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Nigeria, Infectious Diseases

Nigeria: A Strategic Combat against Infectious Disease

For as long as the human race has existed, pathogenic particles of all kinds have existed alongside it. From the bubonic plague in the Middle Ages to the novel corona virus today, infectious disease has shaped and will continue to shape the behaviors, outlook and health of those living on earth. Yet due to certain environmental and economic factors, some places face greater challenges when encountering these medical threats. A number of people in Africa, in addition to fighting hunger and poverty, risk their lives on a daily basis by collecting water, making contact with family members and even just stepping outside. Nigeria's tropical climate, widespread water contamination and underdeveloped organizational response teams have allowed for many spreadable pathogens to compound the nation's current state of struggle. However, budding solutions are on the horizon, employing ideas from global awareness and cooperation to breakthrough mechanical and genetic innovations.

Nigeria is a highly populated West African nation, governed by a federal republic political system. The country's economy is largely dependent upon the profits it obtains through its oil and natural gas exports, as well as agricultural crops such as sesame seeds, cashew nuts, fermented cocoa beans and shrimped prawns ("Unlocking Nigeria's Agricultural Exports"). Its 201 million citizens are divided relatively evenly between rural and urban areas, allowing many to pursue lives as farmers while others commonly make a living as sales representatives, marketing executives, accountants or drivers. Typically, family size is dependent upon the location. Those in rural regions tend to have between 7 and 10 children, but residents of more densely populated areas enjoy smaller families. It is common for those of any lifestyle however to live within multigenerational households that maintain strict traditional gender roles: the eldest patriarchal figure serves as the head, the mother is the one responsible for all domestic duties, and the children are expected to show strong respect for their elders ("Families in Nigeria"). Naturally, overcrowding can ensue as a result, causing many to overflow into make-shift and impoverished shantytowns on the outskirts of cities. Diets may vary widely according to region, but can often be comprised of fruit, fish, plantain dishes, beans, yams, rice, egusi (seeds used to make soups), sausage, egwu (goat-head), coffee and tea. The education system in Nigeria is present, but attendance is inconsistent. Roughly 10.5 million children do not go to school, a large proportion of them females who are frequently encouraged to focus their attention elsewhere. In fact, many girls attend Qu'ranis Muslim schools that, while providing a large emphasis on religious studies, fail to address numeracy or literacy in their curriculums. A number of other societal factors largely impact the livelihoods of residents in Nigeria. Only 10% of the nation's population receives any form of health insurance coverage while only about 60% have access to electricity and therefore the benefits of heating, cooling and household appliances. According to reports collected in 2013, 33% of families suffer from a lack of clean water, with only 41% of the country receiving dependable sanitation services. Those who don't have clean water available are often forced to carry water collected from wells in containers for miles or obtain gallons

from unregulated vendors. In addition to fluid contamination, many struggle daily with food insecurity and malnutrition. Due to the nation's heavy reliance upon food imports and rampant insurgent groups, good sustenance is often difficult to obtain.

Nigeria's state of health insecurity is in direct correlation with its vulnerability to infectious disease. In fact, virulent and bacterial pathogens account for 8 of the 10 leading causes of death. These include lower respiratory infections, neonatal disorders, HIV/AIDS, malaria, diarrheal diseases, tuberculosis, meningitis, and cirrhosis of the liver. Due to the tropical climate exhibited by west Africa, those in Nigeria are particularly prone to contracting vector borne diseases such as malaria, yellow fever and dengue fever that are transmitted to the human blood stream by mosquito bites. Water borne infections like typhoid fever, hepatitis A, hepatitis E, leptospirosis, schistosomiasis, and bacterial/protozoal diarrhea spread readily as a result of contaminated drinking water. Those in rural areas are especially at risk for developing diseases related to soil contact or aerosolized dust like lassa fever and animal contact, such as rabies. Currently the CDC is encouraging prevention measures that involve spreading awareness and innovation of medical advances specific to certain diseases and health threats throughout the continent. While these efforts are contributing to the nation's trend towards improvement, deadly pathogens remain a prevalent threat to Nigeria's people (CDC global health).

