Seasonal and gendered variations in experiences and perceptions of water insecurity among smallholder farmers in western Kenya: a qualitative study

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Abstract

Water insecurity contributes to negative physical and mental health outcomes, and has been found to disproportionately affect women, who are typically primarily responsible for fetching water and managing its use. However, little is understood about how water insecurity manifests among agrarian, HIV-affected populations in sub-Saharan Africa. To explore water insecurity experiences among HIV-affected, smallholder farmers in western Kenya, the unique experiences of women in this context, and coping strategies to water insecurity consequences, data were collected as part of the Shamba Maisha study (NCT02815579). The Shamba Maisha study tests an agricultural intervention to improve the health and nutrition of people living with HIV. Interviews were conducted with 30 adults (24 women; 6 men; age = 41.7±9.4 years). Interviewers asked open-ended questions, probing about water acquisition, uses of water, challenges, strategies to cope with water-related challenges, farming practices, and perceived benefits of the Shamba Maisha program through the go-along interview method. A coding framework was developed after identifying emergent themes, and analysis was conducted using a combination of inductive and a priori methods using Atlas.ti 8. Almost 70% of interviewed households experienced water scarcity and poor water quality. Water insecurity challenges and associated consequences varied depending on the season. Women were responsible for the acquisition and management of water (90%), which resulted from normalized gender roles. Primary methods of coping with water insecurity were storing water (96.7%), treating water (86.7%), and diversifying water sources (83.3%). Shamba Maisha study participation increased participants' empowerment, offered new agricultural opportunities, and increased hope for the future. Addressing water insecurity must be specific to the season and differences in water experiences across gender, and has the potential to significantly improve physical and mental

health outcomes of the women of the household because of their responsibility over water use and management.

Introduction

Access to water and sanitation is considered a human right by the United Nations, reflecting the fundamental nature of these basic necessities in every person's life.(1) Sustainable Development Goal (SDG) number 6 seeks to increase the availability and sustainable management of water and sanitation for all.(2) However, the indicators for SDG 6 are measured at population, environmental, and infrastructural levels, ignoring the consequences of water insecurity on the household. While international attention on water and sanitation is growing, water security on the household level has yet to be appropriately measured or contextualized, despite its relationship with several other health outcomes of interest to the global health community.

Water security is the ability to access and benefit from affordable, adequate, reliable, and safe water for wellbeing and a healthy life.(3) Conversely, water insecurity is a condition when at least one of these variables (affordability, reliability, adequacy, and safety) is significantly reduced or unattainable, therefore threatening health and well-being, as well as the capacity to undertake necessary productive, social, and cultural activities.

There are physical consequences of water insecurity at the household level. Drinking poor quality water or bathing in contaminated water can lead to gastrointestinal infections, leading to diarrhea, cholera, and dysentery.(4-6) Contaminated water can also transmit diseases such as typhoid, and polio.(6) Consumption of contaminated water is estimated to cause 502,000 diarrheal deaths each year, being a leading cause especially for children under the age of 5.(6,7)

Water insecurity impacts physical health through nutrition as well, where water insecurity has been found to be intricately linked to food insecurity, contributing to nutrient access and intake.(8,9)

Water insecurity is also associated with negative psychosocial health. Water acquisition is often stressful and presents a significant cognitive burden. Previous research has demonstrated that the planning and organizing of where, when, and how water will be acquired is psychologically overwhelming.(10) Krumdieck, et al. (2016) showed significant psychosocial impacts of water insecurity, including worrying about getting sufficient water, arguing with neighbors and within the household, as well as psychological stress.(11) Water insecurity has been found to be strongly associated with increased anxiety, depression, fear, and emotional distress, suggesting a syndemic relationship between water insecurity and mental illness.(12,13)

Individuals living with human immunodeficiency virus (HIV) are especially susceptible to the adverse consequences of water insecurity. With a compromised immune system, people living with HIV are vulnerable to opportunistic infections, such as diarrheal diseases and skin infections, which can be contracted from consuming or washing with poor quality water.(14,15) Additionally, unreliable water supply has been found to be related to HIV/AIDS-related absenteeism for medical treatment, and the lack of reliable safe water could lead to resorting to use of poor quality water, increasing risk of exposure to pathogens and waterborne diseases.(16) Furthermore, hydration is crucial for maintaining overall health, as well as managing HIV/AIDS symptoms and medication side-effects.(17,18)

Despite growing recognition of the importance of household water insecurity, there is limited knowledge on how water insecurity manifests, especially among HIV-affected, smallholder farmer populations. Therefore, this paper aims to describe the lived experiences of

water insecurity among 30 smallholder farmers in a water scarce region of western Kenya and evaluate an intervention that seeks to improve upon these experiences through the distribution of a treadle pump.

Data for this analysis are from the Shamba Maisha study, which tests an agricultural intervention to improve the health of people living with HIV, and seeks to turn subsistence agriculturalists into horticulturalists to improve health and nutrition, and lift families out of poverty.(19) The objectives are the following:

1. Characterize water insecurity experiences among HIV-affected, small-scale farmers
2. Explore differences in men's and women's experiences of water insecurity
3. Identify water insecurity coping strategies within this cohort
4. Qualitatively assess the impact of a small-scale irrigation intervention on household water insecurity experiences

Methods

Ethical approval

IRB approval was obtained from Northwestern University (STU00204884) and Kenya Medical Research Institute.

Study setting and population

The Shamba Maisha parent study (NCT02815579) began in 2016 in the Nyanza region of Kenya. Enrollment of participants was completed in 2017. The Shamba Maisha cohort includes HIV-affected farmers with dependent children, and were recruited through six participating health clinics. The clinic communities were randomly assigned to receive the intervention or

control arm of the study. The intervention involved the distribution of 'MoneyMakerMax' treadle pumps, training on sustainable farming practices and financial management, as well as a loan program to purchase the treadle pump, seeds, fertilizers, and other farming tools.(19) The participants in the control arm of the study did not receive pumps, training, or access to the loan program.

