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Mali, Infectious Disease: Malaria

Mali: The Fight against Malaria

For many decades, thousands of humanitarian organizations, the widely known World Health Organization, and various government initiatives have been working to help those suffering from the deadly disease Malaria. One nation that continues to face copious amounts of hardships because of its losing battle with Malaria, is Mali, yet there are possible solutions to greatly help this country in regards to both healthcare and food insecurity.

Previously known as one of the most powerful empires in West African history, Mali is a land-locked nation ranked as the 8th largest on the continent. It has a population of 19 million, % of which live in urban conditions, and spans over 479, 200 square miles. Regarded as an extremely poor nation, about 65% of the population lives in poverty, with one of its highlights being the Niger river that flows through the heart of the land, creating a trading based portion of the nation's economy and serving as a provider of fertile soil at its banks due to occasional flooding (Britannica). This correlates with the nation's primarily subsistence agriculture dependent economy that derives its goods, mainly cotton and rice, from the southern part of the land as it contains more valleys than the Sahara desert north. Besides this, the land is overall dry and flat, with the concentration of its occupants residing near the more attractive riverside locations. There is generally a dry season, characterized by high temperatures and hot wind, and a wet season in which monsoon winds and heavy rainstorms cause excessive rainfall. Apart from the physical traits of Mali is the more important rich culture of the people, many of whom belong to different ethnic groups. The Berbers and Moors are the most dominant of these groups in the northern part of the nation, while the rest of its inhabitants belong to a variety of agricultural groups descended from numerous empires in older years. French is the official language of Mali although the majority of the population speaks one or more of the many African tribe languages (Britannica). Dogon dancing and music related events are commonly conducted as a way of expression for the people, who even have several world famous dance groups and musicians, as well as interest in architecture and religious wood carving shown prolifically. As evident, Mali has a rich, fascinating culture, yet it also faces many hardships tracing back from its inception.

Before the 19th century, the region of Mali was part of the three major African empires that controlled Sahran trade and was separately recognized for its flourishing gold deposits and slave trade. A large portion of the nation's pre colonial era was characterized by the well-known Mali Empire lasting from 1235 to 1600 CE, with its most famous ruler being Manasa Mula. However it was later colonized by France in 1892, finally gaining independence on June 20, 1960 (during which the region was called the Sudanese Republic but very shortly after it was changed to Mali). At that point in time, the Malian government was relatively stable. However, in 2013 and 2014, Mali faced invasions by the French military - known as Operation Serval. It was an attempt to "prevent jihadist armed groups from reaching Bamako and to restore Mali's territorial integrity" (Charbonneau) ultimately leading to the rescission of the 1992 constitution and creation of a new one. There are also radical groups in Mali right now; the "Platform" and the "Coordination" who attempt to overthrow the government. Recently, in August of 2020, a military junta violently gained control of the government for a short period of time before being

forced back into regular rule. Due to these factors, the government is severely unstable, and Northern Mali is a dangerous place (Britannica).

As for the life of a typical Malian, it generally consists of farming and persisting through the many obstacles they must face. About $\frac{4}{5}$ of the working population is involved in agricultural work, whether it's cultivating cotton, wheat, rice, sugarcane, tea, tobacco, and other crops (Afs-Usa). Mali is also one of the primary fishing industries of Western Africa, so fishing families are also common amongst the people. Many of these people travel to Bamako, the nation's capital, with their goods, where major trading markets are set up. Regardless, this normally does not provide them with sufficient money for survival and those that work earn low wages. Malian culture places an abundance of importance on family nature, holding the belief that they are meant to always support one another. The typical family size is about 5 to 6 people, where the men are considered the heads of the family while women take care of children and conduct household activities - both do farm work. The Malian diet mainly consists of rice, corn, dates, meat sauces, milk, and a variety of tropical fruits, common dishes being the porridges with Tigadegna sauce (Afs-Usa). Apart from these features of the Malian lifestyle, comes the more dire circumstances, such as access to proper education and healthcare. Mali is a very poor nation with extremely low literacy rates, as only about $\frac{1}{3}$ of the population is able to read. In fact, 70% of Mali's youth between the ages of 15 and 24 drop out of school to join the workforce, since there are simply not enough people. In terms of healthcare, Mali has very limited opportunities to seek medical aid and it possesses one of the second highest child mortality rates in the world of 11%. Malaria is one of the leading causes of mortality in the nation as it affects 100% of the population, thus making it a topic that needs to be focused on (Britannica).