These existing medical initiatives are addressing the major risks of Nigeria's health crisis with a broad, globally conscious, yet action-based perspective. Ministries of Health (MOH) in western Africa are collaborating with the CDC to provide citizens with education and administration of treatment and prevention measures for tuberculosis and HIV. Laboratory services are also being expanded to better identify and cure these infections. Malaria cases in Nigeria, representing nearly 25% of the world's total number of cases, are being controlled by the development and distribution of rapid diagnostic tests, strengthening of WHO tube techniques and the establishment of a routine health information system responsible for collecting all data necessary for scientists to further research the disease. Vaccine preventable infections and their effects are being accounted for through organized immunizations with special consideration to rural groups. Additionally, the Global Health Security Agenda (GHSA) is working closely with Nigerian government officials to "meet the requirements stated in the International Health Regulations" and work "to achieve these requirements by focusing on workforce development, emergency response, surveillance, laboratory, and border health/point-of-entry interventions" (CDC global health).

Within Nigeria's borders, certain populations may be more at risk to infectious disease than others. Those residing in urban areas experience poor housing and sanitation that may lead to further contamination of food or water sources. Their higher population density also allows for a more efficient spread of airborne pathogens. People living in more rural locations, however, may have increased contact with aerosolized soil or animals and live in more vector-friendly environments. Certain diseases like malaria are more easily contracted by pregnant females as a result of their weakened immune systems and abnormal hormone levels, often causing still births, natural abortions and low-birth weight in their developing fetuses. Socially marginalized groups are additionally more likely to be infected with these conditions as a result of their lack of contact with local health services and increased probability of sleeping out of doors without protective mosquito nets. In general, one can infer that migrant, nomadic and indigenous populations experience increased exposure and subsequent illness by vector borne diseases and contaminated water sources, with little connection to treatment options or health services ("Protecting malaria high risk groups"). In addition to causing widespread fatality and emotional or psychological stress, infectious disease can result in the over usage of larvicides or insecticides in the

eradication of pathogenic mosquito populations as well as the increased release of greenhouse gas emissions through the burning of coal needed to boil contaminated water prior to consumption.

This nation-wide crisis is an ever evolving and threat that demands immediate and effective action. As of today, increased intervention and aid given by global and local organizations is helping to mitigate the spread of disease dramatically. State sponsored agencies such as the NCDC, as well as contributing advisory entities and support groups collaborate extensively to control, research and combat major health threats. Project Hope is an example of a non-profit aid organization whose mission is to place “power in the hands of local health care workers to save lives around the world”. They also “believe in long-term solutions that transform lives and communities”, inspiring them to do everything from equipping hospitals with health care equipment to educating delivery nurses in developing villages (“Learn about project hope's history”). These dedicated and focused service groups are meeting the desperate needs of impoverished communities on all levels of intervention while providing common citizens in first world countries with both an awareness of the issue and a clear path towards a way to help: simple donations. These are the solutions needed by Nigeria in their fight against infectious disease. Once established, these groups could be implemented as mechanisms for public involvement as well as academic progression. By connecting with colleges and universities across the world, global health non-profits would have access to numerous resources including financial support, student volunteers and cutting-edge medical or scientific research. Additionally, younger generations would gain exposure to the dire health crisis that exists in Africa and be inspired to use their talents to relieve such struggles.

In attempts to eradicate vector borne diseases present in other countries, scientists developed genetically modified mosquitoes with a special gene meant to hinder their population’s survival. This “self-limiting” genetic sequence, when passed on to an individual’s offspring, prevents the females from surviving to adulthood (only females bite humans for blood), thus resulting in a lower number of potentially pathogenic mosquitoes from existing in a certain area. In other words, the mosquitoes can no longer harm humans. According to the CDC, these GMO mosquitoes have recently been released throughout Brazil, Panama and the Cayman Islands, helping to successfully control the *Ae. Aegypti* mosquito population that is responsible for transmitting the zika and dengue viruses. This technique is similarly being tested as a method of malaria transmission prevention in Nigeria. By altering the DNA of the female *Anopheles* mosquito, scientists are capable of introducing a gene that provides the insect with a stronger immunity against the *Plasmodium* parasites that reside in their midgut and cause malaria in humans once transmitted to the blood stream. Scientists additionally found that these genetic modifications altered the mosquito’s mating preferences: modified females preferred wild males and wild females preferred modified males. This ensured the effective spread of the gene through the population (“Engineering malaria resistance in mosquitoes”). After several generations in the lab, the mosquitos successfully integrated the protective trait within their gene pool, ultimately eradicating the disease. Experts agree that GMO mosquitos are a useful tool for preventing outbreaks but must be applied in conjunction with other prevention measures in order to truly eliminate any vector-borne disease. These may include removing any bodies of standing water, studying the success of current disease prevention programs, teaching communities about mosquito control, spreading insecticides and larvicides, as well as continuously monitoring mosquito population types and sizes. While the exact price for such large-scale developments is difficult to determine, it is of note that the production facility alone can cost up to 26 million dollars, as determined by a GMO mosquito experiment completed in Brazil in 2017. Subsequent costs are measured by price per million insects. Furthermore, funding may be most effectively sought from globally conscious health agencies such as the CDC and World Health Organization (WHO). Despite these financial concerns, this laboratory investigation holds great promise for Nigeria and its battle against malaria.