The Nyanza region of Kenya is an appropriate setting to study because of the high prevalence of water insecurity, as well as the environmental changes that bring water-related challenges. For example, during the rainy season, water-related disease exposure increases with vectors like mosquitoes in greater abundance.(20) Furthermore, the Shamba Maisha study allows for exploration of the experiences of smallholder farmers, particularly those living with HIV, allowing for greater discovery of the relationship between HIV and water insecurity in a region of the world that has both high prevalence of water insecurity and HIV, with Kenya carrying 6% of the world's HIV burden.(21)

All index participants in Shamba Maisha were adult (≥18 years of age) smallholder farmers with at least one child under 5 years of age in the household. Of these, five participants were purposively selected for qualitative study from each of the six health clinics involved in the Shamba Maisha study if they reported a very high water insecurity score. Twenty-four women and six men were ultimately enrolled to participate in interviews. Water insecurity scores were determined by the quantitative data from the surveys in the parent study. Women were oversampled for this study, because previous studies found that women are primarily responsible for household water use and management. Participants who were unable to consent or who were not actively enrolled in the Shamba Maisha consortium study were excluded from selection.

Data collection

Data on phenotypic gender and age were collected through surveys during the parent Shamba Maisha study in June 2017. Six months later, data collection through go-along interviews began, and ended in June 2018, which was during the annual dry season. This interview methodology combines asking questions and observation, where researchers accompany participants on outings in their familiar environments, such as their neighborhood, household, farm, and water collection locations, connecting participant ideas with the physical environments to which they are related.(22,23) Go-along interviews were semi-structured, using both prepared and ad hoc questions.

In the go-along interview method, two trained qualitative interviewers who were fluent in the local language asked participants a series of questions and asked for the participants to show the interviewer items or locations described in the responses. Interviewers took photos of farms, water sources, storage containers, and other water-related items during the interview. Interviews lasted approximately 90 minutes. The aim was to understand a spectrum of experiences with water security across a variety of geographies.

The interviews were transcribed and translated by the same qualitative team that conducted the interviews. The verbatim transcripts were read by co-investigator Patrick Mbullo to ensure quality before they were translated into English. After translation, the interviews were reviewed by the principal investigator, Sera Young, and the two co-investigators, Patrick Mbullo and Shalean Collins, for completeness and consistency.

Data analysis

Quantitative data were matched with the interview transcripts to allow for analysis of demographic data. Quantitative data were cleaned and analyzed using Stata/SE 15. To determine descriptive statistics of the cohort with this quantitative data, I calculated the proportion of female participants, as well as the mean and standard deviation of age. Numerical data from the qualitative interviews were also manually entered into Stata for quantitative analysis, specifically the reported amount of time participants took to get to a water source and the number of trips they made to the water source in a week, allowing the calculation of the mean and standard deviation for time spent fetching water in one week.

Translated interview transcripts were imported and analyzed using Atlas.ti 8. Patrick Mbullo and I read through the interviews and developed a coding framework from emergent themes. Identified themes included the importance of water, consequences of water insecurity, gender differences related to water, coping strategies for water insecurity, and perceptions on participation in the Shamba Maisha project. I read the interviews again for deeper analysis using a combination of inductive and a priori methods to find nuances in the data within these themes. An abbreviated coding framework can be found in Table 2. Collins, et al. (2018) hypothesized that water insecurity is experienced through four distinct pathways: physical health, psychosocial wellbeing, nutrition, and economic productivity.(10) This framework will be used to organize the consequences of water insecurity found among this cohort.

Water sources were defined using the Joint Monitoring Programme (JMP) 2017 drinking water service ladder.(24) The JMP established five categories of drinking water, which are listed from the safest to least safe categorizations: safely managed, basic, limited, unimproved, and surface water. Safely managed, basic, and limited sources are considered “improved,” offering reliable, generally clean water from a protected source. Unimproved and surface water ladder

levels are unprotected sources, have inconsistent supply, and offer low quality water. The exact definitions of the JMP water ladder can be found in Table 3. While not all water sources were used for drinking water exclusively, water sources that were used for drinking purposes in any capacity were categorized using these guidelines.

Quotations throughout the paper begin with the letters *I* and *R*, where *I* indicates the interviewer is the speaker, and *R* indicates the participant is the speaker. Salience is defined as the number of documents in which a concept is mentioned, and the results are reported by decreasing salience.

Results

The quantitative survey data show that 80% of interview participants were female, with mean age 41.7 years (SD=9.4), range 27 to 59 years old (Table 1). Twenty participants were from the Shamba Maisha intervention group, while 10 were from the control group.

(1) Water insecurity experiences among HIV-affected, small-scale farmers

Value of water for wellbeing

Water insecurity was a major problem for much of the cohort. In fact, 68% of participants stated that water was their primary issue of concern among all other problems they experience. Participants explained their concern by describing the essential nature of water in their daily lives.

> *R: Water is everything. I can't go to town without taking a bath, I can't take three hours without drinking water, so you do everything with water.*

(PID3033, female, age 43)

R: We go the extra mile to get water because as you know, water is life and we can't do without it. (PID5043, male, age 53)

One participant did not answer the question of ranking water amongst his other challenges, because he had resigned to the problem:

I: Looking at all the problems you have in life, where would water fall in? Would it be number one, two, last?

R: I just keep quiet, I can't do anything about it. (PID5027, male, age 35)

It is worth noting that this participant was not the primary member of the household responsible for fetching water, but his daughters. Therefore, his separation in responsibility in water acquisition may allow him to distance himself from the consequences of water insecurity.

Water acquisition

Water was obtained from what JMP would classify as "basic" sources among 83% of participant households. Basic water sources are defined as sources that have the potential to deliver safe water that require no more than 30 minutes for a roundtrip including queuing. Examples of basic water sources include boreholes, wells, and rainwater.(24) Surface water sources were used for both household consumption and agriculture among 67% of households. Surface water sources include rivers, dams, lakes, ponds, streams, canals or irrigation canals.(24) These proportions do not sum to 100% because participants obtained water from multiple sources, where primary sources are the preferred source of water for household needs, followed

by secondary sources, which are used to supplement or as a substitute for the primary water source.

On average, it took participants 16.7 minutes (12.8) to make one trip to their primary water source, ranging from 1 minute to 60 minutes. Fifteen participants (50%) also reported the number of trips taken to their primary water source in a given week, going as few as 2 trips or as many as 28 trips in a week. Participants reported varying water sources, the time it takes to make a roundtrip from each source, and the number of trips to each water source, depending on the season. Therefore, total time spent fetching water per household per week was dependent on the season, but ranged from 8 minutes to 21 hours in one week.

> *R: During rainy seasons, you can go less trips, like let's say two trips or carry two buckets unlike during dry seasons when you are forced to go up to eight trips to get enough water for the household.* (PID10039, female, age 30)

Uses of water

Water was used for a variety of tasks. All participants used water for cooking, drinking, and household activities, like laundry or washing dishes, and 80% reported using water for bathing and hygiene behaviors. Washing clothes were most frequently reported task that used the most water in the household (77%). Cooking (40%), drinking (37%), and bathing (30%) were also salient activities reported as requiring the most water in the household (Table 4).

