AN ANALYSIS OF THE RELATIONSHIP BETWEEN WATER ACCESSIBILITY, USE AND HEALTH IN MUTHARA, KENYA

By

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A REPORT

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This report, "An Analysis of the Relationship between Water Accessibility, Use and Health in Muthara, Kenya" is hereby approved in partial fulfillment of the requirements for the Degree of MASTER OF SCIENCE IN ENVIRONMENTAL ENGINEERING.

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Preface

The studies of water and health described in this report took place during my service as a Peace Corps Volunteer in Muthara, Kenya from July 2004 to July 2006. I worked as a Public Health Volunteer with the community groups that formed the Muthara United Welfare Association.

This paper is submitted in order to complete the requirements of my master's degree in Environmental Engineering from the Master's International Program in Civil and Environmental Engineering at Michigan Technological University. It describes a portion of the work I completed during my service in order to learn more about the people of Muthara, Kenya.

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Acknowledgments

I would like to thank the members of Muthara United Welfare Association in Muthara, Kenya who granted me the opportunity to work with them for two years, in particular Maburwa Women's Group and Mwangaza Women's Group, without which this report would not be possible. Many thanks to Peter Kalung'e, a supervisor and friend who helped me both work and live in the community.

Thank you to Dr. James Mihelcic for his support in completing this report and his reflections on development, and to Timothy Kibet and Jack Opiyo of Peace Corps Kenya who helped me understand the complexity of the term *community health*. Also thank you to Alyssa Lowe, my closest friend in Kenya, with whom I was able to share my experiences.

Finally, thank you to Andrew Kabaya. I could not have completed this report or any work in Muthara without his support through translation, knowledge of the community and people of Muthara, and dedication to working for and giving to the community.

Abstract

The Millennium Development Goals outline targets for improving living conditions in less-developed countries around the world: one target is to halve the number of people in the world without reasonable access to water by 2015. The World Health Organization defines the term reasonable access as the availability of at least 20 liters per person per day (L/capita-day) from a source within one kilometer of the user's dwelling. Using this target, development agencies can know where to focus their efforts.

Improving access to water will help improve the living conditions of those people currently without. However, access to water may not need to be brought to the level of "reasonable" in order for living conditions of inhabitants of an area to be improved. This report investigates the relationship between access to water and health of the household in rural Kenya. While in Kenya as a Peace Corps Volunteer, the author of this report reviewed literature to find connections between access to water, the use of water and the health in the households of users. This report also describes the process of preparing to collect and collecting information in a cross-cultural setting.

The average water use for the Muthara area is 16.7 L/capita-day including laundry and 12.3 L/capita-day without laundry. These values fall within the Basic Access service level (around 20 L/capita-day). Some of the water sources used by villagers are unimproved and some are improved. Reviewing the collection times of respondents of the Access, Use and Health Survey suggests that the quantity of water used does not depend on the collection times. Instead, users collect water to fulfill their needs. This contradicts previous studies which suggest that as collection time increases, the quantity of water collected will decrease. When estimating the amounts of water used for various purposes in the household, the estimations were 1.2 to 6 times greater than the actual volume of water collected for the household each day. The percentages of different water use categories are consumption (21%), hygiene (51%) and productive uses (28%).

The link between water accessibility and health based on the data collected from the Access, Use and Health Survey is not strong as the literature suggests. The hygiene practices that take place in the household have a large impact on the health of the household. Handwashing occurs at different times throughout the day: the importance of handwashing is shown because children are

taught its importance at home and at school. Wearing shoes, disposing of trash and bathing are more health behaviors that villagers practice at home.

1 Introduction

The author of this report served in the United States Peace Corps in Muthara, Kenya from July 2004 to July 2006. During that time, the relationships between access to water, the use of water in the household and human health were investigated. The Millennium Development Goals (MDGs) specify various targets for improving living conditions in less developed countries of the world: one target is to halve, by 2015, the number of people in the world without reasonable access to water (WHO, 2004c). This report describes the investigation of reasonable access and how water use in the community in and around Muthara, Kenya corresponds with the MDGs and targets.

This report begins with an investigation of information linking water use and human health. A literature review was carried out to explore these issues. In preparation for collecting data in the community, literature dealing with different techniques of data-collection was also reviewed. The author wrote and administered a survey to different households in the region in order to collect local data; the process is detailed in this report. Finally, the data collected from the survey was analyzed and compared to information from the literature review.

1.1 Background

This chapter provides background information about the country of Kenya and the United States Peace Corps in Kenya. The Millennium Development Goals (MDGs) are also described, in order to show the targets of development agencies when working to help improve the lifestyles of people in less developed countries. Finally, data are presented addressing the current state of water accessibility in Kenya.

1.1.1 Geography

Kenya is located on the eastern coast of Africa, bisected by the Equator (see Figure 1). The country is bordered to the north by Ethiopia and Sudan and to the west by Uganda and Lake Victoria. Tanzania forms the southern border, and Somalia and the Indian Ocean form the eastern border. The land area is approximately 583,000 square kilometers (CBS Kenya et al., 2004). Two regions form the country: the highlands, extending outward from the Great Rift Valley, and the lowlands, comprised of the coastal and lake regions of the country. Mt. Kenya is the only snow-capped peak in Kenya, reaching an elevation of 5,200 meters.

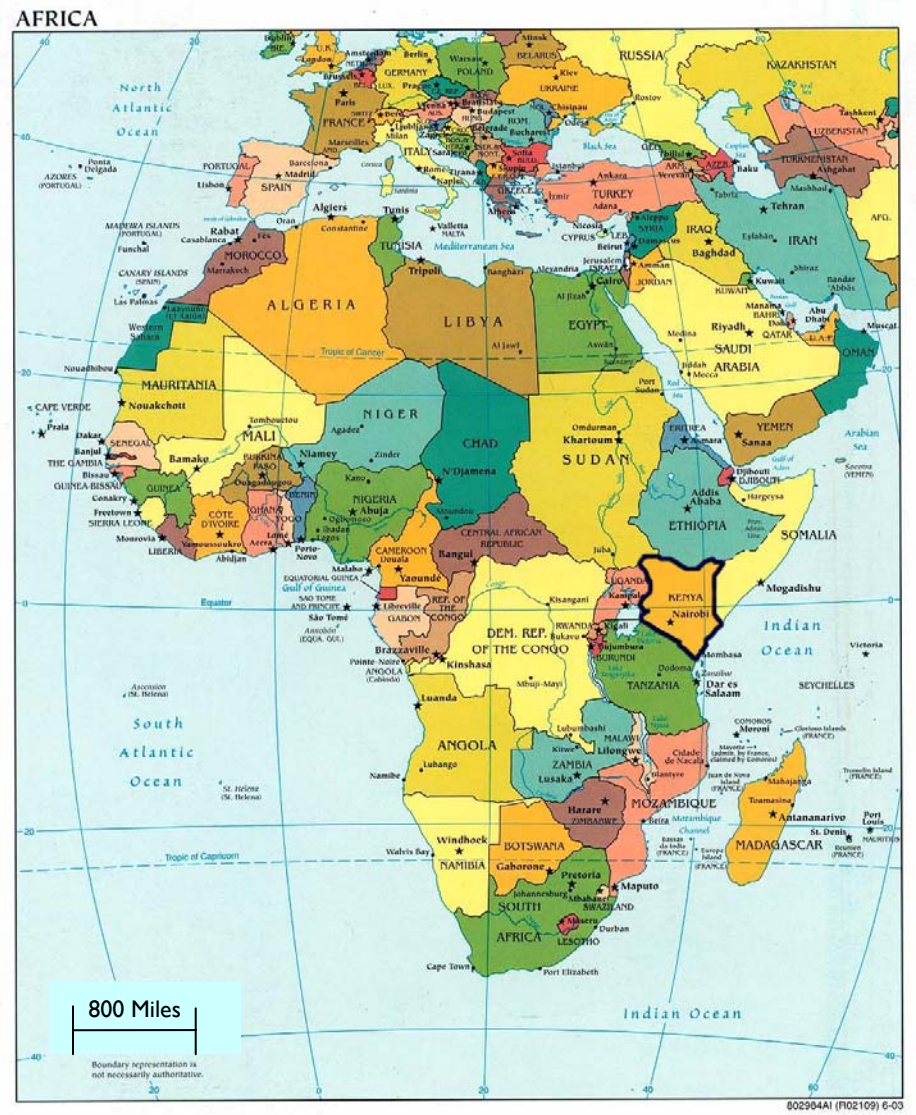

Figure 1. Map of Africa with Kenya Highlighted (Adapted from Political Map of Africa)

Note: Kenya is located in East Africa, bordered by Somalia, Ethiopia, Sudan, Uganda Tanzania and the Indian Ocean. Map Courtesy of the University of Texas Libraries, The University of Texas at Austin.

Kenya is divided into eight provinces (Figure 2). The data collected in this report is from Tigania North Division in Meru North District, located northeast of the town of Meru in Eastern Province. Muthara was the home of the author of this report during Peace Corps service from July 2004 to July 2006. The organization which hosted the author during those two years was located in Muthara. It is located less than 1º north of the equator, and is situated at the foot of the Nyambene Hills. Two smaller villages are homes to community members who participated in the study in this report. Nduluma, about four kilometers to the southeast of Muthara, is located in the

Nyambene Hills, and residents live at elevations between 1,580 to 1,830 meters. Maburwa, about eight kilometers to the northwest of Muthara, is located in a flatter region with an elevation of 1,280 to 1,380 meters. Figure 3 shows a section of a topographic map showing the area around the village of Muthara. It shows the village of Nduluma but does not show the village of Maburwa.

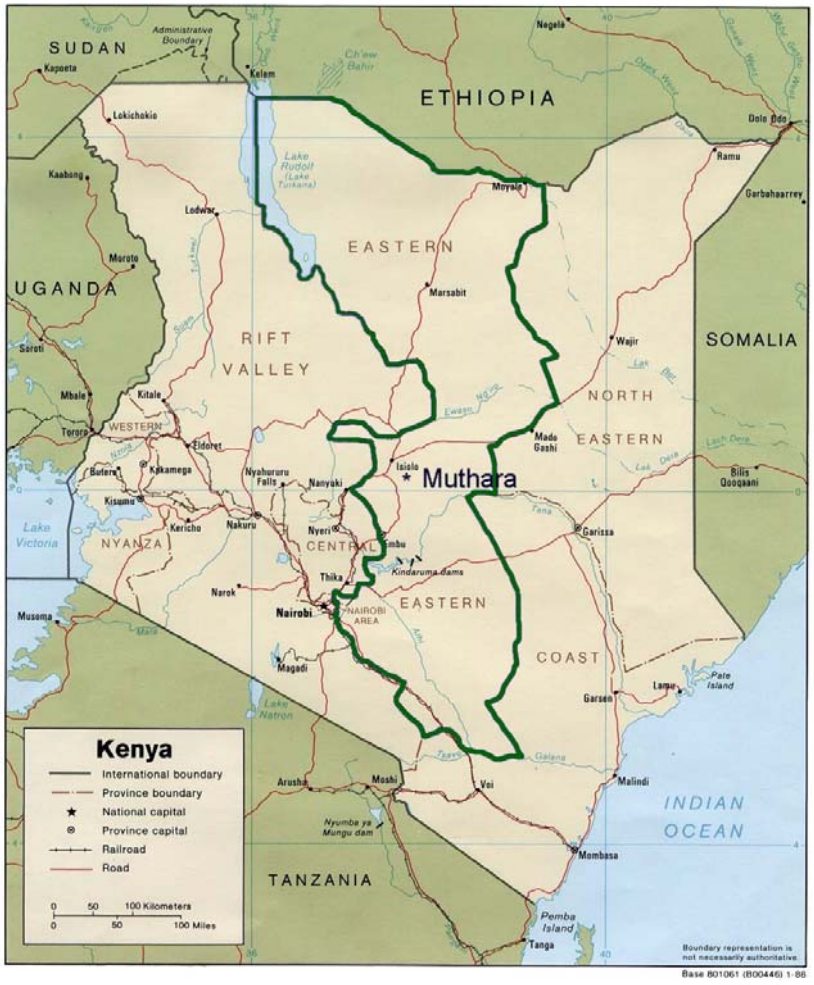

Figure 2. Map of Kenya with Eastern Province and Muthara Highlighted (Adapted from Map of Kenya)

Note: Muthara is located in Eastern Province of Kenya. Map Courtesy of the University of Texas Libraries, The University of Texas at Austin.

1.1.2 Ecology

The climate of Kenya varies with altitude and location throughout the country. Only about twenty percent of the land is arable: the rest is arid or semi-arid. The very arid regions of the country have an annual rainfall of 150-350 mm, arid regions have 300-550 mm annual rainfall and the

semi-arid regions of the country have an annual rainfall of 450-900 mm (Orodho, 2003). The long rainy season in Kenya is from March through May, and the short rainy season spans from October through December. The country is primarily agricultural and the main crops include maize, beans and other cereals. Many fruits and vegetables are also grown. Maburwa lies in a lower region than Nduluma and receives less rain. In the Nyambene Hills, the climate and altitude allow for different crops. Cash crops include coffee, tea and *miraa*. *Miraa*, or *khat*, is a type of tree, the twigs of which can be chewed and act as a stimulant. Parts of the forest in the Nyambene Hills still remain uninhabited.

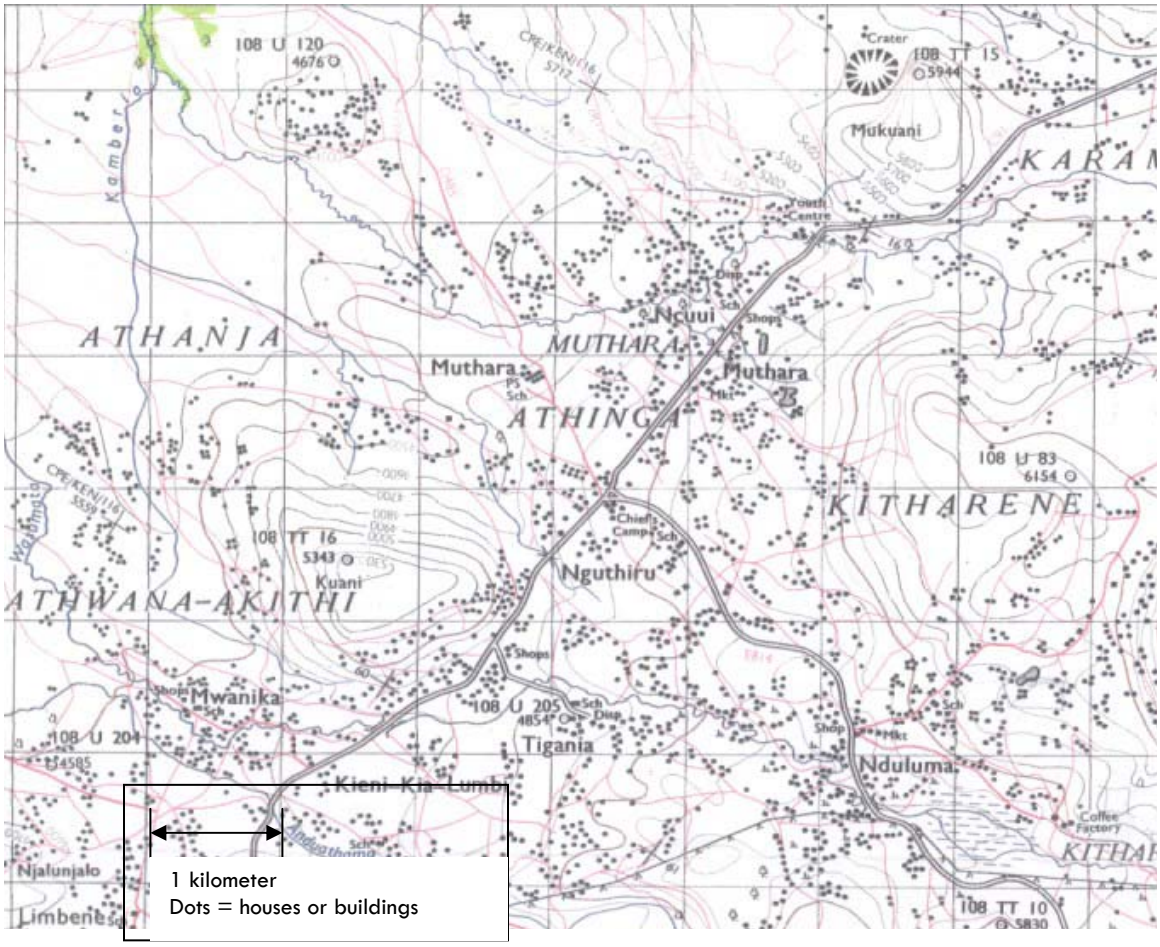

Figure 3. Topographic Map of Muthara, Kenya and the Surrounding Region (Taken from Survey of Kenya)

1.1.3 People

The Kenyan population totals about 34 million, made up of about 42 ethnic tribes. As early as the 15th century, explorers were finding Arabic culture mixed with the earlier presence of African tribes already in eastern Africa. The Bantu originally came to East Africa from the western parts of Africa. In the 16th century, Northern Africans arrived, and in the 19th century, Cushites from Somalia came to the region (Pike et al., 2003). Many tribes from these backgrounds currently live in Kenya. The *Aameru*, or Meru people, have roots in the Bantu, and their ancestry is closely related to two other Kenyan tribes, the Kikuyu and Embu. Although the *Aameru* make up the majority of the population in the Meru North District, the Maasai tribe originally inhabited the land. Many names of hills and rivers still retain their Maasai names. Historically, the *Aameru* came from the east, so the Nduluma area has been inhabited for a longer period of time by the Meru and is more densely populated.

1.1.4 History

From parts of the 19th century until independence in 1963, Kenya was a British colony. In 1964, Jomo Kenyatta became the first president. Daniel Toroitich Arap Moi became president after Kenyatta's peaceful death in 1978. President Moi served through five presidential terms, for 25 years, enacting and removing a constitutional ban on political parties. In 2002, Mwai Kibaki became Kenya's third president. The legislative branch of the government is made up of a 224-seat parliament.

1.2 The United States Peace Corps Kenya

The United States Peace Corps (PC) has been present in Kenya continually since 1964. Currently Peace Corps/Kenya is made of three sectors of Peace Corps Volunteers (PCVs): Small Enterprise Development/Information Technology (SED/ICT), Education, and Public Health. The Public Health PCVs focus on HIV/AIDS education and Water and Sanitation (WatSan). Although a PCV may be assigned to one specific sector, work may often cover various types of activities.

The author of this paper was a WatSan volunteer in Kenya from July 2004 to July 2006 and worked with the Muthara United Welfare Association (MUWA). MUWA is a community-based organization that was made up of about 12 active self-help groups (SHGs) at the time of this report. The research in this report involved administering a survey to members of two of the

SHGs in MUWA. Members of Maburwa Women's Group lived in the village of Maburwa and members of Mwangaza Women's Group lived in the village of Nduluma. The survey was administered in the two locations over the course of five months, February to June 2006.

1.3 Millennium Development Goals

Throughout the 1990s, members of the United Nations (UN) recognized the need for reducing poverty, increasing accessibility to health services, and protecting the environment throughout the world. In September 2000, the UN and development agencies committed to addressing these and other issues that will improve living conditions by creating the Millennium Development Goals (MDGs) (WHO, 2006a). These are the Millennium Development Goals:

- Goal 1. Eradicate extreme poverty and hunger
- Goal 2. Achieve universal primary education
- Goal 3. Promote gender equality and empower women
- Goal 4. Reduce child mortality
- Goal 5. Improve maternal health
- Goal 6. Combat HIV/AIDS, malaria and other diseases
- Goal 7. Ensure environmental sustainability
- Goal 8. Develop a global partnership for development

Each MDG incorporates various targets in order to detail the respective Goal. Describing Goal 7, Target 10 is to "halve by 2015, the proportion of people without sustainable access to safe drinking water" (WHO, 2004c). The World Health Organization (WHO) reported that in 2002, 1.1 billion people still lacked access to improved water sources (WHO, 2004b).

In order to reach Target 10 of the MDGs, the status of water and sanitation must be clearly defined and understood. The *Global Water Supply and Sanitation Assessment 2000 Report* (GWSSA) was presented by the WHO and United Nations Children's Fund (UNICEF) and summarizes the conditions of water supply and sanitation throughout the world. The GWSSA states that access to water and sanitation "does not imply that the level of service or quality of water is 'adequate' or 'safe'." The data from the GWSSA only recognizes if a source is *improved* or *unimproved*, as defined in Table 1 (WHO, 2000). The GWSSA provides a further definition for *functional*: a piped system is functional if it operates at over 50% capacity on a daily basis, and handpumps are functional if they operate at 70% of the time with a lag between breakdown and repair of not more than two weeks.

Table 1. Definitions of Improved and Unimproved Water Supplies (Taken from WHO, 2000)

Unimproved Water Supplies	Improved Water Supplies
Unprotected well	Household connections
Unprotected spring	Public standpipes
Vendor-provided water	Boreholes
Bottled water[1]	Protected dug wells
Tanker-truck provided water	Protected springs
	Rainwater collection

1.4 Access to Water in Kenya

According to the data compiled by the Joint Monitoring Programme (JMP), it is estimated that 43% of rural Kenyans had either a household connection to water or had reasonable access to improved water sources in 2000 (WHO and UNICEF, 2003). These figures are taken from the data collected by various demographic health surveys, the GWSSA and local censuses administered between 1980 and 2000.The *Kenya Demographic and Health Survey 2003* (KDHS) provides an updated countrywide perspective on health issues (CBS Kenya et al, 2004). KDHS provides information on the various types of water sources used by Kenyans: Appendix 1 shows the data from the KDHS concerning water sources. The data is divided both by urban versus residential and by province. Tigania North Division, the location of the villages in this report, is located in Eastern Province. Other data in KDHS relevant to water and health include knowledge of and access to oral rehydration salts (ORS), diarrheal illnesses and malaria prevention.

[1] Bottled water is considered unimproved because of possible problems of sufficient quantity, not quality (WHO, 2000).

2 Methodology

This chapter describes the process of completing the study described in the report. The purpose of this project is to examine access to water, water use and health in a household and to investigate the relationships between them. The objectives of this report are:

- Objective 1. Investigate the relationships between access to water, the use of water in the household and human health.
- Objective 2. Investigate data collecting techniques and how a Peace Corps Volunteer is able to use them in a rural situation.
- Objective 3. Collect data from the Muthara, Kenya community regarding access to a water source, the use of water and the health level of the household.
- Objective 4. Analyze the relationships in the collected data and compare them to published literature.

This report describes the literature review used to investigate the relationship between water and health, the process of writing and administering a health survey and a review of the results. This report also discusses how the data collected relates to the literature. Finally, this report summarizes health behaviors in the communities near Muthara, Kenya.

In order to develop an understanding of the issues of access to water, water use and health, a literature review was necessary. In addition to academic journals, resources included statistical information from organizations such as the WHO and resources dealing with the cross-cultural aspect of health projects. Chapter 3 describes the literature reviewed for this report. The review focused not only on the relationship between water and health, but also on how data were collected for studies.

PC Kenya Pre-Service Training (PST) includes multiple training sessions that deal with collecting data and working in a foreign culture. Based on the knowledge gained from PST, a survey (the community entry survey) was written and administered in order to collect data about the author's community. The purpose of the survey was to investigate potential projects during PC service; data was not sufficient to relate access to water and health. Chapter 4 reviews additional literature used to supplement the experience gained by the author when administering the community entry survey and to review more methods of collecting health data in order to fulfill the second

objective of the report. Chapter 4 also addresses the process of writing and administering the Access, Use and Health Survey (AUHS), which was used to collect specific data about access to water, how water is used in the household, and the health of family members.

Chapter 5 summarizes the data collected during the Access, Use and Health Survey, including the water use, service levels of water accessibility of the community and health data collected from the AUHS and Monthly Health Records. The chapter describes how results were analyzed, and also issues that may occur when collecting data from a survey. The data from the AUHS is compared to the literature reviewed in Chapter 3. Finally, this chapter discusses how there are differences between the collected data and the reviewed literature.

Although a host community organization applies to the Peace Corps to request a volunteer, the PCV's assignment is not always clearly defined. Therefore, Peace Corps Kenya PST teaches different methods of community entry. One method of learning more about a community, the issues it faces, and potential projects for a PCV, is through a general survey. The author of this report wrote and administered the community entry survey to investigate these ideas through a health perspective. Although the focus was general, including health education, water use and farming practices, specific data were collected dealing with access to water. The complete survey is in Appendix 2.

