

Malaria Essay

In this essay I will be discussing the Malaria parasite, and in this, its symptoms, including a high fever, gastral pains, a dry cough, and general muscular pain and fatigue (somewhat reminiscent, and often confused for viral gastroenteritis, a mistake that causes hundreds of thousands more deaths per year than are identified), and how to combat it in a recent outbreak in Mali, West Africa. Malaria is a mosquito transmitted disease which very commonly finds victims along the tropical belt worldwide. I will later be discussing, along with its causes, what can be done to prevent malaria given its main victims; low-income countries' citizens, most notably children and infants with ages ranging from zero to ten years. Third world countries, coincidentally also tropical countries in which the parasite resides and thrives. One of these particularly vulnerable regions at the moment is Mali, a former French colony in West Africa with a population of 19.1 million, of which 67% were estimated to be under the age of 25 in 2017^[7], rendering the country all the more at risk due to the young age of the inhabitants. Children are generally more susceptible to being killed by malaria due to a significant lack of a developed immune system.

Malaria, (more professionally referred to as Plasmodium) ^{[1][2]} is a virus that is extremely infectious, given how much media attention it is given. Malaria can take place in multiple species of the virus that can cause illness in humans. The species of Plasmodium responsible for most malarial infection, being Plasmodium Malariae. This species is more commonly referred to as "benign malaria" also having the least violent infection compared to other species such as Plasmodium Vivax or P. Falciparum, however it is also the second most infectious, resulting in contributing to an overwhelming 99.7% of cases^[6]. All malaria parasites are vector transmitted, requiring transmission from the Anopheles mosquito. P. Falciparum, not only causes the deadliest form of malaria, but has also been found to be a contributing factor in the development of blood cancer (Burkitt's Lymphoma), therefore also being classed as a group 2a carcinogen^[2]. What makes this the deadliest parasite to humans, are the tortuous symptoms victims may have to face should they become infected. A fever of over 38.5°C and in some cases, over 39°. This symptom is possibly the tamest. Other symptoms of Falciparum malaria are severe vomiting and diarrhoea, accompanied by severe muscular pain and extreme headaches. Low-income countries, unfortunately, lack both the funding and basic sanitation to be able to control the infections, (which due to low-income countries being mainly seated on the tropical belt, are rising at an alarming rate).

What can be done to decrease the infection rates of this fatal disease is simple on a surface-level. Since the countries in which most of these infections take place are situated on the tropical belt, where most low-income countries are situated, countries with a higher general income, (such as the United States, the United Kingdom, or internationally renowned unions such as WHO or NATO) would find themselves in the financial position in which it would almost be an obligation of them to aid and assist malaria-infested countries such as countries in the sub-Saharan African regions, Indonesia, and a select few vulnerable countries in the East of South America. If all nations gave a tiny sliver of their help in funds, then the countries affected by malaria in the world would be able to overcome this roadblock in their financial and economic development. Specifically, Mali, residing within the 10 poorest nations in the world in 2019^[8], is at particular risk, being heavily in debt. In 2019, the WHO allocated 45.9 million in USD^[9] to the budget targeted on Africa, which should in turn help Mali substantially. Several actions were taken, and with this budget of 45.9 million USD, the WHO has helped increase the percentage of suspected malaria cases in the public sector receiving a

parasitological test from 76% in 2015 to 85% in 2019. This puts Mali's government on track to be able to combat the outbreak of malaria effectively and ensure the safety of all 19.1 million people residing there.

One crucial step in managing this epidemic in susceptible countries is of course, to understand its biology. When the anopheles mosquito injects its proboscis into a capillary blood vessel, plasmodium sporozoites also find their way directly into the blood vessels, and subsequently red blood cells of the victim.^[3] Through these same blood cells, the blood cycles to the liver, where the sporozoites invade the organ. Once at the liver, the sporozoites invade, and grow and reproduce into merozoites. These merozoites gain entry into the liver's cells through sentinel Kupffer cells^[4], and infect the tissue of the liver walls, destroying various other surrounding cells as a knock-on effect. Assuming the patient is left untreated for multiple days, the merozoite undergoes an abundant nuclear division, multiplying over and over until one single cell serves as a host for thousands upon thousands of new parasites. These new parasites possess the genetic capabilities to infect red blood cells directly, and after infecting multiple of these, hundreds of thousands of parasites are replicated. Once the infected cell is infected, it becomes adherent to blood vessel walls, and once matured, will burst releasing the cultivated parasites into the open blood stream, where another anopheles mosquito will bite the infected victim, and serve as the vector for the now developed parasite.

Thanks to substantial studies on the parasite, its breeding grounds, and its vector (the anopheles mosquito), many treatments, and many more preventative measures have been developed over the decades. The most neglected, yet most simple is to use mosquito nets, which will not only provide protection from mosquitoes infected with malaria but also give protection to Dengue, Zika, and yellow fever vectors in central and South America, where these parasites tend to linger. Another prevention method in this plethora of solutions is to use mosquito repellent bug sprays, which are fundamentally toxic to these anopheles mosquitoes. On the other hand, the excessive use of insecticides can lead to the Anopheles mosquito developing a resistance to Pyrethroids, the main compound utilized in mosquito repellent insecticides. Similarly to the Aedes mosquito^[10], that has already developed a global resistance to Pyrethroids and other commonly used chemicals, with an exception present in Australia where Pyrethroids remain effective. Despite all this, owing to the lack of effective therapeutics or foreign funding, the best measures to control plasmodium-based malaria remain a strong public health surveillance system coupled with rapid diagnostic testing and treatment when necessary. For national outbreaks in low-income countries, cooperation of governmental entities, public health authorities, and health care providers is critical. Future research on plasmodium subspecies will continue to investigate many aspects of viral replication and pathogenesis. First, understanding the propensity of these viruses to jump between species, to establish infection in a new host, and to identify significant reservoirs of the parasites will dramatically aid in our ability to predict when and where potential epidemics may occur. As anopheline mosquitoes seem to be a significant reservoir for these viruses, it will be interesting to determine how they seem to avoid clinically evident disease and avoid becoming persistently infected.

To conclude, Malaria is a parasite-induced illness that is carried by anopheles mosquitoes. Plasmodiums can come in various subspecies, however the most common to cause malaria in humans are Plasmodium Vivax and Plasmodium Falciparum, together amounting to 94% of deaths in sub-Saharan Africa in 2019.^[5] These are injected into the bloodstream where they find their way to the liver and then infect tissue through Kupffer cells, where the new generation of parasites attacks red blood cells, prohibiting the amount of oxygen to get to vital organs. All this, undoubtedly proves that

the ubiquitous problem that is Malaria is a pestilence that will not be eradicated easily, but with the adequate preparation, prevention, and general response, it too can become a problem of the past.

Sources:

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