Problems with water:

Physical health consequences

Poor health consequences as well as other negative water insecurity outcomes varied depending on the time of year (Table 5). During the rainy season, disease and flooding were significant problems. With the floods came increased exposure to infection and disease, due to walking through flood waters or by creating ecological changes that facilitated bacteria and vector growth. Malaria, as well as other communicable diseases such as bilharzia, pneumonia, infections and typhoid were described among 77% of participants as a water-related challenge. The most salient health issues during the rainy season were malaria (60%), epidermal rashes and irritation (57%), stress (40%), and diarrhea (40%).

> *R: I can talk about malaria because when it rains the mosquitoes multiply in that stagnant water and can bite people before people go to sleep.*
>
> (PID3012, female, age 41)

Floods affected 47% of the participants, damaging 40% of the participants' homes, leading 7% of participants to be displaced. Children would play in the contaminated flood waters or have to walk through it, and were susceptible to the cold weather as well as pathogen and contamination exposure in the water (20%). Participants mentioned hearing about community members nearly drowning or dying because of trying to cross flood waters (10%). The rainy season also led to more snakes in the environment (7%).

The dry season brought water shortage and diminished water quality. More than half of participants mentioned not having enough water during the dry season (57%). As a result of water scarcity, households reduced their preferred washing and hygiene practices (50%). Alongside water shortage, 30% of participants discussed poor water quality during the dry seasons. Due to environmental water shortages, 47% of participants reported having to wait in

longer queues for fetching water from a water source. In those queues, 47% of participants reported quarrels breaking out.

Consequences on psychosocial wellbeing

Forty percent of participants mentioned being stressed during the dry season because of the lack of water in the household and having to think more about how they would provide for their family.

> *R: There has to be stress especially when I don't get drinking water, I get really stressed out.*
>
> *I: When does this happen mostly?*
>
> *R: During dry seasons.* (PID10023, female, age 31)

While the participants reported diseases and infection as salient health issues during the rainy season, the high salience of stress during the dry season suggests that psychosocial health outcomes are more pervasive during the dry season than the rainy season.

Nutritional consequences

Due to the water shortage during the dry season, it was also difficult for 37% of participants to obtain food. Water shortage negatively impacted the ability of households to grow their own crops. As a result, many relied on purchasing produce, which was also more expensive during the dry season.

> *R: I am saying this because during rainy seasons, the vegetables are too much, and you can get some from the farm and cook for supper. On the contrary during dry seasons, there is limited water so food supply is low but the demand is high*

and hence the prices are usually very high. (PID9045, female, age 59)

R: It's easy getting food during rainy seasons since at that time I even plant my own vegetables unlike during dry seasons where I have to buy food each day.

(PID10039, female, age 30)

Other consequences of water insecurity arose throughout the year despite the seasonal differences. Frequent downpour during the rainy season, as well as the limited water during the dry season, destroyed crops (73%).

R: For me, I planted in February and both the beans and maize I harvested were of great quality and quantity, so I can say the rain really helped in their growth.

I: So the rain has helped your crops grow fast and it has also destroyed some of your crops?

R: Yes, the destroyed crops have turned yellow in the farm.

(PID9040, female, age 31)

Nutritional practices also changed as a result of water insecurity. Participants reported changing cooking and dietary choices in order to accommodate for water limitations (57%), as well as making tradeoffs between having food or water for the household.

R: Yes, that's because food comes first. I have to ensure there is water for cooking. Then what's left will be used for bathing, washing feet and face.

(PID4042, female, age 39

Consequences on economic productivity

Spending extensive time in queues waiting for water led to being unable to be available for other opportunities and being unable to conduct necessary activities. Sixty-seven percent of participants reported missing opportunities because of the time they spent on acquiring water. These opportunities included the chance to search for a job, being home when people would visit for meetings or business reasons, or carrying out household tasks and child care.

> *R: There is a time my children missed eating lunch, not because there was no food but because I stayed out for long looking for water to cook the food.*
> (PID9040, female, age 31)

> *R: When there is no water and I don't have money, and maybe someone came to look for me at home, definitely they will not find me because I have gone to look for water.* (PID4017, male, age 39)

(2) Women's experiences of water insecurity among the small-scale irrigation intervention within the Shamba Maisha study

Gendered nature of water: a female's responsibility

Both male and female participants defined water acquisition as a woman's responsibility.

> *I: And how are the men involved in water acquisition?*
>
> *R: They do not get water.*
>
> *I: Why so? Any specific reasons?*
>
> *R: The men do not ferry water at all.*
>
> *I: Why?*

R: They have this notion that women are the ones who should be bringing water, that it's their responsibility. (PID5027, male, age 35)

Women were most often reported as being primarily responsible for household water acquisition (90%). In two of the three households that did not report an adult female being responsible for water acquisition, an adult male was responsible for water acquisition, and in all three of these households, children were either fully or partially responsible for acquiring water. School-aged children assisted a female adult when acquiring water in 83% of households. Overall, children were mentioned as assisting in acquiring water in 93% of the interviews. However, their assistance was often conditional on the children being home from school, otherwise it was typically the mother or another adult female who was responsible for water acquisition.

I: What time do they [the children] go to the spring to fetch water?

R: After they come from school.

I: At what time do they go?

R: When they come back for lunch because they don't go back to school in the afternoon so that time is when they go to fetch water from the spring for their bathing.(PID4042, female, age 39)

Children involved in water fetching were often female; 30% of participants explicitly mentioned that at least one female child assists in water acquisition, be it a daughter, another family member, or a community member. Therefore, female responsibility over water acquisition expanded beyond the matriarch of the household, but also to young women and girls in the household.

Women were primarily responsible for acquiring water for the household, and 83% of households also mentioned that women made decisions about the water. Some women were "rather stressed when it [came] to water" as they bore the responsibility of acquiring and managing water (PID10023, female, age 31), but explained the necessity of their role as the decision maker.

> *R: It's me who knows the challenges I face when it comes to water.* (PID3033, female, age 43).

> *R: I give orders [to the household] because fetching water is not an easy task and it takes a lot of my time to do it. I must ensure it is used in the right way.* (PID10021, female, age 30)

Due to the ubiquitous requirement of water in the household, and women's responsibilities acquiring water and managing the household, women were most affected by water insecurity (47%).