Today almost half the world's population, which is 3.4 billion people, are at a risk of Malaria. It is a life-threatening disease that is caused by the bites of infected female *Anopheles gambiae* mosquitoes native to Africa. These insects carry a parasite called Plasmodium that they are resistant to, yet is what causes malaria in humans. The startling statistic that in 2019, 94% of all Malaria cases are concentrated in Africa (WHO) correlates with the fact that those in poorer areas generally have less immunity to the otherwise curable/preventable disease. In areas that are highly affected by malaria, young children are the most vulnerable group, since they haven't developed an immunity or resistance to the disease. It also highly affects pregnant women, whose immunity decreases from being pregnant. For Mali specifically, the disease is thought to have been originated from the times of colonization, but overall the female *Anopheles gambiae* mosquitoes prefer warmer climates in the region that is in close proximity to the equator (WHO).

On June 30, 2005 President Bush launched the U.S. President's Malaria Initiative, or PMI, to "drastically reduce malaria deaths and illnesses in target countries in sub-Saharan Africa with a long-term vision of a world without malaria" (CDC). For the past 15 years, this US government initiative has implemented multiple solutions to 24 target countries, one of which is Mali. As stated on the PMI's official Mali 2020 Malaria Operational Plan, through studies regarding these solutions we can see that there has been a 50% decrease in infant mortality rates from 2006 to 2012 (PMI). Although this is great news, malaria continues to be a persistent problem within the nation, needing a more controlled pack of action to increase the efficiency and timelines of solving the crisis. This is because not only does this fatal disease target and affect individuals, but it also significantly impacts the whole of a country in a negative manner. Due to an increased amount of sickness and those diagnosed with the fatal disease, the span of the workforce is severely decreased. A weaker workforce is detrimental to a society for countless reasons, with the main one being an unstable food supply. This would lead to starvation and poverty as well as

economic instability. If a society does not have sufficient food for itself, how can it trade with other nations? With slow development also comes lack of commerce because the country does not have the ability to create relations and regulations for trade. This disease connects to food security because while other south African countries have a steadily growing population and production of food, Mali barely shows an increase due to minimal workforce growth. Eventually, if mortality continues to increase from not taking proper action, their amount of food will drop to critical levels.

To explore some of the various malaria treatment methods that have been attempted in the past, we can take a look at the root of the problem: Mosquitoes. Many might think that simply getting rid of the pesky insects would solve the problem. However this is not the case because they are so essential to our environment. They act as pollinators and are food to other animals - removing them would disrupt the food chain (McCarthy). This leaves the question of how we would control malaria in Mali. One of the more obvious ideas is to instead reduce the mosquito population. The first accessible solution of this is use of Dichloro Diphenyl Trichloroethane or DDT. It is a chemical used worldwide and has definitely been the most popular solution. Not only does it work, but it's also a very cheap solution to the problem, costing only \$1.44 annually for a certain dosage. Unfortunately, DDT comes with an array of health problems, being known to possibly cause breast or other cancers, male infertility, or even Alzheimer's. DDT has even been banned in many countries - currently 22 including the United States - for its impact on the environment and the health of people (Pesticide Action Network). Should a solution like this be implemented in an already suffering community? Another solution was the use of Indoor Residual Spraying, another very effective one in that, with data based results of reducing 80% of all malaria cases. However, it contains DDT, ruling out the possibility of usage (Pesticide Action Network).

This brings us to my solution. The plan would be to use a combination of two things, ACT's and Insecticide treated nets or ITN's. First, ITN's are nets treated with pyrethroid, a chemical produced by chrysanthemum flowers. It's non-toxic, and is considered an organic pesticide in the U.S. The treatment was used in South Africa, where malaria cases dropped by 80% in a reasonable amount of time (Day). Pyrethroid wears off, so the nets need to be re-treated every 6-12 months. If nets are washed, they need to be treated even more often. Each house only needs one net, and longer lasting nets have been developed, which only need to be retreated every 3 years (Malaria Journal). In a systematic review of Malaria Control Initiative Costs by the Malaria Journal, 22 studies were analyzed to find that the median cost of purchasing/maintaining an ITN per household was \$4.15. Since the population of Mali is 19 million with an average household size of 5 to 6 people, the costs required for the ITN step of the plan would be about 15 million dollars. In 2018, only 5 million was spent on ITNs in Mali (PMI). The reason for this gap is that the PMI seems to be only purchasing one set of ITNs, so the statistics show that many households have one, however they are not being retreated properly. In addition, funding for these nets has recently begun to slow down worldwide. This connects with our solution of amping this funding, as it proves to seem like an ideal part of the solution.

