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Kenya, Water and Sanitation

Kenya: Solving Persistent Sanitation Challenges

Many people around the world do not have the luxury of clean drinking water nor an adequate waste removal system. The global challenge of water and sanitation is particularly dominant in the country of Kenya. Improper water sanitation practices inflict barriers to reaching food security and better quality of life for people in Kenya, but can be resolved by implementing effective water treatment processes ("Kenya: World Food Programme").

Kenya is located along Africa's east coast and home to 54.5 million people ("Kenya Population (LIVE)"). The country experiences two dry seasons and two wet seasons. An uneven distribution of rainfall is typical and sometimes areas experience long periods of drought ("Climate of Kenya"). Farming is very important in Kenya. "Agriculture accounts for 33% of Kenya's GDP, and about 75% of Kenyans earn all or part of their income from the agricultural sector" (Njogu). Corn and wheat are the main crops grown. Kenya is well known for its exports of tea, fresh flowers, coffee, fruits and vegetables ("Agriculture, Forestry, and Fishing"). Despite Kenya's dependence on farming, it is estimated that less than 8% of the land is available for growing crops and feeding. The average farm size is five acres or about 4.5 football fields ("Agriculture, Forestry, and Fishing"). The lack of land has resulted in seven million Kenyans being unemployed. People who do find employment are often self-employed and work labor intensive jobs (Njogu). Nonetheless, those with jobs often struggle to get by. "In 2021, it is estimated that "26.3% of Kenyan workers live on less than $1.50 US dollars a day" (Faria). A significant amount of Kenya's population is living in poverty. 72% of the population lives in rural areas and only 28% live in urban areas ("Kenya Population (LIVE)"). People living at the international poverty line make 92.4 Kenyan shillings ($1.90 USD) per day per capita. In comparison, the upper middle class's income is 267.5 Kenyan shilling ($5.50 USD) per day per capita ("Poverty and Equity Brief"). Location also impacts food affordability. Several areas in Kenya have poor infrastructure, specifically a lack of roads, which causes food to become less affordable. Maize is considered a staple in a Kenyan diet ("The Food of Kenya"). Two-thirds of the price of maize is determined by transportation costs. A lack of roads will raise the price of transporting food (Njogu). Living conditions are also part of Kenya's poor infrastructure. A typical Kenyan household consists of five people (Kamau and Haron). Housing is overcrowded and lacks ventilation as households usually live in a single room. Most households do not have access to clean water ("Housing Poverty in Kenya"). Many use pit latrines, holes in the ground that collect waste, in place of a traditional toilet. Generally, one pit latrine is shared between 20 other families (Mannion). Families in Kenya are at a high risk of getting malaria, respiratory infections, and parasitic jiggers infestation (Kenya A). This is problematic because healthcare is not accessible to all. In fact, "as many as 35 million Kenyans are excluded from quality health care coverage" ("Improving Health Care for Kenya's Poor"). Although Kenya experiences numerous barriers to food security, the most imposing is water.

Water issues impact various aspects of Kenya. For example, not everyone has access to clean water. In fact, 9.4 million people are drinking directly from contaminated water sources. Sanitation practices currently implemented are not effective. "Only 14% of Kenyans have hand-washing facilities with soap and water at home" ("Water, Sanitation, and Hygiene"). Additionally, the present status of Kenya's water sanitation issue is financially burdensome. "Poor sanitation costs Kenya 27 billion Kenyan Shillings each year, equivalent to US $324 million" ("Economic Impacts of Poor Sanitation in Africa"). These water sanitation issues in Kenya correspond to improper waste management.

The main contributor to Kenya's water sanitation problems is the country's lack of an efficient sewage disposal system. A deficiency of available toilets results in the use of latrines instead. "21 million Kenyans use unsanitary or shared latrines" ("Economic Impacts of Poor Sanitation in Africa"). Pit latrines vary based on their sanitation levels. Pit latrines with poor, unimproved sanitation levels cause people to come in contact with their waste (Njuguna). This includes pit latrines without a slab or an area to sit on, hanging latrines where an outhouse structure is built over a river bank and waste lands directly in lakes or streams, and bucket latrines that are prone to overflowing during a flood (Stauffer). Some pit latrines offer limited sanitation and disposed waste is separated from human contact. Pit latrines that fall under this category include pit latrines with a slab or a concrete covering and composting toilets (Njuguna). Sanitation is still an issue with limited sanitation because most Kenyans cannot afford to own a personal pit latrine. Using public latrines requires traveling a great distance to reach them which poses problems for females. Women are hesitant to use public latrines because they are often met with abuse on the way there. Instead women will dispose of their waste in plastic bags. However, sometimes even the use of a public latrine is not available, causing 5.6 million people to defecate in the open (Barton). Open defecation affects each population differently. 15% of people practice defecation in the open in rural areas compared to 3% defecation in urban areas (Mahugu). Open defecation is problematic because Kenya loses 9.7 billion Kenyan Shillings ($88 million US) from the practice ("Economic Impacts of Poor Sanitation in Africa"). Besides the costs, the issue of water sanitation also becomes troublesome when storms hit.

