

## **What is Malaria?**

Malaria is a serious and sometimes fatal disease 'found in more than 100 countries across the globe'[1]. It is caused by a parasite (Plasmodium protist) that commonly infects a certain type of mosquito, (female Anopheles) which feeds on humans. The disease is rife in many tropical regions, where its transmission rate is higher, due to the warmer climate. Malaria cannot be transmitted in temperatures under 68 degrees, this is due to the parasites themselves, being unable to complete their life cycle inside the mosquitoes. Africa accounts for '92% of the global malaria cases, with an estimated 200 million cases.'[2]

There are many different types of Plasmodium (single-celled) parasites, but only five cause malaria in people:

- Plasmodium falciparum
- Plasmodium malariae
- Plasmodium vivax
- Plasmodium ovale
- Plasmodium knowlesi

Cases of malaria within the global population are once again rising, this is an alarming statistic that needs to be addressed. According to the latest World Malaria Report, 'there were 229 million cases of malaria in 2019, compared to 228 million cases in 2018.'[3] 'Internationally, malaria is responsible for approximately 1-3 million deaths per year.'[4] There is no doubt that this disease is a global killer, and needs to be carefully managed. The most vulnerable group affected by malaria are children under the age of 5 'in 2019 they accounted for 67% of all malaria deaths worldwide.'[3] Alarmingly, 'Malaria is the world's fourth leading cause of death, in children younger than the age of 5.'[4]

## **Symptoms**

There are many symptoms for this disease: 'fever (of 38C or above), headaches, vomiting, diarrhoea, muscle or joint pain,' [1] chills, general feeling of discomfort, nausea, abdominal pain, tiredness, rapid breathing, rapid heart rate, cough. When the disease becomes apparent in your body, your skin and eyes turn a yellowish colour (due to the loss of red blood cells). The symptom can show up to a year after returning from travelling, with the parasite remaining dormant in the liver for many months. This can cause a reappearance of symptoms months or even years later. If not treated promptly then it can become severe, and may cause kidney failure, seizures, severe anaemia (where red blood cells are unable to carry enough oxygen around the body, leading to drowsiness and weakness) mental confusion, brain damage, coma (small blood vessels leading to the brain can become blocked) 'often leading to multiple organ failure in adults, or even death.'[2]

## **How Malaria spreads?**

Normally people contract malaria by being bitten by an infected female Anopheles mosquito. These are the only mosquitos that can transmit malaria, but first they have to be infected by malaria themselves. The mosquitoes become infected by taking a small amount of blood which contains microscopic malaria parasites. Roughly seven days later, when the mosquito takes its next blood meal, these parasites mix with the mosquito's saliva and are injected into the person being bitten.

Once you're bitten, the parasite (Plasmodium protist) enters the bloodstream and travels to the liver. The infection develops in the liver before re-entering the bloodstream and invading the red blood cells. Infected blood cells usually burst every 48-72 hours. 'Each time they burst you'll have a bout of fevers, chills and sweating'. [1]

Ironically 'the mosquitos do not become ill and are called vectors because they transmit the disease.' [5] This is one of the reasons why it is such a highly infectious and deadly disease, identifying the infected mosquitoes is virtually impossible, making it one of the most difficult diseases to irradiate. If a mosquito bites a person who is already infected with malaria, it can also become infected and spread the parasite onto other people. However, malaria cannot be spread directly from person to person

Risk of infection is greater between dusk and dawn as mosquitoes are 'night biting'. When you are pregnant you are at a higher risk of being bitten because your blood temperature is slightly higher. Malaria can also be transferred through blood transfusions (where infected blood is used), organ transplant, and using contaminated needles or syringes. It can also be transferred through congenital transmission (from mother to child, during pregnancy or labour).