In other nations that are currently struggling to obtain clean water, humanitarian enterprises like Vestergaard are working to develop lifesaving products to be delivered to those facing these immediate natural threats. Fortunately, Nigeria is continuing to benefit from such innovations, like the portable filtration systems developed by LifeStraw. Other new inventions including the Cycloclean and Aquaduct water purifying bikes are enabling those in sub-Saharan nations to more easily obtain and decontaminate water from nearby sources. At present, these bikes efficiently filter large quantities of water using the pedaling motion as a pump to push water through a hose to a waiting bucket or jug. If the rider hopes to bring the water back home, she must transport it in a small reservoir resting in front of the handlebars or beside the wheels with a limit of approximately 3 gallons (“6 Water-purifying devices for clean drinking water in the developing world”). Fortunately, this technology is culturally inoffensive and universally accessible as it does not require extensive training or resources. However, one suggestion to improve this method would be to attach a bigger tank behind the bicycle that would allow for even more water to be transported back to one’s village from the water source in a single trip. Those in Nigeria would benefit specifically from this model since their dramatic dry and rainy seasons make it more difficult to collect adequate amounts of water consistently throughout the year. It may also be possible to alter the mechanics involved with the bike filtration system so that individuals may have the ability to fill their tanks with dirty water and process the contents with kinetic energy produced through the pedaling motion while en route to their destination. The current prototypes only allow its users to pump the water from its source into the filters when in a stationary position with a stand, thus increasing the time needed to perform the task. This new design would enable needy riders to filter much larger quantities on the go!

In conclusion, as long as innovative strategies combine with socially conscious programs, there is hope for Nigeria’s fight against infectious disease. With the proper organization, these ideas will further strengthen the medical, social and economic aspects of all nations in Africa, allowing for not only the improvement of agricultural and industrial production, but also the quality of life of its people. Without having to focus solely on protecting one’s skin from mosquitoes or collecting clean water, those in threatened countries will have the chance to pursue the joys and successes associated with a life free of immediate health concerns.

Works Cited

- , P., By, Murray, P., -, Peter Murray Peter Murray was born in Boston in 1973. He earned a PhD in neuroscience at the University of Maryland, Peter Murray was born in Boston in 1973. He earned a PhD in neuroscience at the University of Maryland, . . . More, L. (2019, January 29). LifeStraw brings clean water to almost one million In KENYA (video). Retrieved April 01, 2021, from <https://singularityhub.com/2011/11/09/lifestraw-brings-clean-water-to-almost-one-million-in-kenya-video/>
- 6 Water-purifying devices for clean drinking water in the developing world. (n.d.). Retrieved April 01, 2021, from <https://inhabitat.com/6-water-purifying-devices-for-clean-drinking-water-in-the-developing-world/>
- Average household size in Nigeria. (n.d.). Retrieved April 01, 2021, from <https://hub.arcgis.com/datasets/fbb3c5c5fa9f4429be56af8b11ef4643>
- Balarabe, S. (2018). Epidemics of meningococcal meningitis in Northern nigeria focus on preventive measures. Retrieved April 01, 2021, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6330781/#:~:text=Children%20under%2Dfive%20years%20of,of%20age%20and%20young%20children>
- CDC global health - nigeria. (2019, July 03). Retrieved April 01, 2021, from <https://www.cdc.gov/globalhealth/countries/nigeria/default.htm>
- Climate - nigeria. (n.d.). Retrieved April 01, 2021, from <https://www.climatestotravel.com/climate/nigeria>
- Engineering malaria resistance in mosquitoes. (2017, October 31). Retrieved April 01, 2021, from <https://www.nih.gov/news-events/nih-research-matters/engineering-malaria-resistance-mosquitoes>
- Ensuring food and nutrition security in rural Nigeria. (n.d.). Retrieved April 01, 2021, from <https://www.ifpri.org/publication/ensuring-food-and-nutrition-security-rural-nigeria-0#:~:text=Nigeria%20is%20still%20characterized%20by,even%20total%20lack%20of%20food.>
- Fact sheet about malaria. (n.d.). Retrieved April 01, 2021, from <https://www.who.int/news-room/fact-sheets/detail/malaria>
- Food and Agriculture Organization of the United Nations. (2018). Retrieved March, 2021, from <https://fscluster.org/sites/default/files/documents/i9930en1.pdf>
- Genetically modified mosquitoes. (2020, December 28). Retrieved April 01, 2021, from <https://www.cdc.gov/mosquitoes/mosquito-control/community/sit/genetically-modified-mosquitoes.html>
- Learn about project hope's history. (2020, July 21). Retrieved April 01, 2021, from <https://www.projecthope.org/about-us/history/>
- Most popular jobs by states in NIGERIA: MY JOBMAG. (n.d.). Retrieved April 01, 2021, from <https://www.myjobmag.com/blog/664/most-popular-jobs-by-states-in-nigeria>
- Nigeria - agriculture. (n.d.). Retrieved April 01, 2021, from <http://countrystudies.us/nigeria/57.htm#:~:text=In%201990%2C%20estimates%20indicated%20tha,t,being%20cultivated%20at%20the%20time.>
- Nigeria - families In Nigeria. (n.d.). Retrieved April 01, 2021, from <https://family.jrank.org/pages/1210/Nigeria-Families-in-Nigeria.html>

