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Infrastructure, WASH Practices, and Health: A Study of Rural Communities in São Tomé e Príncipe

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Thesis presented to fulfill the necessary requirements to obtain the degree of
Master of Science of Public Health and Development

Resumo:

Introdução**:**

Melhorar os comportamentos de higiene e o saneamento (WASH) é uma maneira económica de reduzir os problemas que as doenças da pobreza e das doenças tropicais trazem, especialmente em comunidades pobres. Em setembro de 2016, um surto de infeções de pele foi acompanhado pela Organização Mundial da Saúde e os questionários aplicados evidenciaram que as questões de higiene em São Tomé e Príncipe merecem mais atenção, principalmente nas comunidades rurais da ilha. Assim, este estudo teve como objetivo caracterizar o comportamento de WASH e as infraestruturas relacionadas com três comunidades rurais, a fim de identificar áreas com maiores necessidades, explorando como os comportamentos em termos de WASH e outros fatores relacionam com alguns problemas de saúde relatados no último mês.

Material e Métodos:

Este estudo transversal ocorreu entre fevereiro e abril de 2019, no distrito de Lobata, em São Tomé e Príncipe, tendo-se recolhido uma amostra aleatória de dimensão n=162. Para a seleção aleatória usou-se a aplicação Random UX. Os dados foram recolhidos através de um questionário digitalizado no programa Qualtrics e aplicado a residentes adultos em três comunidades rurais: C - Canavial (n=56), P - Plancas (n=49) e I - Ilheu (n=57). Após uma análise exploratória de dados e testes de hipóteses (paramétricos e não-paramétricos), utilizaram-se modelos Log-lineares e de regressão logística simples e múltipla.

Resultados:

Encontramos diferenças significativas no uso de fontes naturais de água e na melhoria dos locais de lavagem de roupas entre as três comunidades. Relativamente as latrinas nota-se que faltam nas três comunidades. Canavial e Plancas parecem ter practices menos adequadas. Apenas 8.0% dos participantes no estudo relataram que têm acesso a caso de banho, com diferenças significativas por comunidade (8.9% C; 0.0% P e 14.0% I, p=0.015). Em termos de acesso a uma latrina há diferenças muito significativas entre as três comunidades (7.1% C; 22.3% P e 40.4% I, p<0.001). Em termos de água canalizada, as percentagens são também reduzidas (5.4% C; 0.0% P e 19.3% I, p=0.001). Também identificamos associações entre o uso de fontes naturais de água para beber e outros usos, e o uso de fontes naturais de água para limpar roupas e mais problemas de saúde no mês anterior à recolha de dados. O uso de recipientes fechados para o armazenamento de água foi associado a menos problemas de saúde, sendo um possível fator de proteção de reduzido custo que pode ser útil para intervir nessas comunidades.

Conclusões: Neste estudo registou-se a falta de casas de banho, latrinas e água apropriadas em todas as comunidades e registam-se práticas menos adequadas de WASH, principalmente, em Canavial e Plancas. São necessárias mais pesquisas sobre a qualidade das fontes naturais de água, para entender melhor os riscos que esse tipo de armazenamento de água pode trazer a estas comunidades.

Abstract:

Introduction:

Improving hygiene and sanitation (WASH) behaviors is an cost effective and sustainable way to reduce the problems that diseases of poverty and tropical diseases bring, especially in poor communities. In September 2016, an outbreak of necrotizing fasciitis was reported and monitored by the World Health Organization and subsequent inquiries suggested hygiene issues in Sao Tome and Principe that merit further attention, especially in the rural communities of the island. Thus, the aim of the study is to characterize the WASH behavior and related infrastructure of the three rural communities in order to identify areas of greatest need, exploring how WASH behaviors and other factors relate to some reported health problems.

Materials and Methods:

This cross-sectional study took place between February and April 2019, in the Lobata district of São Tomé and Príncipe, and a random sample size n = 162 was collected. For random selection the Random UX application was used. Data were collected through a digitized Qualtrics questionnaire and applied to adult residents in three rural communities: C - Canavial (n = 56), P - Plancas (n = 49) and I - Ilheu (n = 57). After an exploratory data analysis and hypothesis tests (parametric and non-parametric), a log-linear analysis and simple and multiple logistic regression models were developed and run.

Results:

We found significant differences in the use of natural sources of water and improved washing facilities between the three communities. Furthermore, a serious lack of appropriate latrines in all communities and sub-optimal WASH practices in Canavial and Plancas. Only 8.0% of study participants reported having access to bathrooms, with significant differences by community (8.9% C; 0.0% P and 14.0% I, $p = 0.015$). there were significant differences between the three communities in terms of latrine access (7.1% C; 22.3% P and 40.4% I, $p < 0.001$). Regarding indoor plumbing, the percentages are also low (5.4% C; 0.0% P and 19.3% I, $p = 0.001$). We also identified associations between the use of natural sources of water (for both drinking and other uses) and the use of natural water sources to clean clothes with more health problems in the month prior to data collection. Finally, the use of closed bottles for water storage has been associated with fewer health problems, a possible low-cost protection factor that may be useful for intervening in these communities.

Conclusions:

In this study, a lack of adequate bathrooms, latrines and sources of clean water in all communities was identified, as well as less than adequate WASH practices, mainly in Canavial and Plancas. Further research on the quality of natural water sources is needed to better understand the risks that such types of water storage may bring to these communities.

Dedication: I would like to dedicate this work to my mentor and Professor, Fernando Arenas. His passion for Portuguese and the Lusophone world was instrumental in developing my interest in Portugal, and none of this would be possible without him. May I honor his legacy through this work and all that follow.

Acknowledgements: I wish to extend a heartfelt thank you to Professor Gonçalves for the support and guidance throughout this project, without whom this work would not have been possible. Furthermore, I wish to thank Catia Gonçalves and her family for hosting me and offering logistical support during my time in country, as well as aid in the pre-testing and application of the questionnaire. Many thanks to Almeida Carvalho for the support in gaining access to these rural communities, applying the questionnaire, and his endless patience during my time in country. I also would like to sincerely thank the community members of Ilheu, Plancas, Canavial, Guadalupe for their kindness and hospitality as they welcomed me into their community's. Finally, thank you to Popuxo for his vigilance and protection during my nights in country.

Key words: African Communities, São Tomé e Príncipe, WASH, infrastructure, hygiene related illness

Contents

1. Introduction

1.1 Diseases of Poverty

Diseases of poverty is a broad categorization of diseases that in general have a higher prevalence among low income populations. For most diseases of poverty, poverty is not only a large risk factor for disease, but is also a consequence of long-term infection (Singh and Singh 2008). The complex interplay between health and poverty underscores the importance of understanding the impact of poverty on an individual's health, as well as the influence of poor health on future economic prospects. Poverty is one of the largest risk factors for acquiring diseases, and ultimately for an early death (Alsan et al. 2011). There exists a clear relationship between poverty and shorter life expectancy, wherein countries with lower gross domestic product (GDP) have higher rates of infectious diseases and shorter life expectancy, especially when compared to countries with higher GDP (Alsan et al. 2011). This interplay can have far reaching effects, impacting the lives of many over generations. In *Development as Freedom*, economist Amartya Sen illustrates the importance of a healthy and educated population for democracy. Thus social development is dependent on health, has an impact on economic development, the existence of poverty, and subsequently causes more health problems (Amartya Sen 1999).

This relationship is constantly being studied, and many groups actively work towards reducing these diseases of poverty (Wang et al. 2017). Yet within this broad category exists a smaller group of diseases that receive much less attention. These diseases are known as Neglected Tropical Diseases (NTDs), and they include a wide range of diseases that primarily exist in the tropical, underdeveloped regions of the world (Hotez and Kamath 2009). What sets these diseases apart from the other diseases of poverty is the notable lack of resources committed to research on them (Hotez 2013). While the three largest diseases of poverty: Tuberculosis, Malaria, HIV/AIDS, are responsible for 18% of the diseases in underdeveloped countries and receive significant global attention and research funding, the collective group of neglected tropical diseases are relatively ignored (Luchetti 2014; Kilama 2009).

According to Weng et al., from 2000 to 2010, only 66 novel drugs directed to treating NTDs entered phase I trials, just 1.65% of all phase I trials (Weng, Chen, and Wang 2018).

1.2 Neglected Tropical Diseases

The problem of the 10/90 gap and the lack of focus on NTDs is accentuated by scale of the problem: data accumulated by the World Health Organization suggests that over 1 billion people worldwide are infected with one or more NTDs, including nearly 200 Million children (Hotez et al. 2018; Rees et al. 2019).

These neglected tropical diseases have a wide variety of transmission pathways, including contact with exposed skin, through a vector, or through fecal-oral transmission("Soil-Transmitted Helminth Infections" 2019) (Loukas et al. 2016). The most common NTDs include Schistosomiasis, Lymphatic filariasis, Trypanosomiasis, and Soil Transmitted Helminths (STH). The following includes a brief description of each:

- Schistosomiasis is a parasitic infection caused by flatworms known as blood flukes that infect nearly 250 million humans globally, primarily in poor agricultural and fishing communities (GBD 2015 Disease and Injury Incidence and Prevalence Collaborators 2016). Infection is caused by contact with contaminated fresh water, where the parasites enter the blood stream, mate, and begin producing eggs. The eggs are then excreted to the bladder or intestines, where they re-enter the environment to complete the lifecycle ("'Parasites - Schistosomiasis, Disease'. Www.Cdc.Gov. Archived from the Original on 2 December 2016. Retrieved 4 December 2016.," n.d.). Despite a nearly 24% decrease in prevalence from 2000 to 2015, nearly 700 million people still live in areas of elevated risk for Schistosomiasis, and it is considered one of the parasitic infections with the highest economic impact, second only to malaria. While the WHO maintains a 0.2% disability-adjusted life-year (DALY) weight, the more recent studies estimate the weight of *Schistosoma* infections at 2-15% (King, Dickman, and Tisch 2005).

- Lymphatic filariasis is an infection caused by filarial worms, transmitted by mosquitoes. With nearly 36 million people infected globally, and 950 million at risk, the diseases cause damage to the lymph nodes, kidneys, and alter the immune system. The disease formerly known as elephantiasis is attributed to these diseases ("Lymphatic Filariasis" 2019). The infection is also associated with increased burden and mental health strains on the part of the caregivers, linked with nearly 229,537 DALYs on the part of the caregivers (Ton, Mackenzie, and Molyneux 2015).
- Trypanosomiasis, commonly known as African Sleeping Sickness, is a parasitic disease transmitted by the tsetse fly (Büscher et al. 2017). While sustained control efforts have shown success in reducing the number of infected, the animal variant still has a large economic impact on the regions were it persists (Swallow 1999; "Trypanosomiasis, Human African (Sleeping Sickness)" 2019).
- Soil Transmitted Helminths is a term that encompasses various helminths that parasitize humans and contain a free-living stage. These include hookworms, *ascariasis*, and other roundworm parasites. Infection occurs through contact with contaminated soil, these diseases impact nearly 1.5 billion people globally, with cognitive and physical impairment a result of chronic infection (Loukas et al. 2016; Jourdan et al. 2018).

While the transmission, symptoms, and effects of these NTDs vary, the conditions in which these diseases thrive are similar. Poor housing conditions, inadequate sanitation, contaminated water, lack of education, poor nutrition, and a lack of access to health services are all strongly associated with the prevalence of NTDs. The co-endemicity of many of these parasites implies that polyparasitism is common, compounding the effects of sickness on the hosts (Hotez et al. 2018).

1.3 Impact of Neglected Tropical Diseases

While infection with any one of these diseases rarely is fatal (with the notable exception of trypanosomiasis), these diseases can have significant morbidities, especially when infection is chronic (Hotez 2008). Long term infection with Schistosomiasis increases the risk for bladder cancer, cancer of the gastrointestinal tract, renal failure, and in rare cases can

cross the blood brain barrier to infect the central nervous system (CNS). CNS infections lead to more frequent seizures and other cerebral infections (Ross et al. 2002). Infection with *Schistosoma*, soil transmitted helminths, and other NTDs can also cause anemia, stunting, and loss of appetite (Ross et al. 2002). Soil transmitted helminths can impair the nutritional status of individuals by robbing nutrients or feeding on host tissues (Loukas et al. 2016). Chronic intestinal blood loss due to STH infection worsens these effects and can also reduce physical and cognitive performance, primarily in adolescents. Studies have affirmed the association between NTD infections and poorer scores in memory, learning, reaction time and intelligence tests in school-aged children (Pabalan et al. 2018). In adults over many years, these effects contribute to a loss of economic productivity of infected individuals and play a role in the economic suppression of rural impoverished communities (Hotez 2009). For example, studies found that hookworm anemia causes on average a productivity loss of 6%, raising the economic burden of such diseases into the billions of dollars (Lenk et al. 2016). The impacts of the NTDs are compounded by coinfection between them and other diseases (such as malaria), resulting in more severe infections and worse health outcomes.

These economic effects, whether it be loss of productivity, loss of earning potential, slowed economic growth, or others can be profound, particularly on lower income populations. Studies have illustrated that with such macro-parasitic diseases, the parasite aggregates to a smaller subpopulation, meaning that a small group of hosts carry the vast majority of disease burden (Poulin 2013; Galvani 2003). The high disease burden, with its negative social, economic, and health effects, may lead to long term decline of whole communities. Already vulnerable populations begin to fall into a cycle of poverty, where their poverty is characterized by chronic infections of these diseases that harm their biological development, and the ensuing loss of productivity and economic capital ensures that infected individuals and their subsequent generations remain impoverished. Further studies have shown that infection with these diseases is enough to naturally form a poverty trap, where medium income communities can decline into poverty as a result of these infections (Garchitorena et al. 2017; Bonds et al. 2010).

1.4 NTD Treatment

While the long-term effects of these NTDs are well known, the silver lining is that treatments are generally affordable and easily accessible. To treat schistosomiasis, a single dose of Praziquantel administered by mouth can be given annually to reduce the chronic effects (Danso-Appiah et al. 2013). For soil-transmitted helminths, Albendazole and Mebendazole are inexpensive, effective, and easy to administer (Fitzpatrick et al. 2016). These drugs can also be used in combination with one another to improve effectiveness without increasing toxicity (Speich et al. 2015). The most common strategy involves yearly school based deworming programs (Mwinzi et al. 2012). To treat lymphatic filariasis, yearly deworming campaigns of Albendazole with Ivermectin prevent further spread of microfilaria until the adult worms die ("Lymphatic Filariasis" 2019). While these mass drug administration (MDA) campaigns have shown success in some communities, they still have significant limitations. Firstly, these school-based deworming programs have received criticism for not effectively targeting all stages of the infection (Anderson et al. 2013). Secondly, they fail to reach most at risk community members, such as farmers who work in irrigation schemes, pregnant women, and fishermen (Mwinzi et al. 2012). An intervention that is dependent on school attendance fails to recognize the economic reality of these communities, where often children are required to work and support their family. Furthermore, both schistosomiasis and the soil-transmitted helminths have a free-living larval stage in the environment. This infective stage means that reinfection can occur just days after a deworming campaign has taken place (Strunz et al. 2014).

1.5 WASH practices

With the limitations of MDAs known, the most promising paths to eliminating NTDs include a combination of these deworming campaigns along with work to reducing the conditions that promote transmission of NTDs. Improving water supply, sanitation and hygiene conditions, known collectively as WASH practices, has been a focus for the World Health Organization and a key part of the Millennial Development Goals ("About WASH"

2016). WASH practices include ensuring access to clean and safe drinking water, safe storage systems for water, proper improved sources to urinate and defecate, such that feces do not contaminate the water supply, and ensuring consistent hygiene practices such as handwashing ("About WASH" 2016). Targeting these conditions, a determinant of NTDs, helps contribute to the prevention and management of NTDs, promote economic growth, and reduce diarrheal diseases (another category of diseases of poverty) (Boisson et al. 2016; Woode et al. 2018). Furthermore, by eliminating the conditions in which these diseases thrive, the collective health expenditures related to treating these illnesses would be reduced, furthering the economic growth of these communities (Fitzpatrick et al. 2017).

In Ghana, WASH interventions, such as the Community-Led Total Sanitation (CLTS) and Hygiene Promotion Interventions (HPI) have been shown as cost-effective ways to improve hygiene behavior and therefore lower risk for NTDs (Boisson et al. 2016). The interventions focused on augmenting latrine use, handwashing with soap, and improved water management as improvements that cost as little as $183 per household ($37 per capita) (Woode et al. 2018). This type of intervention, paired with novel distribution strategy for MDAs such as the community directed interventions, shows great promise not only in reducing the NTD burden but also promoting development of these communities (Oswald et al. 2017).

1.6 São Tomé e Príncipe

São Tomé e Príncipe is a small central African island nation situated in the Gulf of Guinea. Consisting of two islands and a population of just under 200,000, it is the second smallest nation in Africa (after Seychelles) (Cardoso 2016). Figure 1 illustrates the country's location within central Africa and the Gulf of Guinea ("São Tomé e Principe - Geography" 2016). Until 1974 the country was a Portuguese colony built around plantations, known as *roças*. These privately owned *roças* were the center of life on the colony, with

Figure 1: Map of São Tomé e Príncipe in the Gulf of Guinea

each one having its own school, health center, infrastructure(Pape 2016). Following independence, much of the infrastructure of the *roças*, including the health system, collapsed and were followed by years of poor conditions. In 2002, the WHO noted São Tomé e Príncipe as one of the countries with the worst rates of iron deficiency anemia ("Sao Tome and Principe" 2015a) ("GHO | By Country | Sao Tome and Principe - Statistics Summary (2002 - Present)" 2019). Currently, the country continues to face elevated levels of schistosomiasis, giardiasis, lymphatic filariasis, and various soil transmitted helminths ("GHO | By Country | Sao Tome and Principe - Statistics Summary (2002 - Present)" 2019). Furthermore, recent epidemiological reported to the WHO suggests there has been a resurgence of malaria in recent years, both on the island of São Tomé and on Príncipe(Global Malaria Programme and World Health Organization 2010).

Increased aid and investment in health and nutrition has helped improve the health indicators of the nation, with the prevalence of malnutrition in children under 5 years old dropping steadily since 2008, from over 30% to nearly 16% in 2014 ("Prevalence of Underweight, Weight for Age (% of Children under 5) | Data" n.d.). These and other health indicators, when considered with economic growth and improving education rates, has led the United Nation committee for development policy to recommend the country graduate from its category of a least developed country ("Making Progress on Sustainable Development, Four Least Developed Countries Tapped to Graduate from Ranks of Poorest" 2018).

Yet despite these improvements, a recent outbreak of Necrotizing Cellulite in the country, which has infected nearly 2,000 individuals, has called into question the countries sanitation system("Weekly Bulletin on Outbreaks and Other Emergencies" 2018). A case-control study being conducted in the country has identified poor hygiene and water use as a significant problem for many interviewed individuals (Gonçalves 2017). This suggests that despite improvements, behaviors and practices- with regards to hygiene and sanitation practices- are not improving to sufficiently eliminate the risk for many of these NTDs. Furthermore, the high proportion of cases occurring in rural communities may suggest a possible uneven

distribution of improvements across the country, condemning rural communities to continue in poorer conditions.

2. Objectives

The aim of the study was to characterize and compare the rural communities of São Tomé e Príncipe, with respect to the hygiene, sanitation infrastructure, WASH practices, and health indicators of the adult community members, as well as to identify areas of greatest need for improvement. In comparing communities of different levels of development, we aim to determine if the existing infrastructure was associated with different hygiene related behaviors of the community members, and to identify the relationship between any behaviors and health problems. The specific objectives were as follows:

1. To characterize the Hygiene and Sanitation (WASH) behavior of the members of each community.
2. To characterize the hygiene, sanitation, and other related infrastructure in each community, both at the community and household level.
3. To explore difference in WASH behaviors in function of community and household improvements, as well as other influencing factors.
4. To compare the health status of the members of each community, particularly with regards to hygiene and water sanitation related illnesses.
5. To evaluate the association of WASH practices and household or community infrastructure on the studied health indicators.

It was hypothesized that if existing sanitation improvements were being appropriately utilized, there would be both a significant difference in the WASH behavior of the community members, as well as a positive difference in some parasitosis associated health indicators, and other diseases of poverty. We further hypothesized that factors such as positive community association and cohesion, as well as distance to certain infrastructures, would be positively associated with improved WASH behaviors.

3. Materials and Methods

The designed study was an analytical transversal study of three rural communities on the island of São Tomé, in the Lobata district. The study included both quantitative and qualitative elements and involved the application of a questionnaire to individuals in each community, as well as documentation and photographing of each community. The communities were selected based on size, presence of infrastructure, and distance from the main highway. Figure 2 illustrates a map of the Lobata district, with red circles around each selected community ("Political and Administrative Map of Sao Tome and Principe" 2019). Note that Ilheu is not labeled, it exists West of Santo Amaro at the circled crossroads. Below is a short description of each community:

Figure 2: Administrative map of the Lobata district, with selected communities circled in red.

Canavial: A former *roça* (plantation) located 5-10 minutes by motorcycle from the principle highway. According to the National Census in 2012, there were 407 people living in 104 houses in the community (Cardoso 2016). Upon visiting the community and speaking with the local community health agent as well as the community president, it was estimated that

the current population is closer to 360 people, with an approximately 100 houses. Of the 100 houses, the president reported approximately 80 of them were currently occupied. The village has access to a public latrine, public clothes washing station, and has one fountain connected to the public water system that services the community. In addition to this infrastructure, there is a stream along the side of the village, and a small river 10 minutes walking from the center. There is also one small convenience store that sells bottled water.

