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The Intersection of Diarrheal Disease and the WASH Sector: A Case Study of the Betafo area in the Vakinankaratra Region

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The Intersection of Diarrheal Disease and the WASH Sector:

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Stephanie Hansen

SIT Madagascar: Urbanization and Rural Development
Academic Director: Roland Pritchett
Spring 2015
The Intersection of Diarrheal Disease and the WASH Sector:

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May 04, 2015

Abstract:

Diarrheal disease is a leading cause of death in Madagascar, with the highest rates of morbidity and mortality in children under-five. Globally, it is the second leading cause of death of children under-five. The prevalence of diarrheal disease is a direct result of inadequate WASH infrastructure in Madagascar, where 48% of the population has no access to safe drinking water and 79% of the population has no access to improved sanitation (WaterAid, 2015). The inaccessibility of medical services in Madagascar is the largest impediment for diarrhea victims seeking treatment; a quarter of the Malagasy population lives 1 to 2 hours away from the nearest medical center (UNICEF, 2014). Diarrheal disease most frequently affects poor populations and results economic losses for families and lower learning outcomes in school-age children, which perpetuates the vicious cycle of poverty and health. The global effort that was put into trying to achieve the Millennium Development Goals brought safe drinking water and adequate sanitation facilities to millions of people, and the global prevalence of diarrheal disease declined as a result. However, the ultimate goal of universal WASH access is far from being achieved and more must be done. To combat diarrheal disease in Madagascar, WASH access must be increased and medical facilities must be decentralized.
Acknowledgements

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I am especially grateful to all of the doctors, nurses, health workers, and interviewees, who graciously took the time to participate in interviews with me. I would specifically like to thank Dr. Fanja Andrianantenaina from Betafo’s CSBII, for allowing me to observe consultations and for teaching me so much.

Finally, I would like to thank the staff at SIT for making this project possible. Thank you to Roland Pritchett, who acted as a wonderful source of support throughout the semester. Thank you to Hanta, Candy, Lydia, and Rivo for your help throughout the semester. Lastly, thank you to Professor Noëline, my academic advisor.

Betafo
April 2015
"It is my aspiration that health finally will be seen not as a blessing to be wished for, but as a human right to be fought for."

—United Nations Secretary-General Kofi Annan
Terminology

**Borne-fontaine** - This French term will be used to describe the community water sources built in Andranomafana through a NGO initiative. These water sources provide free potable water to members of the community. An example of a borne-fontaine is illustrated in the picture below, where my host sister, Faratiana, is using the borne-fontaine constructed in Antanetikely.
Terminology (Continued)

**CHD:** *(Centres Hospitaliers de District)* Public hospital that offers primary care to patients.

**CHRR:** *(Centre Hospitalier de Référence Régionale)* Public hospital that offers secondary care to patients; is better equipped with staff and medical supplies than the CDH.

**CSB:** *(Centre de Santé de Base)* Basic health centers in Madagascar with at least one doctor on staff. CSBs are either levels I or II, the difference being that CSBIIs offer obstetric services.

**Fokontany:** Smallest governmental level in Madagascar, subdivisions of communes.

**Improved Sanitation:** A latrine that hygienically separates human excreta from human contact.

**Improved Drinking Water:** A water source that is protected from outside contamination, specifically fecal contamination.

**Millennium Development Goals:** A set of 8 international development goals established by the UN in 2000 to be achieved by 2015. Some goals, but not all, were met.

**Morbidity rate:** The frequency with which a disease appears in a population.

**Mortality rate:** The ratio of deaths in a given area or period to the population of that area.

**NGO:** Non-governmental Organization.

**WASH:** Water, Sanitation, and Hygiene.
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Introduction

Introduction and Relevance

Diarrheal disease represents one of the largest public health problems in Madagascar. It is the fourth leading cause of death among Malagasy people, with the highest rates of morbidity and mortality in children under-five. The high prevalence of diarrheal disease is a direct result of the lack of WASH infrastructure in Madagascar, where 48% of the population does not have access to safe drinking water and 79% of the population does not have access to improved sanitation (WaterAid, 2015). One quarter of the Malagasy population lives 1 to 2 hours away from the nearest medical facility; this inaccessibility acts as the largest deterrent when trying to obtain necessary treatment. Diarrheal disease is both treatable and preventable and improved access to WASH and medical facilities will have a significant impact on reducing the impact of the disease.

Diarrheal disease and lack of WASH access constitutes a significant global burden as well. On a global scale it is estimated that there are 1.7 billion cases of diarrhea each year, resulting in 1.5 million deaths, 760,000 of which are children under-five. This high prevalence rate is directly related to insufficient global WASH access, where 748 million people do not have access to safe drinking water and 2.5 billion people do not have access to adequate sanitation (UN, 2014).

Fortunately, global trends paint a hopeful picture; the prevalence of diarrheal disease has seen significant declines as access to WASH has seen significant increases. This is due largely to a concentrated global effort through the Millennium Development Goals of 2015. Looking forward, the international community must continue working towards the goal of universal WASH access.
Statement of Purpose

The purpose of this case study is to illustrate the intersection of diarrheal disease and the WASH sector in the Betafo area, while also providing brief insight into the broader Malagasy and global situation. This study also aims to explore the public health impact of diarrheal disease and the factors that contribute to the disease’s high morbidity and mortality rates in Madagascar. Furthermore, this study looks at prevention and treatment methods that are currently being implemented with the intention of offering recommendations for further action and study.

Thesis Statement

Diarrheal disease is overwhelmingly the result of insufficient access to improved drinking water and sanitation, paired with poor hygienic practices. In Madagascar diarrheal disease negatively impacts health and the economy. Prevalence rates can be significantly reduced through increased accessibility of WASH infrastructure and medical facilities.

Methodology

For this case study, I used a combination of primary and secondary sources. I conducted my field study on the intersection of diarrheal disease and the WASH sector primarily in Betafo with a smaller focus on Antanetikely and Antsirabe in the surrounding area.

As a part of the SIT itinerary, I spent a week living with a host family in a rural village in Antanetikely. This village is located just outside of Betafo, a commune that recently changed from a ‘rural’ to ‘urban’ status.