> *R: You know when the water is scarce, a mother is affected because there is no way you will cook for the children. In a house where there is no water, nothing will be done because even if you wanted to cook. And if you also have dirty clothes to wash, you cannot do so. You have to walk long distances looking for water, from one water source to the other.* (PID5002, female, age 48)

Providing water for one participant was connected to social expectations, making it difficult for her to ask other for help for fear of judgement.

> *R: It's very rare for me to even ask for water…Only a bachelor borrows water, a mother like me, no, no I can't.*(PID3031, female, age 44)

Gendered nature of water: male assistance

In six out of the thirty interviewed households, adult males also played a role in water acquisition. Men were reported as assisting with water acquisition when women were unable, though the men were not primarily responsible for water in the household despite their assistance.

> *R: He [her husband] feels that those are jobs [water acquisition] meant for women only when I am sick and bedridden and there is no one to do that than he is forced to fetch water only for cooking.* (PID10006, female, age 33)

> *R: I help her [his wife] sometimes, and that's mainly because she has chest problems. But then there are two children who are in boarding so when they close schools they help her as well.* (PID4041, male, age 47)

One participant reported that his wife had not been around, and so he was left responsible for water acquisition as well as management.

> *R: As of now, I am the one who is in charge of everything. Everything in this house is all on me […] that's because the lady that was here, now as my current wife has not been around for a while now.*
>
> *…*
>
> *I: And who makes decisions on how water is used in the house?*
>
> *R: I am the one who does all that, because you know these young people do not know how to use water and also they don't know the challenges we face to get that water. (PID4017, male, age 39)*

Another female participant reacted with a laugh when thinking about how she feels when her husband helps her with water acquisition, and reported benefiting from his assistance.

> *R: You know when he helps me in that sector, it gives me enough time to do my duties because water is available.* (PID5002, female, age 48)

On the other hand, in 10% of households, every member of the household was involved with water acquisition to some extent.

> *R: Everybody fetches water…They all fetch water, in my house there are no responsibilities left specifically for boy and a girl, even washing plates they do.* (PID3033, female, age 43)

(3) Coping strategies used among this cohort to decrease water insecurity

Coping strategies: variation by season

Coping strategies uniquely employed in the rainy season were related to navigating the rains (Table 5). For household use and consumption, 67% of participants collected rainwater. To manage how the rains could ruin infrastructure and flood homes, 57% of participants constructed walls, canals, or gabions to divert water from homes and farms, and 20% of participants elevated cooking areas, sleeping areas, and infrastructure.

> *R: That raised wall that is sometimes used to rest on when outside, you can't sit there. But the main reason I built it is to prevent water from inundating into the house through the walls because it ever happened to me once while I was sleeping.* (PID9047, female, age 38)

> *R: That aside, some of us also sleep on top of the table because you know as much as there are floods and your house is affected, you can't leave it just like that and move to another house. That's the time thieves also take advantage of the situation and steal from you.* (PID5027, male, age 35)

Children were reported to be susceptible to health problems during the rainy seasons when water is both plentiful and destructive. Twenty percent of participants mentioned preventing their children from playing or walking through flood waters during the rainy season.

> *R: They [children] like playing in water so I keep chasing them away because they don't know the risk of playing in water, but me, I know…There are some diseases that can come as a result of stagnant water or even there could be broken bottles in water that can cut them and in those stagnant water there are mosquitoes.* (PID3012, female, age 41)

To cope with water scarcity during the dry seasons, participants often diversified their water source (83%), waited in long queues (57%), and bought water (57%). Participants also changed the timing of when they fetch water, either going very early in the morning (47%) or late at night (20%).

> *R: We just wait until the water springs out again since it's something that comes from underground. And to get clean water, we just have to go early in the morning since, around 3:00 am, those who stay around the spring are always able to pipe water to their homesteads.* (PID9040, female, age 31)

> *R: There are some who fetch that water even up to ten at night. Most people do that at night because of their fixed and busy morning schedules. Besides, you*

know when you go in the morning the queues are longer and you take more time there so you would rather go at night. (PID5040, female, age 55)

Fetching water from farther water sources occurred among 17% of participants, and sparing and conserving water occurred among 13% of participants.

Some coping strategies were not dependent on the season. The most common way of coping with water insecurity among this cohort was storing water (97%). Water was also treated using methods such as chemicals or filtration among 87% of participants. Twenty percent of participants planned ahead and anticipated impending water shortage.

R: As a woman I have to be prepared, for instance in order to store more water, I'll need more containers. The ones I have right now, I still feel aren't enough and I need/I am planning to buy more.

(PID10023, female, age 31)

Participants also reported psychosocial forms of coping to water insecurity. Some participants reported resigning to the situation, accepting the problem for what it is, and passively waiting for the situation to change (33.3%)

R: There is nothing you can do. Actually you give up because when such things happen. (PID5027, male, age 35)

R: Even if we undergo these challenges we keep to ourselves because we have no one to go to…Even if we suffer we just keep it to ourselves.

(PID3033, female, age 43)

These quotes suggest that there are limited social or institutional structures in place for individuals to advocate for change or seek assistance.

(4) Relationship between the small-scale irrigation intervention and household water insecurity experience within Shamba Maisha study

Intervention benefits

The provided pump was not widely used among the intervention group participants. Indeed, only 58% of the participants reported using the MoneyMaker pump. Three female participants mentioned using a pump and utilizing it for collecting household water. The pump facilitated water acquisition when fatigued (PID9045, female, age 59), and reduced the number of trips to the water source necessary so that "the work is easy" (PID6025, female, age 36).

There is also evidence that the intervention is associated with improved psychosocial wellbeing. Indeed, some participants mentioned that the intervention provided them with renewed hope and optimism.

> *R: I already gave up in life. I gave up on my children and at the same time I was afraid of dying, but you came into our lives and encouraged us and empowered us a lot. We appreciate.* (PID6015, female, age 40)

> *R: I used to be lonely and I wouldn't even talk to anyone or even make friends. I really appreciate the way you have encouraged us and even empowered us to live positively.* (PID6015, female, age 40)

The intervention has led to empowerment through the teaching of practical skills in agricultural practices and food security.

> *R: They teach you means of surviving, how a woman can get food and by which means of getting enough food for both household consumption and some you can sell if you like.* (PID10030, female, age 27)

> *P: I can say that it has really empowered me in various sectors. Because I have my own farm where I can go to anytime of the day, at least I have somewhere to go to when I wake up in the morning.* (PID3031, female, age 44)

One participant shared that she felt encouraged and hints at hopefulness because of her involvement in Shamba Maisha.