Plancas: Formally known as Plancas 1 (Plancas Primeira), the community is located nearly 15 minutes by motorcycle from the principle highway, inland and towards the top of the island's mountainous center. Plancas is a former roça in the interior of the district. The census data reported 182 residents and 52 houses, upon speaking with the community leaders, the current estimated population is closer to 450 residents, with 95 houses, of which 70 are occupied. The community has access to public latrines, clothes washing stations, and three public fountains that service the community with treated spring water. Figure 3 is a photo taken in Plancas of the old "*casa do patrão*", where the ground floor is occupied by homes and an unfinished kindergarten. Beyond this infrastructure, there are no other natural sources of water. The nearest source of water is a river off the main highway. The community has 1 convenience stores and 2 bars throughout the community, all of which sell bottled water.

Figure 3: the community of Plancas, as seen from the old hospital.

Ilheu: Ilheu is located along the major highways connecting the regional capital of Guadalupe with the city of São Tomé. It is a newer community that began to grow in the 1970's following the island's independence. Census data reports 372 residents with 94 houses and community members suggests a current population of 400, with 100 houses, of which

approximately 85 are occupied. The community has access to a public washing station, and four fountains that service the community with treated water. There are numerous convenience stores, bars, and restaurants in the community that sell bottled water. There are two rivers flowing around the community, and a third further down the principle highway.

3.1 Target population and criteria

The determined target population was adults aged 18 and above, who had been living in the community for at least one month. The exclusion criteria were as follows: adults who spend more than half their time living in a different community, and participants who had lived in the community for less than one month. The homes in the communities were divided into sections of 15-20 homes, to be surveyed on certain days. The objective was to randomly select one individual who fulfilled the criteria from each home and have them to respond to the questionnaire. Randomization of eligible members of the household was done using the Random UX application: each eligible person was assigned a number, and once a number was randomly selected, the selected person would be asked to participate. If the selected participant was not present or unavailable, another time was be scheduled to return to the home and interview the applicant. Only after three attempts to interview was a different individual in the household chosen. This ensured a random or at least nearly random sample in each community.

3.2 Questionnaire and variables

The questionnaire contained between 70 to 100 questions, depending on how the participants responded, and took approximately 20 minutes to conduct. As an initial step, the questionnaire was informally tested on collaborators from São Tomé for language, vocabulary, and understanding. Upon arriving in São Tomé, the questionnaire was further pre-tested on locals from a nearby village (Morro Peixe), for both language, vocabulary, and relevance. Certain changes were then made to adapt the questionnaire to the local context and to facilitate understanding.

In its final form, the questionnaire contained 5 subsections: socio-demographic, health outcomes, community association, characterization and perception of infrastructure, and behavior. The variables of interest for each subsection were as follows:

Socio-demographic variables:

1. Gender
2. Age
3. Education level
4. Profession
5. Civil Status
6. Family size
7. Number of children in household

Health outcomes variable:

1. Use of anti-parasitic drugs
2. Episodes of diarrhea
3. Episodes of fever
4. Unexpected visits to the clinic
5. Injuries sustained
6. Weight change
7. Diet change
8. Stomach pain and bloating
9. Hematuria
10. Blood in stool

Community association variables:

1. Community leader approval and election frequency
2. Community events
3. Community cleaning
4. Community meetings
5. Problems among community members

6. Community support
7. Community rules

Infrastructure variables:

1. Perception and distance of public water system
2. Perception and distance of public latrine
3. Perception and distance of public washing station
4. Organized garbage collection
5. Private latrine
6. Private water storage
7. Other improvements

Behavior and practices

1. Primary source of drinking water
2. Primary source of water for other purposes
3. Preparing food before consuming
4. Treating water before consuming
5. Reutilization of washbasin water
6. Handwashing
7. Walking barefoot
8. Primary location of clothes washing
9. Garbage disposal location and treatment
10. Defecating in latrine, open air
11. Urinating in latrine, open air

The questionnaire was digitized and applied using Qualtrics survey software, on two Amazon Kindle Fire Tablets, via a trained local research assistant in Portuguese and *crioulo* (a local Portuguese-based creole language). Annex A contains a copy of the questionnaire in its entirety.

3.3 Statistical analysis

The responses, once collected, were then formatted and analyzed using SPSS version 25. An initial exploratory analysis was performed to each variable. For quantitative symmetric variables, mean and standard deviation were obtained. Instead, for asymmetric variables, median and interquartile range were calculated. Qualitative variables were summarized through absolute and relative frequencies. One-way analysis of variance (abbreviated one-way ANOVA) was used to compare means of the three communities, in case of the quantitative variable meet the assumptions (normality - tested by Kolmogorov-Smirnov and Shapiro-Wilk tests - and homogeneity of variances - tested by Levene test). As an alternative, the non-parametric test of Kruskal-Wallis was used.

Based on expected frequencies, Chi Squared or and Fisher Exact tests were used to compare different proportions or test associations variables between qualitative variables (e.g., three communities and each by health outcome). Statistically significant variables with $p<0.05$ or relevant variables in epidemiological terms (e.g., sex and age) were then included in a multiple binary logistic regression models, to evaluate the significance of the association between these variables and reported health problems, while controlling for other variables. Hosmer and Lemeshow test was used to assess the goodness of fit of models ($p>0.05$), and the Nagelkerke R squared value was used to show the capability of the variables to explain the health outcomes (a larger value corresponds to the variables more accurately explaining the results). Thus, adjusted odds ratio values and their correspondent 95% confidence interval (95%CI) were obtained. The models were also split by gender and run to explore the different risk factors associated with each gender. Furthermore, Log-linear models were used to examine the relationship between these significantly associated qualitative variables and several selected factors to explore their potential association simultaneously in three-way or higher contingency tables.

3.4 Ethical aspects

The study was reviewed and approved by the São Tomé e Príncipe ministry of health, as well as the national ethics committee, on 02/21/2019 – Ref: nº149 Proc nº .38/GMS/19. The information regarding this study, and the conditions to participate were given verbally. Written informed consent documents with two copies were obtained from each participant. One copy was left to the participant, which included pertinent contact information of the researchers, and the second was held by the researcher. Annex B contains an example form of the Informed consent used. All copies of the obtained informed consent will be held in storage for a period of five years at the Institute of Hygiene and Tropical Medicine. There is no conflict of interest to declare.

4. Results

The questionnaire was applied in the communities between February 28, 2019 and April 1, 2019. A total of 162 individuals were interviewed across the 3 communities; 56 from Canavial, 49 from Plancas, and 57 from Ilheu. These numbers equate to nearly 70% of the reported occupied homes in each community, and approximately 29% of the total estimated population of the three communities. In four instances we were unable to reach the randomly selected participants, two in Ilheu, one in Plancas, and one Canavial, and after the third attempt another member of the household was chosen. The minimum and maximum age of respondents was 18 and 85, respectively, with a mean of 40.1 years old (s= 16.1). A total of 71 males and 91 females were interviewed, 43.8% and 56.2% respectively.

4.1 Sociodemographic variables by community

Table 1 describes the sociodemographic breakdown of the sample by community. There were slightly more female than male respondents across all three communities, without significant differences (56.2%, p=0.297). In Plancas, more respondents (53.1%) were male. The 25 to 34-year-old age group was the most common across Canavial and Plancas, while the 35 to 44-year-old age group was most represented in Ilheu (p=0.377). Most respondents (54.0%) reported their civil status as single, followed by those who are married or in a domestic union (42.2%) (p=0.265). The mean and median age of respondents in Canavial was 39.1 and 37 years, respectively. In Plancas, the mean and median age was 41.8 and 40 years, and in Ilheu it was 39.7 and 36 years, respectively. Despite the large number of reported single individuals, most respondents across all communities reported living with at least one other person (84.6%, p=0.450), and with at least one child in the home (71.4%, p=0.498).

The respondents from the community of Ilheu reported the highest levels of education, with 15.8% studying above a secondary education, and with 56.1% of respondents studying through secondary education. These values are higher than the education levels of Canavial and Plancas, with reported levels of higher education to be 7.1% and 0.0% respectively and reported levels of secondary education at 41.1% and 32.7% respectively

(p=0.001). With regards to profession, respondents from Ilheu reported highest levels of employment in the tertiary sector (21.4%), followed by the secondary sector (17.9%). In comparison, most respondents in Plancas and Canavial work in the primary (agricultural) sector, 77.6% and 56.4% respectively (p<0.001). Interestingly, Ilheu also reported the highest percentage of unemployed respondents of the three communities, with 12.5%, compared with 0.0% in Plancas and 5.5% in Canavial.

With regards to existing community wide infrastructure, all three communities (Canavial, Plancas, Ilheu) had access to a public water system and public clothes washing tanks. For the purpose of this comparison, the source of the water (spring water in Plancas and treated water in Canavial and Ilheu) will be regarded as the same. Furthermore, both Canavial and Plancas have public latrines installed for all at use.

At the household level, information was gathered on five household variables: existence of a bathroom, a latrine, indoor plumbing, type of flooring, and water storage. Table 2 illustrates the presence of each improvement divided by community. Across all communities, bathrooms with indoor plumbing were rare. Only, 8.9% of homes in Canavial and 14% of homes in Ilheu had access to such a bathroom, with no reported bathrooms in Plancas. Overall, only 8% of homes had a bathroom with internal plumbing (p=0.015). With regards to outdoor latrines, the prevalence varied significantly, with 7.1% of homes in Canavial, 22.5% in Plancas, and 40.4% of homes in Ilheu had access to outdoor latrines (p<0.001). When considering bathrooms and latrines together, 31.5% of respondents had access to a private location defecate or urinate.

Table 1. Sociodemographic results by community

	Canavial n=56 (%)	**Plancas n=49 (%)**	**Ilheu n=57 (%)**	**Total n=162 (%)**	**P-value**
Gender					0.297
Male	23 (41.1)	26 (53.1)	22 (38.6)	71 (43.8)	
Female	33 (58.9)	23 (46.9)	35 (61.4)	91 (56.2)	
Civil Status					0.265

married/domestic union	21 (37.5)	20 (40.8)	27 (48.2)	68 (42.2)	
Single	34 (60.7)	25 (51.0)	28 (50.0)	87 (54.0)	
other (divorced, widowed)	1 (1.8)	4 (8.2)	1 (1.8)	6 (3.7)	
Age group					0.377
18-24	7 (12.5)	4 (8.2)	10 (17.9)	21 (13.0)	
25-34	19 (33.9)	16 (32.7)	15 (26.8)	50 (31.1)	
35-44	13 (23.2)	10 (20.4)	16 (28.6)	39 (24.2)	
45-54	11 (19.6)	10 (20.4)	4 (7.1)	25 (15.5)	
55+	6 (10.7)	9 (18.4)	11 (19.6)	26 (16.1)	
Household size					0.450*
1 person	6 (10.7)	10 (20.4)	9 (15.8)	25 (15.4)	
2-4 people	23 (41.1)	20 (40.8)	26 (45.6)	69 (42.6)	
5-7 people	20 (35.7)	18 (36.7)	18 (31.6)	56 (34.6)	
8+ people	7 (12.5)	1 (2.0)	4 (7.0)	12 (7.4)	
Children in home					0.498*
0 kids in house	11 (19.6)	18 (36.7)	17 (30.4)	46 (28.6)	
1-2 kids in house	23 (41.1)	18 (36.7)	22 (39.3)	63 (39.1)	
3-5 kids in house	21 (37.5)	13 (26.5)	16 (28.6)	50 (31.1)	
6+ kids in house	1 (1.8)	0 (0.0)	1 (1.8)	2 (1.2)	
Education level					0.001*
no education	6 (10.7)	7 (14.3)	4 (7.0)	17 (10.5)	
primary	23 (41.1)	26 (53.1)	12 (21.1)	61 (37.7)	
secondary	23 (41.1)	16 (32.7)	32 (56.1)	71 (43.8)	
superior and above	4 (7.1)	0 (0.0)	9 (15.8)	13 (8.0)	
Profession					<0.001*
Primary sector (Agriculture)	31 (56.4)	38 (77.6)	7 (12.5)	76 (47.5)	
Secondary sector	4 (7.3)	2 (4.1)	10 (17.9)	16 (10)	

Tertiary sector	5 (9.1)	1 (2.0)	12 (21.4)	18 (11.3)	
domestic	12 (21.8)	8 (16.3)	20 (35.7)	40 (25.0)	
unemployed	3 (5.5)	0 (0.0)	7 (12.5)	10 (6.3)	
*Fisher Exact Test					

Table 2 also describes other characteristics of the household, such as the existence of internal plumbing, the type of flooring, and type of water storage. Internal plumbing was rare and limited to a few newly built homes. Only, 5.4% of homes in Canavial reported internal plumbing, compared to no homes in Plancas and 19.3% of homes in Ilheu (p=0.001). Types of flooring were dividing into three categories: wood, cement, and other. In Canavial, the primary floor type was cement (83.9%), followed by wood (14.3%). In Plancas, cement was most common with 62.5%, followed by 35.4% of homes with wood floors. Lastly, Ilheu had primarily wood flooring (75.4%), followed by cement (21%). These difference in floor type (p<0.001) illustrate the historic and social context of each community. Nearly all homes surveyed across all communities had some form of water storage (97.5%, p=0.842). The types of water storage present in each household are divided into three categories: drums – large (50-100L) barrels closed with a lid, small (1.5-5L) containers with lids, and open bucket containers. Water drums were rare in Canavial and Plancas, reported in only 1.8% and 2.0% of homes, and more common in Ilheu, reported in 15.8% of homes (p=0.004). Containers with closable lids were found in 30.4% of homes in Canavial, 51% of homes in Plancas, and 63.2% of homes in Ilheu (p=0.002). Open containers (such as buckets), were ubiquitous through all communities, present in 96.4%, 95.9%, and 98.2% of homes in Canavial, Plancas, and Ilheu respectively (p=0.742).

Table 2. Household infrastructure and water storage by community

	Canavial n=56 (%)	**Plancas n=49 (%)**	**Ilheu n=57 (%)**	**Total n=162 (%)**	**p-value**
Access to a bathroom					0.015*
no	51 (91.1)	49 (100)	49 (86.0)	149 (92.0)	
yes	5 (8.9)	0 (0.0)	8 (14.0)	13 (8.0)	
Access to a latrine					<0.001
no	52 (92.9)	38 (77.6)	34 (59.7)	124 (76.5)	

yes	4 (7.1)	11 (22.4)	23 (40.4)	38 (23.5)	
Water pipes in house					0.001*
no	53 (94.6)	49 (100)	46 (80.7)	148 (91.4)	
yes	3 (5.4)	0 (0.0)	11 (19.3)	14 (8.6)	
Home flooring					<0.001*
Wood	8 (14.3)	17 (35.4)	43 (75.4)	68 (42.2)	
Cement	47 (83.9)	30 (62.5)	12 (21.1)	89 (55.3)	
other	1 (1.8)	1 (2.1)	2 (3.5)	4 (2.5)	
Water storage					0.842*
no	2 (3.6)	1 (2.0)	1 (1.8)	4 (2.5)	
yes	54 (96.4)	48 (98.0)	56 (98.2)	158 (97.5)	
Water drum					0.004*
no	55 (98.2)	48 (98)	48 (84.2)	151 (93.2)	
yes	1 (1.8)	1 (2)	9 (15.8)	11 (6.8)	
Closable container					0.002
no	39 (69.6)	24 (49)	21 (36.8)	84 (51.9)	
yes	17 (30.4)	25 (51)	36 (63.2)	78 (48.1)	
Open water containers					0.742*
no	2 (3.6)	2 (4.1)	1 (1.8)	5 (3.1)	
yes	54 (96.4)	47 (95.9)	56 (98.2)	157 (96.9)	
*Fisher exact test					

With regards to how the infrastructure is utilized, the results may be divided into two groups: general hygiene behavior, and water usage. Table 3 depicts the defecation and urination habits of participants by community. Rates of daily outdoor defecation rates were elevated in both Canavial (85.7%) and Plancas (75.5%), with only Ilheu reporting daily outdoor defecation of less than 50% of the participants in the community (49.1%, p<0.001). Accordingly, Ilheu reported the highest levels of daily latrine use (45.6%), followed by Plancas (28.6%) and Canavial (12.5% p=0.002). Cumulatively, over half (58.0%) of the respondents reported never using an improved latrine in their day to day life. Urinating outside was also a pervasive behavior, done regularly by 94.5% of respondents from Canavial, 89.9% from Plancas, and 66.7% from Ilheu (p<0.001). These values correspond to the number of private latrines in each community.

Table 3. Defecation and urination habits by community					
	Canavial n=56 (%)	**Plancas n=49 (%)**	**Ilheu n=57 (%)**	**Total n=162 (%)**	**P-value**

Defecation outside					<0.001*
Daily use	48 (85.7)	37 (75.5)	28 (49.1)	113 (69.8)	
regular to occasional use	6 (10.7)	5 (10.2)	4 (7.0)	15 (9.3)	
only in cases of emergency	1 (1.8)	2 (4.1)	9 (15.8)	12 (7.4)	
never/don't know	1 (1.8)	5 (10.2)	16 (28.1)	22 (13.6)	
Defecation in latrine or bathroom					0.002*
daily use	7 (12.5)	14 (28.6)	26 (45.6)	47 (29.0)	
regular to occasional use	6 (10.7)	4 (8.2)	3 (5.3)	13 (8.0)	
only in cases of emergency	1 (1.8)	3 (6.1)	4 (7.0)	8 (4.9)	
never/don't know	42 (75)	28 (57.1)	24 (42.1)	94 (58.0)	
Urinating outside					<0.001*
Yes	53 (94.6)	44 (89.8)	38 (66.7)	135 (83.3)	
No	1 (1.8)	0 (0.0)	9 (15.8)	10 (6.2)	
Sometimes	2 (3.6)	5 (10.2)	10 (17.5)	17 (10.5)	
*Fisher exact test					

Table 4 outlines clothes washing habits. With regards to clothes washing, the primary location varied significantly ($p<0.001$) between the communities. In Canavial, the vast majority (92.9%) of respondents named the nearby natural source of water as the primary source, with very few using the public washing station (3.6%) or their own property (3.6%). In Plancas, the nearly all members of the community washed their clothes in the public washing station (95.9%), with only 2% using either a nearby river or their property. Finally, Ilheu's usage was distributed across all three options, with most using the public washing station (47.4%), followed by their own property (26.3%) and a nearby river (17.5%). Figure 4 illustrates an example of these public washing stations. We also found that clothes washing frequency varied by community ($p=0.036$). In Canavial, 87.5% of respondents washed clothes several times per week, followed by 7.1% who responded doing so daily. In Plancas, 77.6% of respondents washed clothes weekly, followed by 12.2% who washed monthly and 10.2% who washed clothes daily. In Ilheu, 71.9% washed clothes weekly, 24.6% monthly and 3.5% washed daily.

Table 4. Clothes washing habits by community					
	Canavial n=56 (%)	**Plancas n=49(%)**	**Ilheu n=57(%)**	**Total n=162(%)**	**P-value**
Most frequently used location to wash clothes					<0.001
Natural sources	52 (92.9)	1 (2.0)	10 (17.5)	63 (38.9)	
Public washing station	2 (3.6)	47 (95.9)	27 (47.4)	76 (46.9)	
Private property/other	2 (3.6)	1 (2.0)	20 (35.1)	23 (14.2)	
Frequency of washing clothes					0.036*
Every day	4 (7.1)	5 (10.2)	2 (3.5)	11 (6.8)	
Several times per week	49 (87.5)	38 (77.6)	41 (71.9)	128 (79.0)	
Several times per month	3 (5.4)	6 (12.2)	14 (24.6)	23 (14.2)	
*Fisher Exact test					

Figure 4: Public washing station used to clean clothes.

Table 5 describes personal hygiene habits of the respondents in each community, as well as the hygiene habits related to certain activities (such as cooking, cleaning, and walking barefoot). With regards to peeling fruits and vegetables across all communities, 93.8% reported do so regularly, 2.5% reported sometimes doing so, and only 3.7% reported not regularly peeling fruit and vegetables (p=0.943). With washing fruits and vegetables before consuming, there was no significant difference between communities (p=0.163), while 90.1% of respondents reported regularly washing their fruits and vegetables, followed by 2.5% who sometimes washed or were unsure, and another 7.4% reported not washing their fruit and vegetables before consuming. We found that the reutilization of washbasin water varied significantly between communities (p=0.015). In Canavial, 45.5% of the respondents reported regularly reusing washbasin water, 12.7% sometimes did, and 50.9% reported never doing so. In Plancas, 34.7% regularly reused water, 18.4% reported sometimes doing so, and 46.9% reported never reusing washbasin water. Ilheu reported the least amount of reuse of washbasin water, 15.8% reported

regularly doing so, followed by 21.1% doing so occasionally, and 63.2% never doing so. Over half of respondents in Canavial (55.4%) reported walking barefoot outside their home, more than those in Plancas (46.9%) and in Ilheu (31.6%) while there is a decreasing trend across communities, it was not statistically significant (p=0.113). Most respondents reported washing their hands before eating (87.0%, p=0.791) and after defecating (82.1%, p=0.630. While more variation was found in the use of soap with handwashing, results were still not statistically significant (p=0.310). In Canavial, 58.2% used soap, while 41.8% only sometimes or never used soap. In Plancas, 73.5% used compared to 26.5% who only sometimes or never used soap. Lastly, three quarters of participants in Ilheu reported using soap, and 25.0% sometimes or never did.