During the week that I spent in Antanetikely, the biggest point of discussion and excitement revolved around WASH access. Several months ago, the village had received funds and training from an NGO so that they could build a borne-fontaine for their community and a latrine for every family. The project had recently been completed and the village was preparing
a celebration for World Water Day, which would take place the week after my departure. The community gathered several times to write and practice songs about having received access to clean drinking water and to express their gratitude. I was struck by the sense of pride and excitement that the borne-fontaine brought to this community as people spoke frequently and passionately about how their lives had been changed.

The village of Antanetikely now has access to WASH infrastructure, but much of the surrounding area does not. I witnessed the impact that lack of WASH access has on a community and observed the changes that WASH access brings. I also learned that diarrheal disease is the most common illness handled by the CSBII in Betafo, a direct result of insufficient or absent WASH infrastructure in the area.

I chose to return to stay with my host family in Antanetikely to examine the prevalence of diarrheal disease in relation to WASH access in Betafo and the surrounding area for my case study. My study was mainly focused in Betafo because the CSBII and CHD located there represente the most accessible medical facilities in the immediate area. I additionally conducted interviews in several other medical facilities and schools in the surrounding area.

I spent two weekends conducting interviews in Antsirabe because they have more advanced medical facilities, which Betafo diarrhea victims are occasionally sent to. I conducted an interview at the CSBI in Andranomafana because the CSBI lacks medical equipment and often has to send patients to Betafo for care.

I conducted interviews with several doctors, nurses, teachers, NGO staffers and community members. I did not interview any patients suffering from diarrheal disease due to ethical considerations, as most patients are young children. I interviewed people who did not have any access to safe drinking water and people who had recently received access, for which
my host sister acted as Malagasy to French translator. Participant observation was used when I sat in on patient consultations with doctors and also in my day-to-day experience living in a rural Malagasy village.

**Ethical Considerations**

Before conducting interviews I obtained consent from all interviewees and explained my role as a student studying in Madagascar and the nature of my study. I additionally explained that participation was voluntary and that interviewees had the option to remain anonymous. I acted as an observer during multiple patient consultations, which posed an ethical dilemma from an American perspective. From a Malagasy perspective however, my role as an observer was considered to be very acceptable due to different cultural expectations to doctor-patient confidentiality. Ultimately, when a doctor invited me to observe patient consultations, I decided to accept on the basis that patients did not object to my presence. No objections were raised during any of these consultations and many patients initiated conversations with me about my case study and my role as a student in Madagascar.

**Obstacles and Biases**

I encountered several obstacles and biases during the course of this study. One of the largest obstacles that I encountered was a lack of data on both diarrheal disease and WASH access in Madagascar. Although diarrheal disease has the highest morbidity rate in Betafo’s CSBII, there is little attention paid to the disease and it is generally accepted as an unavoidable part of life. Reports showing the age of each patient and the severity of their diarrhea were recorded and organized by month, however I was not able to obtain information about the mortality rate in Betafo, but was told that diarrhea related deaths in the area are rare. It was also
difficult to come across information about WASH access in the region, though I was able to find a 2012 estimate of the number of people who had access to safe drinking water.

Logistics represented another obstacle due to the rurality of the region and the poorly paved roads. This made navigating the area difficult and limited my ability to explore the region and travel on my own. I was also unable to locate an NGO in the region that I had hoped to conduct and interview with. Additionally, I had several appointments fall though without explanation and was not able to meet with the head of the fokontany in Andranomafana or a representative form WaterAid as planned.

I also recognize that there are biases present in my case study. I conducted interviews with many medical professionals who generally all had access to safe drinking water and adequate sanitation and were educated about safe hygienic practices. As a result they may not have fully understood the difficult conditions that the poorest populations live in and may have given answers that did not fully take into account their situations. For example, a number of doctors cited laziness as one of the reason that people do not boil their water, without recognizing that they may lack the means and education necessary to do so.

I also conducted interviews with people who did not have access to safe drinking water or adequate sanitation. I would ask questions such as, “Do you wash your hands with soap, if so when do you do so?” “Do you boil your water before you drink it, if so how often?” “Do you have access to a toilet, if so do you always use it when you need to use the bathroom?” and “Have you or your children ever contracted diarrheal disease, if so how frequently?” These types of questions are personal and the people that I interviewed did not know me at all. Therefore, they may have responded in the way that they thought I wanted to hear or in a way that did not implicate them in participating in unsafe behaviors.
Area of Study

Madagascar: A Brief History

Madagascar is the fourth largest island on earth, located off of the Mozambique coast in the southwestern Indian Ocean. Madagascar is among the poorest and least developed nations in the world and has an estimated population of 22.92 million, approximately 65% of whom live in rural areas (World Bank 2013). The 2014 Human Development Report classifies Madagascar as a low-income country, ranking it 155th out of 187 countries on the poverty scale, with 72% of the population living below the poverty line.

France invaded Madagascar in 1894 and officially annexed the country in 1896. Madagascar gained independence in 1960, after over six decades under colonial rule. Madagascar’s struggles to recover from the effects of colonialism are reflected in a government plagued with corruption and instability. In 2009, President Marc Ravalomanana was removed from power through a coup d’état that gave Andry Rajoelina the presidency. These events launched Madagascar into a disastrous political and economic crisis that lasted for over five years. The majority of the international community, including the United States, refused to recognize Andry Rajoelina’s government and withdrew all non-humanitarian aid to Madagascar. In 2013 Hery Rajaonarimampianina was elected into office after two-round presidential elections that the international community deemed to be fair and transparent. Hery Rajaonarimampianina was sworn in as president in January of 2014. International aid is beginning to flow back into Madagascar, as the country embarks on its slow journey to emerge from prolonged crisis (USAID, 2015).
The Vakinankaratra Region

Located in the Central Highlands of Madagascar, Vakinankaratra is the country’s second most populated region and has estimated population of 1,589,800 (Ralison and Goossens, 2006). Antsirabe is the capital of the Vakinankaratra region and the third largest city in Madagascar (Moser, etc. 2005). Betafo is 1 of 7 districts in Vakinankaratra and has recently changed from being labeled and rural center to an urban center.