> *R: I have been motivated a lot and I have gained so much experience in farming since I joined the group. We were encouraged to practice farming so then by the time we get the pump, we should be in a better position to benefit from it immediately.*
> (PID5031, female, age 44)

Intervention challenges

While the treadle pump use was advantageous in ways, there were some challenges associated with its use. Participants reported that the necessity for two people to operate the pump, so participants either could not use the pump when they were alone, allowed their children to pump because they found it fun, or they paid others to help them (17%). Additionally, participants reported pumping was tiresome, thus hindering use (23%).

> *R: You know when we first received the water pump, we were delighted. But then the challenge comes in when you are alone with no one to help you with it in the*

farm. You can't step on it and at the same time irrigate the farm. Stepping on it alone is very tiresome. (PID3002, female, age 54)

R: You have to be two people, one has to do the watering the farm and the other steps on it, that is the challenge it has. It tires, it needs a man to step on it and if you are a woman you have to be strong. (PID9023, female, age 50)

Discussion

Water insecurity was a major concern for this cohort, and consequences of water insecurity varied depending on the season. Water-related problems emerged across four domains in accordance with Collins, et al. (2018): physical health, psychosocial wellbeing, nutrition, and economic productivity.(10) The rainy season brought increased exposure to pathogens and disease prevalence. Similar consequences were described in Latin America, where flooding was associated with diarrhea and dehydration in the Bolivian Amazon, and contaminated water exposure increased rates of diarrheal diseases among children in Mexico City.(25,26) Water insecurity has also been found to contribute to outbreaks of violence, yet this was not seen in the Shamba Maisha cohort though nonphysical quarreling erupted occasionally at water sources during dry seasons.(27) The seasonal differences in disease exposure and poor physical health outcomes is key to understanding the epidemiology of disease in water insecure areas, and for improving preventive measures to combat these health issues.

Water insecurity affected psychosocial health by causing stress and greater challenges in other aspects of life. A syndemic relationship between water insecurity and mental illness has also been found in Lesotho and urban Bolivia.(12,13,28) Water insecurity disproportionately

affected women's mental health, suggesting that addressing women's health should be incorporated into a holistic household water insecurity approach. Mental health can propagate water insecurity as well, where water insecurity can be determined by not only access and adequacy, but also by the inherent stress from negotiating inequitable systems of water regulation.(29)

Nutrition was influenced by water insecurity in this cohort. Cooking and dietary practices changed to accommodate the lack of adequate clean water. Flooding destroyed farms and crop yield, which was also reported in Vietnam where floods damaged agricultural infrastructure.(30) Difficulty irrigating farms and accessing food during the dry season was prevalent among participants, seen as a common issue in similar regions of Kenya.(31) The close relationship between water availability and food supply coincides with the work of Workman and Ureksoy (2017), who argue that water insecurity and food insecurity should be considered syndemic, because water insecurity and food insecurity are co-occurring and mutually reinforcing.(12)

Participants reported missing opportunities like work, meetings, or income-generating activities because of time spent fetching water. Water insecurity was related to financial instability and depreciation of human capital due to missed opportunities. Similarly, women in urban Bolivia reported loss of income because they lacked the water necessary to carry out productive services.(13) The converse relationship, where financial capital is a determinant of water insecurity, may not be relevant in all contexts, as found in Lesotho.(12) Yet, participants of this cohort bought water during dry seasons, showing that economic status can improve water security.

Women were primarily responsible for water acquisition and decision making, which was emphasized in reported societal norms and distinct gender roles involving household water

supply and use. Female responsibility for water acquisition and management has also been seen in Kenya, Uganda, Ghana and South Africa, as well as in aboriginal populations in Canada.(10,11,32-34). The UN reports that globally women and girls are responsible for water collection in 80% of households that lack access to water on its premises.(35) Collins, et al. (2018) found that women in a Kenyan cohort were responsible for the majority of water-intensive domestic chores, therefore utilizing much of the household's water as well.(10) Women of the household have been found to experience the greatest burden of water insecurity, because they spend time more time than men fetching water. Therefore, women are disproportionately exposed to and at higher risk of contracting water-borne diseases from contaminated water.(36) Examining and addressing water insecurity from the perspective of woman thus has potential to further health equity across genders.

The most salient coping strategies among this cohort included storage and water treatment, addressing water supply and reliability as well as quality, irrespective of the season. However, other coping strategies to deal with water insecurity consequences were related to the season. In the rainy season, participants collected rainwater as a cheap and uncontaminated alternative water source, though the water was often still treated. Participants also built infrastructure to divert water away from their homes. Similar coping strategies appear in communities across the world, including storing water, building infrastructure, collecting water from alternative sources, sharing water, purchasing water, and treating water.(37,38) In the dry season, participants diversified their water sources. In Canada, members of a water-insecure community also looked to other sources for fluids, drinking high-sugar-content beverages.(39) Though drinking sugary beverages is not healthy, it is a safe alternative to contaminated water, an option unavailable to this low-resource community in western Kenya. Majuru and colleagues

(2016) define “coping strategies” as responses to unreliable water supplies, yet this paper assigns coping strategies a broader definition to incorporate reactions to more water-related issues than only scarcity, taking into account the definition of water insecurity by Jepson, et al. (2017).(3,37) Thus, coping strategies is defined as a response to any adverse effect from inadequate water supply, quality, or access. Limited literature exists on coping strategies for water insecurity challenges beyond scarcity and does not describe nuances in temporality or fluctuation of coping strategy utilization depending on environmental variation over a calendar year. Therefore, additional study must be done to inform interventions that address water insecurity and establish preventive measures during each season.

The Shamba Maisha intervention brought about unexpected benefits, even though few utilized the pump available to them. Among the households that used the pump, farming practices and crop yield improved, leading to improvements in food insecurity and income generation, and achieving a primary goal of the Shamba Maisha intervention. Treadle pumps have also increased income generation among smallholder farmers in Bangladesh, growing annual income by $100-200 US dollars per acre of land, sometimes doubling income.(40) Another study in Malawi showed that farmers who used a treadle pump generated greater income, and had a decreased likelihood of falling into deeper poverty compared to farmers who did not use the treadle pumps.(41)

Within this cohort, the treadle pump was also used for household water acquisition, lightening the physical and time burden of fetching water. The WHO supports the use of the treadle pump as an effective way to improve water supply with limited potential for further contaminating the water source.(42) However, limited research has been done on the benefits of

treadle pumps beyond agricultural benefits and on improving household water insecurity. As a result, little is known on the treadle pump's impact on health outcomes of household members.