Table 5. Hygiene habits of participants by community

	Canavial n=56(%)	**Plancas n=49(%)**	**Ilheu n=57(%)**	**Total n=162(%)**	**P-value**
Peel fruit and vegetables before consuming					0.943*
Yes	53 (94.6)	47 (95.9)	52 (91.2)	152 (93.8)	
Sometimes/unsure	1 (1.8)	1 (2.0)	2 (3.5)	4 (2.5)	
No	2 (3.6)	1 (2.0)	3 (5.3)	6 (3.7)	
Wash fruits and vegetables before consuming					0.163*
Yes	50 (89.3)	41 (83.7)	55 (96.5)	146 (90.1)	
Sometimes/unsure	1 (1.8)	3 (6.1)	0 (0.0)	4(2.5)	
No	6 (8.9)	5 (10.2)	2 (3.5)	12 (7.4)	
Reuse washbasin water					0.015
Yes	25 (45.5)	17 (34.7)	9 (15.8)	51 (31.7)	
Sometimes	7 (12.7)	9 (18.4)	12 (21.1)	28 (17.4)	
No	23 (41.8)	23 (46.9)	36 (63.2)	82 (50.9)	
Walking barefoot					0.113
Yes	31 (55.4)	23 (46.9)	18 (31.6)	72 (44.4)	
Sometimes	11 (19.6)	8 (16.3)	14 (24.6)	33 (20.4)	
No	14 (25.0)	18 (36.7)	25 (43.9)	57 (35.2)	
Handwashing before eating					0.791*
Yes	50 (89.3)	42 (85.7)	49 (86.0)	141 (87.0)	
Sometimes	6 (10.7)	6 (12.2)	8 (14.0)	20 (12.4)	
No	0 (0.0)	1 (2.0)	0 (0.0)	1 (0.6)	

Handwashing after defecating and urinating					0.630*
Yes	46 (82.1)	43 (89.6)	51 (89.5)	140 (87.0)	
Sometimes	9 (16.1)	5 (10.4)	6 (10.5)	20 (12.4)	
No	1 (1.8)	0 (0.0)	0 (0.0)	1 (0.6)	
Use soap when washing hands					0.310*
Yes	32 (58.2)	36 (73.5)	42 (75.0)	110 (68.8)	
Sometimes	21 (38.2)	12 (24.5)	13 (23.2)	46 (28.7)	
No	2 (3.6)	1 (2.0)	1 (1.8)	4 (2.5)	
*Fisher exact test					

Table 6 shows the water utilization for different purposes by community. With regards to using the public system for drinking water, respondents from Ilheu and Plancas both reported it being their sole source of drinking water, with almost 98.0% of each community reported it being their daily source of water. While most respondents in Canavial (82.1%) reported using the public system for drinking water daily, a significant number (17.9%) reported using only on a regular to occasional basis ($p<0.001$). Conversely, the use of natural sources (rivers, streams, valleys) for drinking water was most pronounced in Canavial, with 69.6% of respondents reporting regular to occasional use. Most participants in Plancas (98.0%) reported never using river water, and 73.7% of respondents from Ilheu reported drinking water from the river only in cases of emergency, and a minority (21%) using it regularly to occasionally ($p<0.001$).

For using the public water system for other uses, such as cooking and cleaning, most respondents from both Plancas (95.5%) and Ilheu (93.0%) reported using it daily. In Canavial, only 57.1% of respondents reported using public water supply for other purposes daily. 35.7% only used it on a regular to occasional basis. For using water from natural sources to cook and clean, 23.2% of respondents from Canavial reported using water from the river daily, and 58.9% reported regular to occasional use. In Plancas, most respondents (98.0%) reported never using water from natural sources for other purposes. Finally, in Ilheu, while a plurality (47.4%) reported never using it cook and clean, one-third (33.3%) reported using it in cases of emergency, and another 19.3% using it on a regular to occasional basis.

Table 6. Water usage by community					
	Canavial n=56(%)	**Plancas n=49(%)**	**Ilheu n=57 (%)**	**Total n=162 (%)**	**P-value**
With what frequency do you use public system for drinking water					<0.001*
daily use	46 (82.1)	48 (98.0)	56 (98.3)	150 (92.6)	
regular to occasional use	10 (17.9)	0 (0.0)	1 (1.8)	11 (6.8)	
Only in cases of emergency	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
never/don't know	0 (0.0)	1 (2.0)	0 (0.0)	1 (0.6)	
With what frequency do you use natural sources (river, streams) for drinking water					<0.001*
daily use	3 (5.4)	1 (2.0)	0 (0.0)	4 (2.5)	
Regular to occasional use	39 (69.6)	0 (0.0)	12 (21.1)	51 (31.5)	
Only in cases of emergency	12 (21.4)	0 (0.0)	42 (73.7)	54 (33.3)	
never/don't know	2 (3.6)	48 (98.0)	3 (5.3)	53 (32.7)	
With what frequency do you use treated water for other uses (cooking, cleaning)					<0.001*
daily use	32 (57.1)	47 (95.9)	53 (93.0)	132 (81.5)	
regular to occasional use	20 (35.7)	1 (2.0)	3 (5.3)	24 (14.8)	
Only in cases of emergency	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
never/don't know	4 (7.1)	1 (2.0)	1 (1.8)	6 (3.7)	
With what frequency do you use natural sources (river, streams) for other uses (cooking, cleaning)					<0.001*
Daily use	13 (23.2)	1 (2.0)	0 (0.0)	14 (8.6)	
regular to occasional use	33 (58.9)	0 (0.0)	11 (19.3)	44 (27.2)	
Only in cases of emergency	5 (8.9)	0 (0.0)	19 (33.3)	24 (14.8)	
never/don't know	5 (8.9)	48 (98.0)	27 (47.4)	80 (49.4)	
*Fisher exact test					

Other factors explored were variables that may influence or relate to the usage of the public infrastructure. These included factors such as perception of quality of the public infrastructure, distance from the respondent's home to the facilities, and factors related to community association. Table 7 describes the respondent's perception of this infrastructure by community. In Ilheu, 86.0% of respondents viewed the public water system as positive, while only 7% viewed the system negatively. In contrast, just 44.6% of respondents in Canavial held a positive view of the water system, while 41.1% held a negative perception and 14.3% thought the system adequate. In Plancas, 46.8% held a positive perception, 36.2% thought the system was adequate, and 17% held a negative perception. These differences were found to be statistically significant ($p<0.001$). In Canavial, 41.1% of respondents reported holding a negative view of the clothes washing tanks, followed by 29.1% of respondents holding a positive view, and 27.3% reporting the tanks were adequate. Similarly, in Plancas, 44.7% held a negative perception of the tanks, 38.3% thought them adequate, and only 17% held a positive view. Conversely, 49.1% of respondents in Ilheu viewed the washing tanks positively, followed by 26.3% who viewed them as adequate, and only 24.6% with negative views of the tanks ($p=0.008$). With regards to the public latrines in Canavial and Plancas, public perception was decidedly negative. 67.3% respondents in Canavial and 84.8% in Plancas held negative views of the public latrine. Only 5.8% in Canavial and 4.4% in Plancas viewed the latrines positively, and 26.9% and 10.9% of respondents thought the system was adequate, respectively.

Table 7. Perception of public infrastructure by community

	Canavial n=56(%)	**Plancas n=49(%)**	**Ilheu n=57(%)**	**Total n=162(%)**	**P-value**
Public water system					<0.001
negative	23 (41.1)	8 (17.0)	4 (7.0)	35 (21.9)	
adequate	8 (14.3)	17 (36.2)	4 (7.0)	29 (18.1)	
positive	25 (44.6)	22 (46.8)	49 (86.0)	96 (60.0)	
clothes washing tanks					0.008
negative	24 (43.6)	21 (44.7)	14 (24.6)	59 (37.1)	
adequate	15 (27.3)	18 (38.3)	15 (26.3)	48 (30.2)	
positive	16 (29.1)	8 (17.0)	28 (49.1)	52 (32.7)	

public latrines					0.055*
negative	35 (67.3)	39 (84.8)	1 (50.0)	75 (75.0)	
adequate	14 (26.9)	5 (10.9)	0 (0.0)	19 (19.0)	
positive	3 (5.8)	2 (4.4)	1 (50.0)	6 (6.0)	
*Fisher exact test					

Table 8 outlines the distance from each respondents' home to infrastructure improvements. To summarize, the respondents from Canavial most reported be close to all infrastructure (over 70% for each improvement), and conversely being the furthest from the natural source of water (nearly 80% over a 10-minute walk). About half of respondents in Plancas reported being less than a two-minute walk from each surveyed improvement, with no natural source of water a reasonable distance away. Lastly, Ilheu had the largest distribution of improvements, with over half of respondents (57.9%) reporting being within a two-minute walk of a source of improved water. Similarly, half reported being within a five-minute walk from the public washing station. The differences by community, with regards to the distance from each improvement to the respondents' home, was found to be significant for each variable (distance to public water source $p<0.001$, distance to public washing station $p<0.001$, distance to public latrine $p=0.028$, distance to natural source of water $p<0.001$).

Table 8. Distance of feature from respondent's home, by community

	Canavial n=56(%)	**Plancas n=49(%)**	**Ilheu n=57(%)**	**Total n=162(%)**	**P-value**
Distance to public water system					<0.001 *
< 2 minutes	42 (75)	23 (48.9)	33 (57.9)	98 (61.3)	
2-5 minutes	7 (12.5)	8 (17.0)	23 (40.4)	38 (23.8)	
5-10 minutes	2 (3.6)	12 (25.5)	1 (1.8)	15 (9.4)	
> 10 minutes	5 (8.9)	4 (8.5)	0 (0.0)	9 (5.6)	
Distance to public washing station					<0.001 *
< 2 minutes	39 (70.9)	23 (50.0)	18 (31.6)	80 (50.6)	
2-5 minutes	9 (16.4)	8 (17.4)	30 (52.6)	47 (29.8)	
5-10 minutes	2 (3.6)	12 (26.1)	9 (15.8)	23 (14.6)	
>10 minutes	5 (9.1)	3 (6.5)	0 (0.0)	8 (5.1)	
Distance to public latrine					0.028*

< 2 minutes	37 (71.2)	24 (53.3)	2 (100.0)	63 (63.6)	
2-5 minutes	8 (15.4)	16 (35.6)	0 (0.0)	24 (24.2)	
5-10 minutes	2 (3.9)	5 (11.1)	0 (0.0)	7 (7.1)	
>10 minutes	5 (9.6)	0 (0.0)	0 (0.0)	5 (5.1)	
Distance to natural source of water					<0.001
< 2 minutes	2 (3.7)	0 (0.0)	5 (9.3)	7 (6.4)	
2-5 minutes	1 (1.9)	0 (0.0)	17 (31.5)	18 (16.5)	
5-10 minutes	8 (14.8)	1 (100)	21 (38.9)	30 (27.5)	
>10 minutes	43 (79.6)	0 (0.0)	11 (20.40)	54 (49.5)	
*Fisher Exact Test					

The questions regarding community association (shown in table 9A) include how well respondents feel the community is represented, the frequency and accessibility of community events, the frequency of public cleaning, community wide meetings, and problems between neighbors. Regarding their perception on how well their community is represented, those in Canavial felt the community was either adequately (39.3%) or positively (35.7%) represented. Only one quarter felt the community was poorly represented. In Plancas, 50% felt the community is poorly represented, followed by 31.3% and 18.8% who thought the community was adequately and positively represented, respectively. In Ilheu, a similar trend was seen: 45.1% held negative views, followed by 31.4% with adequate views, and 23.5% with positive views of how their community is represented (p=0.073). Canavial also hosted the most community wide events, with 26.8% of respondents saying such events occur frequently, compared to 25% who report these events as occasional, and the remaining 48.2% saying such events are rare. In Plancas, 60.4% reported such events as very rare, and 31.3% reported events as occasional. In Ilheu, such community events were reported as very infrequent, with 86.0% reporting they rarely occur.

The frequency of community wide cleaning also varied by community. Only in Canavial did most respondents report frequent cleaning (58.2%). In Plancas and Ilheu, just 12.5% and 28.8% reported frequent cleanings. When asked about the organization of these cleanings, the participants from Canavial were split evenly in reporting the members organized the cleaning and the leaders of the community (49.1% each). In Plancas and Ilheu,

87.0% and 81.2% of respondents reported cleanings organized by other community members. Only 18.2% of respondents reported cleanings organized by outside groups.

With regards to community wide meetings to discuss problems or questions in the community, such meetings were generally quite rare. Only 8.9% of respondents in Canavial reported such meetings occurring frequently, while close to none reported these meeting in Ilheu (1.8%) and Plancas (0.0%) Such differences were found to be statistically significant ($p<0.001$). Regarding the efficacy of these meeting, over half of the respondents from Canavial felt the meetings sometimes or rarely resolved the problems at hand (35.7% and 25.0% respectively). Half of respondents in Plancas and Ilheu reported the meetings hardly ever/never work (47.9% and 48.2% respectively). These results were not found to be statistically significant ($p=0.060$).

When asked about the frequency of problems between community members, Canavial reported them most frequent (37.5%). Respondents from Plancas and Ilheu found such problems to be rare, with 41.7% and 52.6% reporting as such, respectively. These differences were considered statistically significant ($p=0.015$). Most respondents found the likelihood of receiving support from others in the community to be rare, with 51.8% of respondents in Canavial, 54.2% of respondents in Plancas, and 56.1% of those in Ilheu reported such aid to is unlikely ($p=0.596$). In keeping with these results, most respondents reported never receiving such aid from others in the community. In Canavial 83.9% reported never receiving aid, compared to 16.1% who received aid at least once. In Plancas 79.2% reported never receiving such aid, compared to 20.8% who did at least once. In Ilheu, 75.4% reported never receiving such aid, and 24.6% who did at least once. These differences were not statistically different ($p=0.534$).

With regards to how well the community rules were followed, 42.9% of respondents in Canavial reported the rules were well followed, compared to 57.1% who felt they were not followed. In Plancas, 66.7% reported the rules were generally followed, compared to 33.3% who felt they were not. In Ilheu, 63.2% thought the rules were generally followed, and 36.8% thought they were not followed $p=0.026$).

Table 9A: Social events, public space, and intracommunity conflict, by community					
	Canavial n=56(%)	**Plancas n=49(%)**	**Ilheu n=57(%)**	**Total n=162(%)**	**P-value**
Community representation					0.073
Positive (good - very good)	20 (35.7)	9 (18.8)	12 (23.5)	41 (26.5)	
adequate	22 (39.3)	15 (31.3)	16 (31.4)	53 (34.2)	
negative (bad - very bad)	14 (25.0)	24 (50.0)	23 (45.1)	61 (39.4)	
social events frequency					<0.001
Frequently	15 (26.8)	4 (8.3)	3 (5.3)	22 (13.7)	
Occasionally	14 (25)	15 (31.3)	5 (8.8)	34 (21.1)	
Rarely	27 (48.2)	29 (60.4)	49 (86.0)	105 (65.2)	
Social events accessibility					0.288
yes	32 (57.1)	20 (41.7)	30 (52.6)	82 (50.9)	
no/don't know	24 (42.9)	28 (58.3)	27 (47.4)	79 (49.1)	
Public space cleaning					<0.001
Frequently	32 (58.2)	6 (12.5)	8 (14.0)	46 (28.8)	
Occasionally	19 (34.6)	31 (64.6)	33 (57.9)	83 (51.9)	
Rarely	4 (7.3)	11 (22.9)	16 (28.1)	31 (19.4)	
Public space cleaning organization					<0.001 *
Members of community	27 (49.1)	40 (87.0)	45 (81.8)	112 (71.8)	
Leaders of community	27 (49.1)	6 (13.0)	0 (0.0)	33 (21.2)	
other groups	1 (1.8)	0 (0.0)	10 (18.2)	11 (7.1)	
*Fisher Exact Test					

Table 9B: Social events, public space, and intracommunity conflict, by community (continued)

	Canavial n=56(%)	Ilheu n=49(%)	Plancas n=57(%)	Total n=162(%)	P-value
Frequency of community meetings					0.00*
Frequently	5 (8.9)	0 (0.0)	1 (1.8)	6 (3.8)	
Occasionally	25 (44.6)	5 (10.4)	6 (10.7)	36 (22.5)	
Rarely	26 (46.4)	43 (89.6)	49 (87.5)	118 (73.8)	
Efficacy of community meetings					0.06*
Always	7 (12.5)	2 (4.2)	2 (3.6)	11 (6.9)	
Usually	15 (26.8)	6 (12.5)	8 (14.3)	29 (18.1)	
Sometimes	20 (35.7)	17 (35.4)	19 (33.9)	56 (35.0)	
hardly ever/never	14 (25)	23 (47.9)	27 (48.2)	64 (40.0)	
Frequency of problems in community					0.015
Frequently	21 (37.5)	7 (14.6)	12 (21.1)	40 (24.8)	
Occasionally	19 (33.9)	21 (43.8)	15 (26.3)	55 (34.2)	
Rarely	16 (28.6)	20 (41.7)	30 (52.6)	66 (41.0)	
Probability of receiving aid from community					0.596
Likely	18 (32.1)	19 (39.6)	18 (31.6)	55 (34.2)	
Neither likely nor unlikely	9 (16.1)	3 (6.3)	7 (12.3)	19 (11.8)	
unlikely	29 (51.8)	26 (54.2)	32 (56.1)	87 (54.0)	
Received aid from community					0.534
At least once	9 (16.1)	10 (20.8)	14 (24.6)	33 (20.5)	
Never	47 (83.9)	38 (79.2)	43 (75.4)	128 (79.5)	
Adherence to community rules					0.026
Yes	24 (42.9)	32 (66.7)	36 (63.2)	92 (57.1)	

No	32 (57.1)	16 (33.3)	21 (36.8)	69 (42.9)	
*Fisher Exact Test					

Table 10 shows the results of some related-indicators to parasitosis and hygiene related health outcomes among the participants. The responses were grouped as not occurring in last month (or two weeks) or occurring at least once. No differences were found between communities for self-reported diarrhea in the past month (p=0.427), with 11.2% of all respondents reported having at least one episode of diarrhea. Diarrhea was defined as three or more loose stools in the period of one day(Shane et al. 2017). Episodes of fever in the last month were found to be statistically significant across the three communities (p<0.001), with 48.2% of the respondents in Canavial reporting suffering from at least one episode of fever in the past month. This value was found to be much higher than in Plancas or Ilheu, where 25.0% and 12.3% respectively reported at least one episode of fever. With regards to reported injuries in the past two weeks, Plancas had the largest proportion of reported injuries, at 27.1%. Canavial and Ilheu had fewer reported injuries, with 14.3% and 10.5% respectively. However, these differences were not determined to be statistically significant (p=0.067). There was no difference in reported weight change by community in the past month (p=0.888), where 31.3% of the total sample reported some weight change, and only 13.0% of all respondents reported some change in their diet. Of all male respondents, 3 (4.2%) reported having at least one instance of hematuria in the past month. Regarding instances of seeing blood in the feces, 5.6% of all respondents reported at least one instance in the past month, with no differences between communities (p=0.353). 25.0% of respondents reported some stomach pain or bloating in the last month, without much differences between communities (p=0.292). The total health variable notes the aggregated reported health outcomes of the participants. Most respondents from all communities reported at least one health problem in the past month. In Canavial, 78.3% reported at least one of the problems outlined in the study. In Plancas and Ilheu, 69.2% and 63.3% of respondents reported at least one problem, respectively. While there is a downward trend between by community, these differences were not found to be significant (p=0.554).

Table 10 also outlines two more factors were considered, regarding the health profile of each community: use of antiparasitic drugs and unscheduled visits to the clinic. While no differences were found by community for either (p=0.513 and p=0.830 respectively), 27.5% of all respondents reported the use of antiparasitic drugs by at least one person in their household in the past month, and another 25.5% reported at least one visit to the clinic in the last two weeks. Regarding visits to the clinic, a gradient was found where in Ilheu, the most centrally located community with best access to transportation, had a slightly higher level of usage (28.1%), followed by Canavial (25.0%) which had the next best access. Finally, Plancas, the most remote of the communities, had 22.9% of respondents visiting the health services.

Table 10. Health indicators by community

	Canavial n=56(%)	**Plancas n=49(%)**	**Ilheu n=57(%)**	**Total n=162(%)**	**P-value**
Reported diarrhea (last month)					0.427
0 episodes	48 (85.7)	45 (93.8)	50 (87.7)	143 (88.8)	
At least one episode	8 (14.3)	3 (6.3)	7 (12.3)	18 (11.2)	
Reported fever (last month					<0.001
0 episodes	29 (51.8)	36 (75.0)	50 (87.7)	115 (71.4)	
At least one episode	27 (48.2)	12 (25.0)	7 (12.3)	46 (28.6)	
Reported injuries (last 2 weeks)					0.067
no/don't know	48 (85.7)	35 (72.9)	51 (89.5)	134 (83.2)	
yes	8 (14.3)	13 (27.1)	6 (10.5)	27 (16.8)	
Reported weight change (last month)					0.888
No/don't know	37 (66.1)	33 (70.2)	40 (70.2)	110 (68.8)	
Yes	19 (33.9)	14 (29.8)	17 (29.8)	50 (31.3)	
Reported diet change (last month)					0.134
No/don't know	45 (80.4)	42 (87.5)	53 (93.0)	140 (87.0)	
Yes	11 (19.6)	6 (12.5)	4 (7.0)	21 (13.0)	
Reported hematuria (men, last month)					1.000
No/don't know	22 (95.7)	25 (96.2)	21 (95.5)	68 (95.8)	
yes	1 (4.3)	1 (3.8)	1 (4.5)	3 (4.2)	

Reported blood in feces (last month)					0.353*
No/don't know	51 (91.1)	47 (97.9)	54 (94.7)	152 (94.4)	
Yes	5 (8.9)	1 (2.1)	3 (5.3)	9 (5.6)	
Reported stomach pain or bloating (last month)					0.292
no	39 (69.6)	39 (83.0)	42 (73.7)	120 (75.0)	
Yes	17 (30.4)	8 (17.0)	15 (26.3)	40 (25.0)	
Total health indicators					0.235
None	14 (25.0)	16 (34.8)	23 (40.4)	53 (33.3)	
At least one	42 (75.0)	30 (65.2)	34 (59.6)	106 (66.7)	
Reported use of antiparasitic drugs					0.513
No one in house	37 (67.3)	35 (72.9)	44 (77.2)	116 (72.5)	
At least one person in house	18 (32.7)	13 (27.1)	13 (22.8)	44 (27.5)	
Visits to clinic (last 2 weeks)					0.830
0 visits	42 (75.0)	37 (77.1)	41 (71.9)	120 (74.5)	
At least one visit	14 (25.0)	11 (22.9)	16 (28.1)	41 (25.5)	
*Fisher Exact Test					

4.2 Results by at least one reported health problem in the past month

As seen in Table 10, there is no difference between communities in terms of frequency of health outcomes. Consequently, in the following section, all participants of the three communities were treated together. This recorded variable involved grouping all health indicators together and categorizing responses as either “no problems in the past month” or “at least one reported problem in the past month”, which would subsequently be used to explore logistic regression models.

