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Malaria: The Story of Struggle, Suffering, and Eradication

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HONORS PROJECT

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Imagine tucking your children into bed every night, hearing a distant buzzing sound, and knowing that there is a high chance that the buzzing sound you hear will equate to your child’s death. What is that distant buzzing that can turn a mother’s fear into a reality? The answer: a mosquito. Mosquitoes can carry several different parasites that carry many diseases, but the one that is becoming more prevalent in today’s world is malaria. Many victims do not even realize that have the disease until at least a week after the initial bite of an affected mosquito.

There used to be a malaria endemic in the Southeastern United States during World War II. In July of 1947, the National Malaria Eradication Program started spraying the interior of homes with DDT (a prominent pesticide), digging drainages, eliminating mosquito breeding spots, and spraying of other insecticides. According to the CDC website:

In 1949, the country was declared free of malaria as a significant public health problem. By 1951, CDC gradually withdrew from active participation in the operational phases of the program and shifted its interest to surveillance, and in 1952, CDC participation in operations ceased altogether. ("Elimination of Malaria")

However, just because malaria was eliminated in the United States by 1949 does not mean another outbreak could not happen. There are still plenty of mosquitoes in the United States that carry the malaria parasite.

Fast forward sixty-five years later, where malaria has become a global health issue. Today, according to the United Nations Children’s Fund (UNICEF) website, “40% of the world’s population live in areas with malaria risk” ("Press Centre"); that is
roughly 99 countries and territories around the world. If one would look at all the reported malaria cases in those 99 countries and territories they would see that “90% of malaria cases occur in Africa, south of the Sahara” (“Health”), which is why there is a higher focus on eliminating malaria in Africa than any other place in the world. The World Health Organization (WHO) state on their website that “[a]ccording to the latest estimates, released in December 2013, there were about 207 million cases of malaria in 2012 (with an uncertainty range of 135 million to 287 million) and an estimated 627,000 deaths (with an uncertainty range of 473 000 to 789 000)” (“Malaria”). There has been a worldwide effort in recent years, especially since 2010, to join together to eradicate malaria.

In order to understand malaria as a whole one must first understand the parasites that causes the disease. On the Centers for Disease Control and Prevention (CDC) website, they say "malaria is transmitted among humans by female mosquitoes of the genus Anopheles ("Anopheles Mosquitoes") and belong to genus Plasmodium. They continue on by explaining how the malaria parasite develops:

The successful development of the malaria parasite in the mosquito (from the "gametocyte" stage to the "sporozoite" stage) depends on several factors. The most important is ambient temperature and humidity (higher temperatures accelerate the parasite growth in the mosquito) and whether the Anopheles survives long enough to allow the parasite to complete its cycle in the mosquito host ("sporogonic" or "extrinsic" cycle, duration 10 to 18 days). ("Anopheles Mosquitoes")
There are one hundred known different species. However, there are only four known species that are actually recognized to effect humans: P. falciparum, P. malariae, P. vivax, and P. ovale. There is a fifth known species, a species that is rarer in humans, called P. knowlesi. The significance of this species is that it is the cause of zoonotic malaria or the type of malaria that can be transmitted from animals to human, whether from a bite or contact with an open wound. P. knowlesi is a natural pathogen for the long-tailed and pig-tailed macaques.

The first species, P. falciparum, is found primarily in tropical and sub-tropical areas. Once it enters the blood stream it starts multiplying rapidly, which will eventually cause anemia or severe blood loss. If it enters smaller blood vessels P. falciparum will cause the vessel to clog. If the clog happens in the brain, cerebral malaria occurs and if this species is not treated within twenty-four hours, can be deadly. According to the CDC: “[i]t is estimated that every year approximately 1 million people are killed by P. falciparum, especially in Africa where this species predominates” (“Malaria Parasites”).

The second species, P. malariae, is the only malaria parasite that is found in humans that has a quartan cycle (three day cycle); “[t]he three other species have a tertian, two-day cycle” (“Malaria Parasites”). If this parasite is left untreated it can cause the body to create too much protein, known as nephrotic syndrome.

The final two species, P. vivax and P. ovale, are similar in the fact that they have dormant liver stages that can invade the blood of a host months and even years after the initial bite. They also are known to have clinical relapses months and even years after the first infection. However, P. ovale differs from P. vivax in the way that “it can infect individuals who are negative for the Duffy blood group [a type of protein encoded by the
gene known as DARC], which is the case for many residents of sub-Saharan Africa. This explains the greater prevalence of P. ovale (rather than P. vivax) in most of Africa” (“Malaria Parasites”). P. vivax can be found in some parts of Africa, Latin America, and Asia. P. ovale is found primarily in West Africa and the islands in the Western Pacific.