Some unexpected benefits from the Shamba Maisha intervention were found among the interview responses. Participants, especially women, felt more supported and empowered. Women developed skills and knowledge, grew confidence and agency, and felt more encouraged. This finding suggests that participation in the Shamba Maisha intervention may have improved physical and mental health through social support and direct investment of training and resources into women of the community, similar to how women's empowerment improved health outcomes in South Africa by reducing household food insecurity and reducing intimate partner violence.(43,44) The implementation of the Shamba Maisha project has established an organizational support system for women that has given them not only practical skills, but also hope.

Of note, this study examined the water insecurity experiences of individuals who are infected with HIV, however, the impacts of water problems on HIV infection were not mentioned. While two participants did mention instances when someone else fetched water for them because they were "feeling sick," their illness was not attributed explicitly to HIV-status, therefore HIV and AIDS-related symptoms, and other forms of illness cannot be differentiated. It has been posited that there is a close relationship between HIV and water insecurity, especially in sub-Saharan Africa.(11,45) Yet, this data shows little to no evidence that water insecurity challenges are related to HIV-status, suggesting that either HIV-status did not influence the ways water insecurity was experienced, or that this was not sufficiently probed in interviews.

There are several strengths to this study. The go-along interview method allowed participants to show enumerators what they were talking about and enumerators to take photos as

well. The photos permitted deeper understanding of concepts, like the state of water sources, or the challenges caused by the seasons (Figure 1). This interview method also included open-ended questions and allowed for participants to share nuanced information. The study included participants from all six study health clinics, offering data from throughout the Shamba Maisha study area rather than a single location and allowing some generalizability to all Shamba Maisha participants.

There are also some limitations to this study. Female participants were disproportionately selected for these interviews, therefore, direct comparisons between men and women's perceived water insecurity experiences were not examined. However, women are the individuals responsible for water acquisition and management, and so have a unique and valuable perspective on water insecurity that must be explored and understood. Additionally, these findings cannot be globally generalized. Further quantitative exploration of these themes would help to reveal their salience.

Conclusion

Water insecurity was a prevalent issue in this cohort, especially among women. This study has furthered the characterization of water insecurity challenges, resulting reactions, as well as a potential intervention in the form of a treadle pump in rural western Kenya, yet understanding of household water insecurity experiences must still grow. The experiences of women within these contexts must be further examined to best inform how interventions can most effectively improve both women's health and water quality, supply, and access.

Addressing water insecurity has the potential to significantly improve physical and mental health outcomes, especially among the women in charge of acquiring and managing

household water. Future interventions targeting water insecurity in this cohort must be specific to the season, and can dually improve water insecurity and women's health outcomes.

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References

1. UN-Water. Human Rights [Internet]. UN-Water. [cited 2019 Mar 29]. Available from: http://www.unwater.org/water-facts/human-rights/
2. Sustainable Development Goals Report 2018 [Internet]. 2018 [cited 2019 May 8]. Available from: https://unstats.un.org/sdgs/report/2018
3. Jepson WE, Wutich A, Colllins SM, Boateng GO, Young SL. Progress in household water insecurity metrics: a cross-disciplinary approach. Wiley Interdisciplinary Reviews: Water. 2017;4(3):e1214.

4. Bradford LEA, Bharadwaj LA, Okpalauwaekwe U, Waldner CL. Drinking water quality in Indigenous communities in Canada and health outcomes: a scoping review. International Journal of Circumpolar Health. 2016 Jan 31;75(1):32336.
5. Razzolini MTP, Weir MH, Matte MH, Matte GR, Fernandes LN, Rose JB. Risk of Giardia infection for drinking water and bathing in a peri-urban area in Sao Paulo, Brazil. International Journal of Environmental Health Research. 2011 Jun;21(3):222–34.
6. Drinking-water [Internet]. World Health Organization. 2018 [cited 2019 May 10]. Available from: https://www.who.int/news-room/fact-sheets/detail/drinking-water
7. Brown J, Cairncross S, Ensink JHJ. Water, sanitation, hygiene and enteric infections in children. Archives of Disease in Childhood. 2013 Aug 1;98(8):629–34.
8. Hadley C, Wutich A. Experience-based Measures of Food and Water Security: Biocultural Approaches to Grounded Measures of Insecurity. Human Organization. 2009;68(4):451–60.
9. Wutich A, Brewis A. Food, Water, and Scarcity: Toward a Broader Anthropology of Resource Insecurity. Current Anthropology. 2014 Aug 1;55(4):444–68.
10. Collins SM, Owuor PM, Miller JD, Boateng GO, Wekesa P, Onono M, et al. 'I know how stressful it is to lack water!' Exploring the lived experiences of household water insecurity among pregnant and postpartum women in western Kenya. Global Public Health. 2019 May 4;14(5):649–62.
11. Krumdieck NR, Collins SM, Wekesa P, Mbullo P, Boateng GO, Onono M, et al. Household water insecurity is associated with a range of negative consequences among pregnant Kenyan women of mixed HIV status. J Water Health. 2016 Dec 1;14(6):1028–31.

12. Workman CL, Ureksoy H. Water insecurity in a syndemic context: Understanding the psycho-emotional stress of water insecurity in Lesotho, Africa. Social Science & Medicine. 2017 Apr 1;179:52–60.
13. Wutich A. Intrahousehold Disparities in Women and Men's Experiences of Water Insecurity and Emotional Distress in Urban Bolivia. Medical Anthropology Quarterly. 2009;23(4):436–54.
14. Kamminga E, Wegelin-Schuringa M, Eales RK, Trust M, Mbovani N, Trust M. HIV/AIDS and water, sanitation and hygiene. :59.
15. Masur H, Kaplan JE, Holmes KK. Guidelines for Preventing Opportunistic Infections among HIV-Infected Persons—2002: Recommendations of the U.S. Public Health Service and the Infectious Diseases Society of America*. Annals of Internal Medicine. 2002 Sep 3;137(5_Part_2):435.
16. Ngwenya BN, Kgathi DL. HIV/AIDS and access to water: A case study of home-based care in Ngamiland, Botswana. Physics and Chemistry of the Earth, Parts A/B/C. 2006 Jan 1;31(15):669–80.
17. Chiou P-Y, Kuo BI-T, Lee M-B, Chen Y-M, Chuang P, Lin L-C. A programme of symptom management for improving quality of life and drug adherence in AIDS/HIV patients. Journal of Advanced Nursing. 2006 Jul;55(2):169–79.
18. Tsai Y-F, Hsiung P-C, Holzemer WL. Symptom Management in Taiwanese Patients with HIV/AIDS. Journal of Pain and Symptom Management. 2002 Apr 1;23(4):301–9.
19. Shamba Maisha [Internet]. Shamba Maisha. [cited 2019 May 1]. Available from: https://shambamaisha.ucsf.edu/shamba-maisha