Reviewing the data collected from the community entry survey helped provide a better understanding of the lifestyles and living conditions of the Muthara area. While the survey included questions from many aspects of a village lifestyle, the results helped show that many of the issues faced daily by community members are related and interconnected. The information collected from the community entry survey served as a basis for a deeper investigation of access to water, water use in the household, and health level in the household. To collect more information about these topics, another survey was required.

The Access, Use and Health Survey was designed with different tools, a different purpose, and most importantly, a different perspective. Reviewing methods of data collection allowed the AUHS to be written using specific techniques for the information that was being investigated.

Methods of data collection and difficulties in administering a survey are reviewed later in this report. Because a PCV has the opportunity to live with a community for an extended period of time, he or she may develop a different perspective on how information is shared within a community. This perspective, not necessarily available to other researchers, can help in the process of writing and administering a survey. The complete AUHS is in Appendix 3. The experience of administering the community entry survey helped with the creation and administration of the AUHS because the author could better prepare the survey to minimize the problems encountered during the first experience.

3 Linking Water and Health

This chapter reviews literature that investigates the relationship between water and health. The chapter discusses how water is used in the household and how much water is required for each purpose. This chapter next addresses how changing the quantity, quality and the collection time of water used in the household can affect human health. Finally, the discussion addresses hygiene behaviors and how health is impacted by different health, water or sanitation interventions.

3.1 Improved Access to Water

Classifying access to a water source as improved or unimproved by the criteria in Table 1 is helpful when investigating a water source, but these criteria reveal no information about how the water is used or the quantity used by individuals or households. Access to a water source used by a household can be described in a different way—in a graded scale based on quantity used. WHO defines the term *reasonable access* to a water source as the "availability of at least 20 liters per person per day (L/capita-day) from a source within one kilometer of the user's dwelling" (WHO, 2000). Other studies provide different criteria of what is considered reasonable access to water, depending on varying conditions: for example, laundry and bathing may take place away from home, so the water use in the household describes different usage patterns.

Howard and Bartram (2003) describe four levels of access to water, or service levels, based on the distance the consumer travels or the time spent collecting water. Data reviewed by Howard and Bartram (2003) indicate that water quantity is not as important as service level, and volumes of water can be associated with the different service levels. Table 2 describes these service levels. The table also describes the definitions of service levels based on these associated quantities of water and based on collection time. Collection time to a water source is the amount of time it takes for a person to travel from the home to the water source, collect water and return home. Finally, Table 2 associates a level of health concern with each service level.

Howard and Bartram (2003) state that Basic Access to water is approximately equivalent to the level of reasonable access from WELL (1998) and Intermediate Access is approximately the same as Gleick (1996). Basic Access will provide minimum health protection, and users of this service level will have access to less than 20 L/capita-day: this includes 7.5 L/capita-day required for consumption.

Water for Life: Making it Happen (WHO and UNICEF, 2005) examines water and sanitation coverage data from various country censuses and surveys from UNICEF, WHO and USAID. One point of concern with the coverage data is that there are differing definitions of the same terms in various surveys, such as *safe water* and *basic sanitation*. Moreover, different researchers may interpret some data differently. For example, data dealing with the coverage of a particular service may include a village, but perhaps not everyone in the village will use an improved supply. Although researchers do try to accurately report data, such as showing the use of improved services, more appropriate indicators should be developed to show what is really happening in a community.

Table 2. Service Level Descriptors Defined by Distance and Time to Water Source, Quantities of Water Collected and Level of Health Concern (Taken from Howard and Bartram, 2003)

Service Level	Distance to Source & Total Collection Time	Approximate Quantities Collected	Level of Health Concern
No Access	> 1000 m	Very low	Very high
	> 30 min total collection time	Less than 5 L/capita-day	Hygiene not assured, consumption needs may be at risk. Quality difficult to assure.
Basic Access	100 – 1000 m	Low	Medium
	5 – 30 min	Unlikely to exceed 20 L/capita-day[2]	Not all water needs may be met. Quality difficult to assure.
Intermediate Access	On-plot	Medium	Low
	e.g. single standpipe on compound or in house	Around 50 L/capita-day	Most basic hygiene and consumption needs met. Quality more readily assured.
Optimal Access	Multiple taps in house	Varies	Very low
		Likely to be 100 L/capita-day and possibly up to 300 L/capita-day	All uses met. Quality readily assured.

[2] Laundry or bathing may occur at a source with additional quantities of water used.

3.1.1 Categories of Water Use and the Impact of Water on Human Health

In Table 2, the level of health concern for each service level is derived from the fulfillment of four different uses of water, described in Table 3. Howard and Bartram (2003) discuss the uses of water and the quantities of water required to fulfill each. These observations originate from various studies of water use. Water used for consumption and hygiene purposes impact health via physiological needs and in the control of water-related diseases. Productive uses affect the livelihood of a household and thus indirectly impact human health, while amenity uses may not affect human health at all (Howard and Bartram, 2003).

Table 3. Different Categories of Water Use and Examples of Each

Water Use Category	Description
Consumption	Drinking and cooking
Hygiene	Personal and domestic cleanliness (bathing, laundry, etc.)
Productive	Brewing, animal watering, construction
Amenity	Car washing, lawn watering

Many studies have investigated the amount of water a human body needs to maintain health. A body that is not receiving enough water can be affected in many ways, depending on the magnitude of dehydration. Susceptible groups may experience increased risks of urinary stones, oral health problems, coronary disease, and even certain types of cancer. Many factors influence the amount of water humans need, and published values suggest between 2 and 3 L/capita-day is needed for a 60-kg adult. The amount of water needed by an individual will vary for many reasons, such as body weight, climate and physical activity, and will also vary between different populations, such as athletes, pregnant women or children. For vulnerable populations in tropical climates, the amount of water required by the body to maintain health could be as high as 4.5 L/capita-day (Howard and Bartram, 2003). The volume of water consumed includes water contained in food. The amount of water used in cooking varies with the type of food being prepared and the role of water in the process. Depending on the location and types of food consumed, the amount of water needed for food production can be around 4 L/capita-day, but in most cases 2 L/capita-day should be available. The basic water requirement for consumption and food preparation recommended by Howard and Bartram (2003) is about 7.5 L/capita-day.

Water used to maintain personal hygiene is needed in excess of the water used for consumption. White et al. (1972) is one of many publications that describe a classification system of water-related diseases. These disease categories are described in Table 4. The table also includes a route of transmission of pathogens and sample diseases for the disease categories. Studies have revealed that the quantity of water used for hygiene behaviors is only one important component of maintaining personal health. In addition, timing and availability of water are other factors that influence hygiene behaviors. For example, hand washing after using a latrine. Since many factors influence hygiene and the hygiene behaviors of different communities and cultures, quantities of water needed to maintain hygiene are difficult to generalize.

Table 4. Classification of Water-Related Diseases and Transmission Routes, with Sample Diseases (From White et al., 1972)

Disease Category	Transmission Route	Sample Diseases
Waterborne	Consumption of pathogen in water	Typhoid, Cholera
Water-washed	Contact to pathogen due to lack of hygiene or cleanliness	Scabies, Trachoma
Water-based	Skin contact or consumption of pathogen	Guinea worm
Water-related	Insect vector; part(s) of the life cycle of an insect dependent on water	Malaria, Yellow Fever

Productive uses of water influence the well being of the members of a household in different ways. Howard and Bartram (2003) define productive uses as activities at the domestic level only (home gardening, brewing and home construction) instead of community-level productive uses such as industry or energy production. These small-scale activities may provide better food production and security or additional income. All of these activities can help improve the living conditions of the household. As accessibility to water increases, the collection time may decrease. The time freed by the improved accessibility can be used for other purposes—more time can be spent focusing on activities that can improve or maintain health in a household. The time freed by increased accessibility can be used on more productive uses, which can benefit the health and economic status of a household.

As seen in Table 2, if the quantity of water needed for amenities is available, the health risks are reduced for the household with access to that water. However, there is a greater concern about

access to water on a community level. Water being used for amenities by some households in a community may prevent more vulnerable users from fulfilling their basic needs of consumption and hygiene.

3.1.2 Water Quality and the Prevention of Diseases

"Until the late 1980s, the assumption that poor quality drinking water was the primary source of [diarrheal] diseases was widespread" (Curtis et al., 2000). Various studies have since supported the idea that there are indeed many factors that play important roles in the spread of diarrheal disease transmission. Hygiene behaviors, sanitation and quantity of water used for hygiene behaviors all play important roles. Curtis et al. (2000) reference a study by Vanderslice and Briscoe (1995) that says water quality becomes relatively more important after all other sources of diarrheal pathogens are eliminated via effective sanitation.

The risk of different diseases seen in Table 4 can be reduced greatly by improving a water source. Improving a water source may consist of protecting a water source, constructing a distribution system or treating the water before it is consumed. By protecting a water source from contamination, waterborne pathogens can be blocked from entering a water supply and those diseases can be largely barred from reaching the population. For example, typhoid is caused by consuming a bacterium called *Salmonella typhi*, which is found in human feces. A treatment program can be initiated to remove the bacteria from the water before it can be consumed, protecting the users (WHO, 2006b). Protecting a source may involve installing a fence around the collection point to prevent human or animal contamination. This can reduce exposure to or amplification of water-based diseases. Reducing the incidence of water-related diseases may also result indirectly from improvements to a water source. For instance, construction of a new water distribution system may include better drainage, reducing the conditions favorable for mosquito breeding and, in turn, the spread of malaria.

3.1.3 Water Quantity

While improvements to both water quality and quantity can reduce the burden of disease, improvements to either individually can have positive impacts. Improvements to water supply can increase the level of health in the household: higher quantities of water used can allow for more and better hygiene practices (Esrey et al., 1991). White et al. (1972) explain that the amount of

water used for bathing must be sufficient to remove dirt and soap. If not enough water is available, bathing may be less frequent or water may be used from an unsafe source. Washing clothes and utensils may also suffer with a lack of sufficient water.

The quantity of water used by a household can vary for many reasons. For example, a household may be using water from a new standpipe in the compound instead of a public standpipe. Although improved availability of water increases health benefits, an increase in the quantity of water used is not the only reason for health to improve. Effective use of water and the timing of hygiene practices can also hold important roles. Bathing and laundry may occur at the water source, yet while these practices help prevent disease incidence, the quantity of water collected to the household would not reflect these hygiene practices. Howard and Bartram (2003) state: "for water quantity to act as an absolute constraint on hygiene, it must be available only in very small quantities."

Although an increased availability of water is linked to an increase in health, evidence suggests that only significant differences in water availability have impacts on health. Populations using communal water sources, for example, may be more affected by hygiene behaviors than by increases in water availability. Figure 4 shows that significant differences in water availability affect the amount of water collected and used. The relationship between the quantity of water used and collection time is shown in Figure 4, adapted from *Water for life: Making it Happen* (WHO and UNICEF, 2005), although representations of this relationship appear in other sources. Howard and Bartram (2003) credit Cairncross (1987) with reviewing several studies of water use and collection behavior and representing the relationship with this pattern.

Figure 4 shows that the amount of water collected decreases with an increasing collection time. The amount collected decreases significantly between zero and five minutes travel time. This corresponds to the collection time of a person collecting water that is located in the compound. The drastic change in use is apparent over the short change in collection time. As the collection time continues to increase, the water source is located off the compound of the user. The quantity of water used remains steady until about 30 minutes travel time. A third section of this figure shows that as collection time continues to increase, the amount of water collected begins to change again, decreasing at a slower rate with the continued increase in collection time. An

example from Cairncross (1987) is of a study in Mozambique where water consumption at fifteen minutes was about 12 L/capita-day and a village with a collection time of five hours consumed about 3 L/capita-day. Cairncross (1987) suggests that this example supports the idea that a significant change in water use occurs with a significant change in collection time.

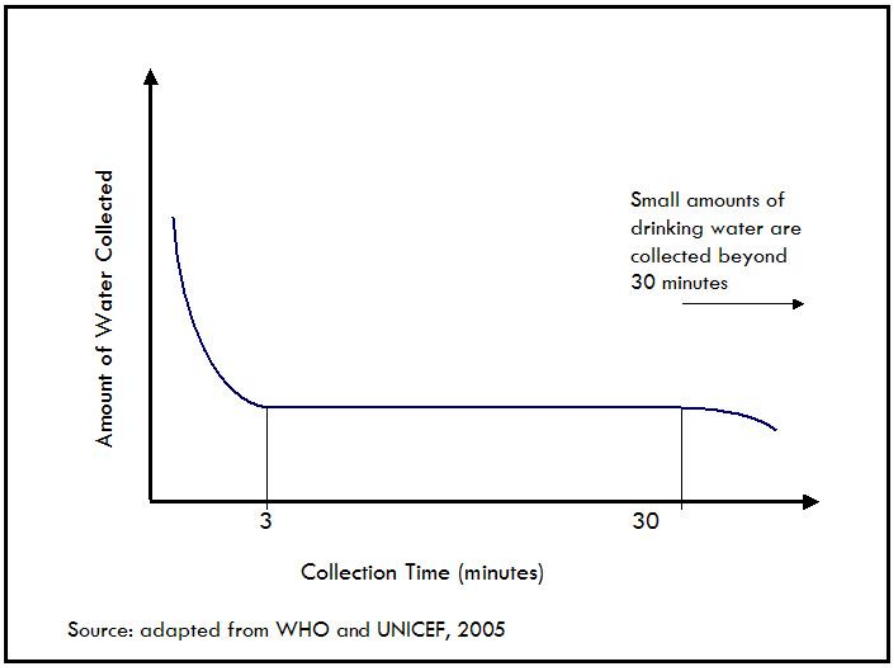

Figure 4. Relationship between Volume of Water Collected and Collection Time (Adapted from WHO and UNICEF, 2005)

3.1.4 Collection Time and Distance to a Water Source

Fewtrell et al. (2005) state that the risk of contamination is present during the transport of water from the source to the home and storage, but there is too little data to relate this risk to service level or water supply interventions. Recorded data do not show that water consumption increases with the improvement of water supply (if collection time is not decreased), but the authors acknowledge that increased supply may decrease the risk of contamination during transport or storage of water.

Howard and Bartram (2003) also review studies which investigate the distance to a water source and show a reduction in the incidence of diseases. Occurrence of trachoma is greatly affected by significant changes in distance to the water source. For example, lack of water for sufficient

bathing can allow for more disease transmission: when more water is available, hygiene behaviors can be improved and disease transmission can decrease. For large reductions in collection time, the use of water can increase drastically—one study (Prost and Négrel, 1989) examined by Howard and Bartram (2003) shows that a reduction from 5 hours to 15 minutes collection time increased the quantity of water used for child hygiene by 30 times. A reduced collection time may allow more time to be spent on other activities, such as child care or food preparation. Another study in the review (Esrey, 1996) suggests that there are only significant gains in health when water becomes available on-plot. Unfortunately, most studies do not cover a wide range of collection times. For example, studies compare households with water on the compound to households using a water source 500 meters away, or with collection times of thirty minutes to two hours.

Another study shows that handwashing is less common when a water source is greater than one kilometer from the home, but more frequent when the water is more accessible (Curtis et al., 2000). Time and energy spent collecting water is also an important factor. Although an improved water source may provide more water that can be used for increased hygiene practices, people may still need to travel long distances to collect the water.

3.2 Hygiene Behaviors

Table 2 showed that the distance to a water source and the quantity of water used are related to health risks, but safe and accessible water is not enough to reduce the morbidity and mortality due to water-related diseases. *Sanitation Challenge: Turning Commitment into Reality* (WHO, 2004a) reiterates that safe water is not enough, as sanitation and hygiene behavior also greatly impact health. In fact, many studies have shown that the disease burden can be reduced by a number of factors. Brownlee (1978) discusses several factors that affect health, not necessarily related to access of water: nutrition, economics, culture, family member's status (for example, who goes to the dispensary), environmental sanitation and pest control. In other words, although a household may have reasonable access to an improved source of water, the inhabitants are not necessarily guaranteed their health.

3.2.1 Disease Transmission

Curtis et al. (2000) examine the reduction of the disease burden of diarrhea. Four alternative routes of transmission of diarrheal pathogens are:

- Human to human via the environment
- Human to human, multiplying in the environment
- Human to animal to human via the environment
- Animal to human via the environment

In each case, the environment is an important factor. The F-Diagram, adapted from Curtis et al. (2000), is another representation of the routes taken by pathogens through the environment to a new host (see Figure 5). One benefit of viewing transmission routes through the F-Diagram is that interventions and barriers can be identified. A primary barrier is the first level of intervention: proper disposal of feces will help prevent disease-causing pathogens from reaching the

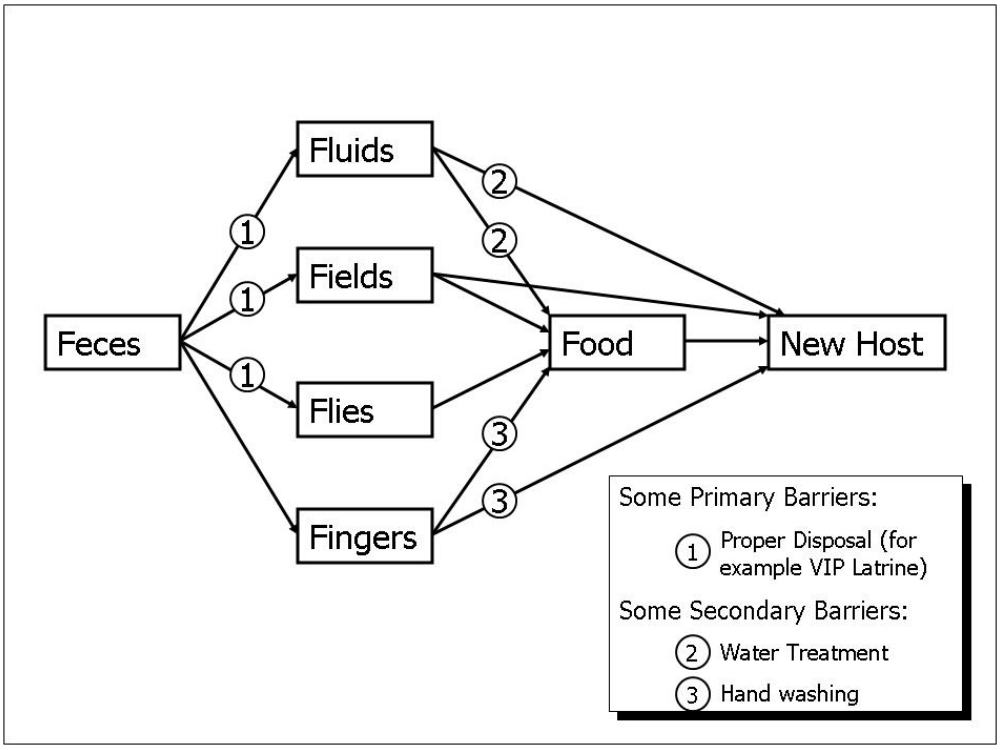

Figure 5. The F-Diagram: Transmission Routes of Various Diseases with Primary and Secondary Barriers to Interrupt Transmission Routes (Adapted from Curtis et al., 2000)

environment. A secondary barrier, such as handwashing before food preparation, will help prevent transmission of a pathogen to a new host. Many times secondary barriers are necessary

even with primary barriers in place. For example, although a water source is protected from fecal contamination (primary barrier), contamination to water may occur during transport. A secondary barrier could be treating the water before use. Figure 5 also shows possible primary and secondary barriers to the transmission routes.

3.2.2 Interventions in Disease Transmission

Fewtrell et al. (2005) review numerous studies to compare the reduction in disease morbidity due to different health interventions. Table 5 describes how these interventions are classified. The range of results from the study is widespread, but overall estimates suggest an important role for each type of intervention in the reduction of illnesses. Although results do not contradict past studies, Fewtrell et al. (2005) show that water quality interventions may be more effective than previously regarded. Furthermore, intervention programs that focus on more than one type of intervention may not produce additive results, as focus may be lost on an individual intervention within a larger program.

Table 5. Interventions to Reduce the Morbidity of Disease (Taken from Fewtrell et al., 2005)

Intervention	Description of Intervention
Hygiene interventions	Health and hygiene education, encouragement of specific behaviors
Sanitation interventions	Excreta disposal (either household or public)
Water supply interventions	New or improved water supply, improved distribution (either household or public)
Water quality interventions	Related to water treatment for the removal of microbial contamination (at either source or household level)
Multiple interventions	Combinations of the other interventions

Curtis et al. (2000) also review different types of interventions and find that the disease burden is reduced from implementing each. The most effective way to prevent transmission of diarrheal pathogens is through the primary barrier of safe excreta disposal. The conclusion reached from the study is that to best reduce the disease burden of diarrhea, two actions should take place: promoting proper disposal of feces and improving accessibility to safe water.

Handwashing is an intervention that is directly related to the accessibility of water, and it can be a primary or secondary barrier to transmission of pathogens. However, it is still not a common practice for everyone. A review of a study from Peru showed only 11% of people washed their

hands after using the latrine, and even fewer people used soap (Curtis et al., 2000). Researchers in Guatemala asked a group of mothers to wash their hands at different times throughout the day: these times included after using the latrine, before preparing meals, after changing a diaper, before going to bed, etc. The study showed that the mothers washed their hands on average 32 times per day, requiring an additional 20 liters of water and one additional hour per day to wash their hands as often as requested. The authors cite several other studies showing a reduction in diarrheal diseases when handwashing programs were introduced to study groups.

Feachem (1984) reviewed studies of handwashing with soap as a hygiene intervention and showed there is a reduction in diarrheal disease morbidity with increased hygiene education. The cost of implementing hygiene education programs is low compared to water and sanitation improvement programs, but the effectiveness of the education may depend on the improvement of water and sanitation facilities.

Esrey et al., (1985), review various studies to examine the impact of improved water supplies on diarrhea morbidity. The results of the study (seen in Table 6) show that improvements in availability of water reduce the incidence rate of diarrheal diseases. Each intervention studied may include aspects of other interventions. For example, improving water availability may also include some water quality improvement.

WHO and UNICEF (2005) references a study by Fewtrell et al. (2005) that provides data showing the impact of various interventions to reduce the occurrence of diarrheal diseases. Table 7 shows the disease morbidity reduction for the four interventions studied. The data show the importance of hygiene behavior education. Education regarding hygiene behaviors will aim to improve the levels of hygiene of individuals and households. Moreover, it shows the importance of accessible water, as water directly impacts each of the interventions. Table 6 and Table 7 show that there are different ways to improve diarrheal disease morbidity, but the same interventions do not have the same impact on disease morbidity in all situations.

Table 6. Percentage Reduction in Diarrheal Morbidity Rates Attributed to Water Supply or Excreta Disposal Improvements (Taken from Esrey et al., 1985)

Type of Intervention	Number of results[3]	Percent reduction	
		Median	Range
All interventions	53	22	0-100
Improvements in water quality	9	16	0-90
Improvements in water availability	17	25	0-100
Improvements in water quality and availability	8	37	0-82
Improvements in excreta disposal	10	22	0-48

Table 7. Reduction in Morbidity of Diarrheal Diseases Due to Water and Sanitation Improvements (Taken from WHO and UNICEF, 2005)

Intervention	Percent Reduction in Diarrheal Disease
Improved water	25%
Improved sanitation	32%
Improved hygiene	45%
Household water treatment	39%

Target 10 of the MDGs is to halve the proportion of people without sustainable access to safe water. Cain and Gleick (2005) show that even if this goal is fulfilled, the death rate due to water-related diseases in 2020 is estimated to be one million people per year, although the rate will be decreasing yearly. If the MDG is not reached, by 2020 the death rate due to water-related diseases could be over 2.5 million people per year, and rising.

[3] "There are 53 results in total but only 44 attributed to specific interventions. The remaining 9 are for other interventions or combinations of interventions having less than 3 results, and include interventions in fly control and health education together with water supply or excreta disposal" (Esrey et al., 1985).

4 Preparation and Collection of Data

This chapter discusses the different methods of measuring health and techniques used to collect data. The chapter also describes preparation of the survey used by the authors of this report to collect data regarding water and health in Muthara, Kenya. Finally, this chapter discusses how Peace Corps Volunteers have advantages collecting information from cross-cultural settings over researchers that visit a region for only a short time period.

4.1 Methods of Measuring Health

Cairncross et al. (1980) describe two different methods to measure health: one manner involves determining the health problems due to inadequate water, and the other involves looking at the health benefits gained from an improvement in water supply. It is more difficult to measure health benefits than health problems. One way to measure health benefits is a follow-up approach: study a community, make changes or improvements to the water supply, and perform a follow-up study to compare the pre- and post-improvement conditions. Another technique is comparative: it involves studying and comparing the health level of two communities, one with improvements to a water supply and the other without. A major problem with this technique is that no two communities are identical and factors other than just the improved water supply influence the level of health and must be accounted for. The best data would come from combining the two study techniques—comparing two communities as well as improving a water supply and conducting a follow up study.