Overflow of waste and sewage contaminates water and food. One instance of contamination is from Wajir County. Wajir County, Kenya depends on water from shallow wells and high groundwater tables for domestic and livestock use. 68% of residents will use buckets instead of putting latrines in the ground to prevent the waste from getting into groundwater. Despite these efforts, during a storm the buckets overflow and shallow wells become polluted. Wajir town suffers from many cases of waterborne diseases like cholera and diarrhea because of this contamination (Ndungu). Similarly, when sewage run-off occurs, rivers become polluted with heavy metal. Kenyans will use this contaminated water for irrigation practices since it is the only water available. This has negative effects on the crops grown. A study done on the irrigation practices of industries in Nairobi, Kenya concluded the presence of heavy metals such as cadmium, nickel, lead chromium, copper and zinc increased in vegetables that were irrigated using treated wastewater (Sayo et al.).

Kenya's water sanitation issue must be accounted for. Sanitation issues come from the practice of open defecation. It is estimated that the practice of open defecation could be eliminated if 1.2 million latrines were built and used instead ("Economic Impacts of Poor Sanitation in Africa"). This could help alleviate Kenya's water sanitation trouble, but the solution is not sustainable long term. Pit latrines need to be emptied after two to five years of usage (Navert and Conroy). The waste is improperly disposed of and could contaminate soil and crops. The ingestion of contained foods leads to health consequences. "Approximately 19,500 Kenyans, including 17,100 children under five, die each year from diarrhea – nearly 90% of which is directly attributed to poor water, sanitation and hygiene" ("Economic Impacts of Poor Sanitation in Africa"). So far there has been little improvement in this trend. "Access to improved sanitation in Kenya increased by only 5% between 1990 and 2015" (Ndungu). In order to solve this problem, an innovative solution needs to be implemented to meet the needs of Kenya's population.

One possible solution to treat contaminated water is using solar disinfection, or SODIS. Countries like Cameroon and Pakistan have found success with this method. 34.3% of children in Cameroon

experienced diarrhea but after treating their water with solar disinfection the risk of diarrhea was reduced by 42.5%. In Karachi, Pakistan, SODIS has been used to effectively reduce 100% of the pathogens in water gathered from natural sources (Zinn et al.). In general, solar disinfection is practiced by filling a plastic bottle with water and placing it on a roof or rack for several hours in direct sunlight. The UV radiation from the sun kills pathogens and makes the water safe to drink. This method works effectively in killing viruses, bacteria and protozoa, single celled organisms that feed off of hosts, in water. Since the plastic bottle can be reused multiple times, the practice is inexpensive. However, there are also disadvantages to SODIS. Solar disinfection only works in locations that have regular access to sunlight. The method can treat waterborne pathogens, but is ineffective toward treating chemical contaminations. Water that is very murky needs to be pretreated or filtered before using solar disinfection. SODIS requires time to work ("Solar Disinfection"). The minimum waiting time is at least six hours, but sometimes it could take up to two days of exposure (Zinn et al.). A large supply of clean plastic bottles is also required in order to treat water with solar disinfection. Currently, Kenya Water for Health Organization, or KWAHO, is working on educating people in Nairobi, Kenya about the usage of solar disinfection. Although Kenyans are skeptical or uninformed about the benefits of SODIS, the KWAHO has trained promoters to inform over 250,000 people and raise awareness ("Solar Disinfection").

Another solution that could relieve Kenya's water sanitation problem is chlorination. This procedure mixes one bottle cap of sodium hypochlorite solution into unclean water. After 30 minutes the water is clean and safe to consume (Zinn et al.). Chlorination is useful for killing bacteria and viruses that cause diseases related to diarrhea. Additionally, Chlorination provides protection against recontamination ("Solar Disinfection"). Chlorination is cheap to use, as "a bottle of hypochlorite solution that treats 1,000 liters of water typically costs approximately 10 cents when using refillable bottles and 11–50 cents for disposable bottles" (Zinn et al.). Sodium hypochlorite solution is often distributed after disasters in Indonesia, India and Myanmar because it efficiently and effectively cleans water in a short period of time ("Solar Disinfection"). Despite these advantages, chlorination has some disadvantages as well. Chlorination is ineffective at removing protozoa. Water treated by sodium hypochlorite might have a certain taste and odor different from normal water. There is a small chance that drinking the solution could lead to long term health effects like colorectal cancer. Nonetheless, Kenya has made use of chlorination as a practical way to purify water. Western Kenya nurses are trained to use the hypochlorite solution in hospitals and to educate patients with diarrhea about safe water sanitation. There are HIV self-help groups in Kenya that generate income by selling hypochlorite solution and storage containers ("Solar Disinfection").