Malaria symptoms do not start to present themselves until at least seven days after the bite of an infected mosquito, typically not for ten to fifteen days. There are seven risk groups that are at higher risk than most:

- Young children
- Non-immune pregnant women
- Semi-immune pregnant women
- Semi-immune HIV-infected pregnant women
- People with HIV/AIDs
- International travelers from non-endemic areas
- Immigrants from endemic areas and their children

For someone who is not familiar with malaria, the symptoms can seem like that of the flu because malaria is an acute febrile illness. They experience a fever, headache, chills, and vomiting. According to WHO, “[c]hildren with severe malaria frequently develop one or more of the following symptoms: severe anemia, respiratory distress in relation to metabolic acidosis [too much acid in the body], or cerebral malaria. In adults, multi-organ involvement is also frequent” (“Malaria”). Those who live in endemic areas, usually suffer from asymptomatic (showing no symptoms) infections because they develop partial immunity.
What most people do not realize is that malaria can be a thing of the past, much like smallpox and polio. UNICEF states that "[m]alaria is both preventable and treatable, and effective preventive and curative tools have been developed ("Health") and what most people do not realize is that this can be done easily and at a low cost. There are drugs out there known as anti-malarials that are affordable for those with limited income, but the issue is that the malaria parasites are becoming resistant to these drugs. Stated on the UNICEF website, the “new and effective treatment, ACTs [artemisinin-based combination therapies], cost far more - $2.00 to $2.50 for an adult treatment dose” ("Press Centre"). Still, there are other ways to help prevent malaria that even some governments are creating programs for so participants have little to no costs.

The main form of treatment today is what is known as insecticide treated nets or ITNs. When describing the benefits of bed nets in malaria endemic areas UNICEF stated on their website that: “[t]here is evidence that ITNs, when consistently and correctly used, can save approximately six child lives per year for every one thousand children sleeping under them” (“Health”) and “widespread use of insecticide treated mosquito nets (ITNs) can reduce child mortality by 20% ("Press Centre"). Before these nets started to get widely distributed one child was dying every thirty seconds because of malaria. Today, that number has decreased to one every minute.

There are two issues that come along with bed nets. The first one is price. By our standards the price for one net is reasonably cheap, around $2 per net, and the price is continually decreasing as time goes on. In 2006, the limited amount of nets that were on the market were anywhere between $5 and $6 and today, those same nets are a little over $2 (see appendix). However, these nets must be retreated every six to twelve months at
around fifty cents for each retreatment. There are newer nets that were developed that are longer lasting called long-lasting insecticidal nets (LLINs). The problem with these nets is that there is a higher upfront cost of “$5-$6 at the present time” (“Press Centre”). The thing that makes these better than the traditional ITNs, as the name suggests, is that they are longer lasting. The LLINs can last up to five years and there are even longer lasting bed nets in development.

The second issue that arises from the bed nets is the use of them. Since malaria nets are a higher price item to those living in Africa, those who receive bed nets see them as a valued possession. For the people of Africa, many of their belongings are hand-me-downs so when they are handed these nets they want to keep the value of the nets high because for the majority of families these nets are the most expensive thing they own. Another problem is that because these are higher valued items many people sell the nets to others instead of using the nets themselves; that is why it is critical for volunteers who help distribute bed nets educate those who they are giving the nets to and checking in on the families to make sure they are not only using the net, but using it properly. “The universal use of insecticide-treated bed-nets can reduce episodes of illness by 50% in areas of high transmission, yet fewer than 2% of African children sleep under a net” (“Press Centre”). Many of the organizations that now help with the distribution of the nets pre-open the packaging to encourage families to use the nets. Then, after the distribution process, they will go in and check on the families to make sure they are using them. If they are not using the nets they find out why they are not using them and figure out a way to resolve the issue.
Malaria is more than a mortality rate; there are social and economic factors too. In some villages in Africa it is believed that if you or someone you in your family contracts malaria that it is some sort of punishment for doing something bad. Some even believe that malaria is an act of witchcraft and in some cases a person is excommunicated from the village. On the economics side of things, life can be quite difficult. “Malaria-afflicted families on average can only harvest 40% of the crops harvested by healthy families” and they “spend an average of over one quarter of their income on malaria treatment, as well as paying prevention costs and suffering loss of income” (“Press Centre”). For many, the nearest hospital is miles away, taking hours or even days to travel there by foot.