Cairncross et al. (1980) further describe several methods to measure health problems: questionnaires or surveys, clinical examinations and laboratory examinations. An important characteristic of using a questionnaire is that there is no way to check the accuracy of the results, and there are many ways that accuracy in results may suffer due to how the survey is written or administered. Clinical and laboratory examinations would reveal more accurate information about the disease presence in a population but are more time consuming than questionnaires and require skilled technicians and special facilities to perform the investigations (Cairncross et al., 1980).

4.2 Techniques of Collecting Data

Simpson-Hébert (1983) recommends useful data to collect for water supply and sanitation projects. The author also describes different techniques that can be used to collect data and how

to adjust these techniques to different situations. Four different data-collection techniques are described: observer participation, key-informant interviews, open-ended questionnaires and surveys. Table 8 ranks these four techniques in the order of more qualitative or more quantitative data. Knowledge of the type of data sought by the researcher can help select which data-collection technique to use for a study.

Table 8. Techniques of Gatherin Data and Type of Data Collected by Each (Taken from Simpson-Hébert, 1983)

More Qualitative Data
↕ Observer participation
Key-informant interviews
Open-ended questionnaires
Survey
More Quantitative Data

In observer participation, a person lives with the community that is being studied and makes observations on the daily life of the community. The observer is able to search for the needed information, as well as learn how the issues being studied impact and are affected by other aspects of the local lifestyle. A benefit of this method is that rapport is built with a community in a way that might not be achieved by short-term visitors. A variation of this method is observation, which only involves short visits to the community without much participation. Simpson-Hébert warns that much information may be missed, however, because many activities will take place outside of the observer's presence.

In key-informant interviews, different people will be interviewed for specific information. For example, in determining the health issues in a community, a local health official might be interviewed. However, "researchers have found that there is a much lower degree of agreement (and hence of reliability) among informants" for questions regarding evaluative information, as opposed to questions dealing with geography, institutions and institutional roles or community history (Simpson- Hébert, 1983). When investigating beliefs or values of the community, the data may be biased because it contains the key informants' opinions.

To overcome the possibility of biases due to an observer's interpretation of data, or that a key-informant's opinion is not representative, open-ended questionnaires can be used to help an investigator find less-biased data. Open-ended questionnaires can also be used to help determine which information is important for further investigation. In an open-ended interview, the discussion is directed by the responses to different topics or broad questions. In this way, investigators may learn ideas that would not have been offered if the questions were more structured. Open-ended interviews can also "provide more reliable data on attitudes, beliefs and values" than using key informants (Simpson-Hébert, 1983).

Surveys will collect the most quantifiable data and can be used to estimate attitudes, beliefs and values. Some disadvantages of a survey include possibly requiring more resources, such as time and money. In addition, since a survey may be more structured, answers dealing with values and personal practices may be limited. Simpson-Hébert (1983) addresses several factors that should be taken into account by researchers. Different types of sampling might be random or based on different social or economic groups, and characteristics of the respondents will obviously have a large impact on the results. Questionnaires should be designed while taking into account the information sought, with the realization that not all of the information might be obtained from respondents. Some information may also be sensitive, such as household income or health status, and may require observation instead of direct questioning.

4.3 Data Collection and the Peace Corps Volunteer

A Peace Corps Volunteer can potentially use all of the data-collecting techniques described by Simpson-Hébert (1983) in Table 8. By living with a community, he or she can build rapport and trust. The PCV can identify key informants from experience rather than relying only on the recommendations of village members. The person administering a survey will be an important factor in how data is collected, which data is collected and, therefore, the accuracy of the data. The respondent must trust an interviewer, and the amount of that trust can influence the amount of information shared. The role of the interviewer in the community, how well he or she is known, and the gender of the interviewer may also influence how much the respondent shares. A PCV can play a positive role in the community, and as a researcher have a minimal negative impact on the data collected.

One benefit that PCVs acquire by living in the community is that they will learn cultural practices and be able to apply those to the data collection. A PCV will be able to observe characteristics of the culture or community that may not be seen during short term visits by other researchers. With the experience of living and working in the culture, a PCV can also prepare for data collecting with a better awareness of how the culture will respond to certain issues or how the culture responds to being questioned in general. The PCV can also determine how to administer a survey in a culturally appropriate way, taking into account holidays or seasonal issues, or speaking to the proper authorities for permission.

4.4 Possible Issues Involved in Collecting Data through a Survey

The author of this report determined that the survey was the most appropriate method of collecting data regarding access to water, water use and health in the household. Once a method of collecting data has been selected, preparation for data collection can help ensure accurate results. Brownlee (1978) suggests several ideas from a social and cultural point of view that can help produce better data dealing with health and the community. One suggestion is to try to learn how important health is to a household and community versus other needs and values. The roles of family members might influence how often they go to the health dispensary or which resources are spent on their health. A family member's health might be a secondary priority to school fees, or family members might receive care in a specific order. For example, the youngest child might go to the dispensary when ever sick, but an adult male might not go unless absolutely necessary.

Brownlee (1978) also describes the importance of language when administering a survey and collecting health information. One problem is the translation of technical terminology into a local language. A translator has the burden of translating from the researcher's language to the local language and then back to the researcher's language. Data can easily be lost or changed through this process. The survey might also be asking for data that is too specific or too technical to learn from the respondent through an interview.

The translator can serve an important role in making certain the survey is appropriate for a culture and community. A translator that understands the purpose of the survey and the information sought by the researcher can help verify that the survey will collect the information intended. A translator can also help identify a survey as culturally appropriate. Brownlee (1978) recommends

concentrating “on the most essential information first” and that a researcher may need to determine which types of information are important and can be conveyed through a translator.

Although a researcher may take many things into consideration when preparing a survey, difficulties may still arise while collecting data. Issues with translation are only one potential problem of collecting data via a survey. Brownlee (1978) describes "some typical problems in gaining information, or why you may have difficulty in determining 'the truth.'" Table 9 lists these typical problems. By realizing and understanding these different issues, a survey can be written in ways to reduce the occurrence of some possible problems.

Table 9. Typical Problems of Gathering Information in a Cross-Cultural Setting (Taken from Brownlee, 1978)

People may not trust you yet
Respondents may wish to tell you what they think you want to hear
You may be asking the wrong people
You may be asking the wrong questions
You may be asking questions at the wrong time or place
People may have difficulty in reflecting on what is second nature to them
What a respondent says may be altered during translation
Your own characteristics may influence the response
Your respondents may mistake the ideal for the real

While the primary purpose of the community entry survey was to collect data for use in identifying projects for the author of the report during PC service, even more important was actually administering the survey and learning about the community and how to begin working with the people and the culture. By the end of the community entry survey, there was more comfort within the culture when trying to complete tasks. The community entry survey was written and administered without knowledge of the specific issues listed in Table 9. Greater preparation by the author of this report for the Access, Use and Health Survey can be attributed to experience from the community entry survey, living in and learning about the community for a longer period of time, and a greater awareness and understanding of Brownlee’s typical problems in collecting data.

5 Results and Discussion

This chapter summarizes the results from the Access, Use and Health Survey and the Monthly Health Record. This section of the report also compares the data from the survey to the published literature from previous chapters. This chapter summarizes the qualitative data collected by the AUHS to give an overview of health behaviors and lifestyles of Maburwa and Nduluma, Kenya. Finally, this chapter addresses the difficulties encountered collecting data when administering the AUHS.

5.1 Access, Use and Health Survey

During Peace Corps Kenya Pre-Service Training, volunteers learn about the importance of understanding local culture. Surveys or questionnaires can be used to find information about host communities—information may be qualitative or quantitative. During service as a Peace Corps Volunteer, the author of this report administered a survey, called the community entry survey, to learn more about the health issues in Muthara, Kenya, as well as other issues community members deal with and find important. The community entry survey is provided in Appendix 2.

The activity of administering the survey helped the author learn about working in the community and how to collect information from the village setting. The survey addressed health education, farming practices and the lifestyles of the respondents. More data was necessary in order to investigate issues of water accessibility, the use of water and health in the household. This is the reason two more questionnaires were written: the AUHS and Monthly Health Record (MHR).

Reviewing data collecting techniques helped select methods that would be useful for the data sought. The Access section investigates the water source used by respondents and collection behaviors. The Use section of the survey addresses how water is used in the household. This section includes questions where the respondent is asked to estimate the amount of water used for different purposes. Finally, the health section of the survey considers how respondents view health issues, such as illness prevention, and the frequency of and attitudes about specific health behaviors. Table 10 lists some sample questions from the AUHS. The complete Access, Use and Health Survey is provided in Appendix 3.

Table 10. Sample Questions from the Different Sections of the Access, Use and Health Survey Administered in Maburwa and Nduluma, Kenya.

Topic	Sample Questions
Access	• How many times is water collected on non-laundry days? • How many times is water collected on laundry days? • How many people use water in the household? • Is the water source protected form contamination? • How much time does it take to return home with the water?
Use	• Estimate how much water is used for the following: drinking, cooking, cleaning, bathing, laundry, watering livestock • Is laundry done at home? • Are there other uses for water (such as tree nursery or kitchen garden)? • How is water treated at home?
Health	• What do people consider "good health"? • What is the frequency of different activities such as: bathing, cleaning the latrine, wearing shoes • When do people wash their hands? • Are children taught to wash their hands?

5.2 Survey Respondents

For the community entry survey, respondents were chosen from the different self-help groups (SHGs) that make up members of Muthara United Welfare Association. Five people were selected from each one of twelve active member groups through a random lottery, and fifty-five total respondents completed the survey. The homes of the respondents were located in two villages throughout the region. For the AUHS, two SHGs were selected from MUWA and the survey was offered to all members of each group. The two groups were selected from the active groups in MUWA because they were found to be more active and reliable with group activities.

The two groups selected for the survey were Mwangaza Women's Group in the village of Nduluma and Maburwa Women's Group in the village of Maburwa. Many of the questions on the survey address issues that are dealt with primarily, if not exclusively, by women in the household. For example, women collect the water, wash clothes, cook meals and care for children. Exceptions do occur, but they generally occur only if a man is not married or is living alone. The women, therefore, know how much water is used for each task and are the best source of information in the household regarding the use of water and health of the household.

In the community entry survey, all of the interviews took place at the homes of the respondents. The surveys were scheduled for five per day, and although the respondents showed kind hospitality, meal preparation and eating added significant time to the survey process, which already included traveling to each household within a region, sometimes located a couple hours from Muthara. For this reason, it was determined that during the AUHS, the surveys would take place at the SHG meeting location. Respondents chose when they wanted to meet for the survey, and five to eight respondents would meet survey administrators at the meeting site. The AUHS took place between February and June 2006.

While the AUHS collected information about access to water, use of water and health in the household of respondents, the Monthly Health Records (MHRs) were used to keep track of the occurrence of illnesses in the households of respondents. There were 57 members in Maburwa and Mwangaza Women's Groups that originally said they would take part in the surveys. Table 11 shows how many respondents participated in the AUHS and MHR. The MHRs are described in more detail later in this report.

Table 11. Number of Respondents that Participated in the Access, Use and Health Survey and Monthly Records in Maburwa and Nduluma, Kenya

Participation	Number of Respondents		
	Total	Village	
		Maburwa	Nduluma
Scheduled to Participate	57	34	23
Completed Access, Use and Health Survey	44	27	17
Completed Monthly Health Record	31	21	10
Completed both Access, Use and Health Survey and Monthly Health Record	26	16	10

5.3 Difficulties Experienced While Administering a Survey

As the AUHS was being administered, issues arose with some of the decisions about how to administer it. For example, although the surveys were scheduled at the SHG meeting locations in order to save time, there were some drawbacks in not visiting the respondents in their homes. Responses to questions dealing with use of water were all from the memory of the respondents. If the survey had taken place at home, some uncertainties could have been clarified, such as the size

of the jerrycan used to collect water or evidence of a hygiene behavior. Another drawback about not visiting homes of the respondents was that the length of time to the water source was estimated by the respondent instead of measured.

When scheduling for the AUHS began in January 2006, the time seemed to be sufficient to complete all surveys. If the survey had been prepared earlier, there would have been perhaps more time to make improvements to the data collecting methods. For example, at times a respondent would have trouble estimating the time it takes to collect water. There was not enough time before the end of service of the author of this report to verify all the collection times of respondents.

Other factors also affected the schedule. The long rainy season began early in 2006 (expected in mid-March) so the survey was delayed while respondents spent time working on their farms. The respondents chose the survey days, but sometimes this process took several weeks to complete. In addition, there were other scheduling conflicts. For example, although the survey day was scheduled sometimes up to several weeks in advance, another village meeting or event could be scheduled and the survey would be dismissed by respondents. In some cases, a SHG would try to schedule several group activities on the same day. When a survey day failed, it would take several weeks for a replacement survey day to be scheduled.

5.4 Water Use of the Respondents of the Access, Use and Health Survey

Water use in the household was calculated in two ways from the AUHS. First, in the Access section, respondents were asked how many trips they made to the water source each day. Respondents were also asked about the volume of the jerrycan or water container and how many people use the water in the household. When asking how many trips are taken per day, the AUHS distinguished between laundry days and non-laundry days. This was done in order to learn the amount of water used for laundry. In some cases, people take their laundry to the water source so they do not keep track of how much water is used for the activity. By asking the amount collected on non-laundry days, the volume for used for laundry could be considered separate from other uses of water in the household.

The second way water use was calculated was from totaling the estimations of water used for the various water use categories from Table 3 (consumption, hygiene, productive and amenities). Table 12 shows how the estimates of water used in the household fit into the respective categories of water use from Table 3. Since productive and amenity uses vary with household, the AUHS asked each respondent to first list uses of water other than consumption and hygiene and then estimate the amount of water used for each. Of the 44 respondents of the AUHS, all respondents were able to estimate the amount water used for various activities in the home, but only 43 respondents were able to estimate the amount of water collected each day. Appendix 4 shows the complete data from the AUHS. The average water use was calculated by totaling the estimations of each different water use.

Table 12. Categories of Water Use Addressed and Estimated by Respondents in the Access, Use and Health Survey in Maburwa and Nduluma, Kenya

Water Use Category	Sample Responses of Water Use in the Access, Use and Health Survey
Consumption	Cooking Drinking and tea
Hygiene	Cleaning house and utensils Bathing Laundry
Productive	Livestock, nursery, kitchen garden, or construction
Amenities	Keeping dust down

Figure 6 shows the total estimated water use per capita per day and the different purposes of the water used. Productive and amenity use values do not always occur daily but are still shown in the figure. For example, using water to construct the home or to keep dust down around the compound does not occur daily. Figure 7 shows how estimations of water use are divided among water use categories. The water use per day only includes estimations of activities that take place at home within the categories of consumption (21%), hygiene (51%) and productive use (28%). Figure 8 shows how each water use category is broken down to the individual estimations from the AUHS that make up the quantities in Figure 7. Since water used for amenities was estimated by only two respondents, amenity uses are not shown in Figure 7 and Figure 8. Most respondents of the AUHS said that bathing and laundry take place at home, although laundry does sometimes take place at the source.

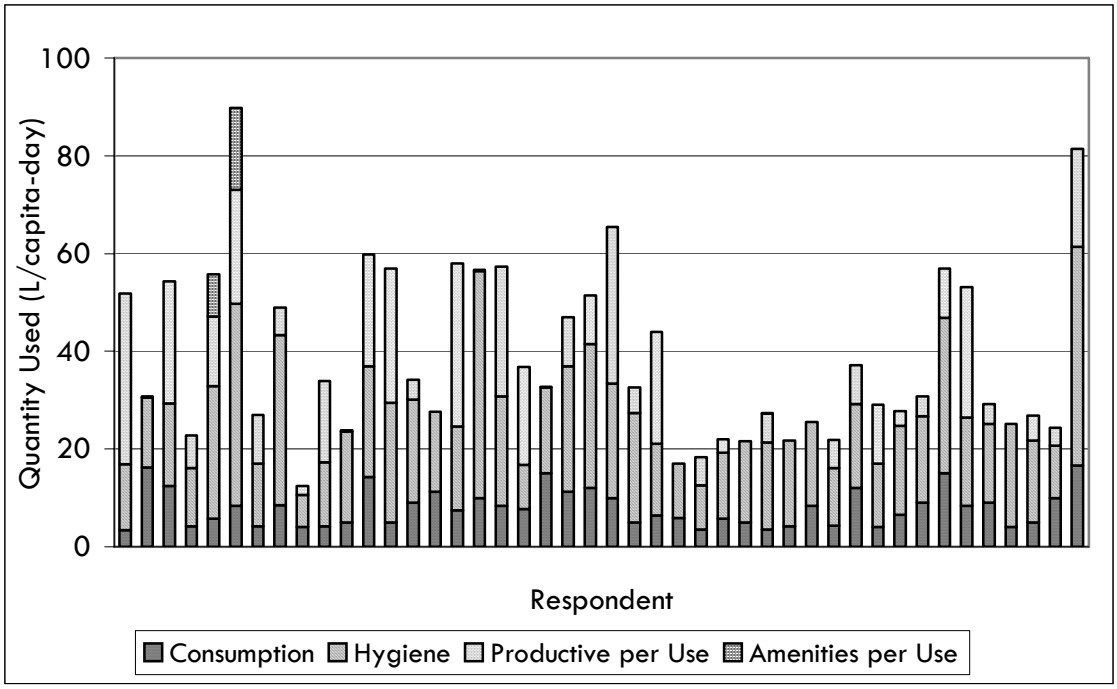

Figure 6. Estimated Quantities of Water Used per Capita per Day for Different Water Use Categories of the 44 Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya

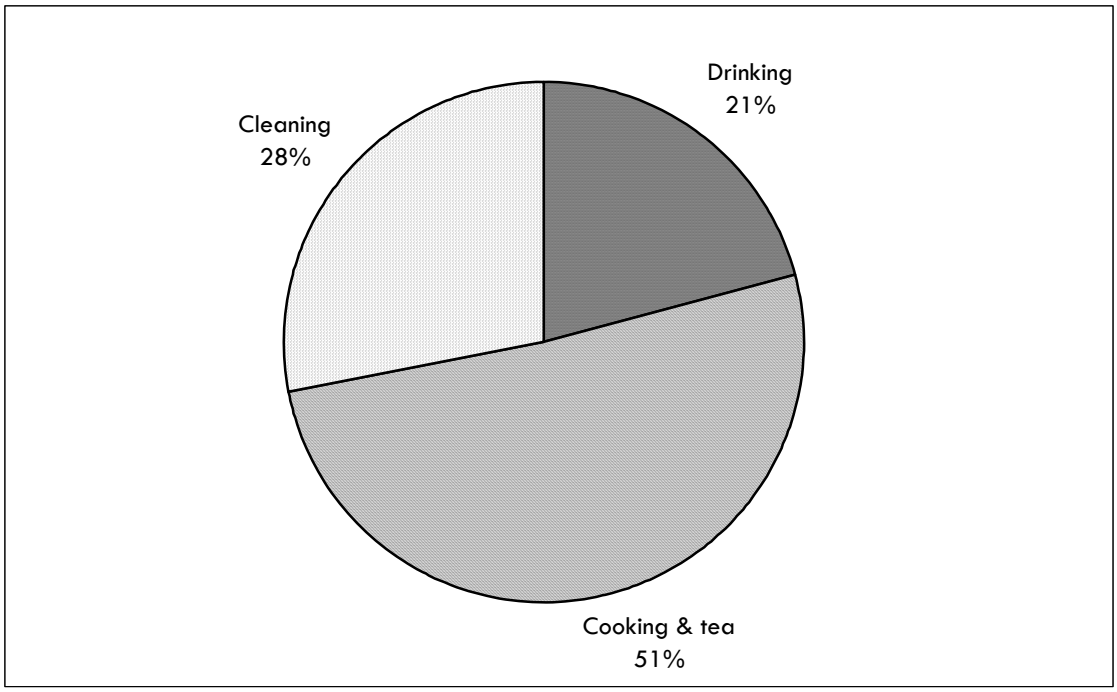

Figure 7. Average Percentages of Total Water Use for Different Water Use Categories Estimated by 44 Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya

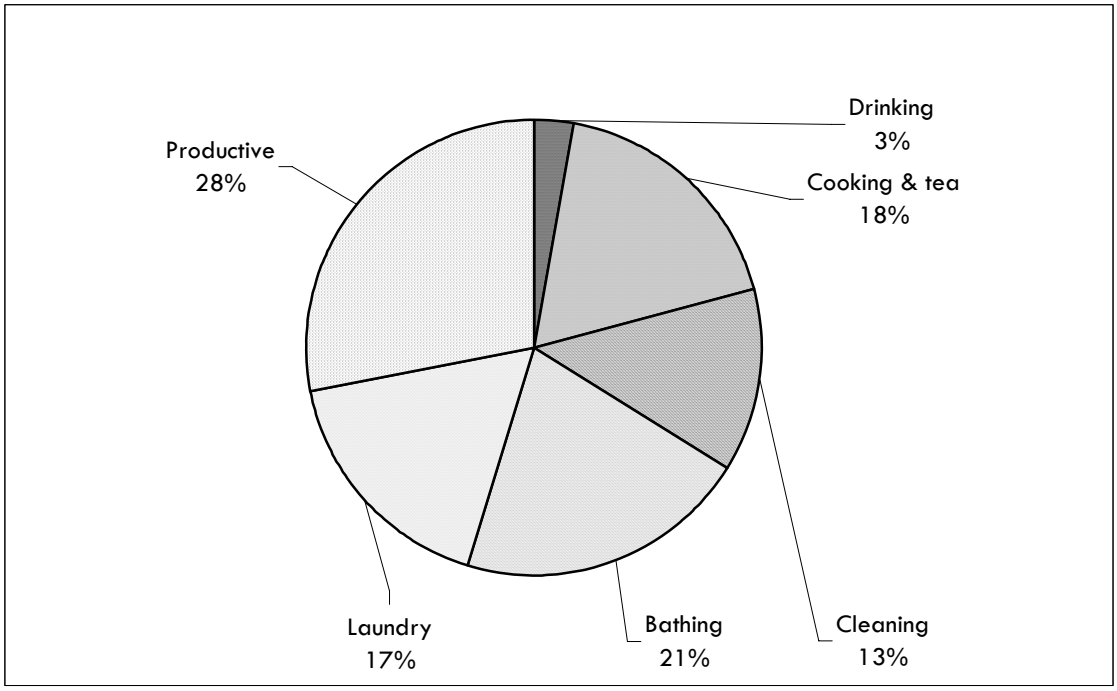

Figure 8. Average Percentages of Water Use for Various Purposes Estimated by 44 Respondents in Maburwa and Nduluma, Kenya

The average total amount of water used per capita per day for respondents is shown in Table 13. These values are calculated from the Access section of the AUHS. The values in Table 13 do not include one respondent who was not able to estimate the amount of water collected per day because the standpipe is located in the household compound. Water use in Muthara, Kenya is 12.3 L/capita-day not including laundry and 16.7 L/capita-day when laundry is included.

Table 13. Average Quantities of Water Collected by 43 Respondents in Maburwa and Nduluma, Kenya in the Access, Use and Health Survey

	Number of Respondents	Water Collected (Excluding Laundry)	Water Collected (Including Laundry)
Maburwa	26	11.5 L/capita-day	16.2 L/capita-day
Nduluma	17	13.6 L/capita-day	17.6 L/capita-day
All	43	12.3 L/capita-day	16.7 L/capita-day

Figure 9 shows a comparison of these two quantities of water calculated from the AUHS: the water use calculated from the questions in the Access section (number of trips, size of jerrycan

and number of users) and the Use section (estimations of water for different water use categories). Figure 9 also shows a line with the slope of 1, which can be used to visualize the difference between the estimated quantity of water used and the quantity of water collected. The estimated quantity of water used exceeds the quantities collected for each day by factors of 1.2 to 6.