The solutions of solar disinfection and chlorination work to sanitize polluted water, the company Sanivation however, has come up with a process that turns Kenya's sewage into fuel. First sewage is gathered from septic systems and pit latrines across Kenya. It is sun-dried for two to three weeks and then treated at 572 degrees fahrenheit. The high temperatures add carbon, making the waste more flammable and odorless. Afterwards, it mixes with biomass waste like sawdust, small amounts of molasses that act as a binder, and gets rolled into balls or blocks called briquettes. When the mixture dries these blocks can be used as a fuel alternative for cooking or heating (Markham).

The briquettes created are an environmentally friendly fuel alternative for cooking and heating. Burning briquettes made from waste lasts twice as long and produces a third of the emissions less than burning charcoal (Whiting). This solution can accommodate small communities of 5,000 or larger communities with 100,000-400,000 people so it can serve both Kenya's rural and urban areas (Dalal). Sanivation will install toilets into people's homes which eliminates the use of public latrines. Unfortunately, conventional toilets cannot be used and new toilets will need to be designed specifically to collect waste. Another issue

is the stigma people will have of using waste for cooking fuel (Lewis). Although there are a couple disadvantages, Sanivation is still a great solution that meets Kenya's needs.

To solve Kenya's water and sanitation issue, I believe implementing a sanitation practice similar to Sanivation would be most beneficial long term. Although Sanivation is a for-profit enterprise, a Kenyan-led nonprofit organization, such as the Kenya Water for Health Organization, has the potential to lead a waste treatment facility like Sanivation ("Our Approach"). To fund the development of new treatment centers, I would first apply for grants. One grant worth considering is the Fondation SUEZ Grant which supports services that improve water, sanitation and waste for developing countries ("Foundation SUEZ Grants to Support Essential Services…"). Likewise, I would also try to obtain a grant from the World Bank Group, an institution that provides financial aid to sustainable development projects (World). Furthermore, I recommend KWAHO partners up with Amref Health Africa, the African Medical and Research Foundation. This non-governmental organization can provide additional funding needs as well as advocate the importance of health care practices ("African Medical and Research…").

Once the waste treatment plants are funded and built, the next step is to install toilets into the homes of Kenyans. Sanivation's installation is 300 Kenyan Shillings (~$3.50 USD) and 700 Kenyan Shillings (~$6.78 USD) a month for usage ("Blue Box Toilet"). The price Sanivation toilets is within the budget of a Kenyan household. The average amount of money an adult has available to spend on household goods and services each month in rural areas is equivalent to less than $20 USD and less than $25 USD in central urban areas (Njuguna). If families are willing to invest, the process of converting the gathered waste into fuel is sustainable in numerous ways. It can aid the environment since it replaces charcoal, a resource many Kenyans depend on, with a cleaner alternative (Whiting). When the briquettes are sold, the profits can be put back into treatment processes or can be used to advance sanitation practices in Kenyan communities. This solution could solve the destruction open defecation has caused on the environment. However, some may be hesitant to try a distinct solution like Sanivation because of personal beliefs.

Stigma with using waste-origin products as cooking fuel could hinder the progress of a project like Sanivation, but measures can be taken to help communities adapt to this new idea. Educating communities is an important step. Showing samples of water contaminated by open defecation and having health officials talk about the diseases associated with practice may not completely eliminate open defecation but it can help people be more mindful of their practices. In addition, lowering the price of briquettes so they are cheaper than charcoal could encourage people to buy more briquettes. In February 2018, Kenya's government issued a logging ban from all forests, causing a shortage of charcoal and firewood. Prices for cooking fuel greatly increased, hurting small restaurant businesses. People who had previously been skeptical of using briquettes bought some during the ban because of its affordability. Many were fond of the longer lasting capacity of briquettes compared to charcoal and have not switched back since (Okonda). Moreover, sometimes simply changing the meaning associated with a word can change a person's viewpoint. When people in Kenya hear the word "toilet" they think of outdoor pit latrines and shun the idea of an in-home toilet because they imagine bringing a filthy open latrine into their home. Sanitation calls their toilets "blue boxes" with the mindset that once people try it for themselves they can see that toilets can be thought of as something clean (Martin). Although it is unknown how long it would take for Kenyans to fully embrace Sanivation methods and for toilets to be installed into every home, there is an effective solution that solves Kenya's water and sanitation issues quickly.

To migrate the unsafe drinking water that is harming Kenyans in the present, I recommend utilizing the method chlorination. Chlorination has been distributed after natural disasters and can be deployed the quickest out of the proposed solutions above. Chlorine dispensers can be set up at various locations, making clean water easily accessible to the public. For refilling convenience and cheap delivery, the solution can be shipped in bulk rather than being sent out in small bottles ("Chlorine Dispensers for Safe Water in Kenya"). Chlorination can be used as a short term water sanitation solution for Kenya while treatment facilities that turn waste in fuel continue to grow.

In conclusion, Kenya cannot have food security and better quality of life without first facing the issues of water sanitation and implementing effective water treatment processes to solve them. By developing a waste treatment under the leadership of KWAHO that is similar to Sanivation, across Kenya, there will be more facilities converting waste into fuel. When properly treated, waste does not need to be a problem, it can be a solution.

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