Table 11 compares the frequency of respondents reporting “at least one health problem) by socioeconomic variables. In comparing the participants by the community in which they lived, we found that 75.0% of participants reported at least one health issue in the past month, compared to 65.2% of participants in Plancas and 59.6% of participants in Ilheu. While this gradient was found by community, the differences were not statistically significant (p=0.235). When dividing participants by gender, 71.4% of men and 62.9% of women

reported at least one health problem (p=0.310). By civil status, an interesting albeit statistically insignificant (p=0.071) difference was found where single individuals had the highest reported health problems (71.4%), followed divorced or widowed participants (66.7%), and married participants (56.7%). When divided by age group, the group with the most reported problems was the 35-44 age group with 81.6%, followed by the 45-54 age group with 75.0%, the over 55 age group with 69.2%, and the 25-34 age group with 59.2%. the 18-24 age group had the fewest reported problems with only 47.6%. These differences were found to be statistically significant (p=0.053).

By household size, respondents living alone reported the most health problems (76.0%), followed closely by respondents with household sizes between 5-7 people (75.9%), and household sizes over 8 (75.0%). Respondents with household between 2-4 people had the fewest reported problems with 54.4% (p=0.044).

Neither the number of children in the home nor the participant's education level were related to health outcomes of participants (p=0.136, p=0.627 respectively). Regarding professional status, those who worked in agriculture reported the highest levels of health problems with 72.6%, followed by 72.2% of other professions limited to working indoors, 70.0% of unemployed respondents, 56.3% of other outdoor related professions, and 55% of respondents whose primary occupation involved domestic duties (p=0.331).

Table 11. Sociodemographic results by health indicator

	None n(%)	**At least one n(%)**	**Total n**	**p-value**
Community				0.235
Canavial	14 (25.0)	42 (75.0)	56	
Plancas	16 (34.8)	30 (65.2)	46	
Ilheu	23 (40.4)	34 (59.6)	57	
Gender				0.310
Male	20 (28.6)	50 (71.4)	70	
Female	33 (37.1)	56 (62.9)	89	
grouped civil status				0.071*
Single	22 (25.9)	63 (74.1)	85	
married/domestic union	29 (43.3)	38 (56.7)	67	

other (divorced, widowed)	2 (33.3)	4 (66.7)	6	
Age group				0.053
18-24	11 (52.4)	10 (47.6)	21	
25-34	20 (40.8)	29 (59.2)	49	
35-44	7 (18.4)	31 (81.6)	38	
45-54	6 (25.0)	18 (75.0)	24	
55+	8 (30.8)	18 (69.2)	26	
Household size				0.044
1	6 (24.0)	19 (76.0)	25	
2-4	31 (45.6)	37 (54.4)	68	
5-7	13 (24.1)	41 (75.9)	54	
8+	3 (25.0)	9 (75.0)	12	
Children in house grouped				0.136*
0 kids in house	16 (35.6)	29 (64.4)	45	
1-2 kids in house	25 (41.0)	36 (59.0)	61	
3-5 kids in house	11 (22.0)	39 (78.0)	50	
6+ kids in house	1 (50.0)	1 (50.0)	2	
Education level				0.627
no education	7 (41.2)	10 (58.8)	17	
primary	19 (32.2)	40 (67.8)	59	
secondary	21 (30.0)	49 (70.0)	70	
superior and above	6 (46.2)	7 (53.8)	13	
Professional status				0.331
agriculture	20 (27.4)	53 (72.6)	73	
other profession outdoor	7 (43.8)	9 (56.3)	16	
other profession indoor	5 (27.8)	13 (72.2)	18	
domestic	18 (45.0)	22 (55.0)	40	
unemployed	3 (30.0)	7 (70.0)	10	
*Fisher Exact test				

In Table 12, the health outcome of participants is broken down household infrastructure. Of respondents with access to a bathroom, 61.5% reported at least one health problem, compared to 67.1% of respondents who do not have access to a bathroom (p=0.761). There was no difference in health outcomes between respondents who have access to a latrine and who do not, with 67.6% and 66.4% reporting having at least one health problem, respectively (p=1.000). Similarly, no difference was found in health outcomes between respondents with indoor plumbing and without, with 66.9% and 64.3% reported at

least one problem, respectively (p=1.000). Regarding type of flooring in their home, respondents who's home contained a cement floor more frequently reported having at least one health problem (70.5%) than those who lived with wood flooring (59.7%), while all four participants who reported having earth or other type of flooring reported having at least one health problem. These differences were not found to be statistically significant (p=0.163).

While most respondents reported having some way to store water, 65.8% reported having at least one health problem, while all four participants who reporting having no way to store water reported health problems (p=0.302). In further exploring the type of water storage, a significant difference was found between respondents who have closable water bottles in their home and those that do not (p=0.029). 74.7% of respondents who do not have closable water bottles reported at least one health problem, compared to just 57.9% of respondents who do. While there was no statistical difference between the health outcomes of participants who have and do not have large water tanks to store water, 67.6% of respondents who do not have water tanks reported health problems, compared to 54.5% who do (p=0.508). Similarly, 80.0% of respondents who reported not having open water containers (buckets, bales, etc.) had at least one health problem, compared to 66.2% of respondents who do (p=0.665).

Table 12. Household infrastructure by health indicator

	None n(%)	At least one n(%)	Total n	p-value
Do you have a bathroom in your house?				0.761*
no	48 (32.9)	98 (67.1)	146	
yes	5 (38.5)	8 (61.5)	13	
Do you have access to a latrine at your house				1.000
no	41 (33.6)	81 (66.4)	122	
yes	12 (32.4)	25 (67.6)	37	
Does your house have water pipes				1.000*
no	48 (33.1)	97 (66.9)	145	
yes	5 (35.7)	9 (64.3)	14	
what type of floor does your home have?				0.163*
wood floor	27 (40.3)	40 (59.7)	67	
cement floor	26 (29.5)	62 (70.5)	88	
earth/other	0 (0.0)	4 (100.0)	4	

Do you have a way to store water				0.302*
no	0 (0.0)	4 (100.0)	4	
yes	53 (34.2)	102 (65.8)	155	
Do you have water tanks in your home?				0.508*
no	48 (32.4)	100 (67.6)	148	
yes	5 (45.5)	6 (54.5)	11	
Do you have sealable water bottles in your home?				0.029
no	21 (25.3)	62 (74.7)	83	
yes	32 (42.1)	44 (57.9)	76	
Do you have open water containers in your home?				0.665
no	1 (20.0)	4 (80.0)	5	
yes	52 (33.8)	102 (66.2)	154	
*Fisher Exact test				

Table 13 compares health indicators between different defecation habits. The most significant difference was found in those who defecate outside, where 71.4% of participants who regularly defecate outside had at least one health problem, contrasted with only 48.5% of those who rarely do (p=0.021). Of participants who rarely defecate in a latrine or improved site, 68.0% reported at least one health problem, compared to 64.4% of those who regularly use an improved site (p=0.728). While most respondents reported regularly urinating outside, 67.8% reported health problems, compared to 50.0% of respondents who rarely do so (p=0.303).

Table 13. Defecation behavior by health indicator

	None n(%)	**At least one n(%)**	**Total n**	**p-value**
How frequently do you defecate outside?				0.021
Never/only cases of emergency	17 (51.5)	16 (48.5)	33	
Regular/daily use	36 (28.6)	90 (71.4)	126	
How frequently do you defecate in a latrine				0.728
Never/only in cases of emergency	32 (32.0)	68 (68.0)	100	
Regular/daily use	21 (35.6)	38 (64.4)	59	
How frequently do you urinate outside				0.303*

Never/only in emergencies	5 (50.0)	5 (50.0)	10	
Regular/daily use	48 (32.2)	101 (67.8)	149	
*Fisher Exact Test				

In comparing the health indicators with different clothes washing habits, as shown in table 14, significant differences were found in the primary location to wash clothes (p=0.021). Of respondents who reported using natural sources of water as the primary location to wash clothes, 79.4% reported at least one health problem in the last month. In comparison, those who used the public clothes station or other locations reported having fewer health problems, 57.5% and 60.9% respectively. Regarding clothes washing frequency, those who washed clothes several times per week reported the most health problems, 68.3% reported at least one problem in the past month, followed 63.6% of those who washed clothes daily, and 59.1% of those who washed clothes several times per month (p=0.738).

Table 14. Clothes washing behavior by health indicator

	None n(%)	**At least one n(%)**	**Total n**	**p-value**
Primary clothes washing site				0.021
Natural source of water (river, stream, valley)	13 (20.6)	50 (79.4)	63	
Public clothes washing site	31 (42.5)	42 (57.5)	73	
Private property/other	9 (39.1)	14 (60.9)	23	
With what frequency do you wash clothes				0.738
Everyday	4 (36.4)	7 (63.6)	11	
Several times per week	40 (31.7)	86 (68.3)	126	
Several times per month	9 (40.9)	13 (59.1)	22	
*Fisher Exact Test				

Table 15 compares the frequencies of the occurrence of at least one health problem by categories of hygiene related behaviors of participants. Of respondents who wash their hands before eating, 65.5% reported at least one health problem in the past month, compared to 75.0% of respondents who reported rarely doing so (p=0.458). Similarly, 65.0% of respondents who regularly washing their hands after defecating and urinating reported health

problems in the past month, compared to 76.2% of those who rarely do so (p=0.337). When health outcomes are compared to the usage of soap when handwashing, those who regularly use soap reported fewer health problems in the past month than those who rarely do so, 62.0% compared to 75.5% (p=0.105).

Table 15. Hygiene behavior of participants by health indicator				
	Never n(%)	**At least one n(%)**	**Total n**	**p-value**
ever reuse the water from the washbasin				0.400
Yes	23 (29.9)	54 (70.1)	77	
No	30 (37.0)	51 (63.0)	81	
ever walk barefoot outside your home				0.379
Yes	32 (30.8)	72 (69.2)	104	
No	21 (38.2)	34 (61.8)	55	
peel fruit and vegetables before consuming?				0.498
Yes	51 (34.2)	98 (65.8)	149	
No	2 (20.0)	8 (80.0)	10	
Wash fruits and vegetables before consuming				0.192
Yes	50 (35.0)	93 (65.0)	143	
No	3 (18.8)	13 (81.3)	16	
wash your hands before eating?				0.458
Yes	48 (34.5)	91 (65.5)	139	
No	5 (25.0)	15 (75.0)	20	
wash your hands after defecating or urinating?				0.337
Yes	48 (35.0)	89 (65.0)	137	
No	5 (23.8)	16 (76.2)	21	
use soap when washing your hands?				0.105
Yes	41 (38.0)	67 (62.0)	108	
No	12 (24.5)	37 (75.5)	49	
*Fisher Exact Test				

Table 16 compares the frequency of total health indicators by the water usage habits of participants. Perhaps the most interesting result is the difference in health outcomes between those who use natural sources of water to drink. Of respondents who reported never

using natural sources for drinking water, 57.7% reported at least one health problem in the past month. Conversely, 83.6% of respondents who regularly use such sources for drinking water reported at least one health problem (p=0.001). Regarding use of natural sources for other uses (such as cooking and cleaning), 58.4% of those who rarely or never did so reported health problems in the past month, compared to 81% of those who reported regularly using these untreated sources for other uses (p=0.005). With respect to the most common combinations of water usage, the health outcomes were compared against participants who reported using all water available for all uses, those who only use treated water, and those who use all water for all uses but only drink treated water. 89.7% of respondent who reported using all available sources reported at least one health problem in the month, compared to 59.2% of those who did not (p< 0.001). Of respondents who only used improved sources of water for both drinking and other uses, 56.8% reported health problems in the past month, in comparison to 78.9% of respondents who did not (p<0.001). There was no significant difference between respondents who use all sources of water to cook but only drink treated water, and those who only did not.

Table 16. Health indicator by water usage of participants

	None n(%)	**At least one n(%)**	**Total n**	**p-value**
Use public system for drinking water				1.000
Never/only in cases of emergency	0 (0.0)	1 (100.0)	1	
Regular/daily use	53 (33.5)	105 (66.5)	158	
use treated water for other uses (cooking, cleaning)				0.664*
Never/only in cases of emergency	1 (16.7)	5 (83.3)	6	
Regular/daily use	52 (34.0)	101 (66.0)	153	
use natural sources (river, streams) for drinking water				0.001
Never/only in cases of emergency	44 (42.3)	60 (57.7)	104	
Regular/daily use	9 (16.4)	46 (83.6)	55	
use natural sources (river, streams) for other uses (cooking, cleaning)				0.005

Never/only in cases of emergency	42 (41.6)	59 (58.4)	101	
Regular/daily use	11 (19.0)	47 (81.0)	58	
Use all sources of water available for all uses				<0.001
Yes	4 (10.3)	35 (89.7)	39	
No	49 (40.8)	71 (59.2)	120	
Use only improved sources of water for all uses				0.003
Yes	38 (43.2)	50 (56.8)	88	
No	15 (21.1)	56 (78.9)	71	
Use all sources of water for other uses, only use treated water to drink				0.554*
Yes	6 (42.9)	8 (57.1)		
No	47 (32.4)	98 (67.6)		
*Fisher Exact Test				

Table 17 outlines the difference in health indicator by respondent's perception of their public infrastructure. Of participants who viewed the public water system as negative, 80.0% reported at least one health problem, compared to 64.2% of those who viewed the system positively, and 57.1% who found it adequate (p=0.126). Regarding their perception of the public clothes washing station, 62.1% of those who viewed the station negatively reported problems, 65.4% of those who viewed it positively reported problems, and 76.6% of those who felt the system adequate reported health problems in the past month (p=0.268). Finally, of participants who had access to a latrine, 72.6% who held a positive perception of the public latrine reported health problems, compared to 63.2% of those who felt the latrine adequate, and all six respondents (100%) who held positive views of the public latrine reported problems in the past month (p=0.239)

Table 18 compares the health indicators of participants with the reported distance of their home from various public improvements. Most of the variables did not return statistically significant differences, with the exception being reported distance from the participants home to the community clothes washing station. For this variable, 73.4% of respondents living within 2 minutes walking reported health problems, followed by 52.2%

of respondents living between 2-5 minutes walking, 78.3% of respondents living between 5-10 minutes walking, and 62.5% of respondents living over 10 minutes away (p=0.058).

Table 17. Perception of public infrastructure by health indicator				
	None n(%)	**At least one n(%)**	**Total n**	**p-value**
public water system				0.126
perceived as negative	7 (20.0)	28 (80.0)	35	
perceived as adequate	12 (42.9)	16 (57.1)	28	
Perceived as positive	34 (35.8)	61 (64.2)	95	
quality of clothes washing				0.268
negative	22 (37.9)	36 (62.1)	58	
adequate	11 (23.4)	36 (76.6)	47	
positive	18 (34.6)	34 (65.4)	52	
quality of public Latrine				0.239*
negative	20 (27.4)	53 (72.6)	73	
adequate	7 (36.8)	12 (63.2)	19	
positive	0 (0.0)	6 (100.0)	6	
*Fisher Exact Test				

Table 18. Distance from public infrastructure by health indicator				
	None n(%)	**At least one n(%)**	**Total n**	**p-value**
distance to public water system				1.000
<2 Minutes	33 (34.0)	64 (66.0)	97	
2-5 minutes	12 (32.4)	25 (67.6)	37	
5-10 minutes	5 (33.3)	10 (66.7)	15	
>10 minutes	3 (33.3)	6 (66.7)	9	
distance to natural source of water				0.785*
<2 Minutes	3 (42.9)	4 (57.1)	7	
2-5 minutes	6 (33.3)	12 (66.7)	18	
5-10 minutes	8 (26.7)	22 (73.3)	30	
>10 minutes	19 (35.2)	35 (64.8)	54	
distance to public washing station				0.058

<2 Minutes	21 (26.6)	58 (73.4)	79	
2-5 minutes	22 (47.8)	24 (52.2)	46	
5-10 minutes	5 (21.7)	18 (78.3)	23	
>10 minutes	3 (37.5)	5 (62.5)	8	
Distance to public Latrine				0.318
<2 Minutes	15 (24.6)	46 (75.4)	61	
2-5 minutes	6 (25.0)	18 (75.0)	24	
5-10 minutes	4 (57.1)	3 (42.9)	7	
>10 minutes	1 (20.0)	4 (80.0)	5	
*Fisher Exact Test				

4.3 Binary logistic regression model

To maintain the model uncluttered, and to remove any instabilities, certain variables were grouped to make them binary. Profession was grouped into two categories; agriculture related, and non-agriculture related. Education level was grouped into Secondary and above, and primary and below. The primary clothes washing location was condensed to the following two categories; natural source (river, stream) and improved location (public washing facility, at home, etc.).

Table 19 shows the binary logistic regression model treating the sample showed several interesting variables. The Hosmer and Lemeshow Test returned a value of p=0.449, suggesting the model is valid and explaining the variation, with a Nagelkerke R Squared value of 0.284. The variables in the model that were found to be significant or interesting included Village (p=0.042), the presence of closable water bottles for storage (p=0.051), and the use of natural sources of water for other purposes (p=0.017).

While further exploring the model, we can see the adjusted Odds Ratio (OR-adj), or the strength of association that each variable carries with regards to health problems. When looking more closely at the community differences, respondents from Plancas were nearly 12 times more likely to experience health issues than respondents from Canavial, while controlling for other variables (OR-adj=12.607). Similarly, respondents from Ilheu were just under 7 times more likely to experience health issues, compared to participants from Canavial

when controlling form other variables (OR-adj=5.851). The use of closable water bottles for storage was also a protecting factor, with respondents who did not have such storage were 2.24 times more likely to have health problems (OR-adj=0.448). Other significant variables in the univariate analysis included in previous tables were no longer significant in this fitted model, and therefore excluded.

Table 19: Association with health problems—significance and odds-ratios with the 95% confidence intervals (95%C.I.), obtained by binary logistic regression (OR adj) models for all significant variables

	p-value	OR-adj	95% CI
Gender			
Male[a]			
Female	0.667	0.822	0.335-2.012
Age	0.073	1.027	0.998-1.057
Village	0.042		
Canavial[a]			
Plancas	0.012	12.607	1.738-91.425
Ilheu	0.055	5.851	0.960-35.672
Household Size	0.112		
1[a]			
2-4	0.197	0.451	0.135-1.512
5-7	0.579	1.439	0.398-5.196
8+	0.520	0.555	0.092-3.332
Profession			
Not agriculture related[a]			
Agriculture related	0.695	0.810	0.283-2.321
Education			
Secondary or above[a]			
Primary or no education	0.188	0.508	0.186-1.391
Presence of sealable water bottles in home			
No[a]			
yes	0.051	0.448	0.200-1.003
Frequency of defecating outside			
Never/emergency			
Regular/daily	0.199	2.015	0.693-5.860
Primary clothes washing location			

Improved locations			
Natural sources (river, streams)	0.111	3.590	0.746-17.280
Using natural sources of water for drinking			
Never/only in emergency[a]			
Regular/daily use	0.185	2.203	0.685-7.081
Using natural sources of water for other			
Never/only in emergency[a]			
Regular/daily	0.017	4.563	1.318-15.791

To further remove any instability, certain variables were removed. Size of home, frequency of outdoor defecation, the use of all sources of water for all uses, and the use of all sources of water except for drinking. Removing these variables left some sociodemographic variables of interest, such as profession, education level, and gender. Also left were targeted variables of interest with smaller confidence intervals. The new adjusted model, seen in table 20, the Nagelkerke R squared value was 0.230, and the Hosmer and Lemeshow Test returned a value of 0.230. Here the variables found to be significant were “village” (p=0.025), “presence of sealable water bottles in the home” (p=0.043), “primary clothes washing location” (p=0.037), “use of natural sources of water for drinking” (p=0.045), and “use of natural sources of water for other uses” (p=0.054).

The new adjusted odds ratio for this model showed similar results. The presence of sealable water bottles in the home was found to be a protective variable, with participants that reported having such water storage less than half as likely to have health issues in the past year (OR-adj=0.453). Using the river or other natural sources to clean clothes was found to be a risk factor, with such participants just under five times more likely to have health problems in the past month (OR-adj=4.913). Both uses of natural sources of water, for drinking and for other uses (cooking and cleaning) were considered risk factors, although only the practice of using natural sources for drinking water was determined as statistically significant. Participants who reported using natural sources to drink were over three times as likely to have health problems in the past year (OR-adj=3.076), and participants who used

such sources for other uses were similarly at higher risk than those that do not (OR-adj=3.127).

