamoja context are hygiene education, specifically hand washing, and point-of-use water treatment. These have been shown to be two of the most effective interventions against childhood diarrhea, and neither are widely implemented in Karamoja (UNDP, Larna Fewtrell,

John M Colford Jr.). In addition, although diarrhea is an important problem in itself, interventions should be focused more widely on decreasing the incidence and spread of other infectious diseases, rashes, and trachoma, as well as improved nutrient absorption (decreasing environmental enteropathy). It is also critical that educational interventions focus on increasing the total volume of water used by individual households. Studies, including the present one, consistently find that people in Karamoja use far less water than recommended by public health experts. A meta-analysis by Fewtrell and Colford found that while water quality interventions reduced diarrheal disease by an average of 17%, water quantity interventions averaged a 27% reduction of diarrhea. Encouraging households to use more water, and structurally enabling them to do so, could have a greater impact than improving the quality of existing sources.

Finally, the impact of livestock on household hygiene is not frequently studied, but is particularly crucial in the semi-pastoralist context of Karamoja. No households had an effective mechanism to keep domesticated birds from roaming freely and defecating throughout the compound, and some also had livestock feces present in their compounds. Since families typically allow vulnerable animals to reside within their compounds, creating messages targeted specifically at compound hygiene in a way that allows attentive animal care is crucial for this culture. The burden of disease caused by livestock and exposure to livestock feces is not known and is an important area of further study.

Recommendations

In the neighboring and closely culturally tied Turkana group, a hygiene and sanitation intervention was proven to be effective in decreasing both infectious coliforms in water and prevalence of child diarrhea (Kariuki 2012). Similar programs could have an important impact in Karamoja. Hygiene education should focus on creating triggers for hand washing, with a

particular emphasis on defecation, on the use of soap and soap alternatives, and on preventing transmission through livestock.

Hygiene and sanitation in combination have been shown to have the greatest effects on diarrheal disease. Sanitation in Karamoja is lacking in both education and infrastructure. The vast majority of residents of Nakapiripirit practice open defecation, and many dispose of child waste improperly (UDHS 2011). Interventions in Karamoja that target hygiene therefore may not be effective without also increasing sanitation education and infrastructure.

Chapter IV: Uganda Demographic and Health Survey: WASH index and Cluster Analysis

INTRODUCTION

Our previous results demonstrated the potential importance of water proximity and type in both hygiene behaviors and morbidity outcomes, but did not have the robust design, variance, or sample size necessary to draw concrete conclusions. The following analysis investigates the validity of our previously discussed results to begin to answer the question of whether the results found in the survey are accurate in Karamoja or simply the result of the low-powered study. Therefore, building upon the mixed-methods field study, we turned to a larger and more robust data set to continue to explore these questions about water and hygiene in Karamoja and wider Uganda.

METHODS

We used data from the 2011 Uganda Demographic and Health Surveys—nationally representative survey that used two-stage cluster sampling within 9 specified regions of Uganda. In 2011, 10,086 households were selected and 9,033 households were interviewed (95% response rate), to include 8,674 women (UBOS & Marco Int., 2012).

This study involved two key methods. For the first, we used three variables demonstrated in the literature and our own study to be crucial in hygiene environment: distance to water, type of water source, and sanitation type. The distance to water variable ranged from 0=less than 5 minutes, 1=5-15 minutes, 2=15-30 minutes, 3=30-60 minutes, and 4=greater than 60 minutes to water. Type of water source includes 0 = unimproved (river, lake, pond, dam, stream, unprotected well), 1 = protected (stream or well), 2 = improved public (borehole, tap) 4 = improved yard/plot (borehole, tap, stand), 4 = piped to home. The sanitation variable consists of 0 = unimproved (field/bush), 1 = uncovered latrine, 2 = covered latrine, 3 = ventilated covered latrine or composting toilet, 4 = flush or pour flush toilet. Each of these was created as a 5-category variable, and then a 15-point WASH Index was created using the simple sum of the three variables. This index was analyzed in a logistic regression model which controlled for floor type, a strong predictor of household wealth in Uganda, and maternal education, shown previously to be a strong predictor of child diarrhea morbidity. All calculations were conducted in Stata 12.0.

The second investigation involved cluster analysis, a joint qualitative and quantitative analysis tool. We determined three key variables, again choosing time to water, type of water, and sanitation type, and forced the computer to create three distinct clusters which best allow the

individual samples to be grouped. These samples provide insight into three typical experiences of households in Uganda.

RESULTS

WASH Index

The WASH Index includes 3 5-level variables, for a total of a 15-point scale indicating distance to water, source of water, and type of toilet facility. The wealthier regions of Karamoja, Central 1, and Central 2 received the highest index scores. The highest index score of any household was 12/15. The Kampala region had by far the greatest number of households with a score of 12, as well as the highest mode, at 7/15. The greatest number of households reporting a score of 0 were found in Karamoja, whose mode score was 2/15. Other regions with apparently poor hygiene environments include East Central, Eastern, and West-Nile (mode = 4/15).