Andranomafana

Andranomafana is a rural commune with an estimated population of 6,000 inhabitants (Census, 2001). My home stay was located in Antanetikely, a village in Andranomafana that neighbors Betafo.

Public Health in the Malagasy Context

The average life expectancy in Madagascar is 62 years old for men and 65 years old for women, the healthy life expectancy is 50 years old. The top causes of death in Madagascar include: stroke, lower respiratory infections, tuberculosis, diarrheal disease, heart disease, HIV/AIDS, and malaria (WHO, 2013).

The Ministry of Public Health is responsible for directing all public hospitals, CSBIs, CSBIIs and other public health centers in Madagascar. They are also responsible for financing a number of public health programs and initiatives. For example, they provide a number of free medications and services, such as: contraception, care for malnourished children, HIV and malaria tests, tuberculosis treatment and prenatal care (Ministère de la Santé, 2015).

The Ministry of Water was created in 2008 with the purpose of mobilizing citizens and financial partners to better manage water resources, expand access to safe drinking water,
increase food security, and to raise awareness about hygienic practices to create changes in behaviors, mentalities, and habits (Ministère de l’eau).

The Malagasy government makes an effort to improve the population’s health and to expand access to WASH infrastructure, but governmental efforts alone are not enough due to their limited resources. Foreign aid comes from both the governmental and non-governmental sectors, from sources such as USAID and WaterAid. It’s estimated that approximately 75% of public budget comes from foreign aid; therefore international aid is important and necessary in the development process (Prof. Moxe). Local Malagasy organizations, such as Miarintsoa, also play an important role in working to improve the situation of their country.

Diarrheal Disease: Background Information

Definition and Categorization by Types of Diarrhea

The World Health Organization defines diarrhea as “the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual). Frequent passing of formed stools is not diarrhea, nor is the passing of loose, "pasty" stools by breastfed babies.” The three clinical types of diarrhea include: acute watery diarrhea, persistent diarrhea, and dysentery. Acute watery diarrhea lasts for several hours or days, persistent diarrhea has a minimum duration of 14 days, and dysentery is when there is visible blood in the stool (WHO, 2013).

The Global Burden of Diarrheal Disease

Globally, there are an estimated 1.7 billion cases of diarrhea each year, resulting in 1.5 million deaths, 760,000 of which are children under-five. This places diarrheal disease second only to pneumonia as the world’s leading cause of death in children under-five.
As of 2012, approximately 58% of deaths caused by diarrheal disease are the result of unsafe drinking water, inadequate sanitation, and poor hygiene; this is down from 88% in 2000 (WHO, 2014). Due to lack of access, diarrheal disease has the highest prevalence rate in developing countries, specifically in South Asia and sub-Saharan Africa (CDC, 2013). The majority of deaths from diarrhea occur in children under 2 years of age, around the time when they are weaned off of breast milk. In developing countries children under 3 years old experience between 3 and 9 diarrhea episodes per year (WHO, 2013).

In Madagascar, diarrheal disease is the fifth leading killer of children under-five and is tied with tuberculosis as the population’s third largest cause of death overall. In 2012 diarrhea disease caused the death of 10,100 Malagasy people, 4,627 of whom were children under-five (WHO). Diarrheal disease constitutes the overwhelming majority of cases received by the CSBII in Betafo but diarrhea cases that result in death are rare (Dr. Andrianantenaina, personal communication, April 10, 2015).

**Pathology and Transmission**

Diarrheal disease can be non-infectious or infectious. Non-infectious diarrhea can be caused by a chemical irritation of the gut or non-infectious bowel disease; it does not have a high fatality rate. The leading cause of global diarrheal deaths is infectious diarrhea, which is usually symptomatic of an infection in the intestinal tract that can be caused by a variety of bacterial, viral, and parasitic agents. It is most commonly spread through the fecal-oral route through the ingestion of contaminated food or water, person-to-person transmission as a result of poor hygiene, or through direct contact with infected feces (Rehydration Project, 2014).

The most common causes of infectious diarrheal disease in children in developing countries include: Rotavirus, Enterotoxigenic Escherichia coli, Shigella, Campylobacter jejuni,
and Cryptosporidium. Globally, rotavirus is the most common cause of diarrhea morbidity and mortality in children under-five. In Madagascar, Rotavirus accounts for approximately one third of all under-five diarrhea deaths, killing over 2,700 Malagasy children each year (Path, 2014).

Children who are malnourished or have weakened immune systems and people living with HIV have the highest risk of dying from diarrheal disease. Diarrhea can also be symptomatic of other infections such as pneumonia, measles, and malaria (WHO, 2013).

**Symptoms**

Diarrhea is an increase in the volume and liquidity of stool that is caused by an imbalance of the secretion and absorption of water and salts in the intestine (Black, 2007). Diarrheal disease results in the loss of large quantities of water and electrolytes and dehydration occurs when these losses are not replaced. Death from diarrheal disease is almost always a result of severe dehydration and loss of fluids (WHO, 2013). There are three stages of dehydration: early, moderate, and severe. Patients in the early stages of dehydration do not present with any signs or symptoms. Moderately dehydrated patients show minimum symptoms that include thirst, irritability, and decreased skin elasticity. Severely dehydrated patient show a wide range of symptoms including: sunken eyes, dry tongues, distended abdomens, pale skin that is moist and cool with decreased elasticity and low blood pressure. Additionally, diarrhea results in a loss of vital nutrients, which makes children more susceptible to malnutrition (Dr. Andrianantenaina, personal communication, April 10, 2015).

**Consultation and Treatment**

In the CSBII and CHD in Betafo and the CBI in Andranomafana, all patient consultations are free. There is a consultation fee at the CHRR in Antsirabe, however, if patients need to be hospitalized the consultation fee is waived to help lighten the financial burden. Patients must pay
for the cost of medications and hospital stays. Hospitals and CSBs have a list given to them by the fokontanys of the destitute people in the community “les démunis,” for which medication is occasionally subsidized or given for free when the medical centers can afford to do so (Madame Aronala, personal communication, April 18, 2015).