Table 20: Association with health problems—significance and odds-ratios with the 95% confidence intervals (95%C.I.), obtained by binary logistic regression (OR adj) models for select variables.			
	p-value	**OR-adj**	**95% CI**
Gender			
Male[a]			
Female	0.554	0.783	0.348-1.760
Age	0.211	1.017	0.990-1.045
Village	0.025		
Canavial[a]			
Plancas	0.007	13.980	2.073-94.279
Ilheu	0.038	6.501	1.109-38.114
Profession			
Not agriculture related[a]			
Agriculture related	0.840	1.107	0.413-2.969
Education			
Secondary or above[a]			
Primary or no education	0.346	0.643	0.257-1.611
Presence of sealable water bottles in home			
No[a]			
yes	0.043	0.453	0.210-0.975
Primary clothes washing location			
Improved location			
Natural sources (river, streams)	0.037	4.913	1.104-21.856
Using natural sources of water for drinking			
Never/only in emergency[a]			
Regular/daily use	0.045	3.076	1.027-9.219
Using natural sources of water for other uses			
Never/only in emergency[a]			
Regular/daily	0.054	3.127	0.981-9.971

The sample was then split by gender and the original model run once again, with the aim of seeing if the same variables explain the variation in health issues for each gender. The

results are illustrated in Table 21. For the male model, the Hosmer and Lemeshow test returned a value of p=0.076, and a Nagelkerke R squared value of 0.349. In this model, there were no significant variables found besides age (p=0.049). The female model returned a value of p=0.117 for the Hosmer and Lemeshow Test, and a Nagelkerke R squared value of 0.296. In this model, the only significant variable found was that of using natural sources of water for other purposes (p=0.040). Female participants who used this water for other purposed (such as cooking and cleaning) were over 5 times more likely to have health problems than females that did not (OR-adj=5.764).

Table 21: Association with health problems—significance and odds-ratios with the 95% confidence intervals (95%C.I.), obtained by binary logistic regression (OR adj) models for all significant variables BY GENDER

	Male			Female		
	p-value	**OR-adj**	**95% CI**	**p-value**	**OR-adj**	**95%CI**
Age	0.049	1.053	1.000-1.109	0.593	1.012	0.969-1.056
Village	0.186			0.176		
Canavial[a]						
Plancas	0.080	11.415	0.745-174.863	0.069	19.164	0.797-460.621
Ilheu	0.389	2.883	0.259-32.057	0.077	13.780	0.753-252.047
Household Size	0.531			0.245		
1						
2-4	0.224	0.338	0.059-1.939	0.800	0.750	0.081-6.926
5-7	0.999	0.999	0.143-6.964	0.405	2.735	0.256-29.197
8+	0.529	0.415	0.027-6.392	0.929	0.879	0.051-15.037
Profession						
Not agriculture related[a]						
Agricultur e related	0.752	0.770	0.153-3.879	0.764	0.788	0.167-3.726
Education						
Secondary or above[a]						
Primary or no education	0.327	0.469	0.103-2.129	0.587	0.656	0.144-2.998

Presence of sealable water bottles in home						
No[a]						
yes	0.179	0.353	0.077-1.615	0.231	0.496	0.157-1.563
Frequency of defecating outside						
Never/emergency[a]						
Regular/daily	0.654	0.646	0.096-4.362	0.155	2.921	0.667-12.791
Primary clothes washing location						
Improved locations[a]						
Natural sources (river, streams)	0.212	3.955	0.456-34.276	0.218	5.005	0.586-64.813
Using natural sources of water for drinking						
Never/only in emergency[a]						
Regular/daily use	0.276	3.159	0.399-25.017	0.529	1.727	0.315-9.478
Using natural sources of water for other						
Never/only in emergency[a]						
Regular/daily	0.190	4.316	0.485-38.394	0.040	5.764	1.083-30.678

4.4 Log Linear analysis

To complement our understanding of which variables are statistically associated with health problems, we explored the statistically significant variables further to determine which, if any, outside factors influence their use. The variables taken for further examination were: “Primary location of clothes washing”, “use of natural sources of water for drinking”, and “use of natural sources of water for other uses”.

Regarding the primary location of clothes washing, the hope was to consider if any outside factors, such as community association or distance from improvements, are associated with participants decision to use improvements or natural sources to clean clothes. We used a log linear model and included the location of clothes washing, as well as three variables related to community association and social adhesion: the frequency of problems between community members, the respondents perception of adherence to community rules, and the respondents opinion on how well represented and serviced their community is. Annex C shows the partial associations between these variables. While there were no three-way associations, there was statistical significance found between the primary location of clothes washing and frequency of problems ($p=0.016$), as well as between location of clothes washing and community approval ($p=0.022$). There was no association between location of clothes washing and respondent’s perception of adherence to community rules.

A separate model was developed to see if any relationship existed between the distance from the respondent’s home to the improvement and natural source, and their primary location to clean clothes. Annex C table 3 shows the partial association table, which demonstrates that both variables, distance from home to natural source as well as distance from home to improved source, are associated with the primary location to clean clothes. But further examination into the specific distribution of responses show unclear results. Annex C table 4 shows that as the distance from the natural source increases, the more respondents who use the natural source to clean clothes. This further examination suggests that while an association may exist, it is not well defined and clear cut.

Regarding the use of natural sources of water for both drinking and other uses, we considered the impact of distance between the home and the natural source of water, as well as the distance between the home and the source of improved water. We did not find any statistically significant associations between these two variables and the use of natural sources of water for both drinking and other (domestic) uses, as shown in Annex C table 5.

5. Discussion

The results of this study offer an interesting perspective on many aspects of the rural communities of São Tomé, including: the communities' sociodemographic make up, the existence of various types of infrastructure related to hygiene and water management, the health profile of the inhabitants, and how these community members utilize the extant infrastructure, for better or for worse. By analyzing these reported factors and comparing them to the self-reported health outcomes, the results allow us an opportunity to identify critical habits that either increase or decrease the risk of incurring health problems in the future. Figure 5 below illustrates the various objectives of the study, and their relationships with one another. The following discussion reviews the results of the analyses, followed by a discussion of the results within the scope of the objectives.

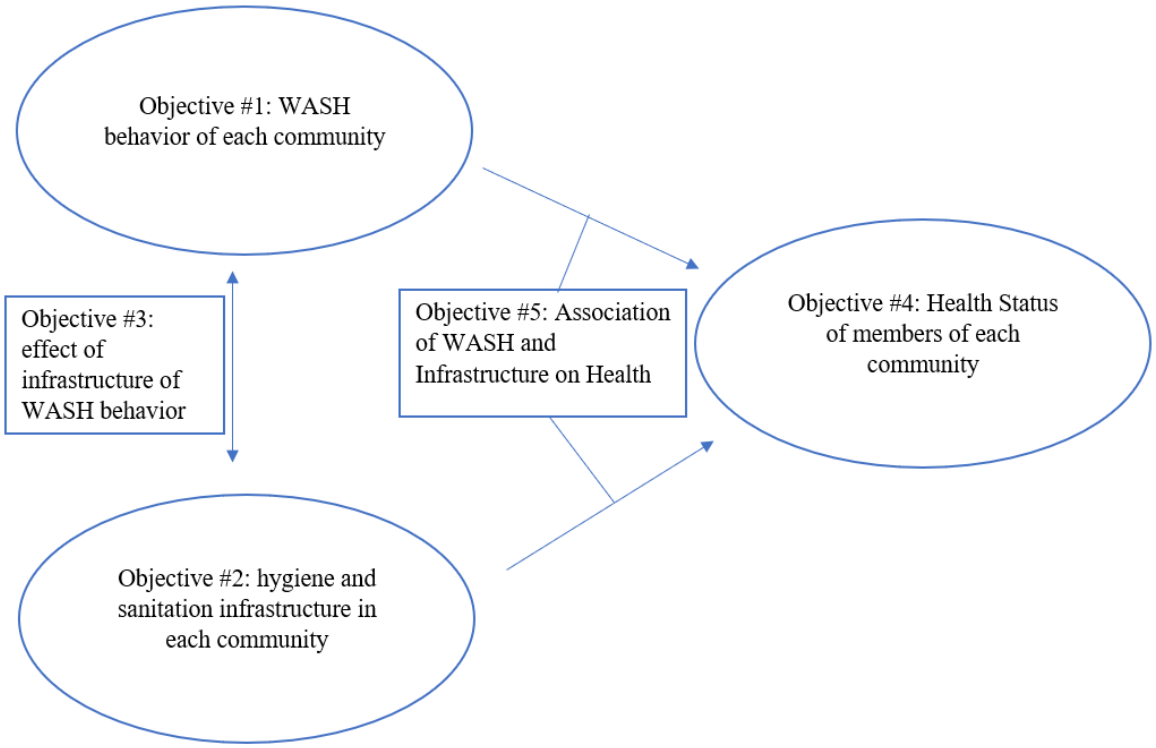

Figure 5: Schematic map of the study objectives.

5.1 Discussion of community differences

5.1.1 Sociodemographic variables

The sample, with a mean age of 40.1 years and a median of 37, is above the national average of São Tomé. National statistics show the country has a median age of 18.2 years. This difference from the national median is primarily a result of the parameters of the study, which excluded all participants younger than 18. But it may also reflect the changing demographics of the rural communities. According to the 2019 estimate, 70% of the nation's population lives in an urban setting("Sao Tome & Principe Population (2019) - Worldometers" 2019). This study demonstrates a weak trend in which the more rural (and distant) the communities have an older the median age. Currently there is little information available on urbanization in São Tomé e Príncipe, but urbanization is a common trend seen across sub-Saharan Africa, with large effects on the population's health and nutritional well-being(Kuate Defo 2014). Further research is required to understand which migration trends are occurring in São Tomé e Príncipe, and which age groups and peoples are being most affected.

In the sample, 54.0% of respondents reported being single, and 42.2 reported being married or in a domestic union. These values differ greatly from the reported national statistics, which state that 92.0% of the population over 12 is single (Cardoso 2016). This elevated value of unmarried adults lies in stark contrast with the number of respondents cohabitating and living with children. Only 15.4% of the sample reported living alone, and 28.6% without children in the home. While the exact proportion of these cohabitations that are romantic in nature and the number of children in the household that are biologically theirs are unknown, these results are in keeping with reported phenomena in many parts of Africa. The concept of cohabitating and having children out of wedlock is common in similar countries such as Cabo Verde, where marriage rates among parents are far lower than fertility rates (Massart 2013). Regarding education and employment rates across the communities, a trend of more education to less follows the more urban to rural gradient. In Plancas, there are the lowest education levels, and highest reported proportion of agriculture related work. Canavial has fewer reported agriculture workers and higher literary levels, while Ilheu has both the highest literary levels and fewest respondents in the agricultural sector. Interestingly,

Ilheu also reported the highest number of unemployed compared to fewer in Canavial and none in Plancas. This follows our understanding of the continued importance of agriculture in the historical communities, compared to the newer and more varied peri-urban settlements like Ilheu. With the importance of agriculture and the cultivation of Cacao in Plancas, all members of the community occasionally aid in cultivation, whether full time or not. Given this context, few if any individuals would define themselves as unemployed, even if they would qualify as such in other communities.

5.1.2. Household and community infrastructure

Regarding the household infrastructure, the number of bathrooms and latrines in each community varied from the reported national statistic. In data collected in 2012, and reported in 2016, the national statistics reported no functioning bathrooms in either Canavial or Plancas, and only one in Ilheu. The results of the study show 5 bathrooms in Canavial, and 8 in Ilheu, and still none in Plancas. Similarly, the national statistics for latrines reported 6 in Canavial, 1 in Plancas, and 30 in Ilheu. Our data now show 4 in Canavial, 11 in Plancas, and 23 in Ilheu. The decrease in Canavial and Ilheu can be explained either by improvements falling into states of disrepair, or a failure to interview the homes with access to latrines. The presence of several abandoned and out of order latrines in all three communities leads to opinion of this researcher to support the former explanation. The lack of maintenance of infrastructure, either by international organizations or the government, was a reoccurring theme throughout the data collection process. This idea is supported by research

Figure 6: three latrines in Plancas in disrepair and unused.

on latrines in sub Saharan Africa, that shows a failure of follow up, maintenance, and cleaning of latrines leading to their inoperability (archiveglobal 2010; Nakagiri et al. 2016).

The type of flooring present in each household suggests the importance of a community's historical context on its present situation. The high proportion of cement floored homes in Canavial and Plancas may be explained by the communities use of colonial era apartments, as well as the transformation of other buildings into homes. These "comboio" style apartments, shown in figure 7, were built to meet the basic requirements of a home, with little to no extra features. In other examples, former storage rooms and hospitals were repurposed into homes. In contrast Ilheu, with little to no colonial history or remaining infrastructure, has a much higher proportion of wooden home built on stilts (such as the home in figure 8). Studies on the island have demonstrated that wooden constructions raised on stilts have fewer anopheles mosquitoes entering and taking blood meals, and therefore less risk of malaria and other vector borne illnesses (Charlwood et al.

Figure 7: Comboio style homes built in rows, with a canal behind.

Figure 8: example of newer home raised on stilts.

2003). This would suggest that these newer homes are conferring more protection on its residents than old cement style colonial homes. Furthermore, of the new cement home that are buying constructed, primarily in Ilheu, nearly all are being built by wealthier residents that are constructing the homes to keep most mosquitoes and other vectors out.

5.1.3 WASH behaviors of respondents

Considering the low frequency of latrines and bathrooms in the communities, the very high rates of defecation and urination are well explained. Despite the presence of public latrines in both Canavial and Plancas, both communities reported daily outdoor defecation of over 75% (85.7% and 75.5% respectively). This value suggests a significant failure of the public latrines to change defecation habits, or a failure in the residents to adopt these healthier habits. Respondents frequently cited insufficient maintenance, poor cleaning and upkeep, and insufficient water supply and why such shared latrines are unused. While lack of sufficient water was a common explanation, both reported by respondents and community leaders, as well as noted by researchers, other research suggests personal accountability as problematic to the success of shared latrines. Research suggests that as the number of user increases, the quality of the infrastructure sharply decreases (Simiyu et al. 2017). This continuing problem results in shared latrines being categorized as "unimproved latrines" by international organizations (Rheinländer 2015).

The site most used by respondents to wash clothes showed an interesting result, particularly in the context of the communities' histories. Respondents from Canavial most often used natural sources to wash clothes, in a nearby river as well as an irrigation channel with cemented sides. This site was used by the community during the colonial era, and continues to be the predominant site, despite the presence

Figure 9: irrigation channel used by residents of Canavial for domestic uses.

of a public washing station. Furthermore, community members cited insufficient treated water as why the river was used over the public laundry site.

Ilheu, as a more recent development that has steady access to both a river and water, had more varied results. The use of a nearby river was a minority in comparison to private property and the public station. But despite this, the use of the river by some individuals may be favored as a result of poor conditions in the public washing stations, as illustrated in figure 10, or limited space.

Figure 10: damaged washing station in Ilheu, rendering 2 sinks inoperable.

Finally, Plancas, situated in the mountain with no nearby river or streams, relied on the treated spring water pumped into the public station for all uses. This also mirrors the community's historical habits of relying solely on the nearby spring water for all its needs. This link between the communities' colonial history and present situation remains, and merits further investigation.

The reuse of washbasin water differed across the communities. It was most common in Canavial, where consistent water supply is infrequent, and least common in Ilheu that has both consistent and proximate treated water sources. This result is consistent with the reasoning that having less access to water forces the community members to make compromises to bridge the gap between their needs and what they have, at the expense of healthier behaviors. This reality of low access to water calls into question the high response of handwashing in the communities. Over 85% of respondents across all three communities reported handwashing with soap before eating, and over 80% reported handwashing with soap after defecating. The lack of clean water and soap, as well as the absence of infrastructure to facilitate handwashing after defecating in open air locations, calls doubt to

the validity of this result. A likely explanation of this result may be response bias and social pressure on the respondents to claim handwashing occurs more regularly than in reality. This overreporting of handwashing is a common occurrence in research, and difficult to overcome, particularly in food related and feces related situations (Contzen, De Pasquale, and Mosler 2015).

The water usage results by community also suggest weaknesses in the water system, primarily in Canavial. Both Plancas and Ilheu had over 95% daily usage of treated water both to drink and for other uses. In Canavial, the proportion was just over 80% for drinking, and less than 60% for other uses. The most common explanation given was the lack of consistent water supply to the one fountain in the community. Respondents claimed the water ran one day every four days, and water storage was inadequate to last until the water returned. Conversely, respondents from Canavial were the only respondents to report consistent use of natural sources (rivers, streams, valleys) for both drinking and other uses. This practice, which has been associated with more reported health problems in the past month, should be the focus of government and nongovernmental organizations to eliminate.

5.1.4 Health indicators by community

While there was no significant difference between communities for reported cases of diarrhea in the last month, 11.2% of the total sample reported at least one episode in the last month. Unfortunately, little data is collected on instances of adult diarrheal diseases, despite the significant morbidity and mortality caused. Most research focuses on the impact of diarrheal diseases on children under five, as diarrheal diseases have a disproportionate impact on this age group (GBD Diarrhoeal Diseases Collaborators 2017). The estimates that exist for adults suggest an incidence rate in the range of 29.9 episodes per 100 person-years to 88.4 episodes per 100 person years (Walker and Black 2010), but it is not possible to compare our findings with these estimates, because of the lack of a temporal element in our study. The lack of present studies on the prevalence, etiology, and impact of adult diarrheal disease highlights the need of additional studies and perspectives, to better understand and combat the impact of diarrheal diseases (Fischer Walker, Sack, and Black 2010).

With regards to episodes of fever in the past month, there were statistically significant differences between the communities. Canavial suffered the highest proportion of fever, followed by Plancas, and then Ilheu. These differences could be interpreted in many ways. Research has demonstrated a link between poverty and febrile illness, both at the macro level and at the individual and household level (Novignon and Nonvignon 2012). Our socio-demographic results, as well as national statistics confirm that Canavial and Plancas population work primarily in the primary sector, compared to the tertiary sector work of the residents of Ilheu. As a more economically vulnerable part of society, those working in agriculture are also a more regularly exposed to pathogens whose infection would result in fever. Another plausible explanation may be the source of drinking water and location of clothes washing. As pointed out by the regression model, using water from natural sources for either drinking or other uses, as well as washing clothes in the river, was positively associated with having health problems. Canavial reported the highest proportion of residents participating in both potential risk factors, which would serve well to explain the elevated rates of fever and diarrhea compared to the other communities. Regarding blood in feces and hematuria in men, there was little to no variation among the communities. With a prevalence of 5.6%, blood in feces can be a symptom of various problems, from gastrointestinal infections to hemorrhoids to sexually transmitted infections, but does not seem to be particularly associated with any community or risk factor. Similarly, the prevalence of reported hematuria in men is around 4% of the total sample. Hematuria is not imminently dangerous, and generally a symptom of an underlying infection or renal disease, and therefore statistics are not closely kept. However, in a literature review involving hematuria, researchers estimate the worldwide prevalence to be around 4-5% in routine clinical practice, and therefore our reported statistic would fall within global estimates of hematuria (Bolenz et al. 2018).

The elevated proportion of reported injuries in the past week can also be explained at least in part by the difference in primary profession of each community. Plancas, with its nearly exclusively agricultural residents, reported the highest number of injuries suffered in the past two weeks. Agricultural work has been well understood to be a more hazardous occupation, especially when compared to other secondary and tertiary sector jobs(Bhattarai

et al. 2016). While most of the injuries were minor lacerations, more dangerous is how the participants clean and treat these wounds. In addition to reporting the highest rate of injuries, Plancas also reported the lowest number of visits to the clinic or health center in the past two weeks. The implication here is that most individuals in Plancas either do not treat, or treat injuries from home, increasing the risk of infections at the injury site, such as cellulitis. Through September 2018, there have been 2915 reported cases of cellulitis across the island, in many communities with similar characteristics to Plancas ("Weekly Bulletin on Outbreaks and Other Emergencies" 2018). Better understanding the decision-making process of individuals with regards to seeking treatment for injuries is an important step to ensuring proper care, and to avoid allowing for the conditions that gave rise to this disease outbreak.

5.2 Discussion of health outcome by other variables

Regarding the association between age group and health indicator, no discernable pattern was found. It was hypothesized that as age increased, reported health problems would also increase. In practice we found participants aged 35-44 had the highest proportion of reported health problems, at nearly 82%. There are various explanations that could account for this finding. The problems could be a result of increased exposure, particularly as the working age population has more exposure to potential health problems via working and daily chores. This result could also be explained by the higher levels of stress experienced by adults in this age group, translating to increased health problems. Studies estimate the peak productivity to occur at around 40 years old, where individuals also have the highest number of commitments, familial professional or otherwise (Population 2012). Increased commitments and productivity can easily translate to increased stress and health problems, as outlined in research that outlines the impacts of stress on older individuals (Radley et al. 2011; Schneiderman, Ironson, and Siegel 2005). Further research would be needed to understand the impact of ageing on health, particularly in developing countries in Africa ("Ageing and Health" 2018).

The lack of significance between the presence of latrines and bathrooms in the home and health indicators was also an interesting result. It was hypothesized that respondents with

access to these improvements would be less at risk for contracting hygiene related infections, and therefore demonstrate better health outcomes. But that was not the case, as there was no discernable difference in health outcome. One possible explanation to this result is the overall high proportion of open-air defecation present in these communities increasing the risk of contamination to all members. With this hypothesis, the risk of infection as a result of outdoor defecation is already elevated, and the few individuals who use a latrine are thus equally at risk for these hygiene related illnesses. Yet research to confirm or deny this hypothesis was not found. Another possibility to explain this result is the possible water contamination as a result of the open air defecation. If a high proportion of individuals are defecating in the open, and the feces contaminates the water supply, then more individuals would be getting sick in the community regardless of their individual hygiene practices. To confirm this idea, water testing for pathogenic *E. coli* and other pathogens would be necessary. Another explanation may be that health outcomes are more associated with other factors, such as water usage (as seen in the regression model), than latrine use.

There was no statistical difference between type of house flooring and health outcomes. A trend did exist where those who reported having a cemented home did have higher reported health problems than those who reported a wood floor, 70.5% to 59.7%, but the difference was no significant. Again, this could be a result of other factors having a larger impact on health. Another hypothesis could be that since the malaria has been nearly eradicated on the islands, the impact of vector borne diseases on health has been diminished. But this explanation fails to account for the other vector borne diseases that persist on the island, namely lymphatic filariasis (“Sao Tome and Principe” 2015b).