The other aspect would be ACT's or Artemisinin-Based Therapy. It is a drug based treatment derived from the *Artemisia annua* plant that rid the malaria inducing parasite from the patient's bloodstream. There are a lot of compounds that are Artemisinin-Based Therapy with reduced likelihood that there will be resistance to it. Only 5 of these compounds are especially for malaria: Artesunate-mefloquine, Loose Artesunate-mefloquine, dihydroartemisinin-piperaquine, Artemether-lumefantrine, and Artesunate-amodiaquine (Smithuis). Out of all the ACT compounds for malaria, the most cost effective and health effective is Artesunate-mefloquine according to a large amount of credible research studies. This specific combination of tablets is used to cure malaria from people that

are already facing it and should be taken every three days. When this certain compound is used to treat malaria, it is extremely effective, with only 0.001% that are left uncured (Smithuis). The action plan would be to distribute enough of these tablets for each child under the age of 5 with malaria for 2 months, due to the alarming child mortality rates. However, artesunate-mefloquine only diminishes mild or moderate malaria, not the severe type, which 85% of the Malaria cases in Mali happen to be (WHO). On the other hand, to cure the severe type of malaria a different drug is used, known as Chloroquine. Sadly this is much more expensive and is dangerous to infants, the main group that should be targeted (Malaria Journal). Yet in the end, through the combination of the artesunate-mefloquine with the Insecticide Treated Nets, the population of Mali with malaria is reduced by an enormous amount.

It is important to note, however, that the PMI previously mentioned has been using these two treatment plans as part of their Mali operational plan. Reported through the numbers in 2018, about 90% of the households received an ITN but only 75% of the population has access to it. This conveys that the government needs to reach out to its people with proper services of distributing these nets. On the other hand, in 2018 only 31% of children received an ACT when they had a fever in the past two weeks, further reiterating the previous point (PMI). Although the PMI's plan is proving to be effective, it needs to be implemented with proper care to ensure that the needed effects are occurring. It is for sure that the costs of curing malaria are high for both the government, who needs to maintain and provide health personnel/resources for the plan to work, and the individuals, who must take time off to care for their health and purchase these drugs when necessary. Even so, it must be done.

Lastly the finances for this plan would be well within reason, seen for example through the PMI's budget of \$23 million for Mali in 2019 (PMI). About \$8 million of the total budget went directly towards ITN (\$5 million) and ACT (\$3 million) purchase. The rest was used for distribution, hospital management, extra pregnancy treatment, and other necessary costs for this proposed plan as well. As discussed earlier, the needed investment towards Insecticide Treated Nets for this solution would be \$15 million. Although the estimate for ACTs finances needed is harder to calculate without advanced research, it can be deduced that it would be a few million more than the current usage for them. The reason why the PMI's investment is so tremendous, is due to the other smaller parts of their Malaria initiative, such as various sprays and medicines that have proven to have very minimal positive effect. For example, a good portion of the budget is currently going towards Indoor Residual Spray, which is something that could be dangerous because of its DDT component as mentioned earlier. In relation to the costs of this solution, is who would provide that money for Mali to battle their Malaria situation. Since both the PMI has already been conducting this in depth Malaria protection plan in Mali and other African countries, the finances of this plan would be handled by them. Their current operational plans would simply be modified to fit with the proposal presented earlier - an action plan that would increase the chances of effectively fighting Malaria detriments. In order to raise more money, the WHO and other organizations could help with this solution as well.

In the end, I propose the use of two different products, insecticide treated nets and artesunate-mefloquine tablets. The nets will be handed out to every family and retreated in a timely manner, subsequently decreasing the number of children/adults who fall victim to Malaria. Since Mali has such a high child mortality rate, kids that are diagnosed with Malaria will receive artesunate-mefloquine tablets at no cost for two months. Though children are the only ones receiving tablets for free, there will be tablets available for sale from the government for adults with Malaria in common places such as local drugstores. This solution is especially suitable for Mali considering that their main economy is farming. Many Malian families live on their farms in mud/cement houses, therefore often being stung by

mosquitoes in their sleep (Britannica). This shows that use of ITNs is crucial to the health of the nation. Additionally, products like DDT are dangerous for the precious farmlands while ACTs are not. The real problem here is mortality and how it is truly negatively impacting the future of Mali. Imagine being a mother who loses their child to Malaria for lack of resources. Listen to Jo Yirrell, a malaria ambassador, speak about her experience of losing her son. “Nothing can describe the intolerable pain of losing a child, I never imagined at the time that I would have the strength to get through my loss and live my life...” To stop others from facing this horrible pain, someone must put a stop to Malaria.

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