Diarrheal disease is most commonly treated over a 10-14 day period with a combination of zinc and oral rehydration salts (ORS). Zinc reduces the occurrence of diarrhea and ORS, a mixture of water, salt, and sugar, replaces lost water and electrolytes. When necessary, this combination can be given intravenously. The cost for this course of treatment is 200 Ariary ($0.06), a price that is affordable for nearly all Malagasy people. In severe cases of diarrhea, patients are hospitalized for up to 3 days and may require stronger medication, most commonly Metronidazole or Chloramphenicol. Metronidazole is available in Betafo and is the cheaper and less effective of the two medications, a round of treatment costs 1,000 Ariary ($0.33). Patients must travel to Antsirabe to buy Chloramphenicol, which costs 9,400 ($3.09) for a round of treatment, not including the cost of transportation. The cost and time involved deters patients from purchasing Chloramphenicol (Dr. Andrianantenaina, personal communication, April 10, 2015).

**Prevention**

Important preventative measures include improving access to safe drinking water and adequate sanitation, promoting hygienic practices such as hand washing and safe food preparation, providing health education, promoting exclusive breastfeeding until the child is 6 months old and supplemental breastfeeding until the child is 2 years old and vaccinating children against rotavirus (WHO, 2013).
Water, Sanitation, and Hygiene

Global Impact

There are currently 748 million people, 1 in 10 of the world’s population, who do not have access to safe drinking water. It is estimated that 1.8 billion people use a water source that is faecally contaminated. There are 2.5 billion people, more than 1 in 3 of the world’s population, who lack access to improved sanitation. As a result, 1 billion people practice open defecation. Hundreds of millions of people do not have access to soap or clean water to wash their hands with (UN, 2014).

Malagasy Impact

In Madagascar 48% of the population, equaling 10.9 million people, do not have access to safe drinking water and 79% of the population, equaling 18 million people, do not have access to improved sanitation (WaterAid, 2015). These percentages drastically increase in rural areas, where 66% of the rural population is without access to safe drinking water and 89% of the rural population is without access to adequate sanitation facilities (UN, 2011). According to 2012 municipal records, 51.9% of Betafo’s population does not have access to safe drinking water, aligning them closely with the national average. Under the category of “Water and Sanitation” the Social Progress Index of 2015 ranks Madagascar 133rd out of 133 countries, identifying the conditions in Madagascar as the worst in the world.

Global Distribution of WASH Access

Large disparities exist in the global distribution of WASH access. Disparities also exist within countries, as urban areas generally always have more access to WASH infrastructure than rural areas. Sub-Saharan Africa has significantly less access to safe drinking water than the rest
of the world, and sub-Saharan Africa and South Asia disproportionately lack access to improved sanitation, as illustrated by UNICEF’s graph below:
It is no coincidence that 88% of diarrheal deaths caused by inadequate drinking water occur in sub-Saharan Africa and South East Asia (WHO, 2014).

**Medical Facilities: Few and Far Between**

**Accessing Patient Care**

According to interviews with doctors in Andranomafana, Betafo and Antsirabe, the biggest impediment to receiving medical care in the area is the patient’s proximity to medical facilities.

In the sprawling communes of Andranomafana and Betafo there are no ambulance services, car ownership is extremely rare, and the majority of roads are rocky and unpaved. Each year during the 5 month long rainy season from November to April, flooding destroys the already precarious dirt roads, making them impossible to traverse by car and even more difficult to traverse by foot. The rainy season is also when the overwhelmingly highest rates of diarrheal disease occur, due to the increased contamination of water sources.

In Andranomafana the only medical facility available to the 6,000 plus inhabitants is a CSBI. As the CSBI has very limited equipment and is unable to admit patients overnight, they often have to refer patients to Betafo for treatment. The walk to Betafo takes about an hour and a half and is a taxing journey for sick patients and makes obtaining emergency services nearly impossible (M. Razanajanaïtary, personal communication, April 23, 2015).

There are two medical centers in Betafo, the CSBII and the Centre Hospitalier de District Betafo (CHD), which serve the commune’s 13 fokontany and approximately 30,000 inhabitants. The two centers offer free consultations and are located across the street from each other in the center of town. The CSBII handles general cases and refers more serious cases to the CHD, which is capable of admitting patients overnight.
The CSBII’s Dr. Fanja Andrianantenaina estimates that the patients she receives walk an average of 2 hours to reach the center. The fokontany that is located the farthest from the center is about 6 miles away, forcing sick patients to walk approximately 3 hours each way across difficult roads to get treatment. Dr. Andrianantenaina named distance as the number one reason that parents commonly wait as long as possible, an average of four days, before taking their children with diarrhea to get treatment. Consequently, when these children reach the CSBII they are often severely dehydrated. Parents often hope that the diarrhea will pass on its own, and when it doesn’t, they try home remedies or self prescribe medication to their children. In Madagascar, pharmacies are much more widely dispersed than medical facilities and prescriptions are not required. As a result, it is common for patients to dangerously self-prescribe drugs (personal communication, April 10, 2015).

While the two centers in Betafo are capable of handling the majority of the cases that they receive, they lack the resources to treat severely sick patients and are occasionally forced to refer patients to the Center Hospitalier du Reference Régional (CHRR) in Antsirabe. With better technology, more resources, and specialists, the CHRR in Antsirabe is much better equipped than the CHD in Betafo. Antsirabe is a 30-minute commute by public transit and costs 1,200 Ariary ($0.39) each way. While the cost of transportation is seemingly very low by US standards, it is high enough to deter patients from seeking the medical treatment that they need. The knowledge that treatment in Antsirabe is generally more expensive than treatment in Betafo also acts as a deterrent. Diarrhea cases are rarely severe enough to be sent to Antsirabe; during the month of March 2015, the CHD in Betafo treated 570 diarrhea cases and only referred 1 patient to Antsirabe for treatment (CHD Patient Log, 2015).