Perhaps the most interesting result concerning not significant associations, there was little association between the reuse of washbasin water and higher health problems in the past month. Several hypothesizes have been suggested to explain this result. Firstly, poor water storage, as seen in open buckets sitting for long periods of time, may contaminate the water before it is used. In this scenario, the reuse of the water would not augment the risk for infections, since the water is already contaminated. Another possible explanation is poor water quality in the public system already impacts the efficacy of handwashing, negating the

risk from reusing water. Finally, improper handwashing technique or not using soap could also impact the efficacy of handwashing and reusing washbasin water. Despite the high reported rate of handwashing with soap, overreporting positive behavior is a common occurrence in research that can invalidate such results (Contzen, De Pasquale, and Mosler 2015). Further research into the effects of reusing washbasin water is necessary, particularly in São Tomé e Príncipe

5.3 Discussion of Logistic Regression Model

With regards to the regression model, there are several interesting results to discuss. The R squared value of 0.227 suggests that while the model is valid, not all the variation seen in the results is explained by the model. Certain instabilities seen by very large confidence intervals suggests that while certain conclusions may be valid, further work may be necessary to confirm the associations found. After controlling for the other variables, our model suggests that inhabitants of Plancas are over 15 times more likely to have health problems in the last month than inhabitants of Canavial. Similarly, inhabitants of Ilheu or nearly 8 times more likely than inhabitants of Canavial to report health problems in the last month. But the confidence intervals vary widely, from as low as 1.3 to as high as 101.284. This suggests that there is uncertainty in this result and making a definitive conclusion would be difficult.

There was also no association between gender, education, and profession and different reported health problems in the past month. We hypothesized that those in agricultural related professions, and those with fewer literary abilities would suffer from more health problems, either as a result of their profession or a link between education and socioeconomic status. This result suggests that when controlling for other variables, the workplace risks of agriculture do not have a substantial impact on health.

The presence of sealable water bottle in the home was found to be significantly associated with fewer health issues in the past month. According to the model, participants with closable water storage were 2.25 times less likely to have health issues. This result confirms what is already well understood with regards to maintaining household-stored water clean. Studies in Ethiopia have when drinking water is stored at the home before

consumption, contamination is highly likely to occur (Chalchisa, Megersa, and Beyene 2017). The WHO recommends storing water in containers with narrow openings for filling and dispensing water ("WHO | Safe Household Water Storage" n.d.). By limiting the exposure of water to outside contaminants, the risk of contaminating the water and thus become sick when consumed is lowered. Here we have confirmed that safe water storage is both an important factor in maintaining good health, and problem in need of attention in these communities of São Tomé e Príncipe.

The use of the river to clean clothes was also identified as a significant risk factor. Compared to other improved locations, respondents who used the river to wash clothes were 5.3 times more likely to report health problems in the past month. While the confidence intervals for this value are large, this result is nonetheless problematic. The use of rivers for domestic purposes is a common occurrence, throughout São Tomé e Príncipe, as well as on continental Africa. This practice exposes people to various bacterial, protozoan, and helminthic infections. The use of infected water for domestic chores is noted as key exposure for infection with Schistosomiasis, according to the WHO ("Schistosomiasis Fact Sheet" 2019) (GBD 2015 Disease and Injury Incidence and Prevalence Collaborators 2016) (King, Dickman, and Tisch 2005). And while the water quality of these rivers has not been tested, research conducted in rural Botswana has identified that 100% of rivers tested were positive for fecal contamination and unsuitable for domestic use(Tubatsi, Bonyongo, and Gondwe 2015). The lack of effective waste management in rural communities of São Tomé e Príncipe leads this researcher to hypothesize the water to be of similar quality. The association between using the river for domestic uses and reported health problems supports the

hypothesis. The potential unsuitable quality of the river is compounded by the historic and cultural habit of these communities. It is common in these communities to use the river for domestic chores, and in many cases specific infrastructure has been built to incorporate the river into the system. Figure 11 illustrates where residents of Canavial go to wash clothes. Keeping in mind this context, further research to understand the quality of the river and the potential risks using it carries is important to prevent further waterborne illnesses.

Figure 11: A local stream used by residents of Ilheu for domestic uses, instead of improved facilities.

The question of poor water quality becomes more problematic when these natural sources of water are used for drinking, cooking, and cleaning. Using natural water for drinking was found associated with more reported health problems in the last month, and those who do use it to drink are over three times more likely to have health problems. Using natural sources for other uses, while not significant at the 0.05 level, was still an interesting result that merits mention. In effect, using natural sources (such as the river) for any purpose carries increased risk of illness. In the study done on water quality and diarrhea in Botswana, the use of untreated water was a significant predictor of diarrhea in participants(Tubatsi, Bonyongo, and Gondwe 2015). Both this result and that of using natural sources to clean clothes paints a picture of increased risk and illness associated with the untreated water of the river and highlights the need to test the water quality for both bacterial and protozoan infections.

Regarding the model in which the groups where split by gender, the differences in risk factors between men and women illustrates the different roles each gender plays in the community. Participants regularly cited that in São Tomé e Príncipe, the women oversee most of the domestic duties, such as cooking, cleaning clothes, organizing the household, and

even selling wares in the markets. This was also noted by the researchers while visiting the markets and various natural sources of water. In this social context, it follows that the female model would more strongly demonstrate the association between using natural sources of water for domestic chores and more health problems. With most male respondents unlikely to participate in these duties unless necessary, such associations would less likely show up.

5.4 Influencing factors

The goal of this section was to, after identifying the key factors associated with more health problems, to consider which variables influence these factors. This was done through a log-linear analysis, and we considered two groups of variables: community association and distance from the home of the improvements and natural sources of water. We did find that the use of the river for clothes washing was associated with more negative community association variables. The social aspect of improved sites to wash clothes may be an explanation to this finding. As noted by the researcher while in the field, the shared laundry space in the community was considered an important social space for the women of the community, where discussions of all topics related to the community occur. For a respondent who does not view the community as positively, or for one with a lower sense of community cohesion (the aspect of togetherness and bonding between members of a community), it follows that they would be more inclined to avoid these locations, and use natural sources to clean clothes and for domestic duties.

In this context, community association and cohesion were used to examine their impact on identified risk factors. But they also can be studied in their association with poorer health problems. In a study on social cohesion and health behaviors in two communities in Africa, those communities with more negative scores had higher rates of heavy drinking, multiple concurrent sexual partners, and increased rates of HIV/AIDS (Lippman et al. 2018). Considering the impact of this social context on risk factors, and further research that suggests its association with health behaviors, studying the impact of social cohesion on health outcomes in these rural communities of São Tomé may merit further study.

5.5 Discussing results in terms of objectives

The following section will consider the results in terms of each specific objective of the study, as well as the overall objective. Specific objective #1 was to characterize and compare the hygiene and sanitation (WASH) behavior of the members of each community. With respect to this objective, the study was for the most part successful. We gained a better understanding of where the inhabitants of these communities' members obtain and store water, both for drinking and domestic purposes. We also understood the extent to which these community members lack improved sources to defecate and urinate. In comparing the results of the communities, we were able to determine which community has the highest risk factors, particularly with regards to WASH practices. The biggest shortcoming in this objective was with regards to characterizing handwashing in the communities. High over-reporting of positive behaviors is a common bias in questionnaires and applied in this situation as well.

With respect to specific objective #2, we were successful and characterizing the hygiene and sanitation related infrastructure in each community, both at the community and household level. We were able to identify which communities had enough access to treated water and enough developed infrastructure for domestic chores. We also were able to understand what infrastructure exists at the household level. In comparing each community with each other, we saw the impact that the communities' histories have on the current conditions and infrastructures and identified which communities most lack public and private sanitation infrastructure.

Specific objective #3, to consider the efficacy of the improvements at changing WASH behavior, was perhaps the least accomplished objective. The hope was to compare each community's infrastructure and behaviors, and to explore if a link exists. Without an element of time to demonstrate a causal relationship, it is exceedingly difficult to say that any improvements changed WASH behaviors. The most we could expect to find was a large difference between the communities with respect to WASH behavior, that could be linked to that community's specific infrastructure context. But we found little statistical difference

between the communities WASH behaviors. In future studies, an intervention and study with an element of time are necessary to study this phenomenon.

The 4th specific objective was to characterize the health status of the community members, particularly with regards to the hygiene and water related illnesses. By focusing on self-reported symptoms instead of doing each specific test, we were able to quickly develop an understanding of the health profile of the communities. And while self-reporting such specifically subjective variables, like fever, diarrhea, stomach pain inserts a bias in the responses, the bias is systemic, applying to the entire sample and can be controlled by statistical models, particularly when searching for differences between the groups. In this regard, this measurement was still valid and allowed us to compare health outcomes in the past month with various variables of interest.

The 5th and final specific objective, to evaluate the association of WASH practices and household infrastructure on the studied health indicators, was also successful. By using both Chi Squared analysis and a logistic regression model, we were able to consider the impact of each variable on the collective reported health indicator, while controlling for the other variables. We found several interesting variables that were associated with reported health problems in the past month, as well as some variables that were interestingly not significantly associated.

6. Study limitations

The primary limitations to the results of this study spawn from the size of the sample and the impact of a foreign researcher present. The total sample size is only 163 participants, of a total estimated adult population of nearly 600 (Cardoso 2016). This small sample size decreases the statistical power of the study, limiting its ability to detect type 2 errors. Due to the small size of the communities, with 85-100 homes in each, it would preferable to apply the questionnaire to more as many people as possible. But the limited time available to conduct the surveys made coordinating with the finals home difficult. Certain homes in each community were sparingly occupied, or the residents spent little time at home or in the community. This phenomenon would also skew the results towards those participants who spend more time in the community. Visits to the community on two separate weekends and on one holiday were done to attempt to minimize this bias, but with little result. Another bias may be that of having a foreign researcher present during the application of the questionnaire. While the trained local research assistant help to build rapport with the participants, simply the presence of a foreigner in the room may affect the responses. Either through the participants over-reporting behaviors they feel desired by the researchers, or in the language used in the survey, this bias can be used to explain the very high reported rates of handwashing and use of soap by the participants, making it difficult to receive an accurate estimate as to the true rate of handwashing in these communities. The use of self-report data collected by questionnaire is also vulnerable to social desirability bias. With this bias, the results may be skewed towards practices considered acceptable in the community, allowing for some results to be more accurate (such as outdoor defecation, a common practice in most communities), and others not as accurate (such as handwashing, something considered acceptable but not as frequently done.

Lastly the use of a transversal study limits what conclusions can be drawn, and the extent to which the results can be considered conclusive. As with all cross-sectional studies, there is no time element of time involved in the study, and therefore causality cannot be established between infrastructure developments, WASH practices, and improved health. A

more appropriate explanation would be that the study has taken a snapshot of the infrastructure and WASH habits of the communities. While this is useful in establishing a better understanding the needs and conditions present, it is also possible that the timing of this snapshot may not necessarily be typical. Perhaps during the rainy season in São Tomé, people are more likely to use the river for domestic purposes, and by collecting the data during this period, we are incorrectly establishing this has normal behavior.

7. Conclusions

The results of this study present a unique perspective on the conditions of these rural communities in São Tomé e Príncipe. The study has allowed us to better understand what infrastructure exists how the residents use these infrastructures, and to gain a general idea of how these behaviors impact health. Five main conclusions can be drawn from the results of the study.

Firstly, the results of the study have illustrated the association between using natural sources of water, both for drinking and domestic chores, and illness. The study also indicated that a substantial number of residents from the community of Canavial use these waters regularly. Local sources generally attribute this problem shortcomings in the public water supply, suggesting stabilizing the water supply would yield substantial improvements. This problem in the community should be the focus of future improvements at the government level.

Secondly, we can reasonably conclude that the public infrastructure is not effective at changing the defecation habits. While this study was unable to demonstrate any association between presence (or lack) of public infrastructure and different WASH behaviors, the elevated levels of defecation, urination, and reuse of washbasin water suggests little use of the infrastructure. In both Plancas and Canavial, where public latrines exist, outdoor defecation and urination is still pervasive. An emphasis on developing and maintaining private latrines should be made in these communities, as well as further developing the access to treated water.

Thirdly, effective and clean water storage is lacking in many homes. This type of water storage can be defined as narrowed openings for filling and dispensing, ideally with closable tops. We have found an association between having this type of water storage and fewer health problems in the past month. Increasing the presence of this type of water storage would be a simple and cost-effective way to improve conditions in these communities and should be considered as the focus of an intervention either by government or nongovernmental institutions.

Fourthly, the colonial history of the communities of Plancas and Canavial seem to have a continued impact on the resident's lives, both in terms of behavior and in health. The members of these communities live in homes that are substantially different to the homes of non-colonial communities such as Ilheu. They participate in different professions, more tied to agriculture, and have different domestic behaviors. Further research, with an emphasis on understanding how the historical context of these rural communities impacts the current situation, may yield interesting results.

Finally, considering the associations between natural water sources and more health problems, more research is necessary to understand what aspect of these waters relates to these health problems. The lack of sanitation and waste management in these communities indicate it is possible to have fecal contamination, chemical contamination from waste runoff, as well as bacterial, viral, and protozoan pathogens in the water, all presenting increased risk to local communities.

8. References

"About WASH." 2016. UNICEF. April 10, 2016. https://www.unicef.org/wash/3942_3952.html.

"Ageing and Health." 2018. February 5, 2018. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health.

Alsan, Marcella M., Michael Westerhaus, Michael Herce, Koji Nakashima, and Paul E. Farmer. 2011. "Poverty, Global Health and Infectious Disease: Lessons from Haiti and Rwanda." *Infectious Disease Clinics of North America* 25 (3): 611–22. https://doi.org/10.1016/j.idc.2011.05.004.

Amartya Sen. 1999. *Development as Freedom*.

Anderson, Roy M., James E. Truscott, Rachel L. Pullan, Simon J. Brooker, and T. Deirdre Hollingsworth. 2013. "How Effective Is School-Based Deworming for the Community-Wide Control of Soil-Transmitted Helminths?" *PLoS Neglected Tropical Diseases* 7 (2). https://doi.org/10.1371/journal.pntd.0002027.

archiveglobal. 2010. "Pit Latrines: A Public Health Concern in Africa." *ARCHIVE Global* (blog). August 12, 2010. http://archiveglobal.org/pit-latrines-a-public-health-concern-in-africa/.

Bhattarai, Devendra, Suman Bahadur Singh, Dharanidhar Baral, Ram Bilakshan Sah, Shyam Sundar Budhathoki, and Paras K. Pokharel. 2016. "Work-Related Injuries among Farmers: A Cross-Sectional Study from Rural Nepal." *Journal of Occupational Medicine and Toxicology (London, England)* 11 (October). https://doi.org/10.1186/s12995-016-0137-2.

Boisson, Sophie, Dirk Engels, Bruce A. Gordon, Kate O. Medlicott, Maria P. Neira, Antonio Montresor, Anthony W. Solomon, and Yael Velleman. 2016. "Water, Sanitation and Hygiene for Accelerating and Sustaining Progress on Neglected Tropical Diseases: A New Global Strategy 2015-20." *International Health* 8 (Suppl 1): i19–21. https://doi.org/10.1093/inthealth/ihv073.

Bolenz, Christian, Bernd Schröppel, Andreas Eisenhardt, Bernd J. Schmitz-Dräger, and Marc-Oliver Grimm. 2018. "The Investigation of Hematuria." *Deutsches Ärzteblatt International* 115 (48): 801–7. https://doi.org/10.3238/arztebl.2018.0801.

Bonds, Matthew H., Donald C. Keenan, Pejman Rohani, and Jeffrey D. Sachs. 2010. "Poverty Trap Formed by the Ecology of Infectious Diseases." *Proceedings. Biological Sciences* 277 (1685): 1185–92. https://doi.org/10.1098/rspb.2009.1778.

Cardoso, Elsa Maria. 2016. "Resultados Gerais Sobre Localidades." https://www.ine.st/index.php/publicacao/documentos/category/51-demograficas.

Chalchisa, Derara, Moa Megersa, and Abebe Beyene. 2017. "Assessment of the Quality of Drinking Water in Storage Tanks and Its Implication on the Safety of Urban Water Supply in Developing Countries." *Environmental Systems Research* 6 (1): 12. https://doi.org/10.1186/s40068-017-0089-2.

Charlwood, J Derek, Joao Pinto, Patrica R Ferrara, Carla A Sousa, Conceicao Ferreira, Vilfrido Gil, and Virgillo E do Rosário. 2003. "Raised Houses Reduce Mosquito Bites." *Malaria Journal* 2 (December): 45. https://doi.org/10.1186/1475-2875-2-45.

Contzen, Nadja, Sandra De Pasquale, and Hans-Joachim Mosler. 2015. "Over-Reporting in Handwashing Self-Reports: Potential Explanatory Factors and Alternative Measurements." *PLoS ONE* 10 (8). https://doi.org/10.1371/journal.pone.0136445.

Danso-Appiah, Anthony, Piero L Olliaro, Sarah Donegan, David Sinclair, and Jürg Utzinger. 2013. "Drugs for Treating *Schistosoma Mansoni* Infection." Edited by Cochrane Infectious Diseases Group. *Cochrane Database of Systematic Reviews*, February. https://doi.org/10.1002/14651858.CD000528.pub2.

Fischer Walker, Christa L., David Sack, and Robert E. Black. 2010. "Etiology of Diarrhea in Older Children, Adolescents and Adults: A Systematic Review." *PLoS Neglected Tropical Diseases* 4 (8). https://doi.org/10.1371/journal.pntd.0000768.

Fitzpatrick, Christopher, Fiona M. Fleming, Matthew Madin-Warburton, Timm Schneider, Filip Meheus, Kingsley Asiedu, Anthony W. Solomon, Antonio Montresor, and Gautam Biswas. 2016. "Benchmarking the Cost per Person of Mass Treatment for Selected Neglected Tropical Diseases: An Approach Based on Literature Review and Meta-Regression with Web-Based Software Application." *PLoS Neglected Tropical Diseases* 10 (12). https://doi.org/10.1371/journal.pntd.0005037.

Fitzpatrick, Christopher, Uzoma Nwankwo, Edeltraud Lenk, Sake J. de Vlas, and Donald A. P. Bundy. 2017. "An Investment Case for Ending Neglected Tropical Diseases." In *Major Infectious Diseases*, edited by King K. Holmes, Stefano Bertozzi, Barry R. Bloom, and Prabhat Jha, 3rd ed. Washington (DC): The International Bank for Reconstruction and Development / The World Bank. http://www.ncbi.nlm.nih.gov/books/NBK525199/.

Galvani, Alison P. 2003. "Immunity, Antigenic Heterogeneity, and Aggregation of Helminth Parasites." *The Journal of Parasitology* 89 (2): 232–41. https://doi.org/10.1645/0022-3395(2003)089[0232:IAHAAO]2.0.CO;2.

Garchitorena, A., S. H. Sokolow, B. Roche, C. N. Ngonghala, M. Jocque, A. Lund, M. Barry, et al. 2017. "Disease Ecology, Health and the Environment: A Framework to Account for Ecological and Socio-Economic Drivers in the Control of Neglected Tropical Diseases." *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 372 (1722). https://doi.org/10.1098/rstb.2016.0128.

GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. 2016. "Global, Regional, and National Incidence, Prevalence, and Years Lived with Disability for 310 Diseases and Injuries, 1990-2015: A Systematic Analysis for the Global Burden of Disease Study 2015." *Lancet (London, England)* 388 (10053): 1545–1602. https://doi.org/10.1016/S0140-6736(16)31678-6.

GBD Diarrhoeal Diseases Collaborators. 2017. "Estimates of Global, Regional, and National Morbidity, Mortality, and Aetiologies of Diarrhoeal Diseases: A Systematic Analysis for the Global Burden of Disease Study 2015." *The Lancet. Infectious Diseases* 17 (9): 909–48. https://doi.org/10.1016/S1473-3099(17)30276-1.

"GHO | By Country | Sao Tome and Principe - Statistics Summary (2002 - Present)." 2019. WHO. October 11, 2019. http://apps.who.int/gho/data/node.country.country-STP.

Global Malaria Programme, and World Health Organization. 2010. *World Malaria Report 2010.* Geneva: World Health Organization.

Gonçalves L, Monteverde E. Análise do estudo de caso-controlo e dados complementares sobre a celulite necrotizante. Lisboa: Ministério da Saúde da República Democrática de São Tomé e Príncipe e Instituto de Higiene e Medicina Tropical Universidade Nova de Lisboa; 2017 Jun.

Hotez, Peter J. 2008. *Forgotten Diseases, Forgotten People: The Neglected Tropical Diseases and Their Impact on Global Health and Development*. ASM Press.

———. 2009. "The Neglected Tropical Diseases and Their Devastating Health and Economic Impact on the Member Nations of the Organisation of the Islamic Conference." *PLOS Neglected Tropical Diseases* 3 (10): e539. https://doi.org/10.1371/journal.pntd.0000539.

———. 2013. "NTDs V.2.0: 'Blue Marble Health'—Neglected Tropical Disease Control and Elimination in a Shifting Health Policy Landscape." *PLoS Neglected Tropical Diseases* 7 (11). https://doi.org/10.1371/journal.pntd.0002570.

Hotez, Peter J., Alan Fenwick, Sarah E. Ray, Simon I. Hay, and David H. Molyneux. 2018. "'Rapid Impact' 10 Years after: The First 'Decade' (2006–2016) of Integrated Neglected Tropical Disease Control." *PLoS Neglected Tropical Diseases* 12 (5). https://doi.org/10.1371/journal.pntd.0006137.

Hotez, Peter J., and Aruna Kamath. 2009. "Neglected Tropical Diseases in Sub-Saharan Africa: Review of Their Prevalence, Distribution, and Disease Burden." *PLoS Neglected Tropical Diseases* 3 (8). https://doi.org/10.1371/journal.pntd.0000412.