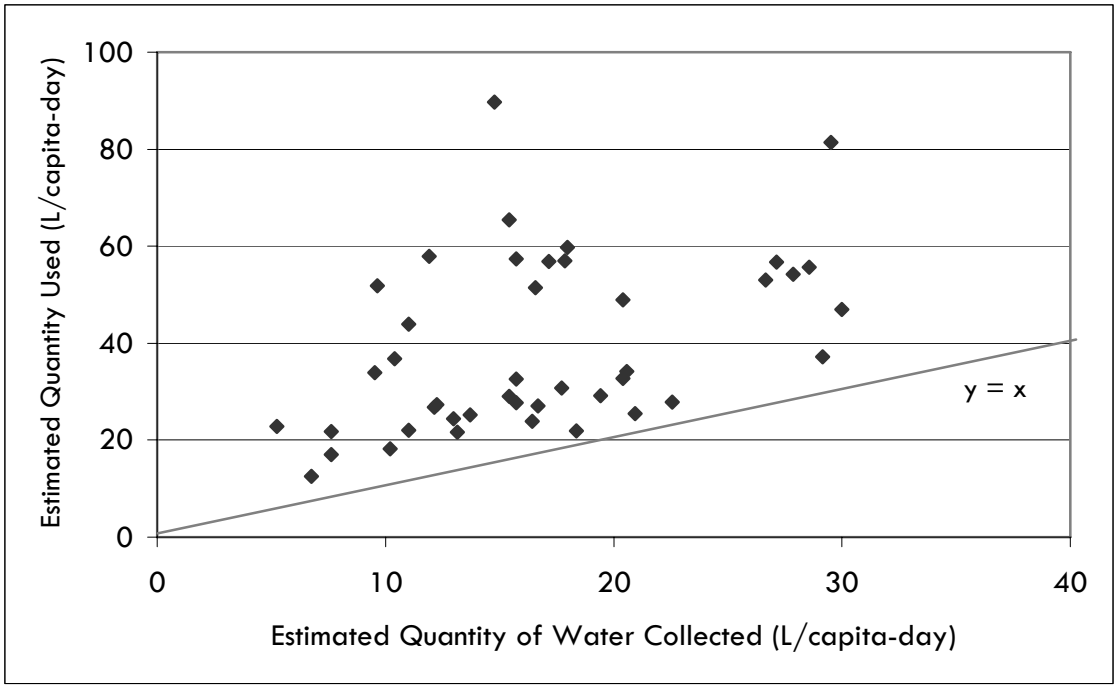

Figure 9. Comparison of the Total Estimated Quantities of Water Used and the Quantities of Water Collected by Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya, Showing that Estimations of Quantity of Water Used are Higher than Actual Quantities of Water Collected

The difference between the estimated quantity of water collected and the quantity of water used may partly be attributed to how the information was collected. Table 14 lists the different variables used for calculating water use. Water use based on the number of trips is determined by fewer variables and calculations: the errors will not be carried through multiple calculations. In water use based on estimations, there are more chances for errors to occur in the estimations and to then be carried through the calculations and perhaps amplified. Accordingly, the author of this report feels that the water use of respondents calculated by the number of trips to the water source is a better representation of the total amount of water used per household than the sum of the individual estimations of water use for various purposes throughout the household.

Table 14. Data from the Access, Use and Health Survey Used to Calculate the Quantity of Water Estimated and the Quantity of Water Collected by Respondents in Maburwa and Nduluma, Kenya

Value	Variables
Water Use (Collected)	Number of trips to water source per day Size of jerrycan Number of users
Water Use (Estimated)	Quantity of water used for Drinking per household per day Quantity used for Cooking & Tea per household per day Quantity used for Cleaning per household per day Quantity used for Laundry per laundry day Number of Laundry days per week Quantity used for Bathing per household per day Quantity used for Livestock per day Quantity used for Productive and Amenity per Use Frequency of Productive and Amenity Use Number of Users

5.5 Service Level of Respondents

The AUHS asked respondents to estimate the amount of times it takes to return from the water source to the household with water. Cairncross et al. (1980) recommend measuring return trip time when investigating the travel time of water collection. Travel time may be greater when water is transported than when water is not transported, and using the return trip for estimates will help ensure that the time will represent the actual transport of water. The collection time is twice the return trip (from the home of the user to the source and from the source back to the home). Figure 10 shows quantity of water used in the household and Figure 11 shows collection times of respondents from the AUHS. Each figure shows the respective definitions of service levels from Table 2 (Optimal, Intermediate, Basic and No Access). Data from respondents is omitted when the quantity of water collected or collection times were not known: this occurs for only one respondent in each case.

As seen in Table 13, most respondents fit into the Basic Access service level (between 5 and 20 L/capita-day). The respondents in Maburwa and Nduluma use water from various sources. The sources are either unimproved or improved partially. Figure 12 is a histogram of the amount of water used by respondents of the survey and indicates that most water users (31 of 43 respondents) fall into the category of Basic Access (between 5 and 20 L/capita-day). The other 12

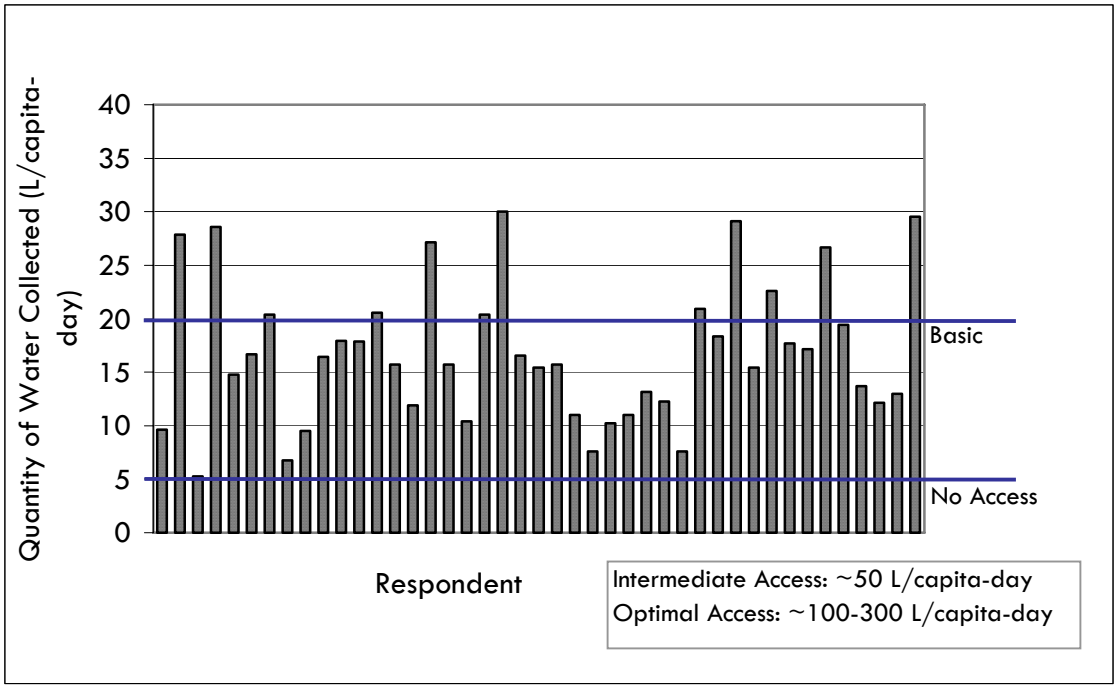

Figure 10. Quantities of Water Collected by 43 Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya with Service Level Descriptions

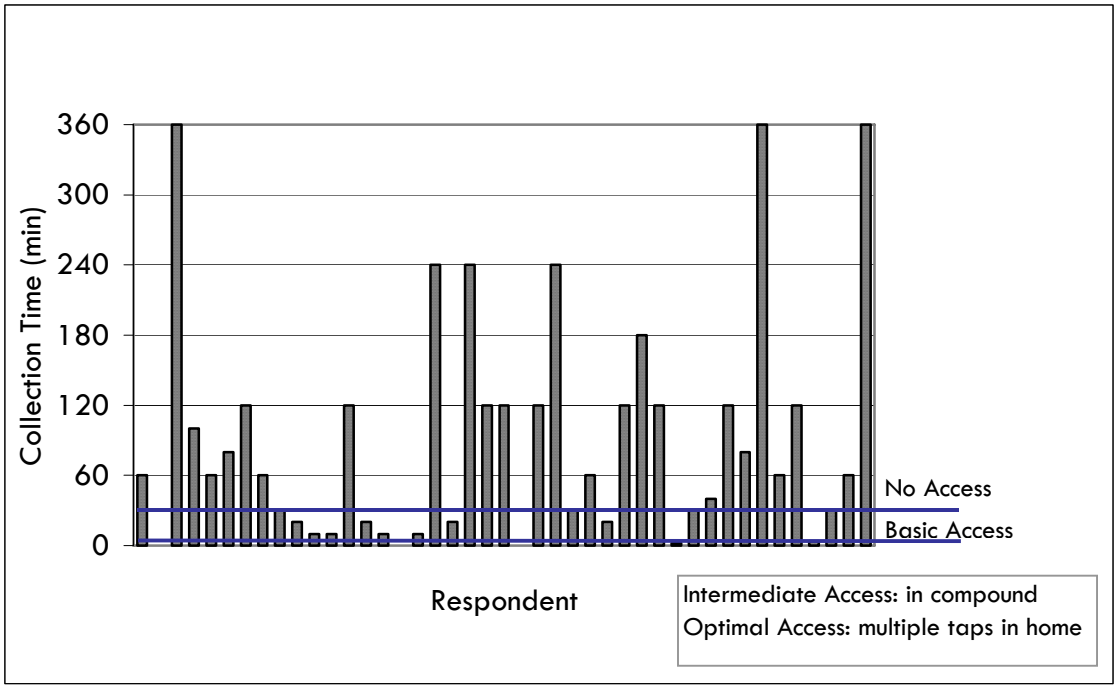

Figure 11. Collection Times of 43 Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya with Service Level Descriptions

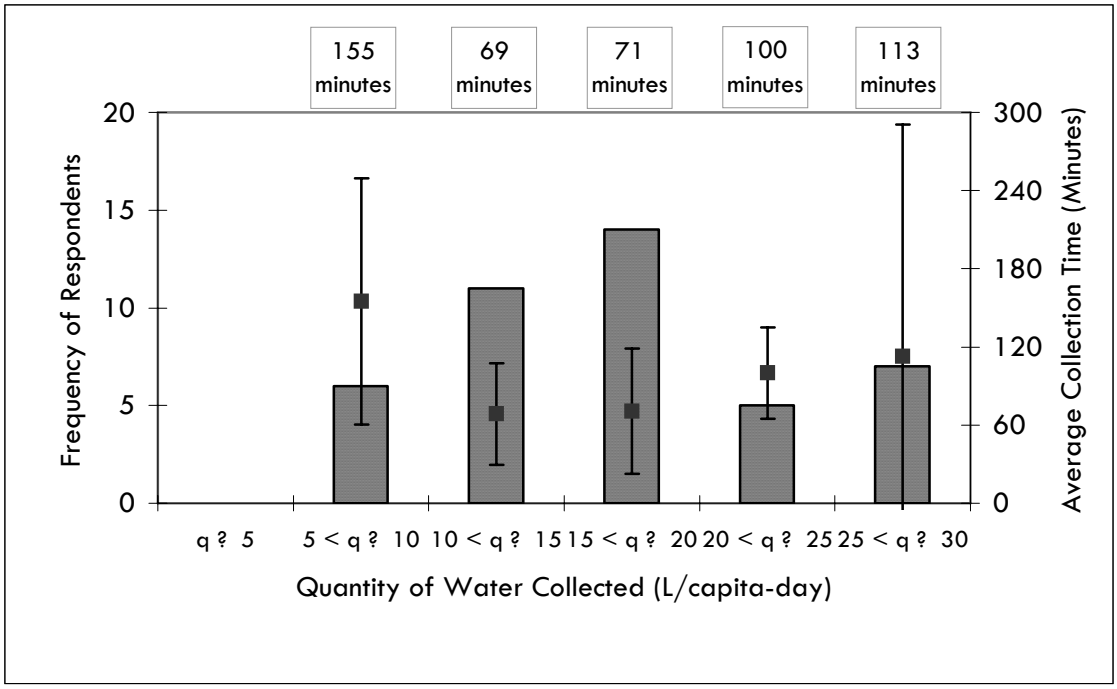

Figure 12. Histogram of the Frequency of Respondents from the Access, Use and Health Survey in Maburwa and Nduluma, Kenya for Intervals of 5 L/capita-day and Showing the Average Collection Time with a 95 Percent Confidence Interval

respondents are in the category of Intermediate Access (20 L/capita-day or more). Figure 13, a histogram of the collection time of the respondents, indicates how the respondents fit into the service levels based on collection time. Most respondents, 26 of 43, are at a service level of No Access (greater than 30 minutes collection time), and 12 of 43 respondents are at a service level of Basic Access (5 to 30 minutes collection time). Only 5 respondents fit into the collection time service level of Intermediate Access (less than 5 minutes). Table 15 is a summary of how respondents fit into the service level demands described by Howard and Bartram (2003).

The times of collection are susceptible to error, and the author of this report realizes that some of the data may include inaccuracies. Estimating times and interpreting some of the survey questions may have been part of the cause. For instance, the respondent may have interpreted the question that asked about returning home from the water source to include total collection time. Translation and the use of a translator are discussed later in this report. Another possible cause for inaccuracies in the times of collection is strategic bias, which occurs when the respondent wants a particular outcome and changes a response in order to influence an outcome. Although the survey was explained to respondents to be meant for collecting data only, a respondent that is expecting

improvements in access to water may give responses to the survey administrator that the situation is different than it really is.

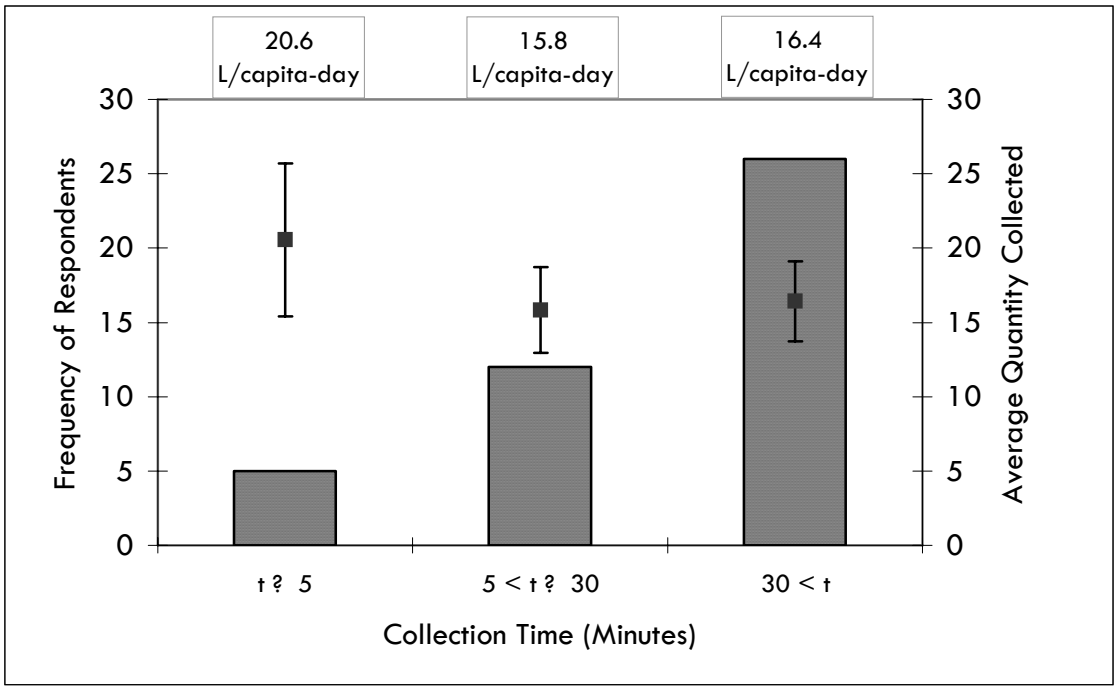

Figure 13. Histogram of the Frequency of Respondents from the Access, Use and Health Survey in Maburwa and Nduluma, Kenya for Intervals Defined by Service Levels from Howard and Bartram (2003) and Showing the Average Amount of Water Collected for Each Bin with a 95 Percent Confidence Interval

When the survey was almost complete, the survey administrators visited some of the households of respondents in order to measure the route followed to water sources. The purpose was to verify collection times to compare to respondents' estimated collection times. In Mali, Telmo (2002) collected the distance to water sources from respondents' homes by traveling the route and recording data. The author of this report found the need to verify some of the data collected during the AUHS and decided to do the same. Verification of six respondents' estimated collection times by following the collection route is shown in Table 16. The ratio between measured collection times and estimated collection times is also shown in the table. When the collection times were measured, the distance along the collection routes were also measured and the data is shown in Table 16. The times measured by the survey administrators represent how long it takes to follow the routes from water source to household for respondents, but they do not take into account the various activities or characteristics of a normal water collection trip, such as

Table 15. Classification of Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya with the Service Level Descriptors from Howard and Bartram (2003)

Service Level	Collection Time		Quantity Used		Level of Health Concern
	Definition	Respondents	Definition	Respondents	
No Access	30+ minutes	26	Less than 5 L/capita-day	0	Very High
Basic Access	5-30 minutes	12	Unlikely to exceed 20 L/capita-day	31	Medium
Intermediate Access	On plot (5 min or Less)	5	Around 50 L/capita-day	12	Low
Optimal Access	Multiple Taps	0	Likely to be 100 and up to 300 L/capita-day	0	Very Low
Total	—	43	—	43	—

greeting neighbors or carrying the water. For this reason, while the measured times are a different representation of the collection time, the author realizes that better data can be collected by candidly timing a respondent while not influencing the route.

Table 16. Comparison of the Estimated Collection Times, Measured Collection Times and Distance to the Source of Six Respondents from the Access, Use and Health Survey in Maburwa and Nduluma, Kenya

Respondent	Respondent Estimated Collection Time (minutes)	Measured Collection Time (minutes)	Ratio Measured to Estimated Times	Distance Measured (meters)
3	180	8	0.04	460
4	50	10	0.2	500
18	10	20	2	920
31	10	5	0.5	80
41	60	15	0.25	1000
45	30	15	0.5	950

Figure 14 shows the relationship between the quantities of water collected by respondents and the collection time. Data from two respondents are not included in Figure 14: one respondent could

not estimate the collection time, and another respondent with water in the household compound could not estimate how much water was collected per day. The data in the first few minutes of collection time was expected to follow the pattern of Figure 4, where the quantity of water collected decreases rapidly, plateaus between three and thirty minutes, and then decreases again with collection times greater than thirty minutes. WELL (1998) states that the shape and turning points in Figure 4 will be similar in all sites, although the exact values will vary. The representation of this relationship in Howard and Bartram (2003) is from Cairncross (1987) and includes measured collection times and quantities. Water in the Cairncross (1987) representation only includes consumption. The plateau of this representation at which the water use does not vary with increasing collection time has a value of 15 L/capita-day.

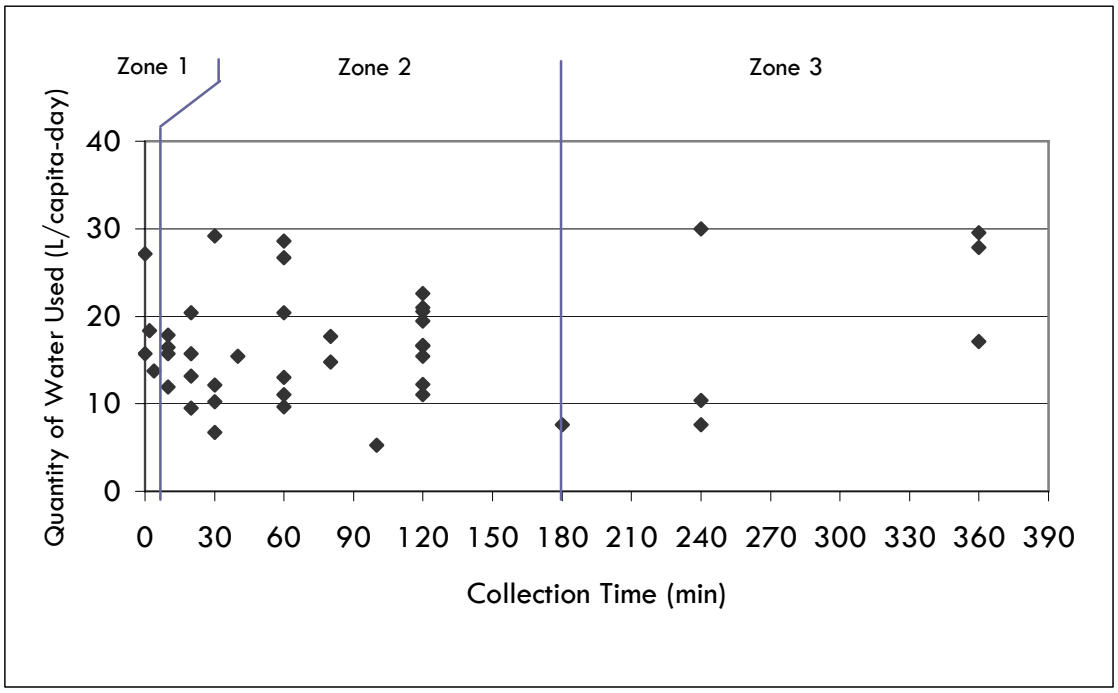

Figure 14. Relationship between Quantity of Water Collected and Collection Time for 42 Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya

Table 17. Division of the Collection Times of 43 Respondents of the Access, Use and Health Survey in Maburwa and Nduluma, Kenya into 3 Zones of Data

Category	Collection Time (minutes)	Number of respondents
Zone 1	$0 \leq$ Time ≤ 5	5
Zone 2	$5 >$ Time >180	30
Zone 3	$180 \leq$ Time	7
Total	—	42

Figure 14 is divided into three zones in order to view and discuss the data. These zones are defined in Table 17. Zone 1 includes respondents who collect water from within their compound and have a collection time of up to five minutes away from the home. Even if a water source is in the household compound of a user, it still may have to be transported to the home for use unless the standpipe is located very close to the home or a hose is used to bring water closer to the home. In addition, Figure 4 shows three minutes as the threshold in which the relationship changes from a decrease in water collection to the plateau part of the pattern, but three or five minutes should not make much difference in the amount of water collected because the water still must be transported from a standpipe to the home. Moreover, since the collection times are estimates, a difference between three and five minutes may not be significant at all.

Zone 2 of Figure 14, from five to 180 minutes, contains the values that should most closely follow the plateau represented in Figure 4. In Figure 14, however, this section of the plot ranges only from three to thirty minutes. The water collected by respondents of the AUHS does not decrease as time increases: this implies several things. First, it appears respondents and households have a particular amount of water that they need and use in their households to maintain their lifestyle and health. Having that particular amount of water for use may be more important than the amount of time it takes to collect the water. The amount of water used by respondents in this zone is generally between 10 and 20 L/capita-day.

As the collection time continues to increase, the quantity of water collected in Zone 3 of Figure 14 is expected to decrease. In the data from the AUHS, there is no decrease in these quantities of water collected. This indicates that although collection may be more time consuming, the respondents of the AUHS still choose to fulfill their need for water. Zone 3 was created in order to separate these seven data points from the rest of the data.

Collection times are not only comprised of the time it takes a user to walk from the home to the water source, wait in queue and return home. Transporting water, in this case a 20-Liter jerrycan, changes the time it takes to travel a collection route. A route may have to change, perhaps because of terrain. A person collecting water may be sick or have injured feet, also changing the collection time. In addition, water collection may not be the only task along the route: a person

may visit neighbors or spend time socializing with others. The collection time is influenced by many factors, not just the distance between a water source and user's dwelling: therefore, it may not be the best way to measure accessibility.

The collection times in Zone 3 may be high because they are estimates. Villagers in Kenya have different perceptions of time and different references, so estimating collection times may not be easy. When collecting data from surveys, researchers must be aware that different biases exist. Some of these are discussed later in this report. Strategic bias occurs when respondents do not report accurate information in order to influence results. The author of this report feels that some of the data from the Access, Use and Health Survey may be unreliable, but strategic bias is not the reason for this. Instead, the author feels that difficulties estimating times may be the cause of some high values found in Zone 3.

There may be a threshold at either end of the plateau section of the pattern in Figure 4 at which the amount of time it takes to collect water affects the amount of water collected, but that is not apparent in the data from the AUHS at either the lower or higher collection times. One reason the upper threshold may not be visible is that the threshold value is beyond the range of the values collected from respondents of the AUHS. Moreover, there may just not be enough data to see any pattern. Similarly, the lower value may or may not be five minutes, but without more data or more accurate data, it is difficult to tell. It is also possible that collection time does not affect the people living in Maburwa and Nduluma villages. In order to draw more conclusions about the relationship between quantity of water collected and collection time, more data is necessary.

5.6 Results of the Monthly Health Record

The Monthly Health Record (MHR) was used to collect data about the occurrence of illnesses in the households of respondents. The process for filling out the MHR was explained to Maburwa and Mwangaza SHGs during the meetings which also explained the AUHS. The MHRs record the date of an illness, the age of the person affected, symptoms exhibited and the duration of symptoms. Table 18 shows the format of the MHR and a sample entry.

