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Madagascar, Factor 10
Reduction of Food-Borne and Water-Borne Diseases in Madagascar

The African Water Development Report and the World Water Development Report states that approximately 3 million people die annually from water-related diseases. Poor water quality is the main cause of poverty and the death of diarrheal diseases. This issue is multifaceted, primarily due to lack of education, adequate systems, and governmental policies. One billion people in Africa do not have access to clean drinking water and 2.6 billion are without adequate sanitation.

A typical family in Madagascar is a single mother of three children in a village of approximately 2,000 people living in about 300 homes. Cattle and rice are their main sources of income. Health care is limited, especially in rural areas, as there is one major government hospital and at least one private hospital in each of the main provincial cities. Nurse midwives staff the majority of the Health clinics in the rural areas. Many traditional healers practice in rural areas. Most homes are constructed of mud bricks plastered with a hard drying mud. Education is required from ages 6 to 14, but is difficult to enforce in the more remote areas where children are needed for the agricultural work force to contribute to the household income. Learning from the elders of the village is often as highly valued as school-based knowledge. Rice is the staple of the Madagascar diet. It is usually served with some form of *kabaka*, a protein dish such as fish, meat, chicken, or beans. In some parts of the island a side dish, *romazava,* made from green leafy vegetables in broth is common. Most Madagascar entrees are prepared in one of four ways: fried, grilled, boiled in water, or cooked with coconut juice. Food is prepared in a kitchen that is physically separated from the main house for fire safety. Meals are served in the house, on the veranda, or on mats placed on the ground outside the house. Lunch and dinner leftovers are warmed for the breakfast meal the following morning. Breakfast consists of rice and tea made of local herbs or leaves and sweetened with sugar. Some alternate breakfast foods include boiled manioc, maize porridge, or fried cakes made of rice flour. Water is the usual beverage served with meals. *Rano ampango,* water boiled in the rice cooking pot, is sometimes served. (http://www.everyculture.com/JaMa/Madagascar.html

Madagascar farmers practice subsistence agriculture, many producing barely enough to feed their families. The average size of a family plot is 1.3 ha, equivalent to 2.471 acres. Growth of in the island's population has resulted in a worsening of the food shortage situation, so that almost half of the children now show some signs of chronic malnutrition and many die or become ill from food- and water-borne illnesses. The isolation of the rural residents also makes living conditions difficult. Many of their roads are in a poor condition and are unevenly distributed over the country, leaving many areas very isolated. (Rural poverty portal website)

The major barriers to improving the health of the residents and decreasing the number of infectious diseases include lack of water sanitation, overcrowding, and inadequate disposal facilities. Many of the homes do not have access to clean water and the water sources they use are unsafe.

The key factor that this research was focused on increasing the access to safe, potable water supplies and education on proper sanitation/hygiene and food preparation techniques to reduce the transmission of food and water-borne disease. Infants and children are most susceptible to infectious diseases. In 2010, the infant mortality rate was 61/1000 and the number of child deaths (under 5 years old) from diarrheal disorders per year was 13,000. Adequate water supply coverage was at 41% and sanitation coverage was only 11%. 71% of the population’s income was below the poverty level. In 2010 the total population of Madagascar was 19.1 million. Approximately 48% of the population is under the age of 18. (Wateraid.org)

Due to lack of necessary systems, supplies, and education, many of the residents pour wastewater on the rice paddies and into the communal streams that many in the village drink from many people become ill from food and water borne diseases, such as typhoid and diarrhea. In 2011, the major food and water-borne infectious diseases in Madagascar included bacterial and protozoa diarrhea, hepatitis A and typhoid fever. The population is considered to be at high risk for these diseases. (www.exxum.com/afd_hy/Madagascar)

The infant mortality rate in the country is 61/1000 and the number of deaths of children under five years old is 13,000 annually. Only 41% have an adequate clean water supply and 11% have adequate sanitation services. (wateraid.org) In 2010, 28% of the urban population shared water sources and 18% had open defecation practices. In the rural population, 17% had a shared water source and 38% had open defecation practices. (wssinfo.org)