Dr. Andrianantenaina described her reluctance to send patients to Antsirabe, saying,
“I do everything that I can before I tell them that they must go to Antsirabe because I know that they will not go. People struggle to find enough money so that they can eat today, they do not have the means to go to Antsirabe. They beg me to treat them here but when there is nothing more that I can do I must tell them to go there.”

She stated that in dire situations families usually find a way to come up with the money, but not always (personal communication, April 22, 2015).

My home stay in Antanetikely, located in between the CSBI of Andranomafana and the CSBII in Betafo, provided me with insight into the struggle of reaching medical centers. To reach the CSBI, a 50-minute walk through rice paddies was necessary. Narrow dirt paths are elevated above the water filled rice paddies and jumping over irrigated canals is a frequent obstacle. As a foreigner unaccustomed to navigating these paths, I fell knee-deep into the mud and water filled paddies on both the way to and from the CSBI. Reaching the CSBII in Betafo requires a hilly 40-minute walk over partially destroyed dirt roads. As an athletic 21-year-old in good health, I found these routes to be physically draining and could not imagine embarking on the journey in poor health. I experienced making this journey with a sick child when my 7 year-old host sister spiked a high fever and needed to be taken to the CSBII in Betafo. She struggled through the 40-minute walk to the center but was unable to make the return trip back and had to be carried by her older sister. During my home stay, my host father’s friend fell and suffered head trauma. The Betafo medical facilities lacked the equipment to treat him and he had to be transferred to Antsirabe. He died en route, leaving behind a wife and 4 children (S. Rakotondrab, personal communication, April 15, 2015).

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1 Original quote: “Je fais tout ce que je peux avant que je leur dise qu’ils doivent aller à Antsirabe parce que je sais qu’ils n’iront pas. Les gens ont du mal à trouver d’argent pour qu’ils puissent manger aujourd’hui, ils n’ont pas les moyens d’aller à Antsirabe. Ils me supplient de les aider ici mais lorsqu’il n’y a rien de plus que je peux faire, je dois leur dire d’aller là-bas.”
**Accessing Medical Training and Supplies**

A few times each year, the CSBII doctors attend medical conferences and medical training in Antananarivo, the nation’s capital. Antananarivo is about a 6-hour journey each way, and the conferences and training typically lasts for a few days. During the time of this case study a 4-day medical conference in Antananarivo took place. All of the doctors attended and only two midwives stayed behind, leaving the CSBII severely understaffed.

Children who suffer from diarrheal disease have a higher risk of becoming malnourished and children who are malnourished have a higher risk of contracting diarrheal disease. The Malagasy government provides free treatment for malnourished children through the weekly distribution of free micronutrient powder packets. However, the doctors in Betafo can only obtain these packets by traveling the 6 hours to Antananarivo. This is problematic because they often lack the time and the resources to do so and consequently run out of packets. During the time of my field study I acted as an observer during one of the weekly malnutrition treatment sessions, but there were not many patients. Dr. Andrianantenaina remarked that there is normally a line of people out the door all day, but they were not there because they were not aware that the CSBII had acquired more micronutrient powder packets. A few weeks prior, the CSBII had run out of packets, they had since gotten more but they lacked they the ability to disperse the message throughout the commune despite their best efforts. Mothers of malnourished children, who are often malnourished themselves, are reluctant to make the long and difficult journey with their sick child if they are not guaranteed treatment (personal communication, April 21, 2015).

**Analysis: Medical Facilities: Few and Far Between**

Treating diarrheal disease is affordable for most Malagasy, yet it is still one of the country’s largest killers. Accessibility, not cost, seems to be the largest deterrent in receiving
care. Government sponsored initiatives to provide free or discounted healthcare are important and are having positive effects, but until healthcare becomes more widely accessible, they will never be enough. The decentralization of medical facilities is crucially important for achieving this. In a country that is 65% rural, establishing medical facilities that are accessible to everyone is a difficult task, however there is significant room for improvement. Paving roads would go a long way in improving access to medical care, as they would be able to withstand the annual flooding and would significantly simplify the journey to medical facilities. This is doubly important because the destruction of the roads during the rainy season coincides with the highest incidence rates of diarrheal disease, when accessible medical facilities are the most needed.

Decentralization is needed on a local level so that everyone can access medical care when they need it. Decentralization also needed on a national level so that Antananarivo is not one of the only places that medical professionals can access medical necessities.

The Cycle of Poverty and Health

Economic Impact

Diarrheal disease has a significant economic impact on poor populations, who represent the disease’s most susceptible victims. The relatively low cost of treatment can be economically burdensome for poor families, especially in combination with the loss of income from time off of work. The case of a 3-month-old baby who had been admitted to the CHRR in Antsirabe for the second time because of diarrheal disease is an illustrative example of this problem. The mother of the baby is raising her four children alone, and her only income comes from selling cheap items on the side of the road. The baby contracted diarrheal disease as a consequence of her family’s extreme poverty and her family’s extreme poverty is exacerbated by her contraction of
diarrheal disease. Each time that she was admitted to the hospital for care she had to stay for a duration of three days and her mother was required to stay with her the whole time. As the sole income earner for her family, each of these three-day periods represented three days that the family received no income at all. In addition to receiving no income, the mother had to spend money on the treatment and care for her child. I am not aware of how much the cost was or if she received any financial assistance. According to the nurse that I spoke with, this case is very typical in Madagascar (Madame Aronala, personal contact, April 18, 2015).

**Impact on Education and School Attendance**

To observe the impact that WASH access has on schools, I conducted interviews in Collège Les Trois Pins, Collège d’Enseignement Général d’Andranomafana and l’Ecole Primaire Publique de Mahamasina.

College Les Trois Pins is a private school in Betafo that is attended by children who come from the wealthier families in the region. Squat toilets and safe drinking water are available to the students at the school. Absenteeism due to illnesses is not a large problem in the school (Mr. Manana, personal contact, April 15, 2015).

Walking up to Collège d’Enseignement Général d’Andranomafana, the first thing that caught my eye was the loud group of cheerful children washing and drinking from the borne-fontaine located right next to their school. Madame Holy, a teacher at the school, explained to me that the borne-fontaine was built three years ago through a WaterAid initiative. I inquired about where the school accessed water from before the borne-fontaine was built, to which she replied gravely, “There was none at all.”² Before I could finish asking her my next question, if she had noticed any changes in the school after the borne-fontaine was built, she interjected.