Table 18. Format of the Monthly Health Record Used by Respondents in Maburwa and Nduluma with a Sample Entry

Date	Age	Symptoms	Duration (days)
10 February	8	Diarrhea	2

When the respondents returned the MHRs, the author of this report grouped the data into nine categories of symptoms as follows:

- Aches, Rheumatism, Cough, Cold, Flu
- Fever
- Malaria
- Worms, Amoeba
- Diarrhea
- Stomachache
- Skin irritation, body pests
- Eye infection/irritation
- Miscellaneous

The "Miscellaneous" category included symptoms such as "high blood pressure," "earache" and "wounds." The symptoms reported by respondents are both defined and diagnosed by the respondent and translated into English by SHG members or Kenyan coworkers of the author of this report. Figure 15 shows the percentage of times different symptoms were reported in the MHRs. In Figure 15, symptoms in the "Aches, Rheumatism, Cough, Cold, Flu" category were reported most often. The complete MHRs are shown in Appendix 5.

Figure 16 shows the occurrence of diarrhea, skin irritations and eye irritations with respect to the quantity of water collected by respondents. The number of respondents in each bin of quantity of water collected also appears in the figure. According to Howard and Bartram (2003) and Table 2, a higher service level would imply less of a health risk. In Figure 16, this would imply that as the quantity of water collected increases, the occurrence of symptoms would decrease. Diarrhea, skin and eye irritations were used in Figure 16 because of the symptoms collected from the MHR, these are most influenced by the quantity of water collected. The data from the MHRs do not show that disease decreases as the quantity of water collected increases. This means the relationship between health and quantity of water used is not strong or present in the data from the AUHS. One reason there may not be an apparent relationship between the symptoms reported and the quantity of water collected is because there is not enough data for any pattern to be revealed. Another factor that may explain a lack of pattern and even a lack of data is that the

health behaviors or hygiene practices in households are positive and water related illnesses do not occur frequently.

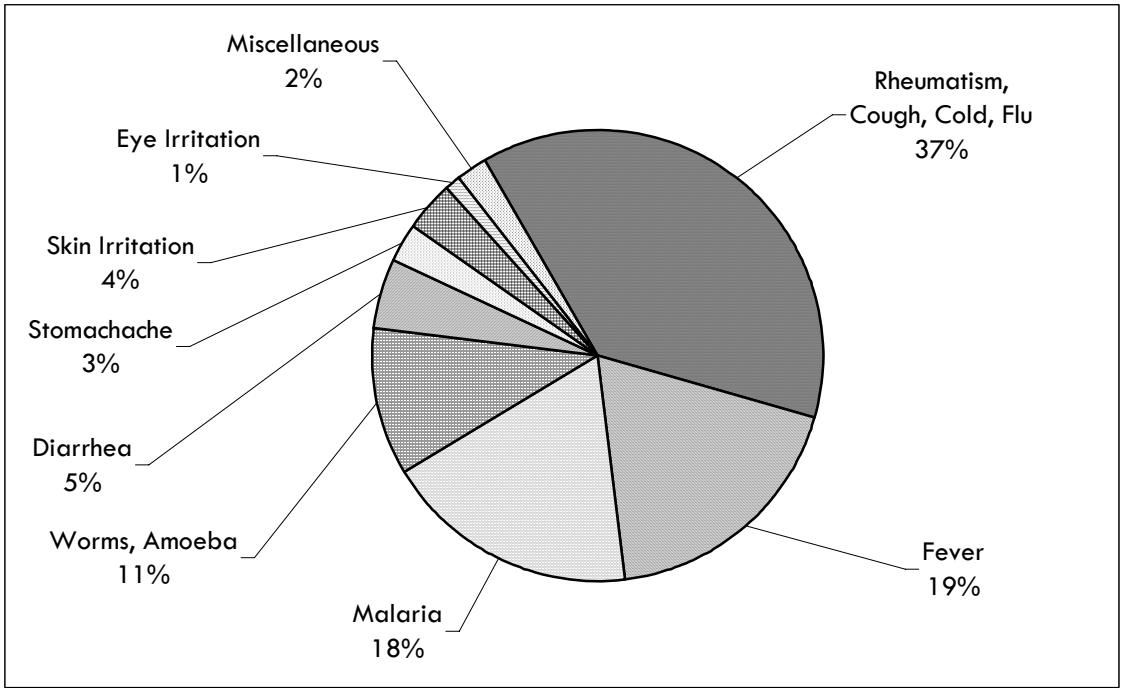

Figure 15. Percentage of Symptoms Reported on the Monthly Health Records by 31 Respondents of the Access, Use and Heath Survey in Maburwa and Nduluma, Kenya

The length of time that the Monthly Health Record was kept by respondents of the survey varies with each respondent. The MHR forms were handed out to the members of the two self-help groups at two group meetings but were not collected at the same time. For example, the author of this report visited a group meeting to collected completed MHRs, but not all members were present that day or not all remembered to bring their form, so some MHRs stayed with respondents for a longer time.

More accurate reporting of the MHR may reveal different information. One way to improve collection of MHR data would be use trained health workers to diagnose symptoms instead of allowing respondents to record their own symptoms. When respondents record symptoms and durations, they are each using their own definition of the symptom and recording it when they

recognize it. Health workers would be trained to recognize and diagnose symptoms and there would be more uniformity in the descriptions of symptoms.

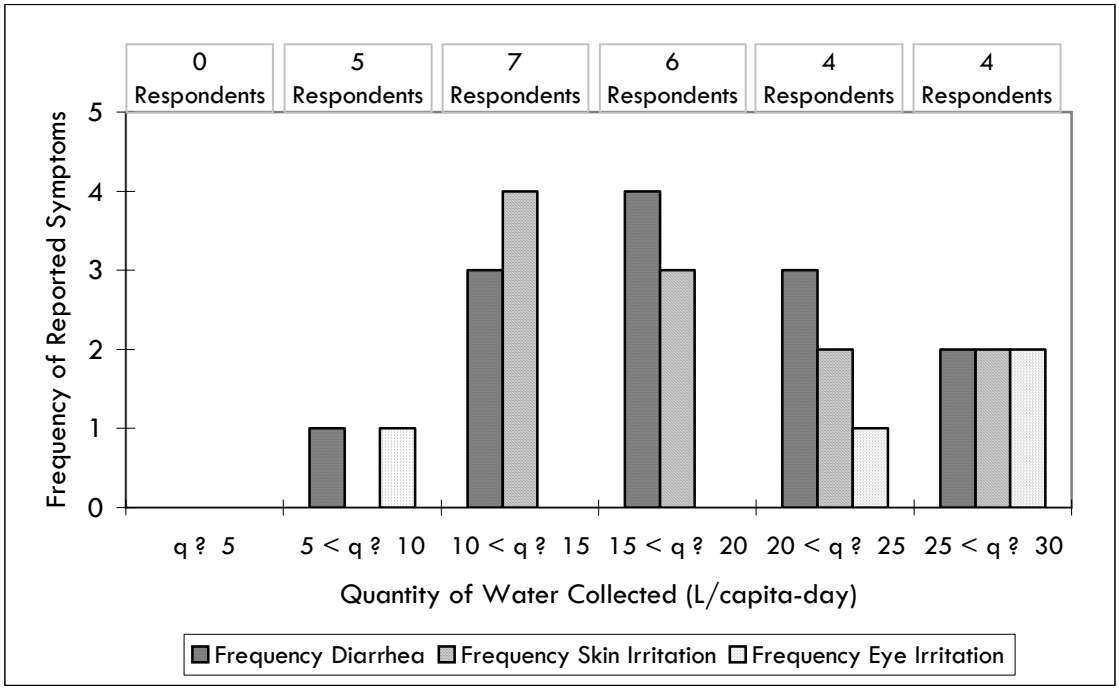

Figure 16. Frequency of Symptoms Reported for a Period of Up to 3 Months on the Monthly Health Records Collected From 26 Respondents in Maburwa and Nduluma, Kenya in Relation to Quantity of Water Collected Shown in Intervals of 5 L/capita-day

5.7 Qualitative Data Collected with the Access, Use and Health Survey

In addition to the data collected by the AUHS and the MHR dealing with water use, service level and health, many different types of qualitative data were collected. In Maburwa, there are two primary sources of water: Likiundu River and Larimunyi spring. Water is collected directly from both sources. Larimunyi has an intake structure that conveys water to the lower areas of the village. Most of the members of Maburwa Women's Group live in the upper part of the community so they must collect water directly from the sources. In Nduluma, there are several different water sources that are used by group members and most of the water sources are springs.

Of the respondents of the AUHS, 98% use water from springs and rivers, compared with 41% for the entire Eastern Province and 37% for the entire country. This and other data about access to water in Kenya are shown in Appendix 1. The percentage of the population that travels less than

fifteen minutes to the water source in Eastern Province is 39%, which is the same percentage as respondents in the AUHS. These values can be compared with 53% for the entire country, which shows that the Muthara area has a lower access than other parts of the country. The median time to the water source for Maburwa and Nduluma is 30 minutes, almost the same as 25 minutes for Eastern Province but more than 15 minutes for the rural population of Kenya. The segment of the population with less than fifteen minutes return trip from a water source for the entire country is 43 percent and 39 percent for Eastern Province. Similar results were found in the AUHs, where the segment of the population with a collection time of less than fifteen minutes is 40 percent. The collection time is sometimes impacted by the queue at the water source. During the dry season, water still flows from most of the springs, but some have very low flow rates and the time respondents wait. Flows in the rivers may decrease at different times of year, but the water is flowing so there is no queue that has a large impact on collection time.

Respondents from both villages recognize that upstream use of a water source makes a source unsafe for downstream consumption. Rivers are available to use for collecting water, laundry, bathing and watering livestock. Moreover, many roads and footpaths (for both humans and animals) cross rivers. Respondents have noticed definite times during the day that it is not safe to collect water from rivers; the water is cleanest early in the morning before many people upstream have begun using the river for the day. Awareness of this property of the water source can help prevent illnesses in the household because it can change people's water use patterns. For example, water collected early in the day can be stored throughout the day for consumption and water collected when the river has poor quality can be used for other purposes.

The time it takes to collect water not only includes the time it takes to travel from water source to home, but also includes the time in queue at a water source. When collecting water from a river, there is usually no delay. When collecting water from springs, the flow of the spring can be low enough that a queue forms. During the dry season, the flow rate of some springs slow down even more and time spent collecting water increases even more.

For the most part, the respondents of the AUHS all had families of their own, and were the primary person responsible for collecting water. Children of the household generally help the respondent collect water unless the children are at school. Water is only paid for if it is collected

from a private standpipe or if someone is sent to collect water for the respondent. The standard price for a 20-L jerrycan of water is KSh. 2 (about USD 0.02 at the time of this study). In some cases members of a community contribute money, labor or materials in order to improve a water source.

If water is stored at home, it is in jerrycans, tanks or kitchen pots. The primary method of water treatment in Maburwa and Nduluma is boiling and it is done by the majority of the respondents of the AUHS. In some cases, responses to the question, "How does the quality of water affect its usage?" involved trying to boil the water or using it for different purposes (such as laundry instead of cooking). Many times, however, respondents said that the water is used anyway and the quality does not affect the usage. For the most part, water is not reused by many respondents, according to the AUHS. If respondents did report the reuse of water, it was for productive purposes or amenity purposes (watering a kitchen garden or keeping dust down).

Respondents generally defined good health as when the body appears healthy and active and is able to get good nutrition and water. For some respondents, good health also involves the ability to stay clean and have clean clothes. A sufficient quantity of water available to users is necessary in order to fulfill these uses and remain healthy. Many respondents said that caring for the body (keeping a clean body and having good nutrition and water) can help prevent illnesses. Cleanliness is also important to staying healthy: keeping a clean food source, compound and environment, cleaning utensils, the home and the latrine. Visiting a health center is also a way to help prevent illnesses.

Some specific cases of illnesses can be prevented. For example, respondents said that malaria can be prevented by controlling mosquitoes via clearing brush and reducing stagnant water, as well as using mosquito nets. Boiling water can prevent waterborne illnesses. The transmission of other diseases such as HIV and TB can also be prevented. One of the group projects of Mwangaza Women's Group is HIV/AIDS education, and the group showed their knowledge during the AUHS: most of the people who responded that HIV can be prevented live in the Nduluma area.

The section of the AUHS asking about ideas and frequencies of different health behaviors gave more evidence that knowledge of keeping healthy is present in Nduluma and Maburwa villages. Most respondents said bathing should occur daily. The responses dealing with frequency of bathing suggest most adults, children and babies bathe once or twice per day. The definition can mean washing hands and face only. Besides bathing, the respondents were able to talk about frequency of washing hands and when it is to be done. Most respondents said that hands are to be washed after work. Other popular responses were before eating or preparing food and after using the latrine. All respondents said that children are taught to wash their hands. Other personal hygiene practices, such as brushing the teeth, combing the hair and using a handkerchief all received responses promoting regular care and practice of these behaviors.

Most respondents said that shoes should be worn all the time to protect the feet. Many respondents also suggested that clothes should be laundered after wearing once and the latrine should be cleaned either daily or as needed. Respondents answered that trash is disposed by giving it to livestock, putting it in the garden or throwing it into the trash pit to burn. Trash in the AUHS was interpreted to be both kitchen scraps that would be eaten by livestock or put into a compost pile and rubbish that would be burned.

Many respondents were able to convey at least one of several common causes or sources of diarrhea: contamination of food by flies, eating contaminated or improperly prepared food and having an unclean latrine. While most respondents could suggest a treatment for diarrhea, all the respondents from Mwangaza Women's Group explained how to make oral rehydration salts at home and administer it to a person to treat for diarrhea.

In Maburwa and Nduluma villages, knowledge about health behaviors is present, whether the source is a SHG meeting, the dispensary or elsewhere. Although the literature reviewed shows that a lower water service level implies a greater health concern, the results from the AUHS and MHR from Maburwa and Nduluma villages show that although a risk is present, the households may still remain healthy. More data dealing with collection time and more accurate health data (disease morbidity) is necessary in making further conclusions. Data about collection time and more accurate health data would be helpful in making stronger conclusions. In addition, more

respondents surveyed would allow for a greater range of data that would help reveal patterns in the data.

5.8 Difficulties in Survey Results

Although the community entry survey was written without knowledge of the typical problems described by Brownlee (1978), PC trainers, counterparts of the author of this report and other PCVs were able to influence the survey in order to help avoid these issues. With the knowledge of these obstacles and the experience of the community entry survey, the AUHS was written and administered to further avoid these issues and to help ensure the quality of data collected.

5.8.1 Characteristics of the Respondents and Survey Administrator

Respondents of the AUHS were all women and members of two self help groups in Muthara. Women were chosen to be respondents based on the assumption that they would be most knowledgeable about health issues and water use in the household. The gender of a researcher may influence responses, though. For example, women may feel more comfortable sharing information about health issues with other women instead of men.

The respondents of the AUHS may not be truly representative of all the households in the community. For example, respondents were active in SHGs, which are a common vehicle for information in the community. Members of SHGs may participate more in educational workshops or be more informed of issues in the community, while non-members may not have as many opportunities to get involved. In other words, being members in active SHGs (from which respondents were selected) means more exposure to activities that can increase the health level and living conditions of a household.

Peace Corps Volunteers have advantages that many researchers do not have. In Muthara, the counterparts and translators of the author of this report had been active in the community for many years and had built a relationship working with individuals and SHGs. Having these community members as counterparts allowed the author to build rapport with the community. The length of service of a PCV is another advantage in a community. When community members

regularly see that the person is living and working in their community, they are able to realize a PCV is not just a short term visitor.

5.8.2 Possible Reasons for Inaccuracies in Survey Data

When a Peace Corps Volunteer begins an assignment, it may take some time for the PCV to adjust to a community and for the community to adjust to a PCV. In the rural villages in Kenya, many of the perceptions of foreigners are based on experiences with tourists and missionaries. The villagers' expectations of a Peace Corps Volunteer may influence activities in which the PCV is involved. Strategic bias occurs when data is skewed because respondents expect particular outcomes based on their responses. For example, respondents may expect improvements to health conditions in the area when a researcher is investigating health issues. In the case of the AUHS, a respondent wanting or expecting improvements to water accessibility may give the impression the situation is worse than reality in order to show more need for improvements.

Evans and Leighton (1995) describe two types of biases in surveys called "recall bias" and "telescoping bias." Recall bias occurs because of memory loss of respondents: data may be inaccurate when remembering events. With telescoping, timing of events may be displaced: an event will seem to have happened more recently. Moreover, Evans and Leighton (1995) cite a study that says telescoping seems to be more severe for frequent activities. In the community entry survey, questions addressed the frequency of illness and visiting the dispensary. Many respondents had difficulty answering. The AUHS improved upon this by inquiring about frequency of illness in only the "last two weeks," and there were fewer difficulties answering.

A difficulty in collecting quantitative data may also be the respondent's ability to estimate values accurately, or reflecting on what is second nature. As seen in Figure 9, the daily quantity of water used based on estimations is greater than the total quantity of water collected per day. It just may not be important for people living in Maburwa and Nduluma, Kenya to know how much water is used for cleaning utensils or making porridge, when the tasks are common and second nature to them. In a Bertrand and Mullainathan (2001) state another difficulty that can be applied to these questions: "perhaps the most devastating problem … is the possibility that attitudes may not 'exist' in a coherent form." The respondents may have not considered these ideas previously. Suchman (1962) presents the idea that although results from a survey may be biased, data is still

contained within those results. The Access, Use and Health Survey holds a lot of data and some may not be completely accurate. However, the data present still provides a lot of information about the communities surveyed.

The order of questions on the AUHS may have caused some issues. Although the questions were written with the intent of being open-ended, the order seemed to influence some responses, most apparent in the questions dealing with hygiene practices. Responses to the question "what are some ideas about combing hair or sharing a comb?" generally received replies of not sharing a comb. Responses to the next questions, "what are some ideas about handkerchiefs?" and "what are some ideas about wearing shoes?" generally also dealt with sharing these items. Responses might have been different if the questions were presented in a different order.

5.8.3 Working with a Translator

One typical problem listed in Table 9 is that "what a respondent says may be altered during translation." Kimeru does not have as large of a vocabulary as English and does not have a technical vocabulary—many technical words are borrowed from English when expressed in Kimeru. When respondents do not have any knowledge of English, a translator must express not only words but also technical ideas via a non-technical language. A translator must also then translate the idea back into English for the researcher.

The translator may act as a filter, whether intentional or not. Translating technical ideas may cause some of the information to be lost, both from researcher to respondent and from respondent to researcher. Since there are many ways to express similar ideas in English, even non-technical ideas may be troublesome. During the community entry survey, two separate questions addressed how people disposed of "rubbish" and "kitchen scraps." Responses for the questions included burning it, throwing it into a pit or garden or giving it to livestock. For the AUHS, one question replaced the two, asking how respondents disposed of "trash." Responses were the same: people disposed of trash by burning it, throwing it into a pit or garden or giving it to livestock. The significance of slightly different terms in English may make a difference to a researcher but may not even be noticed by respondents. Using a translator somewhat hinders the ability of a researcher to ask follow-up questions or to probe for more clarity in responses to questions. Clarifying an idea in English may be easy since there is a larger vocabulary to express ideas, but

translating the clarification into Kimeru may not be as straightforward. Although a researcher tries to clarify an idea with a different wording in English, Kimeru may still limit the translator's ability to clarify the idea for a respondent.

In order to address some of these issues about the loss of information during translation, a researcher can review the purposes of a survey with counterparts and translators throughout the course of administering the survey. The translator can then help the respondent correctly understand the questions and make sure that the respondent is receiving the correct or needed information from the respondent.

6 Conclusions

This report has described the process of reviewing literature related to access to water, water use and human health in the household. The literature discussed the relationship between the collection time and amount of water collected in a household. This report has described how a survey was created to collect data regarding water and health in Muthara, Kenya. Finally, the report summarizes the data collected form the survey in Muthara, Kenya and compares the data to the published literature. The objectives of this report were:

- Objective 1. Investigate the relationships between access to water, the use of water in the household and human health.
- Objective 2. Investigate data collecting techniques and how a Peace Corps Volunteer is able to use them in a rural situation.
- Objective 3. Collect data from the Muthara, Kenya community regarding access to a water source, the use of water and the health level of the household.
- Objective 4. Analyze the relationships from the collected data and compare it to published literature.

Conclusions of this report are:

- The Access, Use and Health Survey was administered to 44 inhabitants of Maburwa and Nduluma villages in Kenya. The survey found that respondents have access to different types of water sources: people collect water mostly from springs or spring-fed rivers. Although some of these water sources are protected or improved, many are either not protected or only partially protected (still susceptible to contamination).
- The service levels describing accessibility show a Basic Access level (around 20 L/capita-day) based on the quantity of water collected from the water source and show a No Access level (greater than 30 minutes collection time) based on collection time. The data from the Access, Use and Health Survey suggests that the service level descriptors from Howard and Bartram (2003) based on collection time may not be equivalent to the service level descriptors based on quantity collected.
- The amount of water used by people in Muthara, Kenya is 12.3 L/capita-day when not including laundry and 16.7 L/capita-day including the water used for laundry. These quantities are less than reasonable access of 20 L/capita-day as defined by WHO (2000).

Although the quantities may not be as high as prescribed by WHO, the quantities may be sufficient to maintain the lifestyles and health of the people of Muthara, Kenya.

- Respondents of the Access, Use and Health Survey estimated the amount of water used for various purposes in the household. These included consumption, hygiene, productive uses and amenities. The estimations of the quantities of water used ranged from 1.2 to 6 times the amount of water collected per day in the household. The average percentages of water use are: consumption (21%), hygiene (51%), and productive uses (28%).
- More than half of the respondents of the Access, Use and Health Survey (26 of 44) have a collection time of over 30 minutes.
- The relationship between quantity of water collected and the collection time described in the literature (Howard and Bartram, 2003) does not apply flawlessly to the data collected from Maburwa and Nduluma, Kenya. The expected relationship is that the quantity of water collected will decrease with an increase in collection time but the data from the Access, Use and Health Survey does not clearly show this.
- Another expectation from the literature is that there would be significant changes in the amount of water collected with significant changes in service level. This is also not clear from the data collected with the Access, Use and Health Survey.
- Collection time is one method of measuring access to water, but it may not be the most appropriate way to measure accessibility. Collection time does not only involve the amount of time it takes to transport water from the water source to the home of the user. Other activities take place during the collection activity, such as visiting other people and waiting at the water source to fill the container. Moreover, different people transport water at varying efficiencies: some people may walk more quickly than others or someone may visit more neighbors along the collection route.
- There is not enough quantitative data collected from the Access, Use and Health Survey in order to link health and access to water. Inhabitants of Maburwa and Nduluma, Kenya have knowledge about health behaviors and hygiene practices. Although water accessibility in the area may be low according to WHO standards, the knowledge of hygiene behaviors is able to help maintain health in the household.
- Although questionnaires and surveys are data-collecting techniques that can be used to collect quantitative data, some data must be verified with other methods. For example,

data that involves respondents' estimations of time or distance should be verified by actually measuring the respective time or distance. Different forms of bias enter survey data and candid observation may be needed to collect some forms of data.

- More data is necessary to draw more conclusions about the relationship between access to water, water use and health in the households of Muthara, Kenya.

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Appendix 1. Percentage of Kenyan Population with Access to Different Water Sources (Taken from Kenya Demographic and Health Survey 2003 (CBS et al., 2004))

	Coverage (%)										
	Residence		Province								
Source of drinking water	Urban	Rural	Nairobi	Central	Coast	Eastern	Nyanza	Rift Valley	Western	North Eastern	Total
Piped into dwelling	19.2	3.8	33.2	11.8	8.1	4.1	0.6	4.5	1.3	0.6	7.6
Piped into compound/plot	30.2	7.8	43.4	19.3	9.7	18.4	2.3	8.2	2.6	1.6	13.4
Public Tap	21.8	6.8	15	3.5	40.1	9.1	11.7	7.8	3.9	0.1	10.6
Open well in compound	1.8	1.7	0.2	2.2	1.3	0.6	0.7	3.3	2.3	3.8	1.7
Open public well	4.1	6	0.1	3.5	9.7	6.6	5.5	6.3	3.5	25	5.5
Covered well in compound	3.3	5.9	0.3	8.3	0.9	1.6	1.2	13	4.1	1.4	5.3
Covered public well	2.6	7.5	0.1	4.5	1.8	8.1	9.4	4.8	13.5	6.1	6.3
Spring	1.7	16.9	0	6.2	0.9	11.5	33.4	3.2	40.3	0	13.1
River, stream	2.5	31.1	0	24.8	11.7	29.9	25	32.4	26.2	21.1	23.9
Pond, lake	0	2.2	0	0.1	1.7	0.3	7.6	1.2	0.2	0.4	1.6
Dam	0.7	4.1	0.1	1.7	9.6	4.6	0.3	3.3	0	34.1	3.3
Rainwater	0.7	2.5	0.1	7.5	0.4	0.9	1.7	1.3	0.9	1.7	2.1
Bottled Water	0.7	0	1.3	0	0.2	0	0.1	0	0.2	0	0.2
Other	10.6	3.5	6.2	6.4	3.9	4.4	0.5	10.7	1	4.1	5.3
Total[4]	99.9	99.8	100	99.8	100	100.1	100	100	100	100	99.9
Time to Water Source											
Percentage < 15 minutes	83.8	43.1	95.9	70.9	63.6	38.7	31.6	50.5	44.6	22.1	53.2
Median time to source (min)	0	14.9	0	0.7	5	24.7	19.7	10	14.4	u	9.7

[4] Total percentages may vary because of rounding.