Table 7 Wash Index Score by Region

WASHindex	kampala	central 1	central 2	east cent	eastern	north	karamoja	west-nile	western	southwest	Total
0	0	2	2	0	1	6	11	8	0	4	34
1	0	3	7	4	4	7	7	6	7	0	45
2	0	30	26	12	28	31	75	33	27	20	282
3	0	37	34	40	34	37	55	50	37	51	375
4	7	45	81	69	101	81	53	71	70	55	633
5	13	26	31	53	71	54	27	65	65	50	455
6	31	15	34	50	44	29	16	24	26	39	308
7	66	23	29	46	36	22	2	32	20	30	306
8	28	17	8	16	9	6	0	4	17	16	121
9	26	15	8	4	4	2	0	2	10	5	76
10	20	6	1	1	0	0	0	2	1	7	38
11	9	4	1	1	2	0	0	1	6	5	29
12	12	1	1	0	4	1	0	1	1	0	21
Total	212	224	263	296	338	276	246	299	287	282	2,723

The WASH Index proved to be significantly predictive of child diarrhea outcomes ($p = 0.038$), reducing the odds of child diarrhea in the last two weeks by 9% for every additional point on the index. Interestingly, floor type (a proxy for wealth) was demonstrated to be an effect modifier rather than a confounder (Table 8). The effects of the WASH index became larger with

improved floor types compared to dirt or dung floors. This suggests that in lower-income households, additional factors, like hand washing behavior and general environmental exposure to pathogens may drive diarrheal risk more than the index of time to water, water source, and type of toilet facility. This was further supported by the fact that when stratified, the only areas in which the WASH Index proved significant were the relatively wealthy region of Kampala, Central 1, and Central 2. These regions were strong enough drivers of the data that the model was significant across Uganda as a whole.

Table 8 WASH Index as a predictor for Child Diarrhea in past 2 weeks

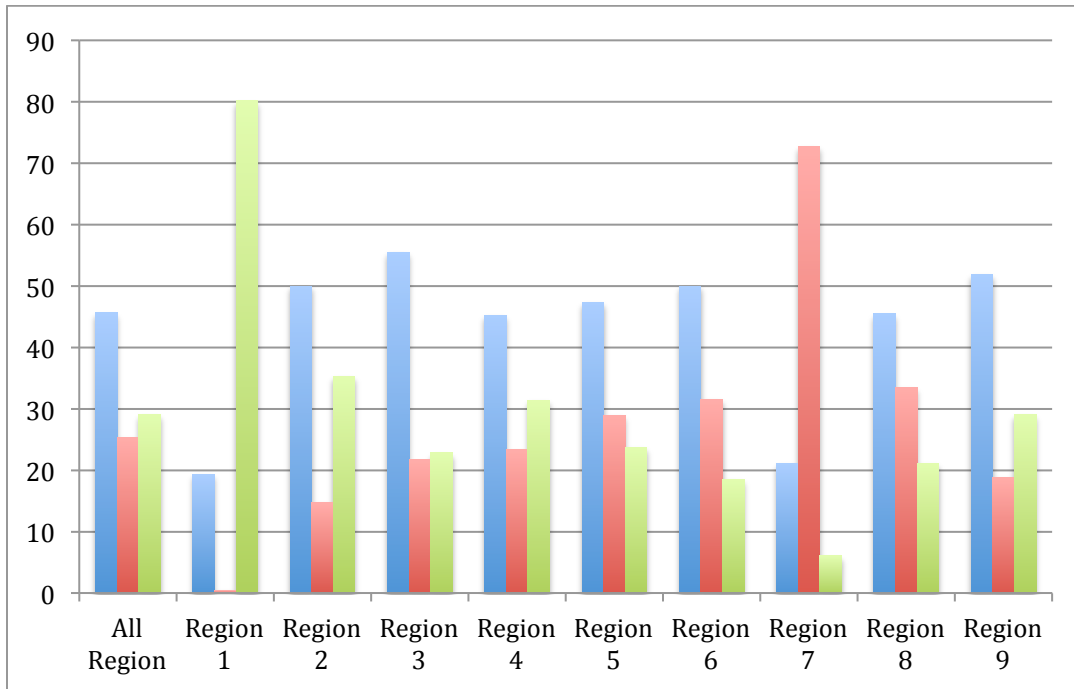
	Floor = Improved	Floor = Unimproved	Floor = Control
All Regions	0.91* (0.85, 0.98)	0.99 (0.94, 1.05)	0.96* (0.91, 0.99)
Kampala	0.82* (0.68, 0.98)	1.23 (0.60, 2.72)	0.84* (0.71, 0.99)
Central 1	0.86 (0.71, 1.03)	0.98 (0.76, 1.23)	0.91 (0.79, 1.05)
Central 2	0.71* (0.55, 0.92)	1.00, (0.84, 1.22)	0.88 (0.76, 1.02)
East Central	0.94 (0.71, 1.24)	0.89 (0.76, 1.04)	0.90 (0.78, 1.03)
North	1.30 (0.99, 1.69)	1.01 (0.87, 1.16)	1.07 (0.95, 1.21)
Karamoja	0.96 (0.58, 1.60)	0.96 (0.82, 1.13)	0.96 (0.83, 1.12)
West-Nile	1.46 (0.20, 10.48)	1.04 (0.85, 1.27)	1.03 (0.84, 1.27)
Western	0.76 (0.47, 1.26)	0.92 (0.79, 1.07)	0.89 (0.77, 1.03)
Southern	1.06 (0.85, 1.31)	0.94 (0.80, 1.11)	0.98 (0.86, 1.12)