Nigeria - housing. (n.d.). Retrieved April 01, 2021, from <https://www.nationsencyclopedia.com/Africa/Nigeria-HOUSING.html>

Nigeria. (n.d.). Retrieved April 01, 2021, from <http://www.foodbycountry.com/Kazakhstan-to-South-Africa/Nigeria.html>

Nigeria. (n.d.). Retrieved April 01, 2021, from <https://wageindicator.org/salary/minimum-wage/nigeria>

Nigeria. (n.d.). Retrieved April 01, 2021, from <https://www.msh.org/our-work/country/nigeria>

Nigeria. (n.d.). Retrieved April 01, 2021, from <https://www.se4all-africa.org/seforall-in-africa/country-data/nigeria/#:~:text=In%20Nigeria%2C%20electricity%20access%20rate,solid%20fuels%20reached%20only%204%25.>

Nigeria. (n.d.). Retrieved April 01, 2021, from <https://www.severemalaria.org/countries/nigeria>

Nigeria: Government. (n.d.). Retrieved April 01, 2021, from <https://globaledge.msu.edu/countries/nigeria/government>

Nigeria: Hunger relief in Africa. (2021, March 22). Retrieved April 01, 2021, from <https://www.actionagainsthunger.org/countries/africa/nigeria>

Nigeria: Hunger relief in Africa. (2021, March 22). Retrieved April 01, 2021, from <https://www.actionagainsthunger.org/countries/africa/nigeria>

Overview. (n.d.). Retrieved April 01, 2021, from <https://www.worldbank.org/en/country/nigeria/overview>

Prevention and control measures for malaria. (2019, July 25). Retrieved April 01, 2021, from <https://www.ecdc.europa.eu/en/malaria/prevention-and-control>

Thu, S., Aregbeshola, S., & Bolaji Aregbeshola Submitted by Bolaji Aregbeshola on Sat. (n.d.). Health care in Nigeria: Challenges and recommendations. Retrieved April 01, 2021, from <https://socialprotection.org/discover/blog/health-care-nigeria-challenges-and-recommendations>

Tuberculosis control in vulnerable groups. (2011, March 04). Retrieved April 01, 2021, from <https://www.who.int/bulletin/volumes/86/9/06-038737/en/#:~:text=Economically%20poor%20and%20vulnerable%20populations,outcomes%20than%20the%20general%20population.>

United States - access to Electricity (% of population). (n.d.). Retrieved April 01, 2021, from [https://tradingeconomics.com/united-states/access-to-electricity-percent-of-population-wb-data.html#:~:text=Access%20to%20electricity%20\(%25%20of%20population\)%20in%20United%20States%20was,compiled%20from%20officially%20recognized%20sources.](https://tradingeconomics.com/united-states/access-to-electricity-percent-of-population-wb-data.html#:~:text=Access%20to%20electricity%20(%25%20of%20population)%20in%20United%20States%20was,compiled%20from%20officially%20recognized%20sources.)

Unlocking Nigeria's Agricultural Exports. (n.d.). Retrieved March, 2021, from <https://www.pwc.com/ng/en/assets/pdf/unlocking-ngr-agric-export.pdf>

Welcome to GeneWatch UK. GeneWatch UK - Home. (n.d.). <http://www.genewatch.org/>.

World Health Organization. (n.d.). *Protecting malaria high-risk groups*. World Health Organization. <https://www.who.int/activities/protecting-malaria-high-risk-groups>.