Appendix 2. Community Entry Survey Used in the Region of Muthara, Kenya Between April 2005 and August 2005

Household

1. Age and gender of interviewee.
2. How many children have you given birth to? How many died before reaching 2 years?
3. How many people are living in the household? What are the ages and gender of members?
4. What is the education level of family members? Of the respondent? Are there any children under 18 years not taking advantage of the free primary education? Why or why not?
5. What are the main sources of income (*shamba*, family member working in the city, etc.)?

Observe: home construction (materials, electricity, number of buildings on compound, etc.)

Food/Garden/Livestock

1. How big is the *shamba* (in acres)?
2. How much do you harvest per season? What types of crops? Do you grow tea, coffee or *miraa*?

2a. How much food do you keep for your own use? How much do you sell?

3. How much food is currently in your store? Will it last until the next harvest?
4. What types of food do you buy at the market? How much money doe you spend at the market per week?
5. What are some symptoms of malnutrition?
6. What are some threats to a good harvest (labor, disease, weather, storage)?
7. What farming techniques do you practice? (compost, pesticide, fertilizer, manure, irrigation)? Are there any problems with these? How much money is spent per season on these?
8. What types of livestock do you own? How many? What is the primary purpose of the livestock?
9. What is the food source (on- or off- the farm grazing or cut and carry)? Who takes care of the livestock? Observe if possible.

Water

1. What is the primary source of water? Is it seasonal? What is secondary source?
2. What is the distance traveled to and from to collect water? Time spent collecting daily? How long do you have to wait at the source? How much do you pay per day?
3. How many times do you collect water per day? What is the quantity used by the household per day (in liters)?

4. How do consider the quality of water?
5. What helpful changes could be made to the water source?

Health

1. What is the closest health facility available in the area? How far do you travel to it? How often is it used per year?
2. What is the main source of knowledge about health issues (dispensary, media, family members)?
3. Has anyone been sick in the last month? What illness did they have?
4. Has anyone been sick for more than 6 months? What did they have? Outcome (death, permanently disabled, saw doctor)?
5. What illnesses affect the family the most (malaria, diarrhea, worms, skin/eye infections, colds/sore throat, TB)?
6. What types of family planning do you know about? What do you think is the best or most accessible? From where? What is your source of knowledge about family planning?

HIV/AIDS

1. What is the primary source of knowledge about HIV/AIDS? What are some ways to prevent the spread of HIV?
2. Have you heard of a Voluntary Counseling and Testing Center (VCT)? Do you know what a VCT is for?
3. Have you heard of Prevention of Mother to Child Transmission (PMTCT)? Do you know some available resources in the area?

If kids are present, ask …

1. What are some ways to prevent the spread of HIV?
2. What are some sources of information about HIV?

Environment

1. What is the main source of energy used for cooking in the household? Who collects it? Will it be a problem in the future?
2. Where is it collected (your own trees, forest)? Do you plant trees in your *shamba*?
3. What is the source of the seedlings? What is you source of technical advice? What are some threats to doing this?

Sanitation/Waste

1. Does the household have a latrine? Who uses it? Who doesn't and why? How are childrens' feces disposed of?
2. What is the latrine constructed of? Are there any problems with it?

3. How do you dispose of solid waste/rubbish (burn, throw aside)? Kitchen scraps?

4. How do you dispose of washwater (soak pit, garden, latrine)?

Community

1. What are some of the main problems that face the community? What is the first step in dealing with the main problem? How could you do this/What would you do to help solve this problem?

2. What are some resources in the community?

3. Is there anything else you would like to mention about health in the household or community?

Appendix 3. Access, Use and Health Survey Used in Maburwa and Nduluma, Kenya Between February and June, 2006

Access

1a. What are the primary, secondary and tertiary sources of water?

1b1. Has anything been done to the source to make it easier to collect water?

1b2. Is the source protected from contamination? How?

1b3. What contamination is there to the source? Is the contamination harmful to people or animals?

1c. Is the source seasonal?

1d1. Are there times when you cannot collect water?

1d2. (if intermittent) How long does the source not have water?

2a. Do you spend time in queue? How much?

2b. How is water collected? (submerge, dipper, standpipe)

3. How much time does it take to return home with the water?

4a1. How much water can one jerrycan hold, in liters?

4a2. How many times is water collected on non-laundry days?

4a3. How many times is water collected on days when you do laundry?

4b. How much is paid for water?

5. Who collects water for the household? What are some reasons that might change?

6a. How many people use the water?

7. How is water stored at home?

8. How does the quality of water affect how it is used?

Use

Estimate how much water is used for the following purposes:

1a1. Drinking

1a2. Cooking and tea

1a3. Cleaning utensils, house, etc.

1a4a.	Is bathing done at the water source?	1a4.	Bathing
1a5a.	Is laundry done at the water source?	1a5.	Laundry
1a6a.	Are livestock watered at the source?	1a6.	Livestock

1b1. What are some productive uses for water? (tree nursery, garden, home brewing)

1b2. How much is used for each purpose?

1c1. What are some other uses for water?

1c2. How much is used for each purpose?

1d1. Is water ever reused?

1d2. For which purposes?

2a1. How is water treated in the household? (boiled, filtered, Waterguard/Jik, settling)

2a2. How often is water treated?

2b. What is the treated water used for?

Health/Hygiene Practices

1a. What do people consider "good health"?

1b1. What are some ideas about the prevention of illnesses?

1b2. For which cases?

1c. What are some methods people use to maintain their health or the health of others?

2a. Has anyone in the household been sick this week? With what?

2b. Was anyone sick last week? With what?

2c. What was the most recent illness?

3b. What are some ideas concerning the following?

3c. What is the frequency of these activities?

- Washing body parts/bathing
- Washing clothes
- Caring for teeth
- Washing/cutting hair
- Sharing a comb/combing hair
- Using a handkerchief
- Wearing shoes
- Cleaning the latrine
- Disposing of trash
- Body pests or parasites

4. What are some things that affect being able to stay healthy?

5a. How often do adults bathe?

5b. How often do children bathe?

5c. How often do babies bathe?

6a. How often do people wash their hands?

6b. When do people wash their hands?

6c. Are children taught to wash their hands?

8a. What are some causes of diarrhea?

8b. What are some ways to treat diarrhea?

7. Do you have anything else to add about water or health in the household?

Appendix 4. Complete Data of 44 Respondents to the Access, Use and Health Survey Administered in Maburwa and Nduluma Kenya Between February and June, 2006.

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
	Village	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa
1a1	Primary water source	Likiundu	standpipe	Likiundu	Likiundu	Likiundu	Likiundu	Likiundu	Likiundu	Likiundu	Larimunyi	Likiundu
	Primary source type	river	spring	river	river	river	river	river	river	river	spring	river
1a2	Secondary water source	spring	Likiundu	standpipe	standpipe	rain	standpipe	standpipe	spring	spring	Likiundu	Larimunyi
	Secondary source type	spring	river	spring	spring	rain	spring	spring	spring	spring	river	spring
1a3	Tertiary water source	n/a	rain, when available	intake of spring	rain, when available	n/a	rain, when available	n/a	n/a	n/a	n/a	n/a
	Tertiary source type	n/a	rain	spring	rain	n/a	rain	n/a	n/a	n/a	n/a	n/a
1b1	Has anything been done to make it easier to collect from the primary source?	no	standpipe	no	no	no	no	no	no	no	standpipe	no
	Has anything been done to make it easier to collect from the secondary source?	standpipe	no	standpipe	standpipe	n/a	standpipe	standpipe	no	standpipe, intake	no	standpipe
	Has anything been done to make it easier to collect from the tertiary source?	n/a	n/a	standpipe at intake	no	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
	Village	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa	Maburwa
1a1	Primary water source	Larimunyi	Likiundu	Likiundu	Likiundu	Likiundu	Larimunyi	Likiundu	Likiundu	Likiundu	Likiundu	Likiundu
	Primary source type	spring	river	river	river	river	spring	river	river	river	river	river
1a2	Secondary water source	Likiundu	Larimunyi	Larimunyi	n/a	standpipe	Likiundu	spring	n/a	standpipe	Kithu	spring
	Secondary source type	river	spring	spring	n/a	spring	river	spring	n/a	spring	spring	spring
1a3	Tertiary water source	standpipe	n/a	n/a	n/a	rain	rain	n/a	n/a	n/a	n/a	n/a
	Tertiary source type	spring	n/a	n/a	n/a	rain	rain	n/a	n/a	n/a	n/a	n/a
1b1	Has anything been done to make it easier to collect from the primary source?	standpipe	no	no	no	no	standpipe	no	no	no	no	no
	Has anything been done to make it easier to collect from the secondary source?	no	standpipe	standpipe	n/a	no	no	standpipe	n/a	no	intake	standpipe
	Has anything been done to make it easier to collect from the tertiary source?	standpipe	n/a	n/a	n/a	no	no	n/a	n/a	n/a	n/a	n/a

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
	Village	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma
1a1	Primary water source	Kalui	Kaluui	Kalichingo	Kaluui	Buanthumara	Kaluui	Kaluui	Kalichingo	Buanthumara	Kailimachoro	Kalimachicho
	Primary source type	spring	spring	spring	spring	river	spring	spring	spring	river	spring	spring
1a2	Secondary water source	n/a	spring	n/a	Tokuro	standpipe	n/a	spring	Buanthumara	Kathima	Kaleo	Buanthumara
	Secondary source type	n/a	spring	n/a	spring	spring	n/a	spring	river	stream	spring	river
1a3	Tertiary water source	n/a	Buanthumara	n/a	Buanthumara	n/a	n/a	Buanthumara	n/a	n/a	n/a	n/a
	Tertiary source type	n/a	river	n/a	river	n/a	n/a	river	n/a	n/a	n/a	n/a
1b1	Has anything been done to make it easier to collect from the primary source?	yes	some	no	standpipe	no	standpipe	no	no	no	no	no
	Has anything been done to make it easier to collect from the secondary source?	n/a	no	n/a	no	standpipe	n/a	no	no	no	no	no
	Has anything been done to make it easier to collect from the tertiary source?	n/a	no	n/a	no	n/a	n/a	no	n/a	n/a	n/a	n/a

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
	Village	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma	Nduluma
1a1	Primary water source	Buanthumara	spring	Kaluui	Buanthumara	Buanthumara	Likiundu	Larimunyi	Kalui	Likiundu	Likiundu	Likiundu
	Primary source type	river	spring	spring	river	river	river	spring	spring	river	river	river
1a2	Secondary water source	Kathima	Kaleo	n/a	Kalimachicho	Kalimachacho	Larimunyi	Likiundu	Buathumara	Larimunyi	Larimunyi	Larimunyi
	Secondary source type	spring	spring	n/a	spring	spring	spring	river	river	spring	spring	spring
1a3	Tertiary water source	spring	standpipe	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Tertiary source type	spring	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1b1	Has anything been done to make it easier to collect from the primary source?	no	no	pipe	no	no	no	standpipe	no	no	no	no
	Has anything been done to make it easier to collect from the secondary source?	no	no	n/a	no	no	standpipe	no	no	standpipe	standpipe	intake
	Has anything been done to make it easier to collect from the tertiary source?	no	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
1b2	Is the primary source protected from contamination?	no	no	no	don't know about upstream	no	no	no	no	no	intake	no
	Is the secondary source protected from contamination?	intake	no	intake	no	n/a	no	no	no	intake but not covered	no	intake
	Is the tertiary source protected from contamination?	n/a	n/a	intake	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1b3	What types of contamination affect the source(s)?	animals walk through	sediment in pipe	upstream use	upstream use-laundry	upstream use-laundry water, bathe	upstream use	floods bring rubbish	floods bring dirt	rain brings dirt	human waste	flood (dirt, rubbish)
		upstream use-laundry	upstream use of river		floods collect rubbish	flooding brings dirt		upstream use-laundry water		washwater-upstream use	animal waste	human waste
		wild animals	worms		upstream use-washing vehicles			animal waste		animals, humans walk through river		
			human waste									
	Is the contamination harmful to humans and/or animals?	yes	yes	n/a	yes	yes	n/a	n/a	n/a	yes	yes	yes

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
1b2	Is the primary source protected from contamination?	yes	no	no	no	no	intake	no	no	no	no	no
	Is the secondary source protected from contamination?	no	intake	intake	n/a	no	no	intake	n/a	no	no	no
	Is the tertiary source protected from contamination?	yes	n/a	n/a	n/a	no	n/a	n/a	n/a	n/a	n/a	n/a
1b3	What types of contamination affect the source(s)?	animals	laundry water	human waste (river)	rubbish	human waste	flooding	cut grasses	human waste	worms during dry season	flooding	animals walk through
		dirt	algae (spring)		water is brown	rains bring dirt	human waste	worms	flood			amoeba, other worms
		human waste	human waste		people and animals walk through	animal carcasses	animal waste		rubbish			
	Is the contamination harmful to humans and/or animals?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
1b2	Is the primary source protected from contamination?	small improvement	no	no	no	no	no	no	no	no	no	no
	Is the secondary source protected from contamination?	n/a	no	n/a	no	no	n/a	no	no	no	no	no
	Is the tertiary source protected from contamination?	n/a	no	n/a	no	n/a	n/a	no	n/a	n/a	n/a	n/a
1b3	What types of contamination affect the source(s)?	floods bring trash	animal waste	human waste	tree	carries dirt	soil	dirt from floods	animals	human waste	flooding	flooding
			human waste	animal waste, carcass	grass wastes	rubbish			worms	worms	upstream users	rubbish
			trash	fertilizer, pesticide	animals				frogs, crabs		rubbish	
	Is the contamination harmful to humans and/or animals?	yes	yes	yes	yes	yes	no	don't know	no	yes	yes	yes

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
1b2	Is the primary source protected from contamination?	no	no	some protection	no	no	no	intake	no	no	no	no
	Is the secondary source protected from contamination?	no	no	n/a	no	no	intake	no	no	yes-intake	yes	n/a
	Is the tertiary source protected from contamination?	no	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1b3	What types of contamination affect the source(s)?	flood	animals	snakes	human waste	laundry	algae (spring)	algae (spring)	flooding	human waster	human waste	human waste
		rubbish	humans	human waste	flood	waste, rubbish	worms	human waste (river)	rubbish	flooding	flooding (soil and sand)	laundry
		human waste	laundry					animal waste (both)	human waster			
		upstream use										
	Is the contamination harmful to humans and/or animals?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
1c	Is the primary source seasonal?	no	no	yes	no, but level lowers some	no	low levels because of upstream use	no	lower in dry season	no, but level changes some	no	no
	Is the secondary source seasonal?	no	no	n/a	no	n/a	no	no	no	no	some	no
	Is the tertiary source seasonal?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1d1	Are there times when you cannot collect water? When?	no	yes	n/a	no	no	n/a	sometimes standpipes are dry	n/a	n/a	no	only when standpipe has problems
1d2	What is the intermittency of the source (if applicable)?	n/a	up to a month	n/a	n/a	n/a	n/a	up to a month	n/a	n/a	n/a	n/a
2a	How much time is usually spent in queue at primary source?	0	0	0	0	0	0	0	0	0	0	0
	How much time is usually spent in queue at secondary source?	n/a	0	120, up to	0	n/a	30	10	60, up to	0	0	0
	How much time is usually spent in queue at tertiary source?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
1c	Is the primary source seasonal?	no	no	no	no	some	no	no	some	no	no	no, but lower level
	Is the secondary source seasonal?	yes	no	no	n/a	no	no	no	n/a	no	no	no
	Is the tertiary source seasonal?	no	n/a	n/a	n/a	yes	yes	n/a	n/a	n/a	n/a	n/a
1d1	Are there times when you cannot collect water? When?	when people upstream use it a lot and lower level	no	no	no	the standpipes fail often	if pipe breaks	no	no	river is low during dry season	no	late in day river is very contaminated from upstream use, so use alternative source
1d2	What is the intermittency of the source (if applicable)?	n/a	n/a	no	n/a	up to a week	up to 1 week	n/a	n/a	n/a	n/a	n/a
2a	How much time is usually spent in queue at primary source?	60	0	0	0	0	0	0	0	0	0	0
	How much time is usually spent in queue at secondary source?	0	0	0	n/a	60, up to	0	60, up to	n/a	0	0	120, up to
	How much time is usually spent in queue at tertiary source?	0	n/a	n/a	n/a	n/a	0	n/a	n/a	n/a	n/a	n/a

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
1c	Is the primary source seasonal?	no	yes	no	no	no	no	no	no	river level is low in dry season	no	yes
	Is the secondary source seasonal?	n/a	yes	n/a	no	yes	n/a	no	no	n/a	no	no
	Is the tertiary source seasonal?	n/a	yes	n/a	no	n/a	n/a	no	n/a	n/a	n/a	n/a
1d1	Are there times when you cannot collect water? When?	less flow during dry season	low levels in dry season	n/a	no	sometimes the standpipe and river are dry	sometimes lower flow, so queue	sometimes lower levels	sometimes have to wait for dirt to clear	n/a	n/a	spring in dry season
1d2	What is the intermittency of the source (if applicable)?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2a	How much time is usually spent in queue at primary source?	60	120, up to	0	240, up to	0	180, up to	180, up to	0	30	0	240, up to
	How much time is usually spent in queue at secondary source?	n/a	120, up to	n/a	20	0	n/a	n/a	0	n/a	0	n/a
	How much time is usually spent in queue at tertiary source?	n/a	n/a	n/a	0	n/a	n/a	n/a	0	n/a	n/a	n/a

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
1c	Is the primary source seasonal?	no	no	some protection	no	yes	no	no	no	no	no	no
	Is the secondary source seasonal?	n/a	n/a	n/a	no	n/a	no	no	no	no	no	n/a
	Is the tertiary source seasonal?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1d1	Are there times when you cannot collect water? When?	n/a	no	lower in dry season	river sometimes so dirty that go to spring	when river is polluted, use spring	no	yes (spring)	no	low in dry season, so use spring	when raining, river floods so use spring	no
1d2	What is the intermittency of the source (if applicable)?	n/a	n/a	n/a	n/a	n/a	n/a	up to 2 weeks	n/a	n/a	n/a	n/a
2a	How much time is usually spent in queue at primary source?	0	0	300, up to	0	10	0	0	180	0	0	0
	How much time is usually spent in queue at secondary source?	120, up to	n/a	n/a	30	n/a	0	0	n/a	60	30	0
	How much time is usually spent in queue at tertiary source?	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
2b	How is water collected at the primary source?	submerge	standpipe	submerge	submerge, dipper if low level	submerge	dipper	dipper	submerge	dipper	standpipe	submerge
	How is water collected at the secondary source?	standpipe	submerge	standpipe	standpipe	n/a	standpipe	standpipe	dipper	standpipe	submerge	standpipe
	How is water collected at the tertiary source?	n/a	n/a	standpipe	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	How long does it take to return home from the primary source with the water?	30	0	180, up to	50	30	40	60	30	15	10	5
	How long does it take to return home from the secondary source with the water?	n/a	5	n/a	60	n/a	45	30	60	30	30	0
	How long does it take to return home from the tertiary source with the water?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4a1	What is the volume of a jerrycan (liters)?	20	10	20	20	20	20	20	20	20	20	20
4a2	How many times per day is water collected on non-laundry days?	3	no estimate because right there	5	2	4	4	5	5	3	5	2

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
2b	How is water collected at the primary source?	standpipe	submerge	submerge	clean jerrycan then use dipper	dipper	standpipe	dipper	submerge	dipper	submerge, dipper	submerge, dipper
	How is water collected at the secondary source?	submerge	standpipe	standpipe	n/a	standpipe	submerge	standpipe	n/a	sstandpipe	standpipe	standpipe
	How is water collected at the tertiary source?	standpipe	n/a	n/a	n/a	n/a	tank	n/a	n/a	n/a	n/a	n/a
3	How long does it take to return home from the primary source with the water?	n/a	5	60	10	5	0	5	120	10	120	60
	How long does it take to return home from the secondary source with the water?	120	60	120	n/a	5	3	n/a	n/a	0	120	40
	How long does it take to return home from the tertiary source with the water?	n/a	n/a	n/a	n/a	n/a	0	n/a	n/a	n/a	n/a	n/a
4a1	What is the volume of a jerrycan (liters)?	3	don't know (verified 20)	don't know (verified 20)	don't know	10	25	36	20	20	10	20
4a2	How many times per day is water collected on non-laundry days?	4	5	4	3	3	2	4	5	5	3	6

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
2b	How is water collected at the primary source?	standpipe	standpipe	submerge, dipper	pipe	submerge	standpipe	standpipe	submerge, dipper	submerge	dipper	dipper
	How is water collected at the secondary source?	n/a	submerge	n/a	submerge	standpipe	n/a	n/a	submerge, dipper	dipper	dipper	n/a
	How is water collected at the tertiary source?	n/a	n/a	n/a	submerge	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	How long does it take to return home from the primary source with the water?	30	10	60	90	60	1	15	20	60	40	180
	How long does it take to return home from the secondary source with the water?	n/a	20	n/a	n/a	10	n/a	n/a	n/a	n/a	n/a	n/a
	How long does it take to return home from the tertiary source with the water?	n/a	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4a1	What is the volume of a jerrycan (liters)?	20	20	20	don't know	don't know	5	don't know	100	don't know	20	5
4a2	How many times per day is water collected on non-laundry days?	3	2	3	2	3	5	6	3	10	3	3

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
2b	How is water collected at the primary source?	dipper	submerge	standpipe	dipper	submerge	submerge	pipe	pipe from intake	submerge, dipper	submerge	submerge
	How is water collected at the secondary source?	dipper	submerge	n/a	dipper	n/a	standpipe	submerge	dipper	standpipe	standpipe	standpipe
	How is water collected at the tertiary source?	dipper	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	How long does it take to return home from the primary source with the water?	30	60	2	15	30	60	0	180	60	120	15
	How long does it take to return home from the secondary source with the water?	n/a	n/a	n/a	180	n/a	30	30	240	n/a	n/a	17
	How long does it take to return home from the tertiary source with the water?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4a1	What is the volume of a jerrycan (liters)?	20	20	don't know	20	20	20	20	20	25	20	20
4a2	How many times per day is water collected on non-laundry days?	3	4	3	4	5	3	3	3	3	2	3

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
4a3	How many times per day is water collected on laundry days?	5	no estimate because right there	7	6	10	5	5	10	8	10	5
4b	How much is paid for water (per jerrycan or per _ time)	0	n/a	0	0	0	0	0	0	0	0	0
5	Who collects water for the household?	self, kids	self, kids	self	self, kids, sometimes hire people	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids
	What are some reasons other people collect water for the household?	tired	tired, busy with other work	n/a	tired, kids at school, other commitments	tired	tired	n/a	alternate	after school	tired, when busy	tired
6a	How many people use the water in the household?	8	4	4	12	7	6	6	7	11	12	4
7	How is water stored at home?	storage tank	no storage	storage tank	storage tank of 140L	storage tank	spare buckets	spare jerrycans	storage tank of 240L	small tank	tank	sufurias (pans)
8	How does the quality of water affect how it is used?	don't use if contaminated	clothes or cooking	boil to drink, else use as is	no alternative, so use as is	only use if it is clean	if it's not good then use it for different things	always good quality from standpipe	boil for drinking	boil for drinking and washing utensils	use as is	use as is