## **Interventions**

I have taken into consideration the location and resources of the small rural village in Mali, West Africa, when identifying interventions that can be implemented to combat the current malaria outbreak. I recognise that some of the interventions used in the wealthier, western world to combat this disease, will not be transferable to the village, most notably the Mosquirix vaccine, costing '\$25 for the four required doses.' [6]

Prevention methods used in the more developed countries would include, introducing mosquito screening on doors and windows, this would not work in the Mali village, as the vast majority of the accommodation do not have any windows or doors. The wearing of long loose fitted garments over their arms would also not be applicable, as this is not their traditional dress and may offend their heritage. The application of insect repellent is also not an option due to the high cost and low accessibility, together with DEET being banned in large areas of Africa. Finally, due to the location and nature of the rural village, the use of air conditioning is not viable.

However, there are many low cost interventions that can be used to help prevent the further spread of malaria in the village.

## **Insecticide-treated mosquito bed nets**

One of the most commonly used prevention methods are insecticide-treated mosquito bed nets (ITNs) 'ITNs are a form of personal protection that has been shown to reduce malaria illnesses, severe disease and death.' [7] Bed nets form a protective barrier around people sleeping underneath them, for increased protection bed nets are treated with an insecticide. They also repel mosquitoes, as well as other insects reducing the number that enter the accommodation. 'If all the people living in the village use ITNs (high community coverage) the number of mosquitoes as well as their length of life will be reduced.' [7]

They are also very effective, low cost methods, costing only '£1.51 (\$2.00)'[8], per net. The insecticide used on each net will also last up to 3-4 years protecting two people on average. 'In community wide trials in several African settings, ITNs were shown to reduce the death of children under five years from Malaria by about 20%'[7]

There are however, a number of negatives towards the use of ITNs, they can tear easily and will need to be either be retreated with insecticide or replaced after 3-4 years. It also relies on you having a location in which to hang, store the net and ensure it is used every night 'A study in western Kenya showed that despite high mosquito net ownership, actual usage is still remarkably low'[9] Finally, taking into consideration that the families in this rural village are large, this will increase the cost to each family, which may not make it financially viable without support.

### **Mass Drug Administration (MDA)**

Mass drug administration is the treatment of the entire population in a geographic area with a dose of a drug, in this case Chloroquine. NCBI indicated that this drug has been successful in controlling malaria, 'the standard, effective drug for decades, costs about 10 U.S. cents per course of treatment for an adult.'[10] MDA has proved in recent times to be one of the most effective ways of assisting with the elimination of malaria.

NCBI are advocates of this drug stating that 'Chloroquine is one of the few drugs used in human mass drug administration (MDA) campaigns, and more than one billion treatments have been delivered over the last 25 years.'[9]

On the other hand, there is a large negative towards the use of MDA and that is the substantial resources required to administer the drugs, together with the uptake, however it does 'show significant results' according to the BMC malaria journal.[11]

### **Indoor residual spraying (IRS)**

IRS involves spraying the indoors of buildings with an insecticide. Indoor residual spraying was the main strategy of the Global Malaria Eradication Campaign 'which resulted in the elimination of malaria from many countries and greatly reduced its burden in others'[9]. This is currently being implemented in poor areas in Africa, as 'it reduces the lifespan of the vector mosquitoes' [12]. In addition to the previous point, it is also reducing the density of the mosquitos.

The main negatives to implementing IRS is the cost, currently standing at '£5.34 per year'[11] and frequency of spraying, together with the accessibility of the village. 'Some insecticides such as dichlorodiphenyltrichloroethane (DDT), despite proving to be successful in controlling mosquitoes, are banned by some countries because of environmental hazards.'[9] It is recommended for use by WHO only under specific conditions. Another concern over its use is that Pyrethroid resistance also poses a big threat in the use of IRS.

## **Conclusion**

Malaria and the rapid rate at which it can spread, can have long term devastating consequences to everyone. I believe that the best strategy to reduce the infection in the village in Mali would be to provide and use ITNs, this is not only a low cost solution but it has also been proven to be highly effective. Coupled with the rollout of an MDA, this would significantly help to bring this outbreak under control. This is such an important topic as carrying out a few steps will help to eradicate the disease, save the lives of many vulnerable people, and one day make malaria a disease we only learn about in science and history.

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