20. Paaijmans KP, Jacobs AFG, Takken W, Heusinkveld BG, Githeko AK, Dicke M, et al. Observations and model estimates of diurnal water temperature dynamics in mosquito breeding sites in western Kenya. Hydrological Processes. 2008;22(24):4789–801.
21. Kharsany ABM, Karim QA. HIV Infection and AIDS in Sub-Saharan Africa: Current Status, Challenges and Opportunities. Open AIDS J. 2016 Apr 8;10:34–48.
22. Carpiano RM. Come take a walk with me: The "Go-Along" interview as a novel method for studying the implications of place for health and well-being. Health & Place. 2009 Mar 1;15(1):263–72.
23. Jones P, Bunce G, Evans J, Gibbs H, Hein JR. Exploring Space and Place With Walking Interviews. Journal of Research Practice. 2008 Nov 14;4(2):2.
24. Drinking water [Internet]. JMP. [cited 2019 May 3]. Available from: https://washdata.org/monitoring/drinking-water
25. Rosinger AY. Household water insecurity after a historic flood: Diarrhea and dehydration in the Bolivian Amazon. Social Science & Medicine. 2018 Jan 1;197:192–202.
26. Cifuentes E, Rodriguez S. Urban Sprawl, Water Insecurity, and Enteric Diseases in Children from Mexico City. EcoHealth. 2005 Mar 1;2(1):70–5.
27. Carius A. Expert Group Meeting "Natural Resources, Climate Change and Conflict in Africa: Protecting Africa's Natural Resource Base in Support of Durable Peace and Sustainable Development." 2009.
28. Wutich A, Ragsdale K. Water insecurity and emotional distress: Coping with supply, access, and seasonal variability of water in a Bolivian squatter settlement. Social Science & Medicine. 2008 Dec 1;67(12):2116–25.

29. Stevenson EGJ, Greene LE, Maes KC, Ambelu A, Tesfaye YA, Rheingans R, et al. Water insecurity in 3 dimensions: An anthropological perspective on water and women's psychosocial distress in Ethiopia. Social Science & Medicine. 2012 Jul 1;75(2):392–400.
30. Reynaud A, Aubert C, Nguyen M-H. Living with Floods: Protective Behaviours and Risk Perception of Vietnamese Households. Geneva Pap Risk Insur Issues Pract. 2013 Jul 1;38(3):547–79.
31. Oluoko-Odingo AA. Vulnerability and Adaptation to Food Insecurity and Poverty in Kenya. Annals of the Association of American Geographers. 2011 Jan 21;101(1):1–20.
32. Baguma D, Hashim JH, Aljunid SM, Loiskandl W. Safe-water shortages, gender perspectives, and related challenges in developing countries: The case of Uganda. Science of The Total Environment. 2013 Jan 1;442:96–102.
33. Harris L, Kleiber D, Goldin J, Darkwah A, Morinville C. Intersections of gender and water: comparative approaches to everyday gendered negotiations of water access in underserved areas of Accra, Ghana and Cape Town, South Africa. Journal of Gender Studies. 2017 Sep 3;26(5):561–82.
34. Anderson K, Clow B, Haworth-Brockman M. Carriers of water: aboriginal women's experiences, relationships, and reflections. Journal of Cleaner Production. 2013 Dec 1;60:11–7.
35. Martin. Water and Sanitation [Internet]. United Nations Sustainable Development. [cited 2019 Mar 29]. Available from: https://www.un.org/sustainabledevelopment/water-and-sanitation/

36. Caruso BA, Sevilimedu V, Fung IC-H, Patkar A, Baker KK. Gender disparities in water, sanitation, and global health. The Lancet. 2015 Aug 15;386(9994):650–1.

37. Majuru B, Suhrcke M, Hunter PR. How Do Households Respond to Unreliable Water Supplies? A Systematic Review. Int J Environ Res Public Health [Internet]. 2016 Dec [cited 2019 May 6];13(12). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5201363/

38. Pearson AL, Mayer JD, Bradley DJ. Coping with Household Water Scarcity in the Savannah Today: Implications for Health and Climate Change into the Future. Earth Interact. 2015 Jul 17;19(8):1–14.

39. Sarkar A, Hanrahan M, Hudson AV. Water insecurity in Canadian Indigenous communities: some inconvenient truths. Rural and remote health. 2015;15(4):3354.

40. Shah T, Alam M, Kumar MD, Nagar RK, Singh M. Pedaling out of poverty: Social impact of a manual irrigation technology in South Asia. IDEAS Working Paper Series from RePEc; St Louis [Internet]. 2000 [cited 2019 May 8]; Available from: http://search.proquest.com/docview/1698626502?rfr_id=info%3Axri%2Fsid%3Aprimo

41. Mangisoni JH. Impact of treadle pump irrigation technology on smallholder poverty and food security in Malawi: a case study of Blantyre and Mchinji districts. International Journal of Agricultural Sustainability. 2008 Jan;6(4):248–66.

42. Pedley S, Pond K, Joyce E. Interventions for water provision. In: Valuing Water, Valuing Livelihoods. IWA Publishing, London, UK; 2011. p. 28.

43. Sharaunga S, Mudhara M, Bogale A. The Impact of 'Women's Empowerment in Agriculture' on Household Vulnerability to Food Insecurity in the KwaZulu-Natal Province. Forum for Development Studies. 2015 May 4;42(2):195–223.

44. Kim JC, Watts CH, Hargreaves JR, Ndhlovu LX, Phetla G, Morison LA, et al. Understanding the Impact of a Microfinance-Based Intervention on Women's Empowerment and the Reduction of Intimate Partner Violence in South Africa. Am J Public Health. 2007 Oct 1;97(10):1794–802.
45. Ashton P, Ramasar V. Water and HIV/AIDS: Some Strategic Considerations in Southern Africa. In: Hydropolitics in the Developing World: A Southern African Perspective. 2002. p. 217–35.