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
4a3	How many times per day is water collected on laundry days?	8	10	8	4	5	10	9	10	10	10	10
4b	How much is paid for water (per jerrycan or per _ time)	0	0	0	0	0 at river, 2KSh/jerrycan at standpipes	0	0	0	0	0	0
5	Who collects water for the household?	self, kids	self	self	self	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self
	What are some reasons other people collect water for the household?	tired, not home	n/a	n/a	n/a	after school	tired, school	after school	tired	after school	tired	donkey helps fetch for laundry days
6a	How many people use the water in the household?	7	8	5	4	6	4	6	11	7	4	10
7	How is water stored at home?	tank	buckets	tank	spare jerrycan-alternate	small tank	spare jerrycans	storage tank	tank	storage tank	buckets	no storage, just use from jerrycan
8	How does the quality of water affect how it is used?	not good quality, so don't drink	quality is not good but use as is	use as is	don't consider, use as is	treat for drinking, otherwise use as is	spring is good quality	use as is	treat for drinking, else use it anyway	don't consider	use it anyway	river is not good quality for home use

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
4a3	How many times per day is water collected on laundry days?	5	5	6	4	4	10	9	6	13	8	8
4b	How much is paid for water (per jerrycan or per _ time)	0	50KSh one time for spring	0	0	2KSh/jerrycan at standpipe	0	0	0	0	0	0
5	Who collects water for the household?	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids	self, kids
	What are some reasons other people collect water for the household?	tired, if no school	n/a	can't do it all alone	help out	n/a	tired	when in school	when busy	school	tired	tired
6a	How many people use the water in the household?	7	5	7	6	3	7	5	5	10	5	6
7	How is water stored at home?	tank	spare jerrycan	spare jerrycans	spare jerrycans	store in jerrycan	tank	small tanks, pans	spare jerrycans, bucket	small tanks and spare jerrycans	pans, buckets	tank
8	How does the quality of water affect how it is used?	quality is not bad, use it anyway	fear just drinking without boiling	use as is	take caution for drinking	use as is	boil to drink, else use as is	sometimes boil, else use as is	use as is	use as is	use as is	have to treat

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
4a3	How many times per day is water collected on laundry days?	10	6	4	6	10	6	9	8	5	4	5
4b	How much is paid for water (per jerrycan or per _ time)	0	0	0	0	0	0	0	20/- if someone else fetches, else 0	0	0	0
5	Who collects water for the household?	self, kids	self, kids	grandchildren	self	self, kids	kids, self	self, kids	kids	self, kids	self, kids	self, kids
	What are some reasons other people collect water for the household?	if not at home	n/a	tired	n/a	n/a	during school	when busy	aching leg	tired	tired	tired, other commitments
6a	How many people use the water in the household?	3	5	5	8	11	5	6	3	7	6	7
7	How is water stored at home?	spare jerrycans	spare jerrycans	spare jerrycans	pans, bucket	small buckets	tank	small tank	buckets	buckets	buckets	buckets
8	How does the quality of water affect how it is used?	use as is, boil to drink	use as is	not bad quality since protection	use as is	use as is	not good	boil some, else use as is	not good quality, but use it anyway	treat for drinking, else use it anyway	treat for drinking, else use it anyway	use it anyway

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
1a1	Estimate the amount of water use for: Drinking	7	5	20	10	don't know	10	5	10	5	10	don't know
1a2	Cooking and tea	20	60	30	40	40	40	20	50	40	40	20
1a3	Cleaning house and utensils	15	20	20	20	20	40	40	80	20	20	20
1a4a	Where is bathing done?	home	home	home	home	home	home	home	home	home	home	home
1a4b	Bathing (per household)	50	20	30	100	70	80	20	60	40	80	20
1a5a	Where is laundry done?	home	home	home	home	home	home	standpipe	home	home	home	home
1a5b	Laundry times (per week)	100	40	60	80	100	300	60	240	80	400	80
1a5c	Laundry	3	often	2	2	7	3	1, 2	3	1	1	3
1a6a	Where is livestock watered?	home, source	source	home	home, source	source	home	home, source	home	home	source	source
1a6b	Livestock	80	n/a	80	80, (20-30L/cow)	n/a	80	40	40	20	n/a	n/a
1b1	What are some productive uses (nursery, garden)?	kitchen garden	garden	tree nursery	spray livestock	construct house	construct/fix house	tree nursery	none	kitchen garden	nursery	kitchen garden
	Volume for each productive use (per time)	200	piped, so don't know	20	n/a	100	60	20	n/a	sprinkler so don't measure	200	from tap

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
1a1	Estimate the amount of water use for: Drinking	don't know	20	5	5	5	don't know	10	5	5	5	20
1a2	Cooking and tea	100	20	40	40	40	40	40	80	100	40	100
1a3	Cleaning house and utensils	60	30	20	20	20	60	60	20	20	20	80
1a4a	Where is bathing done?	home	home	home	home	home	home	home	home	home	home	home
1a4b	Bathing (per household)	30	80	40	40	60	40	60	60	60	40	100
1a5a	Where is laundry done?	home	home	home	home	source	home	home	home	home	home	home
1a5b	Laundry times (per week)	120	200	160	40	80	200	100	140	100	100	200
1a5c	Laundry	4	3	2	1	2	3	1	1	3	3	4
1a6a	Where is livestock watered?	home	home	source	source	source	home	home	home	source	source	home, source
1a6b	Livestock	60	100	n/a	n/a	n/a	from tap	60	100	n/a	n/a	100
1b1	What are some productive uses (nursery, garden)?	nursery	nursery	nursery	none	tree nursery	kitchen garden	kitchen garden	nursery	wash house	nursery	none
	Volume for each productive use (per time)	100	120	20	n/a	200	from tap	100	120	don't know	40	n/a

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
1a1	Estimate the amount of water use for: Drinking	don't know	5	5	5	5	10	don't know	don't know	5	5	10
1a2	Cooking and tea	40	20	20	20	20	20	60	20	60	40	80
1a3	Cleaning house and utensils	20	20	20	20	20	20	20	40	20	20	60
1a4a	Where is bathing done?	home	home	home	home	home	home	home	home	home	home	home
1a4b	Bathing (per household)	40	20	70	80	20	40	40	25	60	40	80
1a5a	Where is laundry done?	home	home	home	home	home	home	home, source	source	home	home	home
1a5b	Laundry times (per week)	80	100	80	40	80	80	60	don't know	240	100	120
1a5c	Laundry	3	3	7, 1 sometimes	1	1	2	3	2	3	2	3
1a6a	Where is livestock watered?	home	no livestock	home	don't have	no livestock	home	home	home	home	home	home
1a6b	Livestock	20	n/a	40	n/a	n/a	40	40	60	30	20	60
1b1	What are some productive uses (nursery, garden)?	none	none	kitchen garden	kitchen garden	none	none	none	none	none	none	none
	Volume for each productive use (per time)	n/a	n/a	n/a	recycled	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
1a1	Estimate the amount of water use for: Drinking	5	5	don't know	don't know	10	20	10	10	5	5	5
1a2	Cooking and tea	20	40	20	40	100	30	20	40	40	30	20
1a3	Cleaning house and utensils	20	5	40	60	20	20	40	40	20	10	5
1a4a	Where is bathing done?	home	home	home	home	home	home	home	home	home	home	home
1a4b	Bathing (per household)	20	50	40	40	55	40	60	60	40	40	35
1a5a	Where is laundry done?	home, source	home	home	home	home	home	home	home	home	home	home
1a5b	Laundry times (per week)	100	60	60	80	100	200	120	120	100	120	80
1a5c	Laundry	1	3	3	3	3	2	2	2	3	1	2
1a6a	Where is livestock watered?	source	home	don't have	home	home	home	home	home	home	source	source
1a6b	Livestock	n/a	20	n/a	40	40	40	30	60	40	n/a	n/a
1b1	What are some productive uses (nursery, garden)?	nursery	none	none	none	none	kitchen garden; nursery	nursery	none	nursery	none	kitchen garden
	Volume for each productive use (per time)	80	n/a	n/a	n/a	n/a	20; 100	don't know (hosepipe)	n/a	120	n/a	40

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
1c1	Other uses and volume of water used per time?	none	none	none	none	settle dust- 60	settle dust- 100	none	none	none	none	none
1d1	Do you reuse water? For what?	for kitchen garden if not too dirty	no	no	yes- laundry water	no	no	laundry water used to clean latrine	no	no	no	no
2a1	How is water treated in the household?	boil, keep in container	no treatment	boil	boil	boil	no treatment	boil	boil	boil	boil	no treatment
2a2	How often is water treated?	daily	n/a	as needed	often	daily	n/a	always	daily	daily	daily	n/a
2b	What is treated water used for?	drinking	n/a	drinking	when raining (flooded river)	drinking	n/a	drinking	drinking	drinking, washing utensils; clean water for cows (but not boiled)	drinking	n/a

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
1c1	Other uses and volume of water used per time?	none	none	none	none	none	none	none	wash choo	none	none	none
1d1	Do you reuse water? For what?	no	no	no	no	no	no	no	no	washwater used in garden, no reuse of laundry water	no	no
2a1	How is water treated in the household?	settling (stored in tank)	boil	no treatment	boil, keep separate	boil	boil (river only)	no treatment	boil	boil, keep water covered	storage	boil
2a2	How often is water treated?	n/a	as needed	n/a	daily	daily	daily	n/a	daily	daily	n/a	daily
2b	What is treated water used for?	cooking, washing utensils	drinking	n/a	drinking	drinking	drinking	n/a	drinking	drinking	n/a	drinking

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
1c1	Other uses and volume of water used per time?	none	none	keep dust down around house	none	none	none	none	none	none	none	none
1d1	Do you reuse water? For what?	no	no	no reuse	use on shamba, but not laundry water	no	no	no	no	no	no	no
2a1	How is water treated in the household?	settling, boil	boil	no treatment	no treatment	boil	boil	boil	boil	boil	boil	boil
2a2	How often is water treated?	sometimes	daily in dry season	n/a	n/a	as needed	daily	n/a	daily	daily	as needed	as needed
2b	What is treated water used for?	drinking	drinking	n/a	n/a	drinking	drinking	drinking	drinking	drinking	drinking	drinking

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
1c1	Other uses and volume of water used per time?	none	none	none	none	none	none	none	none	none	none	none
1d1	Do you reuse water? For what?	no	no	no	no	no	no	no	no	no	no	no
2a1	How is water treated in the household?	boil	boil	boil	no treatment	storage only	boil; store and cover	boil	boil	boil	boil	no treatment
2a2	How often is water treated?	as needed	as needed	as needed	n/a	n/a	n/a	daily	2 per day	daily	daily	n/a
2b	What is treated water used for?	drinking	drinking	drinking, sometimes washing utensils	n/a	n/a	drinking; cooking	drinking	drinking and washing utensils	drinking	drinking	n/a

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
1a	Define "good health"	no one sick no one hungry no one dirty	god is helping and not sick	when a person is not sick for a long time	when enough food no sickness environment clean clean clothes, utensils, bedding	when no one is sick	bodies are well when not sick good nutrition clean house	when someone is not sick	check physical health	children will play person will work effectively	good water good nutrition	good eating maintain cleanliness
1b1	What are some ideas about preventing illnesses?	keep compound clean keep utensils clean keep body clean	don't know- treat if needed	keep kitchen clean eat well	have good water sufficient food	boil water keep clean good nutrition	when unhygiene feeding	wash food before cooking, peeling boil water wash hands before eating	boil water use mosquito net	keep flies down keep latrine clean don't share utensils	keep clothes clean wash food keep choo clean from children's excrement	properly cooked foods see food source

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
1a	Define "good health"	when people, animals aren't sick	washing having a clean compound	body appearance body functions well	body appears good and no problems	when eating well when not sick	when enough food when looks healthy	children play, are happy	when have wealth when body functions well	when not sick when a person has all needs/necesssities at home	don't know	when enough food when people are happy
1b1	What are some ideas about preventing illnesses?	go to hospital get immunization if pregnant go to dispensary, take baby to clinic	keep environment clean keep body clean care for water clean choo	don't know	cleanliness	keep environment clean use mosquito nets take medicine	go to hospital	sanitation clean around house	boil water wash hands after choo	nothing to prevent-just have to take medicine	keep environment clean use latrines maintain clean utensils	depends on going to the hospital for treatment

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
1a	Define "good health"	washing	look at body, see if it's well-functioning	body appearance dressed well	environment is clean linens are clean bodies are well functioning	body stature clean compound	when not thin when eating differently than before	don't know	body looks nourished livestock are healthy environment is neat	body stature environment	when nobody is sick active during the day	comes from good water
1b1	What are some ideas about preventing illnesses?	keeping compound clean	good nutrition	good diet body cleanliness wear warm clothes eat food foods	maintain cleanliness in environment, home avoid mixing with sick people	keep body clean have a latrine empty containers of stagnant water clean kitchen be careful mixing with other people	boiling water clean utensils wash hands wash foods	don't know	don't know	take care of body	boil water have good latrine	use good water bathe regularly

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
1a	Define "good health"	when not sick when have enough good food water available	notice in body	stature or strong body	when clean water need firewood need shelter	appearance of body environment looks okay	body looks good skin looks healthy	good environment eat good food body functioning	washing clean clothes cleanliness in general	when body is well-functioning when eating well good clothing	clean utensils good water	when eating well when the body is healthy not much thinking (stress)
1b1	What are some ideas about preventing illnesses?	keep home, compound clean	balanced diet	boiling water	need clean utensils avoid uncleanliness in home and what you use	should have good latrine keep clean utensils keep environment, compound clean	keep clean keep environment clean no stagnant water	try to maintain clean environment clean utensils cover food	to have clean water keep beddings clean all are caused by uncleanliness	use medicine take care of environment	use boiled water clean utensils	care for environment burn rubbish avoid stagnant water

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
1b2	Which illnesses can be prevented?	n/a	n/a	n/a	n/a	n/a	malaria via nets	n/a	malaria via net	waterborne via boiling	stomach diseases colds	TB (keep away from sick person) HIV (no adultery)
1c	What are some methods of maintaining the health of yourself and others?	need variety of food, variety of diet	drink river water only if boiled during rainy season	keep kitchen clean, eat well, get medicine if needed	have good shamba, harvest	clean compound	kids wash hands	cleaning the house, clearing vegetation	nutrition	bathe regularly	eat well, keep clean, use lotion on skin	a person can't care for others, only advise people outside of the home
2a	Has anyone in the household been ill this week?	no	no	yes	yes	yes	yes	no	yes	no	yes	yes
	With what illness?	n/a	n/a	operation-stomach	joint,back aches	cough	malaria, cough, flu	n/a	cough	n/a	pneumonia	cough, backache
2b	Was anyone in the household ill last week?	yes	yes	yes	yes	no	no	yes	no	yes	no	no
	With what illness?	cold	cough	cold/cough	flu, cold	n/a	n/a	cold/flu	n/a	coughing	n/a	n/a

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
1b2	Which illnesses can be prevented?			don't know	malaria via clearing brush	malaria via nets	diarrhea (boil water)	malaria via medicine waterborne via boiling	typhoid cholera	malaria via nets waterborne via boiling	cholera malaria	n/a
1c	What are some methods of maintaining the health of yourself and others?	take baby to clinic	go to hospital	medicine	don't know	keep latrine clean, avoid flies	clean environment, clean utensils	hospital, people taught, keep home and surroundings clean, use mosquito nets, boil water	to have piped water to homes	keep hands clean, keep clean self, utensils, environment; prevent stagnant water	take medicine	buy medicine
2a	Has anyone in the household been ill this week?	yes	no	yes	no	yes	no	yes	yes	yes	yes	yes
	With what illness?	stomachache	n/a	joint pains, ribs ache	n/a	malaria, cough	n/a	flu	headache	stomachache	coughing, malaria, flu, typhoid	malaria
2b	Was anyone in the household ill last week?	no	yes	yes	no	yes	no	no	yes	yes	yes	yes
	With what illness?	n/a	body pains	joint pains	n/a	swollen finger	n/a	n/a	neck aches	coughing, headache	coughing, malaria, flu, typhoid	sick in hospital

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
1b2	Which illnesses can be prevented?	diarrhea- prevent contamination (wash hands)	malaria via nets waterborne via boiling		HIV TB	not rheumatism	diarrhea (wash foods from obscure source) TB HIV	HIV TB- avoid people and utensils	don't know	HIV	TB measles	diarrhea cholera
1c	What are some methods of maintaining the health of yourself and others?	dig latrines	balanced diet; keep environment clean	clean water, fruits and good foods	can advise others to remain healthy	keep clean	careful not to eat bad food, take time to cook properly	don't know	clothes- to avoid cold; avoid contaminated water	individuals can't care for others	wash utensils between uses or when sharing	good diet, keep kids and environment clean
2a	Has anyone in the household been ill this week?	yes	no	no	yes	yes	no	no	no	yes	yes	no
	With what illness?	malaria	n/a	n/a	pains, aches; treated with herbal medicines	rheumatism	n/a	n/a	n/a	almost crippled	coughing	n/a
2b	Was anyone in the household ill last week?	yes	no	no	no	no	yes	no	no	no	yes	no
	With what illness?	joint pains	n/a	n/a	n/a	n/a	throat swelling	n/a	n/a	n/a	headache	n/a

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
1b2	Which illnesses can be prevented?	waterborne illnesses	don't know	worms (boiling) rheumatism (can get from cold water)	stomach illnesses HIV	cholera typhoid HIV	malaria (stagnant water and vegetation kept minimal) amoeba (take worm medicine)	malaria (mosquito nets) cholera (clean environment, foods)	HIV TB, don't share utensils	some dirty foods cause illnesses	cholera typhoid	malaria-control mosquitoes
1c	What are some methods of maintaining the health of yourself and others?	keep good nutrition	food	eat good food, prepare food well	keep healthy environment	don't know	good nutrition, body building foods	education about prevention in groups or gatherings	be faithful	don't know	boiling water, clean utensils	eat properly, bathe frequently
2a	Has anyone in the household been ill this week?	no	yes	no	yes	no	no	yes	no	yes	yes	yes
	With what illness?	n/a	measles	n/a	rheumatism	n/a	n/a	joint pains	n/a	headache, malaria	malaria	coughing, vomiting; scratching
2b	Was anyone in the household ill last week?	yes	yes	no	no	yes	yes	no	no	yes	no	yes
	With what illness?	stomachache	headache	n/a	n/a	malaria, pneumonia	headache	n/a	n/a	headache, malaria	n/a	coughing, vomiting; scratching

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
2c	What was the most recent illness in the household?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3b/c	What are some ideas about bathing?	n/a	wash to prevent body odor	keep things clean	problem when not much water	n/a	don't use cold water when joints ache or cold weather	keep away fleas, bedbugs, jiggers	to keep clean, feel okay, keep pores open	have to use soap, hot water to do well	because sweat, tired	to keep body fresh, relaxed, prevent bad odor, open pores
	What is the frequency of bathing?	n/a	3/week	n/a	n/a	n/a	n/a	at least 3/week	n/a	n/a	2/day	daily
	Ideas about laundry?	n/a	wear once	good to keep self neat	n/a	don't mix father and kids clothes	to look neat	daily	keep pests away	use soap	keep clean	maintain cleanliness, prevent bad odor, maintain fabric
	Frequency of laundry?	n/a	n/a	n/a	2/week	n/a	n/a	n/a	n/a	n/a	as needed	wear twice
	ideas about cleaning teeth?	n/a	after eating	keep regular	n/a	n/a	keep regular	daily	keep gums clean	can buy toothpaste; use twig	use toothpaste	always

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
2c	What was the most recent illness in the household?	n/a	n/a	n/a	malaria, but not recently	n/a	no recent illness	n/a	n/a	n/a	n/a	n/a
3b/c	What are some ideas about bathing?	to keep clean	prevent bad odor, stay clean	to relax	n/a	wash all over	to prevent bad odor	boil water	keep body clean	wash body after work	to refresh body	when one is sick, he fears the cold
	What is the frequency of bathing?	daily	all the time	3/week	n/a	n/a	2/day	n/a	2/day	n/a	3/day	n/a
	Ideas about laundry?	to keep clean	prevent bad smell, stay clean	n/a	n/a	wash underwear separate	to keep clean	use soap	avoid bad odor	wash as normal	to keep clothes clean	none
	Frequency of laundry?	wear once	all the time	2/week	n/a	n/a	as needed	n/a	as needed	n/a	wear once then wash	n/a
	ideas about cleaning teeth?	use brush and toothpaste	n/a	n/a	brush with twig	use salt if no toothbrush	all the time	use toothpaste	n/a	n/a	after eating	use stick or brush unless aching tooth

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
2c	What was the most recent illness in the household?	n/a	coughing, stomachea che	n/a	n/a	n/a	n/a	2 weeks ago; cough	don't remember	n/a	n/a	n/a
3b/c	What are some ideas about bathing?	makes body clean, opens pores	prepare for soaps, location	refreshes body, don't smell, clean	use warm water	use boiled water, keep privacy	refreshed, drive awat tiredness	boil water	to avoid bad smell, keep relaxed	to keep clean	because of dirt	to avoid various disease
	What is the frequency of bathing?	2/week	daily	daily	daily	daily	daily	3/week	daily	3/week	2/day if possible	daily
	Ideas about laundry?	to keep clothes clean	n/a	n/a	n/a	n/a	to avoid bad smells	use basin	n/a	n/a	to keep clean of dirt, odor	regular washings
	Frequency of laundry?	wear once then wash	wear once	wear once	1/week	wear once	wear once	3/week	wear once	wear once	wear once	n/a
	ideas about cleaning teeth?	brush after eating	after eating	after eating	don't do it	n/a	n/a	don't do it so nothing to say	branch, twig, toothpaste	daily	after eating	to avoid decay, keep clean

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
2c	What was the most recent illness in the household?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	a month ago- typhoid and malaria	n/a	n/a	n/a
3b/c	What are some ideas about bathing?	wash to prevent bad odor	open body pores, for tiredness	to keep bad odor away	washing opens skin pores	keep bad smell away	wash or remain tired, prevent bad odor	to avoid bad smell	to open body pores	keep odor away	to keep body clean	prevent bad odor
	What is the frequency of bathing?	daily	after work	daily	every 2 days	3/week	after work	2/day	3/week	daily	daily	always when going out
	Ideas about laundry?	to remain tidy	work clothes daily	to keep clean	to prevent bad smell	n/a	keep clean	keep clean, prevent odor	to keep clean, avoid smelling bad, to keep warm	to stay neat	to keep clean	to keep clean, avoid bad smells
	Frequency of laundry?	wear twice	as needed	as needed	1/week, Saturday	3/week	n/a	wear once	wear twice	daily	all the time	every 2 days
	ideas about cleaning teeth?	after eating	use toothpaste	don't have any	use toothpaste	to prevent bad odor	n/a	n/a	use toothpaste and brush, don't share brush		they should be brushed	can use twigs

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
	Frequency of cleaning teeth?	n/a	n/a	after eating	when needed	n/a	after any meal or could wear out	n/a	after eating	after eating	after eating	after eating
	Ideas about caring for hair?	n/a	shave kids hair	women don't shave	personal decision	don't cut kids' hair (traditional)	good to maintain or shave	when overgrown, as needed	to keep lice away, kids every 3 weeks	should was and cut hair short	wash and comb it	should cut short if can't dress
	Ideas about using a comb?	don't share	each has own	can share	can share	don't share	can share comb	can share comb	n/a	use a comb	kids have their own, self and husband share	should have, can share
	Ideas about using a handkerchief?	dispose in compost	each has own	each has own	each has own	dispose in compost	each has own	each has own	each has own	each has own	each has own	should use
	Ideas about wearing shoes?	n/a	each has own	each has own	can share	wear sandals	can share shoes	each has own	to keep feet health	each has own	share if same size	to avoid contamination and wounds
	Frequency of wearing shoes?	when going out	all the time	not around house	sometimes barefoot at home	n/a	all the time	all the time	all the time	all the time	all the time	all the time

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
	Frequency of cleaning teeth?	daily	after eating	after eating	n/a	daily	after eating	n/a	every morning	after eating		anytime
	Ideas about caring for hair?	keep it good	good to do	wash hair	cut short, or shave (sons)	does not cut hair	always	don't shave hairs	dress and use oil	go to salon	should be combed and washed	can be short or grown
	Ideas about using a comb?	use when dressing and washing	use a comb	each has own	each has own	share, always	each has own	don't comb my hair	each has own (to prevent disease transmission)	each has own	family can share comb	can share comb
	Ideas about using a handkerchief?	each has own	always	each has own	each has own	each has own	each has own	each has own	each has own	each has own	each has own	each has own
	Ideas about wearing shoes?	n/a	n/a	each has own	each has own	each has own	each has own	each has own	each has own	each has own	don't share	each has own
	Frequency of wearing shoes?	all the time	always	all the time	all the time; slippers near home	all the time	all the time	all the time	when working, at home	wear when going out, slippers around the home	all the time	all the time