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² Original Quote “Il n’y avait rien du tout.”
stating “Absolutement,” with a true sense of conviction. A significantly lower rate of absenteeism was the first major change that she noted, presumably due to a decreased rate of waterborne illnesses. She continued by stating,

“There has been a big change in behavior as well. Before the borne-fontaine was built the children came to class dirty; dirty faces, dirty hands, dirty feet, and dirty clothes. They were often sick in school and had no energy to learn. WaterAid provided us with teacher training on the proper utilization of water so that we can teach the children. Now the children wash everyday before coming to class. They are clean and in good health and their grades have improved”\(^3\) (personal communication, April 23, 2015).

The changes that access to safe drinking water brought to this school were very evident.

Next, I went to L’Ecole Primaire Publique de Mahamasina, a small public primary school located in Betafo, where I conducted a group interview with 4 of the school’s 8 teachers. The school’s 375 students fill the school beyond its capacity, resulting in a large amount of students sitting on the cement floor. A borne-fontaine that provides no water is prominently located in the center of school’s courtyard, serving only as a reminder of what the school lacks. Madame Liva Rakotondrazanany explained, “The borne-fontaine does not work very often, but even when it does work, there is not enough water.”\(^4\) In order to provide water for the school, twice a day, the teachers must send 2 to 3 students on a walk to fetch water from a river located 20 minutes away. She went on to say, “We drink the river water untreated because we do not have the means to boil it”\(^5\) (personal communication, April 15, 2015).

A hygiene education class is taught during the first trimester of each academic year, but education can only go so far when means are lacking. The students know that they should wash

\(^3\) Original Quote "Et il y avait un grand changement de comportement. Avant que la borne-fontaine ait été construite les enfants sont venus à la classe sale; les visages sales, les mains sales, les pieds sales, et les vêtements sales. Ils étaient souvent malades à l’école et ils manquaient l’énergie à apprendre. WaterAid nous a donné une formation à suivre sur l’utilisation de l'eau pour qu’on puisse enseigner aux enfants. Maintenant, les enfants se lavent chaque jour avant de venir en classe. Ils sont propres et en bonne santé et leurs notes sont meilleures.”

\(^4\) Original quote: “La borne ne marche pas souvent, mais même quand elle marche, il n’y pas assez d’eau.”

\(^5\) Original quote: “On boit d’eau de la rivière directement parce qu’on n’a pas des moyens de faire bouilir d’eau.”
their hands before they eat and after they use the toilet (the school has 3 outdoor squat toilets) but there is no water and no soap for them to put their knowledge to use.

Madame Jololonirina Rondromalala spoke sadly about the effects that poverty and health are having on her students. There is a high absence rate among the students, especially during the rainy season when diarrheal disease is the most prevalent, causing them to fall behind in their studies. Many of her students are malnourished and consequently lack the energy to concentrate and learn in class. Poverty further impedes the learning experience of the students, as several cannot afford to buy notebooks and writing utensils. “Because of these problems,” Madame Jololonirina explained, “the students have an academic level that is much lower than the rest of the country”6 (personal communication, April 15, 2015).

**Analysis: The Cycle of Poverty and Health**

Poverty is both a cause and consequence of poor health and diarrheal disease is both a cause and consequence of poverty. Poverty greatly increases the risk of contracting diarrheal disease and the costs associated with treating diarrheal disease drive people even further into poverty. This creates a vicious cycle from which many people never emerge.

The poorer children attend public schools, which are less likely to have access to safe drinking water. Drinking contaminated water causes diarrheal disease, which causes children to miss school and fall behind in class. Diarrheal disease causes and results from malnutrition, draining children of energy and diminishing their ability to learn. This results in lower performance levels that can have long lasting consequences such as limiting a student’s ability to attend college and pull themselves out of poverty.

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6 “A cause de ces problèmes, les élèves ont un niveau académique qui est très bas par rapport au reste du pays.”
Improved health is often seen as a result of an improved economic situation, but it is important to recognize that health is not only a result of development but it is a vital and fundamental component of the development process. Improving access to safe drinking water and adequate sanitation and promoting hygienic practices is the most significant way that the health of these communities can be improved and the prevalence rate of diarrheal disease can be reduced.

Water, Sanitation, and Hygiene: An Educational Approach

*Educational Resources: An Overview*

In each of the three areas where I spent time conducting this case study (Antsirabe, Betafo and Andranomafana) there were at least some WASH educational services available to the population. The amount and the types of educational services varied between areas. The following is a brief, certainly not comprehensive, overview of the WASH educational services that I observed in each area.

**Antsirabe:** The Bureau Municipal d’Hygiène (BMH) is an organization that raises awareness about proper hygienic practices in Antsirabe. The BMH was a governmentally financed agency up until the 2009 coup d’état. The economic instability that ensued caused them to lose governmental funding, which remains indefinitely withheld. The BMH was able to find some international donors who have managed to keep the organization afloat, but only barely. The BMH’s 35 employees have not received a salary since November and are hoping to see December’s salary sometime in May. The last project that the BMH implemented was over two years ago, the last time that they had adequate funding, when they visited 235 local restaurants *(hotelys)* and provided them with hygienic education classes for food preparation. Before the
2009 crisis, BMH employees regularly went out into the ‘field’ to raise awareness about hygienic practices, with a specific focus on the poorest neighborhoods. They created and dispersed educational posters around the city, promoting behavior such as hand washing and treating water before drinking it, they even financed a billboard that promoted hand washing. Since the 2009 crisis the BMH has lacked the funding to continue these activities and they now work largely out of their office, providing smaller scale education courses to the community on various hygiene, health and environmental subjects (Mrs. Tobiniaina, personal communication, April 17, 2015).

Both the CSBII d’Ambalavato and the Center Hospitalier du Reference Régional à Antsirabe reported that they do not provided educational programs for the communities, but they do provide hygiene education for parents children with diarrhea. They explain the importance of hand washing, treating water before drinking it, storing water in a sanitary container and hygienic food preparation methods.