The division between malaria stricken regions and wealth around the world is quite noticeable (Figure 1 and Figure 2). According to Jeffrey Sachs and Pia Malaney in their article “The Economic and Social Burden of Malaria” the place where “malaria prospers most, human societies have prospered least” (681). They also suggest that there is a correlation not only between malaria and poverty, but malaria and economic growth as well.

Malaria-endemic countries are not only poorer than non-malarious countries, but they also have lower rates of economic growth. Between 1965 and 1990, countries in which a large proportion of the population lived in regions with Plasmodium falciparum malaria experienced an average growth in per-capita GDP of 0.4% per year, whereas average growth in other countries was 2.3% per year. (681)

That is a difference of 1.9% a year; imagine what that 1.9% could do for those countries in Africa. Imagine how many more people could be fed or how many more children
could go to school. According to the UNICEF website: "[i]n endemic areas, as much as 60% of children’s schooling may be impaired as a result of absenteeism due to repeated bouts of malaria” (“Press Centre”). Imagine those 60% getting their full education. Imagine families not having to spend a quarter of their income on malaria treatment, so they can send all of their children to school and not just a few of them.

Education is the most important thing when it comes to spreading awareness about malaria, which is why for my honors I chose to create an event that focused on educating people on malaria. On April 13th I hosted a malaria event at First United Methodist Church where I set up stations that people could walk through to learn about the effects of malaria and how it can be prevented. The first station was a simple sign-in station where I asked guests to sign their name and provide their email address so that I could give them updates on the process of eradicating malaria. The second station was my geographic station. I wanted to show the guests that although the focus is Africa, there are other places around the world where malaria is a problem. I did this by creating an interactive PowerPoint that focused on each of the geographic locations.
For the third station I created a video where people gave their first hand accounts of how malaria has personally affected either themselves or someone they know. In the fourth station I set-up a bunch of typical household products such as laundry detergent, deodorant, and things we do not typically think about such as a meal at Wendy’s and then I attached price tags to them. I compared those prices to the cost of a single bed net and asked the question: could you afford to give up one of these things to save a family from malaria? I also had charts provided by WHO that showed funding for malaria control from 2009 to 2011. I really wanted to show that we take for granted the things we buy. If everyone in the United States gave up the non-essential things that we buy, such as fast food or food from any other
type of restaurant once a year and used that money to buy a bed net for someone who needed one, the United States would provide roughly 313,000,000 bed nets. According to UNICEF, “150 million new ITNs are needed to maintain protection for all populations at risk in SSA [Sub-Saharan Africa]” (“Health”). Now, say that the following year instead of donating nets the United States provided the money they would have used to go out to eat; that is roughly $1,565,000,000. It only takes an estimated “$5.1 billion annually to achieve universal coverage and fully scale-up malaria interventions around the world” (“Health”). We have the power to single handedly help end malaria.

At the fifth station I wanted guests to have a more hands on experience so I put up makeshift walls and put a cot and bed net on the floor so the guests could see if they could properly hang up a bed net. On the other side of the “walls,” I placed charts that gave statistics on both reported and estimated malaria cases and deaths that have occurred between 2010 and 2011. The sixth and final station is what I called my resource station. At this station I had handouts from various malaria organizations, such as Imagine No Malaria, that had information about malaria and ways guests could help. I also
placed some handouts for younger people to keep them entertained, such as crosswords and word searches. There was also a handout that parents could take with them that showed how to create pipe cleaner mosquitoes that they could do as a craft with their children. Also at this table, there was a craft where guests could make their own mosquito out of clothespins and wire.

Overall, I think that the event was successful. I did not get as many people to come as I would have liked, in total I had ten people sign my book, but I did have several more people glance at a few stations as they were cutting through the room. In the following days and weeks I had several people come up to apologize that they could not come and ask me what my event was about, which is what I wanted out of this event. I wanted to spark conversation among people about malaria and encourage them to go out and talk about it with others; education is one of the most important things and one of the best ways to spread awareness. The more people that are aware and educated on the issue, the more help there is in the fight against malaria, making the goal of eradicating malaria by 2015 no longer just a dream. It could easily become a reality.
Now, imagine tucking your children into bed every night and still hearing that distant buzzing sound, only this time you know your children are safe because they are tucked safely in under a bed net. No one else has to die from this deadly disease. No mother will have to fear losing her child before their fifth birthday because of one little mosquito bite. Malaria can be stopped, but there needs to be a global effort. Education and awareness is one of the first things that needs to be done to help end this killer disease. Spread the word. Become educated. Help end malaria.
Works Cited