In some areas the water sanitation issue has improved with the assistance of organizations such as the United States Agency for International Development (USAID). Other private and non-governmental organizations have also helped in some areas. In the village of Talatamaty, the USAID piloted a community based education program. Educated community leaders taught the rest of the village about sanitation, waste disposal, and well water protection. Steps were also taken to improve the physical environment, such as digging wells that contain potable water and improving the lighting around water sources. These measures made a positive improvement in the village by improving water quality and decreasing the number of food and water borne infections. (www.usaid.gov)

Another measure that has begun in a few areas is education in the schools about sanitation and safe water. In many schools children are told to bring a bottle of water each day. This bottle of water is used to wash their hands and to consume. This amount is usually not enough to cover all of their needs, but does help. Some schools are able to provide soap for the children. There has not been enough government funding to provide even this small measure to all schools.

The indicators used to measure this trend include the rates of infectious diseases, incidence of food and water-borne infections, and the mortality rates, especially those of infants and children. These indicators, implemented by private researchers and foundations, have not changed much over the last 15 years. Many of the systems found for the research were either pilot studies or systems in an isolated area. The government of Madagascar was not involved in this.

Any improvement in this area, even small, would have a positive effect on the health and well being of families, especially children. Some families may also be able to provide more income for their families if they were involved with some of the systems and ongoing businesses to maintain the systems, which would decrease the amount of people living in poverty. The environmental effects for the land would also be beneficial and provide more productive agricultural land for many years to come, as well as decreasing the strain on the environment and lack of water.

The major issues that would affect the family and the problem of water sanitation are water scarcity, the isolated rural areas, poverty, and the lack of communication. Climate change and the demands for water are also a factor. Major weather events including drought and flooding contribute to ongoing problems. In addition, one quarter of the people experience water stress and water scarcity. In a few years it is projected that at the current rate the demand of water will be below the level of their future water supply. The rapid population growth and expansion of urban settlements, industry and agriculture is also placing pressure on water resources. The water quality is affected by seasonal changes, weather climate and human activity. Approximately 75% of Africa's drinking water comes from underground and has little purification. Much of the water currently used is contaminated with pollutants that spread diseases. It is not uncommon to spend three hours collecting water for the day for each household.

The rural population has other issues, such as their remoteness, difficult terrain and lack of communication. These areas have little government investments to improve the water. The isolation of communities and their lack of access to media for information is also a factor(Ram, 2007). The cost of supplies and services continue to be another barrier. In 2010, the estimated cost of training an educator to teach about water safety and hygiene was about 6 Euros. Building a school sanitation area with two showers for 200 children would cost approximately 1,950 Euros. (Wateraid.com)

Because this issue is multifaceted and there is a vast difference in the environment and circumstances between the urban and rural areas, there are recommendations in several areas that need to be considered. The Millennium Development Goal to solve this situation by 2015 is Number 6: "Combat HIV/AIDS, malaria, and other diseases." The main target of this goal to address is Number 3: "Halt and begin to reverse the incidence of malaria and other diseases." (www.beta/undp.org)

The recommendations to improve the sanitation and to decrease infectious diseases include the use of a Safe Water System, urine-diverting units, non-urine diverting units, and the Gulper. There are pros and cons to each of these and some may work better in some areas of the country and others in other areas. Both of the urine diverting and non-urine diverting units are ecological and consist of three components, a pedestal or squatting pan, a slab or chamber, and sometimes a superstructure if outdoors. Along with an ecological form of sanitation. These units prevent diseases, and reduce water use and pollution.

A system for water purification includes the use of a Safe Water System (SWS). The SWS is a household system to improve drinking water quality and reduce the risk of infection. The system consist of three parts, water disinfection with diluted chlorine at the point of use, safe water storage and behavior change techniques. Each bottle of diluted chlorine cost approximately 0.33 cents and will treat about 1000 liters of water. This will be an adequate supply for a family of four for six weeks. Another advantage is that these are portable and can be used in remote areas. Some barriers to long-term use of this system include the smell and taste of chlorinated water, the use of plastic containers, (instead of bamboo), variability of supplies, and cost to very poor people. (Ram, 2007)