Jourdan, Peter Mark, Poppy H. L. Lamberton, Alan Fenwick, and David G. Addiss. 2018. "Soil-Transmitted Helminth Infections." *Lancet (London, England)* 391 (10117): 252–65. https://doi.org/10.1016/S0140-6736(17)31930-X.

Kilama, Wen L. 2009. "The 10/90 Gap in Sub-Saharan Africa: Resolving Inequities in Health Research." *Acta Tropica*, Health Research in Africa: Ethical and Practical Challenges, 112 (November): S8–15. https://doi.org/10.1016/j.actatropica.2009.08.015.

King, Charles H., Katherine Dickman, and Daniel J. Tisch. 2005. "Reassessment of the Cost of Chronic Helmintic Infection: A Meta-Analysis of Disability-Related Outcomes in Endemic Schistosomiasis." *Lancet (London, England)* 365 (9470): 1561–69. https://doi.org/10.1016/S0140-6736(05)66457-4.

Kuate Defo, Barthélémy. 2014. "Demographic, Epidemiological, and Health Transitions: Are They Relevant to Population Health Patterns in Africa?" *Global Health Action* 7 (May). https://doi.org/10.3402/gha.v7.22443.

"Political and Administrative Map of Sao Tome and Principe." 2019. 2019. https://www.mapsland.com/africa/sao-tome-and-principe/large-political-and-administrative-map-of-sao-tome-and-principe-with-all-cities-roads-and-airports.

Lenk, Edeltraud J., William K. Redekop, Marianne Luyendijk, Adriana J. Rijnsburger, and Johan L. Severens. 2016. "Productivity Loss Related to Neglected Tropical Diseases Eligible for Preventive Chemotherapy: A Systematic Literature Review." *PLoS Neglected Tropical Diseases* 10 (2). https://doi.org/10.1371/journal.pntd.0004397.

Lippman, Sheri A., Hannah H. Leslie, Torsten B. Neilands, Rhian Twine, Jessica S. Grignon, Catherine MacPhail, Jessica Morris, et al. 2018. "Context Matters:

Community Social Cohesion and Health Behaviors in Two South African Areas." *Health & Place* 50 (March): 98–104. https://doi.org/10.1016/j.healthplace.2017.12.009.

Loukas, Alex, Peter J. Hotez, David Diemert, Maria Yazdanbakhsh, James S. McCarthy, Rodrigo Correa-Oliveira, John Croese, and Jeffrey M. Bethony. 2016. "Hookworm Infection." *Nature Reviews. Disease Primers* 2: 16088. https://doi.org/10.1038/nrdp.2016.88.

Luchetti, Marco. 2014. "Global Health and the 10/90 Gap." *British Journal of Medical Practitioners*. https://www.bjmp.org/content/global-health-and-1090-gap.

"Lymphatic Filariasis." 2019. October 6, 2019. https://www.who.int/news-room/fact-sheets/detail/lymphatic-filariasis.

"Making Progress on Sustainable Development, Four Least Developed Countries Tapped to Graduate from Ranks of Poorest." 2018. UN DESA | United Nations Department of Economic and Social Affairs. March 15, 2018. https://www.un.org/development/desa/en/news/policy/4-countries-suggested-for-ldc-graduation.html.

Massart, Guy. 2013. "The Aspirations and Constraints of Masculinity in the Family Trajectories of Cape Verdean Men from Praia (1989-2009)." *Etnográfica. Revista Do Centro Em Rede de Investigação Em Antropologia*, no. vol. 17 (2) (June): 293–316. https://doi.org/10.4000/etnografica.3131.

Mwinzi, Pauline N. M., Susan P. Montgomery, Chrispin O. Owaga, Mariam Mwanje, Erick M. Muok, John G. Ayisi, Kayla F. Laserson, Erick M. Muchiri, W. Evan Secor, and Diana M. S. Karanja. 2012. "Integrated Community-Directed Intervention for Schistosomiasis and Soil Transmitted Helminths in Western Kenya - a Pilot Study." *Parasites & Vectors* 5 (August): 182. https://doi.org/10.1186/1756-3305-5-182.

Nakagiri, Anne, Charles B. Niwagaba, Philip M. Nyenje, Robinah N. Kulabako, John B. Tumuhairwe, and Frank Kansiime. 2016. "Are Pit Latrines in Urban Areas of Sub-Saharan Africa Performing? A Review of Usage, Filling, Insects and Odour Nuisances." *BMC Public Health* 16 (February). https://doi.org/10.1186/s12889-016-2772-z.

Novignon, Jacob, and Justice Nonvignon. 2012. "Socioeconomic Status and the Prevalence of Fever in Children under Age Five: Evidence from Four Sub-Saharan African Countries." *BMC Research Notes* 5 (July): 380. https://doi.org/10.1186/1756-0500-5-380.

Oswald, William E., Aisha E. P. Stewart, Michael R. Kramer, Tekola Endeshaw, Mulat Zerihun, Berhanu Melak, Eshetu Sata, et al. 2017. "Association of Community Sanitation Usage with Soil-Transmitted Helminth Infections among School-Aged Children in Amhara Region, Ethiopia." *Parasites & Vectors* 10 (1): 91. https://doi.org/10.1186/s13071-017-2020-0.

Pabalan, Noel, Eloisa Singian, Lani Tabangay, Hamdi Jarjanazi, Michael J. Boivin, and Amara E. Ezeamama. 2018. "Soil-Transmitted Helminth Infection, Loss of Education and Cognitive Impairment in School-Aged Children: A Systematic Review and Meta-Analysis." *PLoS Neglected Tropical Diseases* 12 (1). https://doi.org/10.1371/journal.pntd.0005523.

Pape, Duarte. 2016. "THE FIELDS (ROÇAS) OF SÃO TOMÉ AND PRÍNCIPE - a," 17.

"'Parasites - Schistosomiasis, Disease'. Www.Cdc.Gov. Archived from the Original on 2 December 2016. Retrieved 4 December 2016." n.d.

Population, Institute of Medicine (US) Committee on the Long-Run Macroeconomic Effects of the Aging U. S. 2012. *Aging, Productivity, and Innovation*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK148825/.

Poulin, Robert. 2013. "Explaining Variability in Parasite Aggregation Levels among Host Samples." *Parasitology* 140 (4): 541–46. https://doi.org/10.1017/S0031182012002053.

"Prevalence of Underweight, Weight for Age (% of Children under 5) | Data." n.d. Accessed June 30, 2019. https://data.worldbank.org/indicator/SH.STA.MALN.ZS.

Radley, Jason J., Mohamed Kabbaj, Lauren Jacobson, Willem Heydendael, Rachel Yehuda, and James P. Herman. 2011. "STRESS RISK FACTORS AND STRESS-RELATED PATHOLOGY: NEUROPLASTICITY, EPIGENETICS AND ENDOPHENOTYPES." *Stress (Amsterdam, Netherlands)* 14 (5): 481–97. https://doi.org/10.3109/10253890.2011.604751.

Rees, Chris A., Peter J. Hotez, Michael C. Monuteaux, Michelle Niescierenko, and Florence T. Bourgeois. 2019. "Neglected Tropical Diseases in Children: An Assessment of Gaps in Research Prioritization." *PLoS Neglected Tropical Diseases* 13 (1). https://doi.org/10.1371/journal.pntd.0007111.

Rheinländer, Thilde. 2015. "Redefining Shared Sanitation." *Bulletin of the World Health Organization*, July. http://dx.doi.org/10.2471/BLT.14.144980.

Ross, Allen G. P., Paul B. Bartley, Adrian C. Sleigh, G. Richard Olds, Yuesheng Li, Gail M. Williams, and Donald P. McManus. 2002. "Schistosomiasis." *The New England Journal of Medicine* 346 (16): 1212–20. https://doi.org/10.1056/NEJMra012396.

"Sao Tome & Principe Population (2019) - Worldometers." 2019. July 1, 2019. https://www.worldometers.info/world-population/sao-tome-and-principe-population/.

"Sao Tome and Principe." 2015a. September 9, 2015. http://www.healthdata.org/sao-tome-and-principe.

"Sao Tome and Principe." ———. 2015b. Institute for Health Metrics and Evaluation. September 9, 2015. http://www.healthdata.org/sao-tome-and-principe.

"São Tomé e Principe - Geography." 2016. October 24, 2016. https://www.globalsecurity.org/military/world/africa/stp-geography.htm.

"Schistosomiasis Fact Sheet." 2019. April 17, 2019. http://www.who.int/news-room/fact-sheets/detail/schistosomiasis.

Schneiderman, Neil, Gail Ironson, and Scott D. Siegel. 2005. "STRESS AND HEALTH: Psychological, Behavioral, and Biological Determinants." *Annual Review of Clinical Psychology* 1: 607–28. https://doi.org/10.1146/annurev.clinpsy.1.102803.144141.

Shane, Andi L., Rajal K. Mody, John A. Crump, Phillip I. Tarr, Theodore S. Steiner, Karen Kotloff, Joanne M. Langley, et al. 2017. "2017 Infectious Diseases Society of America Clinical Practice Guidelines for the Diagnosis and Management of Infectious Diarrhea." *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America* 65 (12): e45–80. https://doi.org/10.1093/cid/cix669.

Simiyu, Sheillah, Mark Swilling, Sandy Cairncross, and Richard Rheingans. 2017. "Determinants of Quality of Shared Sanitation Facilities in Informal Settlements: Case Study of Kisumu, Kenya." *BMC Public Health* 17 (January). https://doi.org/10.1186/s12889-016-4009-6.

Singh, Ajai R., and Shakuntala A. Singh. 2008. "Diseases of Poverty and Lifestyle, Well-Being and Human Development." *Mens Sana Monographs* 6 (1): 187–225. https://doi.org/10.4103/0973-1229.40567.

"Soil-Transmitted Helminth Infections." 2019. April 16, 2019. https://www.who.int/news-room/fact-sheets/detail/soil-transmitted-helminth-infections.

Speich, Benjamin, Said M. Ali, Shaali M. Ame, Isaac I. Bogoch, Rainer Alles, Jörg Huwyler, Marco Albonico, Jan Hattendorf, Jürg Utzinger, and Jennifer Keiser. 2015. "Efficacy and Safety of Albendazole plus Ivermectin, Albendazole plus Mebendazole, Albendazole plus Oxantel Pamoate, and Mebendazole Alone against Trichuris Trichiura and Concomitant Soil-Transmitted Helminth Infections: A Four-Arm, Randomised Controlled Trial." *The Lancet Infectious Diseases* 15 (3): 277–84. https://doi.org/10.1016/S1473-3099(14)71050-3.

Strunz, Eric C., David G. Addiss, Meredith E. Stocks, Stephanie Ogden, Jürg Utzinger, and Matthew C. Freeman. 2014. "Water, Sanitation, Hygiene, and Soil-Transmitted Helminth Infection: A Systematic Review and Meta-Analysis." *PLoS Medicine* 11 (3). https://doi.org/10.1371/journal.pmed.1001620.

Swallow, B. M. 1999. "Impact of Trypanosomiasis on African Agriculture." In . OAU/STRC. https://cgspace.cgiar.org/handle/10568/50693.

Ton, Thanh G. N., Charles Mackenzie, and David H. Molyneux. 2015. "The Burden of Mental Health in Lymphatic Filariasis." *Infectious Diseases of Poverty* 4: 34. https://doi.org/10.1186/s40249-015-0068-7.

"Trypanosomiasis, Human African (Sleeping Sickness)." 2019. October 11, 2019. https://www.who.int/news-room/fact-sheets/detail/trypanosomiasis-human-african-(sleeping-sickness).

Tubatsi, G., M. C. Bonyongo, and M. Gondwe. 2015. "Water Use Practices, Water Quality, and Households' Diarrheal Encounters in Communities along the Boro-Thamalakane-Boteti River System, Northern Botswana." *Journal of Health, Population, and Nutrition* 33 (November). https://doi.org/10.1186/s41043-015-0031-z.

Walker, C. L. Fischer, and R. E. Black. 2010. "Diarrhoea Morbidity and Mortality in Older Children, Adolescents, and Adults." *Epidemiology and Infection* 138 (9): 1215–26. https://doi.org/10.1017/S0950268810000592.

Wang, Wei, Jin Chen, Hui-Feng Sheng, Na-Na Wang, Pin Yang, Xiao-Nong Zhou, and Robert Bergquist. 2017. "Infectious Diseases of Poverty, the First Five Years." *Infectious Diseases of Poverty* 6 (1): 96. https://doi.org/10.1186/s40249-017-0310-6.

"Weekly Bulletin on Outbreaks and Other Emergencies." 2018. World Health Organization Health Emergencies Programme. https://apps.who.int/iris/bitstream/handle/10665/275136/OEW39-2228092018.pdf.

Weng, Hong-Bo, Hai-Xia Chen, and Ming-Wei Wang. 2018. "Innovation in Neglected Tropical Disease Drug Discovery and Development." *Infectious Diseases of Poverty* 7 (June). https://doi.org/10.1186/s40249-018-0444-1.

"WHO | Safe Household Water Storage." n.d. WHO. Accessed July 3, 2019. http://www.who.int/water_sanitation_health/water-quality/household/safe_storage/en/.

Woode, Paa Kwesi, Bismark Dwumfour-Asare, Kwabena Biritwum Nyarko, and Eugene Appiah-Effah. 2018. "Cost and Effectiveness of Water, Sanitation and Hygiene Promotion Intervention in Ghana: The Case of Four Communities in the Brong Ahafo Region." *Heliyon* 4 (10). https://doi.org/10.1016/j.heliyon.2018.e00841.

STP hygiene + community

Start of Block: Secção 1: sociodemográfica actual

S1Q1 Número do Participante

- Número: (1) _____

S1Q2 Sexo:

- Masculino (1)
- Feminino (2)

S1Q3 Qual é a sua data de Nascimento e idade?

- Data de Nascimento (dd/mm/yyyy) (1)
_____
- idade (em anos) (2) _____

S1Q4 Qual é a última nível de escolaridade atingido?

- ○ Sem nível de escolaridade (1)
- ○ Pré-escolar (2)
- ○ Ensino Básico (3)
- ○ Secundário (4)
- ○ Profissional/Técnico (5)
- ○ Superior (6)
- ○ Alfabetização de adultos (7)

S1Q5 Qual é a sua principal profissão/atividade profissional?

- ○ Agricultores e trabalhadores da agricultura e floresta? (1)
- ○ Trabalhadores de pesca e palaiês (2)
- ○ Vendedores ambulantes (3)
- ○ Vianteiros (4)
- ○ Trabalhadores ligados à construção civil (5)
- ○ Artesão e trabalhadores similares (6)
- ○ Mecânico (7)
- ○ Operadores de instalações de máquinas e trabalhadores da montagem (8)
- ○ Quadros superiores e diretor (9)
- ○ Técnicos e profissionais médios (10)
- ○ Pessoal administrativo (11)
- ○ Pessoal do comércio/lojas (12)
- ○ Profissões especificamente militares/paramilitares (13)
- ○ Estudante (14)
- ○ Doméstica/trabalhadora doméstica/limpeza (15)
- ○ Desempregados (16)
- ○ Outro? qual (17) _____

S1Q6 Qual é o seu estado civil?

- ○ Casado/união de facto (1)
- ○ Solteiro (2)
- ○ Divorciado/Separado (3)
- ○ Viúvo (4)

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*

S1Q7 Quantas pessoas vivem em sua casa (Contando Consigo)?

- ○ Número de pessoas: (1) _____

S1Q8 Quantas crianças abaixo de 12 anos vivem em sua casa?

- ○ Número de crianças: (1) _____

End of Block: Secção 1: sociodemográfica actual

Start of Block: Secção 2: Desfechos clínicos actual

S2 Q1 Você ou alguém em sua casa utilizou u cumprido de desparasitante no último mês?

- ○ Ninguém em minha casa (1)
- ○ Apenas eu (2)
- ○ Eu e outro membro da minha família (3)
- ○ Outro membro da minha família (a minha família tomou, mas eu não) (4)

Display This Question:

If Você ou alguém em sua casa utilizou u cumprido de desparasitante no último mês? != Ninguém em minha casa

Q50 Quem forneceu o cumprido de desparasitante?

- ○ O centro de saúde/posto de saúde/hospital (1)
- ○ Uma instituição particular (2)
- ○ Na escola (3)
- ○ Foi comprado pelo próprio (4)
- ○ Outra situação (5) _____

Q51 No último mês, quantos episódios de diarreia teve?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 (5)
- ○ 5 (6)
- ○ Mais que 5 (indicar o número) (7)

_____

Q52 No último mês, quantos episódios de febre teve?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 (5)
- ○ 5 (6)
- ○ Mais que 5 (indicar o número) (7)

_____

Q53 Nas últimas duas semanas, quantas consultas não programadas teve no centro de saúde/hospital?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 (5)
- ○ 5 (6)
- ○ mais que 5 (indicar o número) (7)

_____

Q54 Nas útimas duas semanas, feriu-se alguma vez?

- ○ Sim (1)
- ○ Não (2)
- ○ Não sei/Não lembro (3)

Display This Question:

If Nas útimas duas semanas, feriu-se alguma vez? = Sim

Q55 Para cada ferimento, descreva o local do ferimento no seu corpo

	Local e causa do ferimento		qual foi o tratamento?
	Local (1)	Causa (2)	

Primeira ferida: (1)			▼ Medicina Moderna (1 ... Nenhum tratamento (4)
Segunda ferida: (2)			▼ Medicina Moderna (1 ... Nenhum tratamento (4)
Terceira ferida: (3)			▼ Medicina Moderna (1 ... Nenhum tratamento (4)
Quarta ferida: (4)			▼ Medicina Moderna (1 ... Nenhum tratamento (4)
Quinta ferida: (5)			▼ Medicina Moderna (1 ... Nenhum tratamento (4)

Q56 No último mês, teve uma variação no seu peso que lhe parece relevante?

- ○ Sim (1)
- ○ Não (2)
- ○ Não sei (3)

Display This Question:

If No último mês, teve uma variação no seu peso que lhe parece relevante? = Sim

Q57 Se sim, que foi?

- ○ perdeu peso (1)
- ○ ganhou peso (2)

Q58 Ocorreu alguma alteração significativa na sua dieta no último mês?

- ○ Sim. Que? (1) _____
- ○ Não (2)

Q60 Ocorreu algum episódio de inchaço o dor de barriga, procurou tratamento?

- ○ Sim- de medicina tradicional (1)
- ○ Sim- de medicina convencional (3)
- ○ Sim- uma combinação de medicina tradicional e convencional (4)
- ○ Não/Não sabe (2)

Display This Question:

If Sexo: = Masculino

Q61 Se for homem, ocorreu hematúria (sangue na urina)?

- ○ Sim, Quantos episódios? (1) _____
- ○ Não (2)

Q62 Teve a presença de sangue nas fezes no último mês?

- ○ Sim. Quantas vezes? (1) _____
- ○ Não (2)
- ○ Não sei (3)

End of Block: Secção 2: Desfechos clínicos actual

Start of Block: Seccão 3: Associação comunitária

Q62 Sua comunidade elege um presidente para representá-los? (para fins políticos, de saúde, econômicos)?

- ○ Sim (1)
- ○ Não (2)

Display This Question:

If Sua comunidade elege um presidente para representá-los? (para fins políticos, de saúde, econômico... = Sim

Q63
Com que frequência são as eleições para presidente?

- ○ cada ano (1)
- ○ dois em dois anos (2)
- ○ mais do que dois em dois anos (3)
- ○ Não sei (4)

Display This Question:

If Sua comunidade elege um presidente para representá-los? (para fins políticos, de saúde, econômico... = Sim

Q64
Quão bem você se sente que o presidente da comunidade representa vocês aos grupos externos?

- ○ Muito bom (1)
- ○ Bom (2)
- ○ adequado (3)
- ○ mal (4)
- ○ muito mal (5)

Display This Question:

If Sua comunidade elege um presidente para representá-los? (para fins políticos, de saúde, econômico... = Não

Q65 Quem representa sua comunidade para organizações externas?

_____

Q66
Além do trabalho do presidente, Quão bem a sua comunidade é representada aos grupos externos?

- ○ Muito bom (1)
- ○ Bom (2)
- ○ Adequada (3)
- ○ Mal (4)
- ○ Muito mal (5)

Q67
Com que frequência a sua comunidade organiza eventos sociais (festas, trabalho comum)?

- ○ frequentamente (1-2 vezes por semana) (1)
- ○ ocasionalmente (umas vezes por mês) (2)
- ○ raramente (umas vezes por ano) (3)

Q68
Estes eventos são para todos membros da comunidade? (ou só para alguns membros)

- ○ Sim (1)
- ○ Não (2)
- ○ depende/não sei (3)

Display This Question:

If Estes eventos são para todos membros da comunidade? (ou só para alguns membros) = Não

Q69
para quem esses eventos servem principalmente?

- ○ Homens (1)
- ○ Mulheres (2)
- ○ Jovens (3)

Q140 Costuma de participar em algumas campanhas de limpeza na sua comunidade?

- ○ Sim (1)
- ○ Não (2)
- ○ Às vezes (3)

Q70
Com que frequência a sua comunidade junta para limpar espaços públicos?

- ○ Frequentamente (cada semana) (1)
- ○ Ocasionalmente (cada mês) (2)
- ○ raramente (cada ano) (3)

Q141 Quem organiza estas limpezas?

- membros da comunidade (1)
- LIderas da comunidade (2)
- organização externa (centro de saude, ong, etc) (3)

Q72
Com que frequência são realizadas reuniões comunitárias para discutir problemas ou questões na comunidade?

- frequentamente (cada semana) (1)
- Ocasionalmente (cada mês) (2)
- raramente/só em casos de emergência (cada ano) (3)

Q73
Estes reuniões geralmente resolvem as questões discutidas?

- Sempre (1)
- Normalmente (2)
- As vezes (3)
- Nunca (4)

Q74
Quando há um problema entre membros da comunidade, qual é o primeiro passo para resolver estes problemas?