Tables and Figures

Table 1. Demographic characteristics of study cohort

Characteristic	**Participant Results(N=30)**
Women respondents, %	80.0
Age, Mean(SD)	41.7 (9.4)
Participants in intervention group (%)	66.7
Water Source Level Used,* %	
Surface Water	66.7
Unimproved	30.0
Basic	83.3
Limited	16.7
Safely Managed	30.0

*Percentages do not sum to 100% because households often used multiple water sources.

Table 2. Coding framework for qualitative analysis

Theme	Code
Importance of water	Water challenge rank
Water insecurity consequences (WIC)	WIC: Cooking and diet changes WIC: Difficult to get food WIC: Displaced from home WIC: Floods WIC: Health impact_bacteria/infection WIC: Health impact_cholera WIC: Health impact_cough WIC: Health impact_diarrhea WIC: Long Queues WIC: Miss opportunity WIC: Stress WIC: Unable to wash/hygiene
Gender	Decision-making_Female Decision-making_Male Gender roles Water acquisition: Responsibility_Child Water acquisition: Responsibility_Female Water acquisition: Responsibility_Male
Coping Strategies (CS)	CS: Accept/resign/wait CS: Borrowing

	CS: Crop diversity CS: Fetch in the early morning CS: Fetching water at night CS: Improve on water acquisition CS: Storage
Shamba Maisha	SM_benefit Pump use_Yes Pump use_No

Table 3. Joint Monitoring Programme drinking water ladder from its 2017 Thematic Report

Safely managed	Drinking water from an improved water source which is located on premises, available when needed and free from faecal and priority chemical contamination
Basic	Drinking water from an improved source, provided collection time is not more than 30 minutes for a roundtrip including queuing
Limited	Drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing
Unimproved	Drinking water from an unprotected dug well or unprotected spring
Surface water	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

Table 4. Ways that water was used

Water Use Activity	**Proportion (N=30)**
Household Activities	100.0
Nutrition	100.0
Hygiene	80.0
Livestock	73.3
Farming	80.0
Infant nutrition	40.0
Repair home/infrastructure	13.3
Medicine consumption	6.7
Wash crops to sell	3.3

Table 5. Health problems experienced due to water insecurity.

Health Issue	**Frequency (%) (N=30)**
Malaria	60.0
Skin irritation/rash	56.7
Diarrhea	40.0
Stress	40.0
Cholera	36.7
Stomach ache	36.7
Increased exposure from walking in flood water	33.3
Fatigue	26.7
Cough	23.3
Feeling cold	23.3
Physical pain	23.3
Bacteria/infection	20.0
Headache	16.7
Typhoid	13.3
Bilharzia	10.0
Pneumonia	10.0
Vomit	10.0
Flu	6.7
Bloody urine	3.3
Chest congestion	3.3

Cut by debris in flood water	3.3
Foot disease	3.3
Not specified	10.0

Table 6. Water insecurity consequences and coping strategies based on season

	Consequences of Water Insecurity	**Proportion (N=30)**	**Coping Strategies**	**Proportion (N=30)**
Rainy Season	Communicable disease*	76.7	Collect rainwater	66.7
	Floods	46.7	Construction of water canals/gabions	56.7
	Ruins home/ infrastructure	40.0	Prevent children from going near water	20.0
	Drown	10.0	Elevate infrastructure	20.0
	Attracts snakes	6.7	Wear protection/water-resistant clothes	13.3
	Displaced from home	6.7		
Dry Season	Not enough water	56.7	Diversify source	83.3
	Unable to wash (hygiene)	50.0	Buy water	56.7

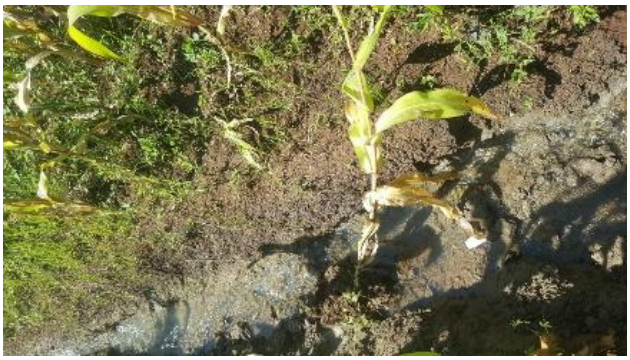
	Long queues	46.7	Go very early morning to water source	46.7
	Quarrels or fights	46.7	Fetching water at night	20.0
	Stress	40.0	Fetch farther	16.7
	Difficult to get food	36.7	Water sparing	13.3
	Water sources dry up	30.0		
	Poor quality water	30.0		
Year-round	Ruin crop production	73.3	Storage	96.7
	Missed opportunities	66.7	Water treatment	86.7
	Cooking and diet changes	56.7	Borrowing	66.7
	Livestock loss	26.7	Crop diversity	33.3
	Difficult to feed livestock	13.3	Accept/resign/wait	33.3
			Improve on water acquisition method**	26.7

		Anticipate/plan ahead	20.0
		Ask others to get water for the HH	20.0
		Borrow money to buy water	20.0
		Dig/repair water source	20.0
		Plant season-resistant crops	20.0
		Clearing drainage systems	16.7
		Skip meal(s)	10.0

*Diseases that are included under Communicable Disease are infections and bacterial exposure, bilharzia, malaria, pneumonia, and typhoid. Cholera was excluded, because cholera was seen as a water-insecurity-related issue not specific to the rainy season.

**Improvements to water acquisition methods included using donkeys, motorbikes, or hiring people to get water for the participant.

Figure 1. Examples of photos and related quotes from go-along interviews.

<table>
<tr>
<td>A
 
R: I get water from the tap and bore hole.
(PID4001, female, age 34)</td>
<td>B
 
R: I have seven jerricans that contain 20 liters of water, a super drum and two water pots.
(PID4001, female, age 34)</td>
</tr>
<tr>
<td>C
 
R: The dispenser contains chlorine which is used for water treatment at the water source. Actually I am the one who is</td>
<td>D
 
R: You see how the crops were affected, that is still soil erosion. And the maize was in the farm but was swept away.
(PID9047, female, age 48)</td>
</tr>
</table>

responsible for refiling it when it is all used up. (PID9047, female, age 48)	

(A) Water source – photo evidence confirmed service level of water source. (B) Water storage containers – evidence for water storage coping strategy. (C) Chlorine container – visual aid showing water treatment occurred directly after fetching from source. (D) Soil erosion in farm – visual aid to understand how rain harms farms.