The hygiene education services provided by the Service Médical Interentreprises d’Antsirabe (SMIA) parallel those of the CSII and CHRR listed above, with the addition of educational videos played in the waiting room. The SMIA was exceptional in the fact that they had an indoor waiting room and TVs, as this was something that I had never before witnessed in a Malagasy medical facility. The patients who attend SMIA are local enterprise employees and their families, who are generally in the lower middle class (F. Ramanankasina, personal communication, April 18, 2015). One educational video showed a woman washing her hands with liquid soap and a sponge in her kitchen sink and explained how to properly wash your hands and the benefits of doing so. A second video showed a woman showering under a showerhead with running water and explained the importance of showering properly and regularly. I found both of these videos to be problematic because they were not representative of
hand washing and showering experience of the majority of Malagasy people, as most do not have access to running water and take bucket showers.

**Betafo:** Seecaline is a local NGO that works to reduce the national malnutrition rate. They work in 9 communities in 30 fokontanies throughout Madagascar, providing treatment for malnourished children and health and hygiene education. Seecaline works in 1 of Betafo’s 13 fokontany, where they give educational lessons once a month, with a specific focus on educating mothers on how to avoid malnutrition and diarrheal disease in their children (A. Narijama, personal communication, April 14, 2015).

Both of the schools that I visited in Betafo provide hygiene education to their students. Once a year a Japanese NGO called Volunteers Japanese visits the College Les Trois Pins to give hygiene education classes to students. L’Ecole Primaire Publique de Mahamasina teaches hygiene education classes during the first trimester of each academic year. Both schools noted that the goal of these programs was not only to educate the students but also to have the students use what they had learned to education their families and incorporate the lessons into their daily lives.

**Andranomafana:** Four years ago WaterAid, a British NGO, and Miarintsoa, a Malagasy NGO, formed a partnership to bring drinking water and sanitation to each village in each of the 6 fokontanys in Andranomafanoa. The project focuses on 1 fokontany per year and places a strong emphasis on community empowerment. Over the course of two months, hygiene education classes are held on a weekly basis in every village and a representative from each family is required to attend. The villagers are then given the training and materials needed to build the borne-fontaine and create a water irrigation system. Wash blocks are built next to the borne-
fontaine so that women do not have to risk parasitic infections, such as schistosomiasis, from doing laundry in the river and every family is given the materials needed to build an outhouse.

Every member of the village plays a contributing role in the approximately nine-month long process of building the borne-fontaine. After the project is completed WaterAid encourages the villagers to form a council with a representative from every family. The council creates rules and regulations for usage of the borne-fontaine along with a maintenance schedule. In my host family’s village of Antanetikely, the council decided that each family would contribute 400 Ariary per month ($0.16) to create a fund incase the borne-fontaine needs to be repaired and created a maintenance rotation among the families. WaterAid provided the council members with the resources and knowledge to continue holding hygiene education classes every month and did the same for schoolteachers (S. Rakotondrab, personal communication, April 9, 2015).

When Education Isn’t Enough

WASH education plays a critical role in reducing the prevalence of diarrheal disease, but education alone is not enough. People can be taught the importance of washing their hands, properly preparing their food, using a latrine and boiling their water before drinking it, however, without access to water, soap, a toilet, or fuel to build a fire, education can have no impact.

This point was echoed in several of the interviews that I conducted with medical professionals and villagers. Madame Aronala, a pediatric nurse in Antsirabe, spoke about the futility that she feels when educating the poor families of children with diarrhea, stating, “Even if we educate the people, there is nothing that they can do because they do not have any financial means.”7 To illustrate this she spoke about the three-month-old baby girl that she was currently treating, from the case referenced above. It was the baby girl’s second time being admitted to the

7 “Même si on fait sensibilisé les gens, il n’y a rien que ils peuvent faire parce qu’ils manquent les moyens.”
hospital for severe diarrhea within her short lifetime. The baby’s mother has three other children that she is raising alone in extremely impoverished conditions. As part of her job, Madame Aronala must tell her mother keep the baby clean and to clean her breasts before she feeds her. She has to tell her these things, even though she knows that the mother has no access to clean water and cannot afford to buy soap (personal communication, April 18, 2015).

In an interview with a women living in a village without access to safe drinking water, the woman stated that she knew that it was important to boil her water before drinking it but that she was not always able do so. Often times, people living in extreme poverty cannot afford to buy fuel to light a fire every time they need to drink (Anonymous, personal communication, April 24, 2015).

**The Challenges of Behavioral Change**

Conversely, it is not sufficient to provide a population with access to safe drinking water and adequate sanitation without a WASH educational component, as then they will have the materials but not the knowledge on how to properly use them or an understanding of the importance behind doing so.

Even with education, encouraging behavioral change is very difficult. People are reluctant to break habits that they’ve held for a lifetime and are often not convinced that these habits are bad for them. In an interview in Ambaratonga, a village in Andranomafana without access to safe drinking water, a man explained to me that he knows he should boil his water before drinking it but he often drinks the water directly from the rice fields and has not experienced any negative health consequences. It is inconvenient to boil water every time that you are thirsty. The man illustrated this point by talking about working in the rice fields under the hot sun; he does not have time to get boiled water to drink and also does not want to drink
hot water. The water in the rice fields is cool, refreshing, and immediately available
(Anonymous, personal communication, April 24, 2015).

In my home stay village of Antanekely, in which all of the families had recently received
latrines and WASH education, I occasionally observed villagers relieving themselves out in the
open. Forgetfulness is also important to mention; it is not easy to remember to wash your hands
before eating and after going to the bathroom, to boil water before drinking it, or to use a latrine
when you have spent a lifetime doing otherwise.