- ○ Com discussões somente entre as pessoas (1)
- ○ Com discussões entre as pessoas e com ajuda de outras na comunidade (2)
- ○ é resolvido por outro grupo na comunidade (3)
- ○ Resolvido pelos autoridades (polícia etc) (4)

Carry Forward All Choices - Displayed & Hidden from "Quando há um problema entre membros da comunidade, qual é o primeiro passo para resolver estes problemas?"

X→

Q142 Se o primeiro passo não resolva o problema, o que tu consegues fazer para resolver?

- ○ Com discussões somente entre as pessoas (1)
- ○ Com discussões entre as pessoas e com ajuda de outras na comunidade (2)
- ○ é resolvido por outro grupo na comunidade (3)
- ○ Resolvido pelos autoridades (polícia etc) (4)

Q75
Com que frequência surgem problemas entre os membros da comunidade?

- ○ frequentamente (cada semana) (1)
- ○ ocasionalmente (cada mês) (2)
- ○ raramente (cada ano) (3)

Q76
Se alguém na comunidade está em necessidade, qual a probabilidade de os outros membros da comunidade darem apoio material (comida, dinheiro, água) a eles?

- ○ Muito provável (1)
- ○ Provável (2)
- ○ pode ou não acontecer (3)
- ○ Improvável (4)
- ○ Muito improvável (5)

Q137
Você já recebeu apoio (comida, dinheiro, água) de outros membros da comunidade quando estava em necessidade?

- ○ Sim, várias vezes (1)
- ○ Sim, as vezes (mas não com frequência) (2)
- ○ Sim, raramente (3)
- ○ Nunca (4)

Q139 As regras da comunidade são geralmente cumpridas?

- ○ Sim (1)
- ○ Não (2)

End of Block: Seccão 3: Associação comunitária

Start of Block: Secção 4: Infraestrutura

Q76 Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica)

- ☐ Fonte de rede pública (água canalizada, chafariz) (1)
- ☐ Lavandaria (2)
- ☐ água nascente/poço (3)
- ☐ Fonte natural de agua (rio, canal, riacho) (4)
- ☐ Latrina pública (5)
- ☐ sistema de recolha do lixo pela camara (6)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte de rede pública (água canalizada, chafariz)

Q77 Quão distante é a rede pública (água canalizada, chafariz) da sua casa? (a pé)

- ○ Menos do que 2 minutos (1)
- ○ entre 2 e 5 minutos (2)
- ○ Entre 5 e 10 minutos (3)
- ○ Mais do que 10 minutos (4)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte de rede pública (água canalizada, chafariz)

Q78 Na tua opinão, a água da rede pública (água canalizada, chafariz) é de boa qualidade (potável, pronto para beber, etc)?

- Sim (1)
- Não (2)
- Não sei (3)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte de rede pública (água canalizada, chafariz)

Q79 Como descreveria a qualidade da rede pública (água canalizada, chafariz)?

- Muita má (1)
- má (2)
- adequada (3)
- Boa (4)
- Muita boa (5)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Lavandaria

Q80 Quão distante é a lavandaria da sua casa? (a pé)

- ○ Menos do que 2 minutos (1)
- ○ Entre 2 e 5 minutos (2)
- ○ Entre 5 e 10 minutos (3)
- ○ mais do que 10 minutos (4)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Lavandaria

Q81 Como descreveria a qualidade da lavandaria?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita boa (5)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = água nascente/poço

Q82 Quão distante é o fonte de água nascente/poço da sua casa? (a pé)

- ○ Menos do que 2 minutos (1)
- ○ Entre 2 e 5 minutos (2)
- ○ Entre 5 e 10 minutos (3)
- ○ Mais do que 10 minutos (4)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = água nascente/poço

Q83 Como descreveria a qualidade do fonte de água nascente/poço?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita boa (5)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte natural de agua (rio, canal, riacho)

Q84 Quão distante é o fonte natural de água (rio, riacho, canal) da sua casa (a pé)?

- ○ Menos do que 2 minutos (1)
- ○ Entre 2 e 5 minutos (2)
- ○ Entre 5 e 10 minutos (3)
- ○ Mais do que 10 minutos (4)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte natural de agua (rio, canal, riacho)

Q85 Na sua opinão, a água do fonte natural é de boa qualidade?

- ○ Sim (1)
- ○ Não (2)
- ○ Não sei (3)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Latrina pública

Q86 Quão distante é a latrina pública da sua casa? (a pé)

- ○ Menos do que 2 minutos (1)
- ○ Entre 2 e 5 minutos (2)
- ○ Entre 5 e 10 minutos (3)
- ○ Mais do que 10 minutos (4)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Latrina pública

Q87 Como descreveria a qualidade da latrina pública?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita boa (5)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = sistema de recolha do lixo pela camara

Q88 Com que frequência o lixo é recolhido pela câmara?

- ○ Todos os dias (1)
- ○ umas vezes por semana (2)
- ○ umas vezes por mês (3)
- ○ o serviço é infrequente (4)

Page Break

Q89 Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica)

- ☐ Casa de banho (dentro da casa) (1)
- ☐ Latrina (fora da casa) (2)
- ☐ fornecimento de água (canos, pias, etc) (3)
- ☐ armazenamento de água (4)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = Casa de banho (dentro da casa)

Q90 A casa de banho tem água corrente?

- ○ Sim (1)
- ○ Não (2)
- ○ Ás vezes (3)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = Casa de banho (dentro da casa)

Q91 Como descreveria a qualidade da casa de banho?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita boa (5)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = Latrina (fora da casa)

Q92 A latrina tem água corrente?

- ○ Sim (1)
- ○ Não (2)
- ○ Ás vezes (3)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = Latrina (fora da casa)

Q93 que tipo de chão tem na latrina?

- ○ terra (1)
- ○ cimento/pedra (2)
- ○ madeira (3)
- ○ outra: que? (4) _____

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = Latrina (fora da casa)

Q94 Como descreveria a qualidade da latrina?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita boa (5)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = fornecimento de água (canos, pias, etc)

Q95 Que tipo de fornecimento de água tem na casa?

- ☐ Canos com torneia (1)
- ☐ bacia/pia (2)
- ☐ Outro, que? (3) _____

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = fornecimento de água (canos, pias, etc)

Q96 Quem fez a instalação de fornecimento de água?

- ○ Membros da casa (1)
- ○ Vizinhos/membros da comunidade (2)
- ○ Organização externa (ONGs) (3)
- ○ Empresa (5)
- ○ Estado (4)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = fornecimento de água (canos, pias, etc)

Q97 Como descreveria a qualidade do sistema de fornecimento de água?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita boa (5)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = armazenamento de água

Q98 Na sua casa, que tipo de armazenamento tem?

- ☐ Tanque (1)
- ☐ garafoes (2)
- ☐ bulos (3)

Display This Question:

If Qual dos seguintes tem accesso na sua casa? (escolhe tudo que aplica) = armazenamento de água

Q99 como descreveria a qualidade do sistema de armazenamento?

- ○ Muita má (1)
- ○ Má (2)
- ○ Adequada (3)
- ○ Boa (4)
- ○ Muita Boa (5)

Q100 Que tipo de chão sua casa possui?

- ○ Terra (1)
- ○ Madeira (2)
- ○ Cimento/pedra (3)
- ○ Outro, Qual? (4) _____

End of Block: Secção 4: Infraestrutura

Start of Block: Secção 5: comportamento

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte natural de agua (rio, canal, riacho)

Q101 Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = água nascente/poço

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q102 Com que frequência se usa água nascente/poço para limpar ou cozinhar?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte de rede pública (água canalizada, chafariz)

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q103 Com que frequência se usa água da rede pública (chafariz, água canalizada) para limpar ou cozinhar?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Q104 Por favor colocar, por ordem, qual usa mais, do maior para o menor uso (água para limpar ou cozinhar)

_____ Fontes naturais (1)
_____ Água de poço (2)
_____ Água da rede pública (água canalizada, chafariz) (3)

Page Break

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte natural de agua (rio, canal, riacho)

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q106 Com que frequência se usa água de fontes naturais (fio, ribeira, riacho, vale, etc) para beber?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = água nascente/poço

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q107 Com que frequência se usa água nascente/poço para beber?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Qual dos seguintes existe na comunidade, e tem acesso (escolhe tudo que aplica) = Fonte de rede pública (água canalizada, chafariz)

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q108 Com que frequência se usa água da rede pública (água canalizada, chafariz) para beber?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Q109 Por favor colocar por ordem, qual usa mais do mair para o menor uso (água para beber)

_____ Água obtida pelos fontes naturais (1)
_____ Água obtida por um poço (2)
_____ Água obtida pela rede pública (água canalizada, chafariz) (3)

Page Break

Q111 Normalmente descaca a fruta e vegetais antes de consumir?

- ○ Sim (1)
- ○ Não (2)
- ○ Não sei (3)

Q112 Lava as frutas e vegetais antes do consumo?

- ○ Sim (1)
- ○ Não (2)
- ○ Não sei (3)

Q113 Se lavares os seus alimentos, quais dos seguintes tipos de água se usa mais que todo?

- ○ Água de fontes naturais (rio, ribeira, riacho, vale) (1)
- ○ Água de poço (2)
- ○ Água da rede pública (3)
- ○ Outra: (4) _____

Page Break

Q114 Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que aplicam)

- ☐ Ferver a água (1)
- ☐ Tratar com algum produto químico (exemplo: Lixívia) (2)
- ☐ Usar filtro, ou filtrar com uma ferramenta" (3)
- ☐ Não sei/nenhum listada (4)
- ☐ Não faço nada (5)

Display This Question:

If Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que ap... = Ferver a água

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

X→

Q115 Com que frequência se costuma a ferver a água antes de consumo?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que ap... = Tratar com algum produto químico (exemplo: Lixívia)

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q116 Com que frequência se costuma tratar sua água com produtos químicos antes de consumir? (exemplo: Lixívia)

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que ap... = Usar filtro, ou filtrar com uma ferramenta"

Carry Forward All Choices - Displayed & Hidden from "Com que frequência se usa água de fontes naturais (rio, ribeira, vale, riachos, etc) para limpar ou cozinhar?"

Q117 Com que frequência se costuma filtrar a água com um filtro/uma ferramenta antes de consumir?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em situações de emergência (exemplo: quando falha a rede pública) (4)
- ○ Não sei (5)
- ○ Nunca (6)

Display This Question:

If Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que ap... != Não faço nada

Carry Forward All Choices - Displayed & Hidden from "Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que aplicam)"

X→

Q118 Por favor colocar por ordem, qual usa mais do mair para o menor uso (tratamento de água)

_____ Ferver a água (1)
_____ Tratar com algum produto químico (exemplo: Lixívia) (2)
_____ Usar filtro, ou filtrar com uma ferramenta" (3)
_____ Não sei/nenhum listada (4)
_____ Não faço nada (5)

Display This Question:

If Antes de consumir, costuma a tratar sua água em uma das seguintes maneiras? (escolhe todas que ap... = Não sei/nenhum listada

Q119 Se não soube, se costuma fazer uma coisa à água antes de consumir?

_____

Page Break

Q120 Costuma lavar as mãoa antes de comer?

- Sim (1)
- Não (2)
- Às vezes (3)

Q121 Costuma lavar as mãos depois defecar ou urinar?

- Sim (1)
- Não (2)
- Às vezes (3)

Q143 Quando lavas as mãos, usa sabão?

- Sim (1)
- Não (2)
- Às vezes (3)

Q122 De onde vem a água do lavatório/bacia? (escolha todas que aplica)

- ☐ Água de fonte natural (rio ribeira, riacho, vale, etc) (1)
- ☐ Água do poço (2)
- ☐ Água da rede pública (água corrente) (3)
- ☐ Não sei/nenhum listado (4)

Q123 Costuma usar a água do lavatório/bacia mais de uma vez?

- ○ Sim (1)
- ○ Não (2)
- ○ Ás vezes (3)

Q124 Quantas vezes por dia se costuma trocar a água do lavatório/bacia?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 (5)
- ○ 5 (6)
- ○ Mais do que 5 vezes (7)

Q125 Quais dos seguintes locais usa para tomar banho? (escolhe todas que aplicam)

- ☐ Espaço dentro da casa (1)
- ☐ Fora da casa, mas dentro do quintal/ propriedade (2)
- ☐ Na lavandaria (3)
- ☐ Nas águas naturais (rio, riacho, ribeira, cascata, etc) (4)
- ☐ Outra: (5) _____

Carry Forward Selected Choices from "Quais dos seguintes locais usa para tomar banho? (escolhe todas que aplicam)"

X→

Q126 Por favor colocar por ordem, qual usa mais, do maior para menor uso (Sítio de banhar)

_____ Espaço dentro da casa (1)
_____ Fora da casa, mas dentro do quintal/ propriedade (2)
_____ Na lavandaria (3)
_____ Nas águas naturais (rio, riacho, ribeira, cascata, etc) (4)
_____ Outra: (5)

Page Break

Q127 Costuma andar descalço fora de casa?

- ○ Sim (1)
- ○ Não (2)
- ○ Às vezes (3)

Q128 Onde costuma ir para lavar roupa (você ou seu conjuge)? (escolhe todas que aplicam)

- ☐ Fontes de água natural (rio, riacho, ribeira, cascatas, vale, etc) (1)
- ☐ lavandaria (2)
- ☐ Na sua propriedade (3)
- ☐ Outra: (4) _____

Carry Forward Selected Choices from "Onde costuma ir para lavar roupa (você ou seu conjuge)? (escolhe todas que aplicam)"

X→

Q129 Qual é o sítio mais usado para lavar roupa?

- ○ Fontes de água natural (rio, riacho, ribeira, cascatas, vale, etc) (1)
- ○ lavandaria (2)
- ○ Na sua propriedade (3)
- ○ Outra: (4) _____

Q130 Com que frequência você ou seu cônjuge costuma lavar roupa?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)

Page Break

Q131 Com que frequência deitam o lixo fora?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)

Q132 Onde deita o lixo? (escolhe todas que aplicam)

- ☐ Na sua propriedade (1)
- ☐ Fora da propriedade em qualquer sítio (rua, matte, etc) (2)
- ☐ Em alguma instalação pública (área marcada, contentores de lixo da câmara) (3)
- ☐ O lixo esta recolhido pelos serviços da câmara (4)
- ☐ Outra: (5) _____

Q145 Costuma tratar o lixo? (Exemplo: queimar, enterrar, etc)

- ○ Sim (1)
- ○ Não (2)
- ○ Às vezes (3)

Carry Forward Selected Choices from "Onde deita o lixo? (escolhe todas que aplicam)"

Q133 Por favor colocar por ordem, qual usa mais do maior para o menor uso (deitar o lixo)

_____ Na sua propriedade (1)
_____ Fora da propriedade em qualquer sítio (rua, matte, etc) (2)
_____ Em alguma instalação pública (área marcada, contentores de lixo da câmara) (3)
_____ O lixo esta recolhido pelos serviços da câmara (4)
_____ Outra: (5)

Page Break

Q134 Com que frequência defeca ao ar livre?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em tempos de emergência (eg quando a latrina não esta disponivel) (4)
- ○ Nunca (5)

Carry Forward All Choices - Displayed & Hidden from "Com que frequência defeca ao ar livre?"

X→

Q135 Com que frequência defeca numa latrina?

- ○ Todos os dias (1)
- ○ Algumas vezes por semana (2)
- ○ Algumas vezes por mês (3)
- ○ Somente em tempos de emergência (eg quando a latrina não esta disponivel) (4)
- ○ Nunca (5)

Q136 Costuma urinar ao ar livre?

- ○ Sim (1)
- ○ Não (2)
- ○ Às vezes (3)

End of Block: Secção 5: comportamento

CONSENTIMENTO INFORMADO, LIVRE E ESCLARECIDO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO

ESTUDO TRANSVERSAL

Por favor, leia ou escute com atenção a seguinte informação. Se achar que algo está incorreto ou que não está claro, peça mais informações. Se concorda com a proposta que lhe é feita, agradecemos-lhe que assine ou que aceite colocar a impressão digital neste documento.

Título do estudo: **COMPORTAMENTOS E PRÁTICAS HIGIENE EM COMUNIDADES RURAIS DE SÃO TOMÉ: DESAFIOS PARA MELHORAR AS CONDIÇÕES DE SAÚDE.**

Enquadramento: Sabe-se que a Saúde está muito ligadas às condições de saneamento e higiene num local. Com este estudo queremos entender melhor esta relação aqui na localidade onde vive. Assim, gostaríamos de lhe fazer algumas perguntas.

Explicação do estudo A participação no estudo consiste em responder a perguntas sobre seus hábitos de higiene e perceção de melhorias nas infraestruturas de saneamento nesta localidade. Esta entrevista deve levar aproximadamente 15-20 minutos. Se você concordar em participar neste estudo, pedimos-lhe que assine neste documento, dando-nos seu consentimento. Para si, também temos uma cópia para ficar com os nossos contactos, no caso de precisar de mais alguma informação no futuro.

Condições e financiamento: A participação é voluntária, só participa se achar bem. Pode interromper a sua participação a qualquer momento durante esta entrevista. Não receberá nenhum pagamento pela sua participação, mas a recolha destes dados pode contribuir para informar os decisores políticos e eventualmente pode ter benefícios futuros para esta comunidade.

Confidencialidade e anonimato:

Será garantida a confidencialidade de todos os dados recolhidos no presente estudo. O seu nome e as suas informações dadas não são divulgados, ficando apenas restritos à equipa de investigação.

Caso lhe surja alguma dúvida posteriormente sobre o estudo pode contactar com a nossa equipa no terreno, através dos seguintes contactos:

Nome do contacto local (legível): Almeida Carvalho Telefone (São Tomé e Príncipe): 9968492 **Assinatura** … … … … … … … … … … … … … … …	Alexander Goggins Mestrado de Saúde Publica e Desenvolvimento Instituto de Higiene e Medicina Tropical Rua da Junqueira 100, 1349-008 Lisboa, Portugal Email: a21000819@ihmt.unl.pt / agoggins818@gmail.com Telefone: 9803147

	Assinatura … … … … … … … … … … … … … … … ….

Declaro ter lido/escutado e compreendido este documento, bem como as informações verbais que me foram dadas pela pessoa que acima assina. Foi-me garantida a possibilidade de, em qualquer altura, recusar participar neste estudo sem qualquer tipo de consequências. Desta forma, aceito participar neste estudo e permito a utilização dos dados que dou de forma voluntária, confiando em que apenas serão utilizados para esta investigação e nas garantias de confidencialidade e anonimato que me são dadas pelo/a investigador/a.

Nome: … … … … … … … ..... … … … ..... … … … … … … … … … … … … Número de participante: ……

Assinatura/ impressão digital: … … … … … … … ..... … … … … … … … … … … … … … … … … Data: …… /…… /…….

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UMA VIA PARA A EQUIPA DE INVESTIGAÇÃO, OUTRA PARA A PESSOA QUE CONSENTE

Table 22: Log-linear model, partial associations of community association and clothes washing site				
Effect	df	Partial Chi-Square	Sig.	Number of Iterations
clothes_washing_site*community_approval*problems_frequency	4	1.767	0.778	3
clothes_washing_site*grouped_community_approval*community_rules	2	4.581	0.101	3
clothes_washing_site*problems_frequency*community_rules	2	1.951	0.377	4
community_approval*problems_frequency*community_rules	4	2.409	0.661	4
clothes_washing_site*community_approval	2	7.671	0.022	4
clothes_washing_site*problems_frequency	2	8.286	0.016	4
community_approval*problems_frequency	4	6.601	0.159	3
clothes_washing_site*community_rules	1	1.905	0.168	4
community_approval*community_rules	2	5.194	0.074	4
problems_frequency*community_rules	2	14.140	0.001	4
clothes_washing_site	1	7.080	0.008	2
community_approval	2	3.998	0.135	2
problems_frequency	2	7.837	0.020	2
community_rules	1	2.854	0.091	2

Table 23: Log-linear model, partial associations of distance and clothes washing site				
Effect	df	Partial Chi-Square	Sig.	Number of Iterations
clothes_washing_site*laundry_distance_house	3	15.232	0.002	2
clothes_washing_site*river_distance_house	3	21.488	0.000	2
laundry_distance_house*river_distance_house	9	6.823	0.656	2
clothes_washing_site	1	1.112	0.292	2
laundry_distance_house	3	62.497	0.000	2
river_distance_house	3	45.677	0.000	2

Table 24: examination of use of river and distance from home				
		Primary location of clothes washing for model		p-value
		not the river	the river	
Distance from home to public washing station.	>2 minutes	40	40	<0.001*
	2-5 minutes	34	13	
	5-10 minutes	19	4	
	<10 minutes	3	5	
Distance from home to natural source of water	>2 minutes	3	4	<0.001*
	2-5 minutes	14	4	
	5-10 minutes	21	9	
	<10 minutes	11	43	
*Fisher Exact test				

Table 25: Log-linear model, partial associations between natural water use and distance				
Effect	df	Partial Chi-Square	Sig.	Number of Iterations
river_distance_house*river_drinking*river_other	3	3.072	0.381	3
river_distance_house*river_drinking*distance_water_sys	9	5.124	0.823	2
river_distance_house*river_other*distance_water_sys	9	5.666	0.773	3
river_drinking*river_other*distance_water_syste	3	0.420	0.936	4
river_distance_house*river_drinking	3	3.589	0.309	4
river_distance_house*river_other	3	7.559	0.056	4
river_drinking*river_other	1	16.284	0.000	4
river_distance_house*distance_water_system	9	5.736	0.766	4
river_drinking*distance_water_system	3	1.366	0.714	4
river_other*distance_water_system	3	5.030	0.170	3
river_distance_house	3	45.509	0.000	2
river_drinking	1	0.000	1.000	2
river_other	1	0.334	0.564	2
water_system	3	109.646	0.000	2