Cluster Analysis

The cluster analysis, using three variables of time to water, primary source of water, and type of sanitation facility, and forcing the samples into three distinct groups, highlighted the importance of the Karamoja Region in water and sanitation. Cluster 1 was driven by the presence of water within 15 minutes and by improved toilet facilities, and was primarily driven by the Kampala region. Cluster 2 was driven by intermediates; households with improved sanitation, typically improved water, but longer walks to their water source. Cluster 2 was heavily driven by the Karamoja Region itself, demonstrating its unique situation within Uganda.

Membership in Cluster 2 was driven by lack of sanitation, variable distance to water, and public rather than personal water sources (Table 9).

Table 9: Cluster Analysis of Uganda by Region



DISCUSSION

The results of this small exploration into the 2011 DHS dataset confirm our understanding that in Uganda time to water, source of water, and access to sanitation important major predictors of child diarrhea. In addition, we demonstrate that these factors interact, and are potentially more important as an index than as individual variables. However, we found that these three factors are only predictive within the context of relative wealth. Therefore, we conclude that the germ, vector, and environmental factors in extremely poor areas such as Karamoja may not be well predicted by existing models and understandings of hygiene. We used cluster analysis to reinforce the understanding of the types and categories of lived experiences in regards to sanitation and hygiene in Uganda. This clustering highlighted the Karamoja region as a standout in terms of poverty and interactions between negative hygiene

environments. This, too, may explain another possible reason for the lack of findings in the above study of the region, in that the experience of living in Karamoja, particularly surrounding hygiene and water environments, may not closely follow existing WASH paradigms.

Conclusion

Karamoja is an extremely unique case within Uganda, but its problems parallel pastoralist communities throughout Eastern Africa. This study has demonstrated the need for new WASH paradigms to apply to extremely underserved regions like Karamoja.

Additional literature needs to be developed on household water collection and continue to evaluate water quality and quantity used in homes, and for what purposes. In addition, further study of what allows a community to be successful caretakers of their own boreholes, or successful long-term partners with NGOs to do so would be useful. Almost all major randomized-control trials and meta analyses include only sedentary agricultural societies with different cultural practices and livelihood strategies.

Water development practices have thus far been unsuccessful because the funds allocated to the region are focused either on short-term relief, disarmament, or agricultural projects. Making WASH a priority in itself can go a long way. In addition, both NGO and government projects are rarely conducted with adequate funds allocated for upkeep. After decades of humanitarian relief and development attempts, communities are unable to maintain their own structures, but NGOs fail to follow through on their water projects.

Educational material for this region needs to become more nuanced and creative. Hand washing education should focus on hand washing after defecation rather than only cooking, as well as effective hand and child-washing mechanisms. In particular, finding cost-free alternatives to soap, like ash or mud, could increase behavior uptake. Focusing on correcting myths, such as that inadequate hygiene can cause malaria, while increasing correct understanding, like that hygiene can decrease diarrhea and eye infection, could prove helpful. Additionally, understanding and addressing reasons that women do not use the boreholes

available to them is important, and providing them choice in water purification methods.

Ensuring that women have strong understandings of, and access to, alternative water purification methods like boiling, filtering, and chlorine treatment could improve the likelihood that they and their children will consume clean water.

Livestock are crucial in this context. Livestock are a unit of wealth and a family's prized possession. They also pose a poorly understood level of disease risk. Building upon the finding that livestock are rarely partitioned and that many compounds have livestock feces present, further research should be done on both the health consequences of not partitioning a family's animals and feces. On the other hand, livestock can be used as an additional motivator to maintain clean water supplies; not only will they benefit the community members as well, but they also provide a source of water for the livestock without extensive travelling.

With Karamoja's lack of sanitation, the community living style, and the overall high exposure to disease agents, perfect water access and use alone will not solve all water-related health problems. Children in each village all play in the same dirt, particularly when their mothers spend a large portion of their days working. Finding household-level indicators may not be the most meaningful variables in this context; studies and interventions should perhaps use villages and communities as the unit of study. I found through this study that Karamoja faces a unique set of challenges that may not be able to be addressed with traditional understandings of WASH implementation. However, communities are willing to learn and excited to raise healthy children, and water access and use has improved within the past few decades. With greater research on the area, more sustained involvement rather than emergency-level response by NGOs and the government, and greater effort to think outside box in terms of service provision

and education strategies, there is hope that water and sanitation, and in turn child health, can improve in this underserved corner of Uganda.

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