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
	Frequency of cleaning teeth?	morning	daily	all the time	n/a	after eating	after eating	n/a	after eating	after eating	all the time	after meals
	Ideas about caring for hair?	when it's dirty	all the time	wash regularly	comb and cut	sometimes, but takes a long time	comb always	kids have hair cut, so no comb	when bathing, then comb	take care every day	should wash and comb	wash regularly
	Ideas about using a comb?	family can share comb	share a comb	don't comb, can share a comb	each has own	daily, share comb in the family	don't share, also don't share oil	once a week, dress hair; can share comb	use every day, don't share	share a comb, daily	not good to share	each has own
	Ideas about using a handkerchief?	each has own	each has own	each has own	each has own	each has own	each has own	each has own	each has own	each has own	not good to share	each has own
	Ideas about wearing shoes?	can share	each has own	each has own	each has own	each has own	each has own	each has own	each has own	each has own	not good to share	each has own
	Frequency of wearing shoes?	all the time	in school, not always around home	all the time	all the time	all the time	all the time	all the time	all the time	all the time	all the time	around the compound

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
	Frequency of cleaning teeth?	3/day	after eating, at night		after eating	after eating	after eating	after eating	after 4 days	every morning	before bed and in the morning	when going out
	Ideas about caring for hair?	should wash and dress	wash when bathing	don't care for it	should be washed and combed	wash to keep clean, don't need to shave	dress to keep clean, also relaxes head	wash and comb	cut very rarely b/c doesn't grow much	wash weekly	should be combed	should be combed and washed
	Ideas about using a comb?	can share	after bathing, can share a comb	people share comb	each has own	should be used	share comb	each has own	family can share comb	each has own	family can share comb	family can share comb
	Ideas about using a handkerchief?	each has own	each has own	each has own	each has own	should be used to keep from spreading germs	wash daily	each has own	each has own	each has own	each has own	each has own
	Ideas about wearing shoes?	some sharing	each has own	each has own	each has own	to prevent diseases, to keep warm	keep clean	each has own	sometimes can share	each has own	each has own	each has own
	Frequency of wearing shoes?	all the time	all the time	all the time	all the time	all the time	all the time	all the time	all the time	all the time	all the time	all the time

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
	Ideas about cleaning the latrine?	daily	as needed	as needed	3/week	3/week	daily	daily	regularly, as needed, 2/day	daily, to always keep clean	as needed	to avoid flies
	Ideas about disposing of trash?	livestock, throw away	livestock, burn	compost pile	compost	livestock	trash pit on compound	livestock, compost	compost, burn	shamba	compost pile	livestock or trash pit
	Ideas about body pests?	spray; wash bedding, clothes; put in sun	boiling water for laundry	spray, put beddings in the sun	spray, boil water for laundry	spray	spray, clean with hot water	spray, heat water for laundry	spray and laundry with boiling water	brought by uncleanliness; wash with omo, don't wear clothes for a long time, quarantine	wash with hot water	spray
4	What are some things that affect the ability to stay healthy?	to keep health	no obstacles	take care of bedding	to avoid bad smells	to upkeep livelihood	balanced nutrition	should be continuous	uncleanliness	regular washing	eat balanced diet	wash utensils
				eat well	how people see home		keep body clean			remaining active in work	wash	use clean water
							keep seating area clean			eat well	stay active	cover food

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
	Ideas about cleaning the latrine?	as needed	as needed	often	not cemented-wood; use ashes for smell, when needed	cannot wash because bad wood, put old batteries in for smell	as needed	daily	should be daily	daily	when needed	as needed
	Ideas about disposing of trash?	livestock, else throw away	compost	livestock	livestock, compost	livestock or throw away	compost, burn	compost for manure	throw to compost	livestock, compost	compost	livestock, compost
	Ideas about body pests?	spray	boil water and wash clothes	don't know	n/a	not a problem	spray	because of dirt, use spray, wash clothes	spray insecticide	spray, boil water for laundry	spray insecticide	buy spray, laundry with boiling water
4	What are some things that affect the ability to stay healthy?	wash self	body pests cause diseases	use medicine	maintain laundry, clothes	use handkerchief to avoid spreading germs	good diet	when feeling well, person must check self and maintain	keep good nutrition	balanced diet	good diet	need clean water
		clean clothes			eat well					disease outbreaks	keep body clean	attend hospitals
		change diet all the time										

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
	Ideas about cleaning the latrine?	as needed	weekly, use ashes	as needed, regularly because of kids	sweep when needed	sweep 1/week	check daily, clean as needed	3/week, covered with polythene so wash and dry	sweep as needed	as needed	keep it clean, also area outside	to avoid diseases, daily
	Ideas about disposing of trash?	thrown in shanba, livestock to eat	compost	compost	livestock, or in shamba	some to animals, shamba	livestock, throw into shamba	livestock, shamba	livestock, shamba	shamba	livestock, compost	compost
	Ideas about body pests?	boil water then wash clothes in hot water	spray for fleas	some are cleaned with washing	wash clothes with hot water	spray	brought by dirt, uncleanlin ess	spray	due to uncleanlin ess or sharing clothes, keep clothes clean	spray to treat	spray with pesticides	n/a
4	What are some things that affect the ability to stay healthy?	good diet	not enough money to buy variety (food)	cleanliness	cleanliness	n/a	avoid too much thinking	uncleanlin ess	don't know	uncleanlin ess	should have balanced nutrition	keep environme nt clean
			some people don't like some foods	good diet			lack of food					

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
	Ideas about cleaning the latrine?	daily	as needed	as needed	as needed	as needed	all the time	as needed	as needed	when needed	all the time	use ashes and sweep as needed
	Ideas about disposing of trash?	livestock, compost	compost	livestock	throw in shamba	compost, to keep for shamba	compost	compost	trash pile in shamba	give to livestock, throw away	give to livestock, trash pile	give to livestock, throw away
	Ideas about body pests?	pesticides	spray and pesticides	when not clean	due to uncleanliness	spray home	pesticides	use pesticide	clean with hot water	spray	keep clean to prevent	spray
4	What are some things that affect the ability to stay healthy?	lack of nutrition makes body vulnerable	dirtiness	good food to maintain health	one might be clean for a long time, so to prevent	need planning and how to monitor health	calm life and peace at home	eat well	teach people to keep clean	when there are no problem at home	use clean utensils	pray to god
				having good clothes				peaceful home			eat good diet	keep body clean

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
5a	What is the frequency that adults bathe?	2/day	wash after work, when tired	depends on work-morning or night	1/week	daily	even 2/day, before bed	daily	daily	daily, before and after work	2/day	2/day, with warm water
5b	What is the frequency that children bathe?	2/day	daily	as they want	personal choice	2/day	daily	always b/c more vulnerable to dirt than adults	daily	daily, morning	2/day	daily, before school
5c	What is the frequency that babies bathe?	morning, when hot	all the time	even 2/day	daily	morning, when hot	2/day	all the time	daily	daily, morning	1/day	morning and evening
6a	What is the frequency of washing hands?	sometimes	often	depends on touching dirty things	sometimes	sometimes	often	always b/c more vulnerable to dirt than adults	sometimes	always	n/a	always
6b	What are some times that hands are washed?	after work	after work	after choo	after work	after work	anytime	before eating	after work	before eating	when eating	before eating
			before eating	going to milk	before eating		contact dirt	after work	after choo	during the daytime	after work	after work
			before bed	before eating			after choo			when come home from work		
							before eating					

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
5a	What is the frequency that adults bathe?	2/day	2/day	3/week (face and hands daily)	at least 3/week	3/week	after work	daily	all the time	daily after work	3/day	even 2/day
5b	What is the frequency that children bathe?	2/day	2/day	daily	n/a	daily	2/day	daily	daily	dialy	2/day	at pleasure-from school or lunch
5c	What is the frequency that babies bathe?	not regular	daily	2/day	daily	regularly	3/day	daily	2/day	3-4/day	all the time	morning and at bed
6a	What is the frequency of washing hands?	always	always	n/a	always	regularly	always	always	n/a	often	sometimes	often
6b	What are some times that hands are washed?	when eating	before eating	after choo	after greeting people	after choo	after greeting people	before eating	after work	after work	after work	before eating
		after work	after work	when eating	preparing food	after work	after touching something dirty	after eating	after choo	after choo		after eating
		after choo		after work	after shamba			when needed		preparing food		before bed
					after choo							after work

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
5a	What is the frequency that adults bathe?	3/week	daily	daily	daily after work	after work	daily	daily after work	daily	every 2 days	1/day	daily
5b	What is the frequency that children bathe?	all the time	3/week	daily	don't have any	after work	daily	daily because of school	daily	daily	2/day	daily
5c	What is the frequency that babies bathe?	every 2 days	daily	regularly	when she had kids, she believed: every other day or will become weak	2/day	up to 3 days between	don't have	regularly	daily	3/day but depends	morning and before bed
6a	What is the frequency of washing hands?	sometimes	daily	can't all the time	as needed	always	always	always	often	often	always	often
6b	What are some times that hands are washed?	after work	before eating	before eating	after work	before eating	after choo	because of touching dirty things	when feeding baby	after work	after choo	before eating
		after choo		after choo	after eating	after work	after work	after choo	after work	after choo	before eating	after work
				after shamba	after choo			after work		when get home		
					after caring for baby							

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
5a	What is the frequency that adults bathe?	1/week is enough, Saturday	daily after work	daily	3/week	daily, after work	even 3/day	3/week	3/week	daily	when one feels like it	every 3 days
5b	What is the frequency that children bathe?	daily	daily	daily	3/day (2 in morning, before bed	every 2 days, feet before bed	even 5/day	daily	daily as they go to school	daily	daily	daily
5c	What is the frequency that babies bathe?	daily	as needed	all the time	anytime they are dirty	all the time	depends on baby size	2/day, before bed	every 4 days	every 2 days	daily	every 3 days
6a	What is the frequency of washing hands?	sometimes	often	any time	always	n/a	sometimes	always	often	sometimes	sometimes	all the time
6b	What are some times that hands are washed?	before eating	after work	after shamba	before eating	after work	before eating	after work	after work	after work	after choo	before eating
		after work	before eating	before bed	before bed	after eating	after work	after choo	in the morning	after getting home	after work	after choo
			after choo						before eating			after greeting many people
												after working in shamba

Question	Respondent	1	2	3	4	5	6	8	10	11	12	14
6c	Are children taught to wash their hands?	yes	yes	yes-in school, encouraged at home	yes	yes	yes	yes	yes	yes	yes	yes
8a	What are some causes of diarrhea?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	flies-step on food	when touch things in surroundings	flies on food
										by eating food unwanted by the body	dirtiness in choo	
8b	What are some ways to treat diarrhea?	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a		boil water, add sugar and salt, drink; dispensary	hospital
7	Do you have anything else to add about water or health in the household?	n/a	n/a	fruits are good for health	n/a	n/a	don't wash if after a long day tired and no water	n/a	n/a	n/a	water to the home for health and shamba	nothing
							or have to drink without treating					

Question	Respondent	15	16	17	18	19	20	21	24	25	27	29
6c	Are children taught to wash their hands?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
8a	What are some causes of diarrhea?	uncleanliness	dirt	uncleanliness	eating dirty foods	when one is sick	dirt	bad environment	eating uncooked foods	worms	because of dirt	n/a
		it's a disease				when eat bad food		eating soil (kids)	foods poorly prepared			
								unfavorable foods				
8b	What are some ways to treat diarrhea?	take to hospital	dispensary	medicine	n/a	n/a	dispensary	boil water, keep home clean to prevent	hospital	n/a	buy medicine	n/a
7	Do you have anything else to add about water or health in the household?	nothing else except need for water	have balanced diet	nothing	n/a	keep utensils clean always	nothing		nothing	n/a	nothing	good water is always important
						watch dogs waste						

Question	Respondent	30	31	32	33	34	36	38	40	41	42	43
6c	Are children taught to wash their hands?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
8a	What are some causes of diarrhea?	contamination-unclean food	bad diet	eating dirty foods	dirtiness	bad foods	some illnesses cause	dirty surroundings	foods not favored by stomach	eat food unwanted by body	drinking untreated water	cholera
					eating unclean foods	foods not cooked well	worms	eating improper foods		amoeba	shaking hands with someone dirty	bad foods
						old food	unfamiliar foods				dirty hands after choo	insects
						some dirty posho mills					flies	
8b	What are some ways to treat diarrhea?	boil water, add salt and drink	boil water, add sugar and salt; to dispensary if needed	boil water with salt and sugar	find medicine	boil water, add sugar and salt; go to dispensary	boil water, add sugar and salt; go to dispensary	boil water, add salt & sugar; go to dispensary	boil water, add sugar and salt; go to dispensary	boil water, add sugar and salt; to dispensary	boil water, add sugar and salt to drink	give water with sugar and salt, go to dispensary
7	Do you have anything else to add about water or health in the household?	water is the most important issue	community needs frequent education and open discussions	nothing	diet is most important	family relationships are important-if not at peace, then can cause problems	leg aches after climbing high places	eyes are aching (translator advised to wash them with cold water)	nothing	water = unprotected (even frogs)	nothing	concentrate on food
		need dispensary in the area								children take unteated water		

Question	Respondent	45	48	49	50	51	52	53	54	55	56	57
6c	Are children taught to wash their hands?	yes	yes	yes	yes	yes	yes	yes	yes	yes	very few remember	yes
8a	What are some causes of diarrhea?	eating improperly prepared foods	eating dirty foods	eating dirty foods	eating bad food	using unclean utensils	because of unclean environment	because of dirt	eating unclean foods	dirt	being unclean	unclean water
		unclean water	using dirty utensils	flies can bring germs	bad preparation of food	improperly cooked foods	dirty foods		food from bad source		eating dirty foods	unclean hands
			flies									
8b	What are some ways to treat diarrhea?	boil water, add sugar and salt	boil water, add sugar and salt	medicine	boil water, add sugar and salt	boil water, add sugar and salt	medicine	hospital	boil water with sugar and salt; go to dispensary if necessary	boil water plus salt and tea	boil water with sugar and salt	boil water, add salt and sugar; or tea leaves
7	Do you have anything else to add about water or health in the household?	nothing	request for help to improve	spring is in better condition since improvement	firewood is a major problem	clean water at home is necessary to maintain health	nothing	nothing	nothing	nothing	nothing	nothing

Appendix 5. Complete Data of the 31 Respondents of the Monthly Health Record Used Between March and June, 2006 in Maburwa and Nduluma, Kenya

Respondent	Date	Age	Symptoms	Duration (days)
1	30-Mar	12	cold, cough	4
	30-Mar	50	malaria, fever	7
	10-Apr	30	malaria	5
	15-May	45	fever, cough	5
	30-May	20	worms, fever	3
	15-Jun	33	malaria, fever	6
	20-Jun	30	cold, fever, cough	7
	24-Jun	48	malaria, stomachache, fever	5
	25-Jun	35	malaria, body aches, rheumatism	10
	29-Jun	33	worms, fever, rheumatism	1
	29-Jun	33	worms (amoeba), rheumatism, fever	1
	29-Jun	12	malaria, cold, fever	1
3	1-Feb	37	back pain, rheumatism, arthritis	5 yrs
	1-Mar	48	malaria, typhoid fever	30
	10-May	55	eye infection	3 yrs
	14-May	37	acute attack of malaria	7
	15-May	37	eye infection (short sighted)	2 yrs
	21-Jun	4	malaria, jaundice	14
4	25-Feb	60	cold, fever, cough	3
	20-Mar	65	cold, cough	4
	30-Mar	60	rheumatism, cold	2
	20-Apr	30	malaria, fever	4
	25-May	60	rheumatism, fever	5
	30-May	29	rheumatism, worms	7
	1-Jun	30	malaria, cold, fever	4
	10-Jun	60	rheumatism, cold	5
	15-Jun	33	worms(amoeba), fever, cough	4
	20-Jun	15	malaria, fever, cold	3
	25-Jun	30	cough, rheumatism, fever	6
	27-Jun	60	rheumatism, fever	2
6	10-Mar	40	cough, rheumatism, fever	7
	22-Mar	10	worms	6
	7-Apr	20	itch	2
	15-Apr	15	fever	3
	10-May	17	fever	4
	28-May	32	cold	3
	10-Jun	20	diarrhea	2
	16-Jun	14	malaria	4
7	22-May	36	cough	7
	25-May	9	malaria	3
	23-May	42	worms	5
	28-May	36	malaria	4
	30-May	39	itch	5

	8-Jun	4	cough	6
	22-Jun	39	itch	3
	29-Jun	7	cold	unknown
10	10-Mar	0.1	diarrhea, itching, cold, cough	3
	20-Mar	0.5	diarrhea, malaria, cold	2
	30-Mar	2	malaria, amoeba, cold	3
	4-May	30	malaria, amoeba, rheumatism	21
11	10-Apr	35	rheumatism, malaria, fever	30
	20-May	60	rheumatism, worms, headache	10
	30-May	55	headache, worms	3
	15-Jun	10	cold, fever, malaria	3
	19-Jun	52	headache all the time	almost all the days
	26-Jun	1.1	flu, cough	3
	26-Jun	36	worms, headache, rheumatism	5
	29-Jun	12	earache	1
12	monthly	35	psychosis	30 days
	5-May	5	malaria, diarrhea, fever	3
	15-May	10	cough, cold, fever	5
	16-Jun	2.25	pneumonia	7
	24-Jun	11	amoeba	7
	27-Jun	16	malaria	5
13	3-May	50	rheumatism, fever, cough	10
	9-May	60	rheumatism, cold, headache	15
	2-Jun	14	worms, fever, cold	7
	2-Jun	6	rheumatism, cold, fever	4
	15-Jun	3	coughing, fever, diarrhea	6
	18-Jun	10	malaria, fever, cold	6
	20-Jun	5	malaria, fever, cold	3
	20-Jun	2	diarrhea	2
	23-Jun	0.25	flu, cough	3
	25-Jun	3	malaria, diarrhea, fever	5
16	11-Jan	100	malaria, sweating	30
	13-Jan	0.1	cough, fever	7
	11-Feb	20	diarrhea, vomiting	7
	12-Mar	16	cough, sweating	8
	16-Mar	13	malaria, worms	7
	16-Mar	5	malaria, fever	1
	16-May	22	cold, fever	6
	17-May	2	cold, aches	30
	16-Jun	16	diarrhea, vomiting	14
	20-Jun	50	malaria, shivering	4
17	11-Mar	9	malaria	3
	28-Mar	48	diarrhea	5
	1-May	25	cough	14
	22-May	40	malaria	7
	4-Jun	15	malaria	5
	25-Jun	18	malaria	2
	27-Jun	56	rheumatism, cold, fever	7
	28-Jun	50	headache, cold, fever	3

	29-Jun	56	rheumatism, malaria, fever	1
19	7-Apr	48	malaria, earache, fever	3
	8-May	50	malaria, itching, fever	5
	2-Jun	44	high blood pressure	30
	4-Jun	18	malaria	14
20	18-Mar	16	headache, cold, cough	90
	5-Jan	48	painful legs, malaria	120
	13-May	16	painful ribs legs and back	45
	15-May	48	rheumatism, malaria, worms	120
	10-Apr	14	malaria, worms, amoeba	28
22	18-May	35	stomachache	6
	19-May	4	stomachache	3
	25-May	35	flu, cough, headache	8
	27-May	13	cough	7
	2-Jun	4	diarrhea	2
	5-Jun	35	diarrhea, fever	4
	25-Jun	8	cough, cold, flu	2
	25-Jun	4	malaria, fever, rheumatism	10
	29-Jun	25	headache, cough, cold	1
	29-Jun	30	headache, malaria, fever	1
24	5-Mar	0.5	diarrhea, vomiting, fever	3
	10-Apr	2	itching, cold, cough, malaria	10
	18-May	0.5	itching, worms, malaria	5
	20-May	15	malaria, worms, cough, fever	6
	20-May	48	malaria, rheumatism, fever	10
	30-May	55	rheumatism, malaria, fever	28
	10-Jun	20	worms, rheumatism, amoeba	35
	20-Jun	30	rheumatism, amoeba, worms	60
	20-Mar	27	worms, amoeba, cold, fever	7
25	3-May	18	eyes	5
	3-May	67	malaria	21
	4-May	30	malaria	3
	23-May	50	cold, pneumonia, shivering	5
	24-May	28	backache, joint pains	7
	28-May	28	malaria	4
	30-May	8	coughing, chest pain	4
	3-Jun	7	fever, lack of appetite	1
	7-Jun	5	stomachache, strong bit??	2
	9-Jun	4	fleas/body pest	2
	15-Jun	16	cold, legs	2
	17-Jun	9	ring worms	60
	20-Jun	34	cold	3
	28-Jun	10	wounds, boils	14
	30-Jun	7	shivering	3
26	30-Mar	25	malaria, fever, cough	5
	13-Apr	29	malaria, rheumatism, fever	30
	12-May	14	fever, rheumatism	3
	19-May	30	pain, cold, cough	5
	22-May	30	malaria, fever	7

	1-Jun	10	pain, headache, cold, fever	2
	10-Jun	6	pain, fever, cough	4
	15-Jun	37	pain, rheumatism, cough	10
	20-Jun	45	headache, malaria, cough	6
27	8-May	2	fever	3
	13-May	10	malaria	7
	15-May	4	fever	2
	20-May	88	cough	4
	1-Jun	15	stomachache	18
	20-Jun	60	malaria	10
	24-Jun	28	cold	6
	24-Jun	12	body pests	15
	26-Jun	36	worms	13
	27-Jun	57	diarrhea, cold	9
	28-Jun	1	malaria, worms, fever	8
	30-Jun	6	fleas	9
28	18-May	1.5	fever, cough, flu	4
	15-Jun	35	malaria, headache	7
	22-Jun	13	cold	14
	14-Jun	14	worms	2
	11-May	14	cold	7
29	6-May	6	cough	6
	9-May	32	malaria	12
	14-May	70	malaria, worms, cough	5
	28-May	15	cold	8
	30-May	45	fleas	10
	1-Jun	5	worms	unknown
	4-Jun	9	fever, cold	16
	8-Jun	10	body pests	14
	10-Jun	2	cough, fever	18
	24-Jun	18	body pests	15
	25-Jun	23	body aches/joint pain	7
	29-Jun	1	malaria, fever	4
31	25-May	11	cough	5
	28-May	6	fever, cough	6
	29-May	1	cough, fever, cold	10
	30-May	27	worms	2
	25-Jun	6	worms	2
	27-Jun	1	cold	5
	27-Jun	27	headache	1
	27-Jun	28	toothache	unknown
32	25-May	5	headache, scratching all over	1
	26-May	35	cough, leg ache	3
	26-May	55	continuous dry cough	5
	29-May	35	vomiting worm	1
	31-May	35	headache, backache	2
	11-Jun	9	pain from urine, reddish urine	5
	11-Jun	9	stomachache, headache, diarrhea	6
	12-Jun	38	pain, hiccough	14

	15-Jun	3	toothache	8
	17-Jun	48	Died going to get injections in hospital. Drank local brew (Nubian gin). He went to the hospital after drinking these drinks. Family was told it is medicine that made him die.	unknown
33	10-May	70	all joints ache	14
	22-May	70	eyes	still sick
	23-May	24	malaria, cough, cold	still sick
	27-Jun	70	cough	still sick
	28-Jun	15	worms	still sick
36	15-Jun	50	malaria	13
	2005	40	pain in the legs	1 yr
	20-Jun	12	fever, worms	5
	23-Jun	50	backache	still sick
	26-Jun	50	worm, stomachache, headache	still sick
41	10-May	35	worms	still sick
42	16-Jun	12	malaria	23
	20-Jun	40	fever	7
	1-Jul	26	cough	4
48	1-May	35	cough, headache, worms	still sick
	4-May	4	diarrhea	still sick
	15-May	20	malaria, pain in joints	30
	16-May	70	headache, pain in joints	still sick
	30-May	70	coughing, pain in joints	on going
	20-Jun	20	measles	18
	25-Jun	25	worms, diarrhea	5
49	10-Jun	86	pain in legs	90
	21-Jun	18	headache	7
	21-Jun	86	backache	still sick
	22-Jun	12	cough, headache	5
	25-Jun	39	pain in legs	2 yrs
	25-Jun	86	cough	still sick
50	15-May	39	continuous cough	still sick
	30-May	19	joint ache	still sick
53	11-May	14	cold	7
	18-May	87	malaria	28
	23-May	18	malaria	4
	14-Jun	19	worms	2
	19-Jun	18	cold	8
	23-Jun	13	cold	14
54	1-May	35	malaria, diarrhea, fever	30
	11-May	48	problem in the leg	still sick
	12-Jun	18	headache	still sick
	20-Jun	14	cold, cough, fever, worms	8