The following types of ecological and economical toilets could improve the sanitation and decrease the incidence and spread of infections. Urine-Diverting Units separate urine and feces during the treatment process. These are suitable to use in the home and do not require any water or a connection to a network. Because of the way they are constructed, an inexpensive unit and can be used in poor households and rural areas. After the urine is stored for a couple of days, with limited ventilation, it may be diluted with water and applied to vegetation. During the storage process, the nitrogen is converted to ammonia, killing off any pathogens that are present. One drawback to this system is that unless the area where the urine is collected is close to and above the area it will be placed on, the treated urine will need to be collected manually in buckets. The feces are collected in a chamber below the pedestal unit and after each use lime, soil or ash is sprinkled into the chamber to raise the pH. Raising the pH is the most effective way to prevent odors and kill pathogens that may cause infections. Other than raising the pH, reducing moisture and increasing the temperature help to some extent. These are double-chambered systems, so that the chamber in use does not interface with the feces that are being treated. After adequate time to be treated the feces is odorless and light in color. At this point it is ready to be added to the soil to fertilize or to compost further. (The waterpage.com)

Non-Urine Diverting Units, such as the ArborLoo, Fossa Alterna, and anaerobic digesters are inexpensive and offer environmental benefits. These systems collect and treat the urine and feces together in a ventilated pit, sprinkling lime or ash after each use. Composted humus will be formed in approximately three to four months, as long as there is good ventilation and low humidity. Some have built-in fans to speed the process. At the end of the treatment time, the humus can be applied to plants and fields. These systems are effective for 6-12 months and cost approximately five to eight dollars. (The waterpage.com)

The ArborLoo, used in rural areas, consists of a portable slab, pedestal and a superstructure. The chamber is about a meter deep pit that is dug in the ground. Ash or soil is added after each use to decrease odors. These are added until the pit is approximately three-forth full, then a small tree is planted in the pit with extra soil added. The unit then is moved to another area and the process begins again. The major advantage of this system is that no one handles the urine and feces. (The waterpage.com)

The Fossa Alterna consists of a moveable slab pedestal, and superstructure, there are chambers one under a toilet, that stores excreta while it is composted. When the humus is formed, a process takes place for several months and it is spread over the fields and then the cycle continues. The cost of use for 12-24 months is 86.33 Euros or $135 for family of 6. (The waterpage.com)

The Gulper is a manual operated pump for emptying wet pit latrines. The rods and valves are constructed from stainless steel, and the dimensions of the gulper are around 2m long and 100mm in diameter. A butterfly valve is fitted beside the puller rod and another is fitted on the bottom of the pipe. The t-angle pipe at the top of the Gulper allows a release of materials. The cost of the Gulper is approximately $160 and the cost to remove the sludge from the pits is approximately $20 to $50. It takes about 2-3 hours to empty a full pit the major advantage of this system is that local people can be trained and develop ownership in a business in their community. The major health benefits are that the operators do not come in contact with the sludge. Without this device people needed to empty the sludge with buckets. Use of the Gulper lowers the health risk of spreading disease. (Ideas at Work, the Gulper, Nov 2007)

The role of communities, organizations, corporations, and the government will be to communicate and educate citizens about procedures. The government will need to be involved in a monitoring system of the water safety and incidence of diseases. Recommendations for the best way to communicate would be by radio, as that is the main access for the majority of the population and only means of communication for much of the rural population. Holding local group sessions led by trusted people in the community would also be a beneficial way to educate and implement the programs.

The main issues that need to be managed for long-term success include plans and policies for monitoring water safety, monitoring agricultural use of water and chemicals that may pollute the water, water and sanitation services, monitoring health/infectious diseases, education and communication. The most beneficial overall system would be one that includes business opportunities for the local residents and ensure continued use of the systems and products, while increasing the countries self-sufficiency and employment opportunities.

My recommendations to address this problem are to use the Safe Water System and the Gulper. The Safe Water System will improve the water quality. Local citizens can perform the implementation and ongoing servicing of the Gulper system. Both of these are relatively simple and inexpensive, which will encourage the ongoing use of the systems. Education by community leaders with government oversight and monitoring is essential for ongoing success.

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