**Analysis: An Educational Approach**

In the fight to reduce the global disease burden of diarrhea, it is vital to recognize that
WASH access cannot come without WASH education and that WASH education cannot come
without WASH access if meaningful results are going to be achieved. WaterAid’s project in
Andranomafana can be viewed as model example, as they provided both resources and education
through community empowerment. Community empowerment is also crucially important
because it allows for the perpetuation of the project without creating a dependency on outside
aid. Community members were given training on how to teach WASH education classes and on
how to build and repair the borne-fontaine. WaterAid conducts occasional follow up during the
first few months following the completion of the project, until they are sure that their help in the
community is no longer needed. The four fokontanys who have already received assistance from
WaterAid are now completely self-sufficient (S. Rakotondrab, personal communication, April
15, 2015). During my home stay experience the faucet of the borne-fontaine broke. Instead of
being left indefinitely with a non-working borne-fontaine, the council used the money that they
collect monthly from each family to buy a new faucet and they used their training to replace it
themselves within a matter of two days. The monthly continuation of WASH educational classes
is important as well because of the difficulty of creating behavioral changes. Perhaps what stood out to me the most about this project was the sense of community pride that it fostered. By empowering the community members to build the borne-fontaine themselves and to be the creators of the rules regarding the borne-fontaine’s usage, people were enthusiastic and passionate about what they had accomplished and what they had learned, as well as dedicated to maintaining the borne-fontaine and implementing WASH practices.

**Reducing Diarrheal Disease Through the Expansion of WASH Access**

**Global Trends**

The number of diarrheal deaths has dropped dramatically over the past 25 years, falling from approximately 2.5–2.9 million deaths in 1990 to 1.5 million in 2012. Mortality rates from diarrheal disease also decreased in children under-five during the same period, falling from 1.5 million in 1990 to 622,000 in 2012. The significant drop in diarrheal deaths coincided, not coincidentally, with the significant increase in improved WASH access. Other factors that played a smaller contributing role in these declines are: improved access to health care, oral rehydration and reduction of malnutrition in children period (WHO 2014, Preventing Diarrhea Through Better Water, Sanitation, and Hygiene).

The aim of the Millennium Development Goals for water and sanitation was to cut the number of people without access to safe drinking water and adequate sanitation in half by 2015. The target for safe drinking water was met ahead of schedule for in 2010 and coverage has continued to increase. In 1990, 76% of the global population had access to improved drinking water; this figure increased to 89% by 2012. The target for adequate sanitation was not met, but significant progress was still made; the coverage of improved sanitation rose from 49% of the global population in 1990 to 64% in 2012, bringing access to improved sanitation to nearly
2 billion people during that time period (WHO 2014, Preventing Diarrhea Through Better Water, Sanitation, and Hygiene).

**Malagasy Trends**

Madagascar has followed the global trend of a decrease in diarrheal disease and increase in WASH access. Access to safe drinking water increased from 29% in 1990 to 48% in 2015. Access to improved sanitation facilities improved from 8% in 1990 to 21% in 2015 (World Bank, 2015).

**The Situation as a Whole: Analysis and Recommendations**

Diarrheal disease is a leading cause of death in Madagascar and represents a significant public health problem for the country. It has the highest prevalence rate among the most vulnerable populations, the poor and children under-five. The most effective way of combatting diarrheal disease is improving access to water, sanitation, and hygiene. Improving WASH access is a priority for the Malagasy Government and local and international actors and significant progress has been made in recent decades. Despite all of this, Madagascar is still ranked as the worst country in the world for access to water and sanitation; nearly half of the population does not have access to safe drinking water and an overwhelming majority does not have access to adequate sanitation facilities. These findings are startling, unacceptable, and a clear indication that what is being done is far from being enough.

The Malagasy Government and outside organizations do not pay enough attention to diarrheal disease itself, despite the fact that it is one of the country’s biggest killers. Perhaps this is due to the unpleasant nature of the disease, but whatever the reason, nothing is more unpleasant than the diarrhea related deaths of about 4,627 Malagasy children under-five each year (Path, 2014).
The effects of diarrheal disease extend into the economic sector, resulting in loss of productivity and lower performances in students. This perpetuates the vicious cycle of poverty and health, trapping people in a life of destitution and disease. Diarrheal disease can also have long-term health effects on children lowering their immunity level and making them more susceptible to malnutrition and stunted growth. In order to effectively combat diarrheal disease all of these interrelated factors must be take into consideration.

Diarrheal disease is both treatable and preventable, making it an incredibly important area to intervene in. The treatment itself costs pennies; the real issue is accessing treatment. Decentralization of medical facilities and improved road conditions are crucially important in the fight against diarrheal disease. This is especially relevant because rural populations are the most effected by diarrheal disease and also live the furthest away from treatment centers. The Malagasy government offers free contraception to women, but a large amount of women have a fear of taking birth control because they believe that it is bad for their health, despite education efforts to convince them otherwise (Dr. Andrianantenaina, personal communication, April 21, 2015). Fewer children will alleviate poverty rates, so contraception education should be continued and expanded.

Prevention must come through a combination of WASH access and education, and should focus on community empowerment in order to achieve the best results. When water sources are brought to rural villages it is not a granteer that all villagers will be able to access the water source due to the vast distance in between homes and unreliable roads, as I witnessed during my case study. It is important not to over look remote and isolated populations when creating water access points.
The rotavirus vaccine was introduced to Madagascar a little over a year ago, and further study should be done to monitor the impact that the vaccine has on diarrhea morbidity and mortality rates in children. An effort should also be made to widely distribute the vaccine in rural areas.

**Conclusion**

The WASH situation in Madagascar is dire. WASH access is abysmally low resulting in a diarrheal prevalence rate that is astronomically high. The Social Progress Index of 2015 ranks Madagascar as the worst country in the world for access to water and sanitation, and diarrheal disease is one of the leading causes of death. The conduction of this case study in the Betafo area concludes that insufficient WASH access is the leading cause of diarrheal disease in the area and the centralization of medical facilities is the largest impeding factor to patients receiving treatment. The most vulnerable populations most commonly contract diarrheal disease, setting them back further economically and putting them at greater risker for contracting other diseases. Diarrheal disease is preventable and treatable, so significantly reducing the disease’s morbidity and mortality rates is a very attainable goal. More action needs to be taken by both the Malagasy government and outside organizations to work towards this goal, which would immensely benefit the Malagasy people.
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