

# Underestimated plasmodium malariae



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Over the past decade, malaria control strategies in Africa have decreased in numbers of malaria cases and deaths (Lo et al., 2017). Nevertheless, Plasmodium falciparum malaria is still a major case of elimination. The malaria elimination programs are focused on this parasite, which has been resourced to *P. vivax*. There are two other malaria parasites, which don't receive much attention, *P. malariae* and *P. ovale*. These are the most neglected tropical diseases (Lo et al., 2017). The following paper will be discussing on the article *Plasmodium malariae Prevalence and csp Gene Diversity, Kenya* published in 2017 that will explain the findings of how and why *P. malariae* should be considered in the category of malaria elimination in Africa, with the need of sensitive outreach applicable methods to specifically identify *P. malariae* in malaria endemic regions.

### Malaria and Africa

Between the months of June and August in the year of 2014 and 2015, blood samples were collected from individuals in 4 villages in Western Kenya. These areas were tested due to the high and stable rates of malaria transmission among the ages of 5-14 years of age (Lo et al., 2017). The writers also collected community samples in 7 public schools between the ages of 6 to 15 years to determine the difference in the adult population (Lo et al., 2017). They examined a total of 663 samples from the selected regions, which had given them an estimation in parasitic prevalence, having the individuals with no exhibiting fever or malaria like symptoms (Lo et al., 2017).

They had a second group of blood samples that were clinical samples collected from 113 male and 132 female patients less than 1 to 76 years of age in three selected hospitals. These patients had fever or malaria like symptoms that were resulting in a high percentage of being positive for *Plasmodium* spp. by microscopy (Lo et al., 2017).

As a result of the 663 samples of asymptomatic individuals, 5.3% were detected for *P. malariae*. From this total, 29 were mixed with *P. falciparum* infections and 6 were found with *P. malariae* mono-infections (Lo et al., 2017). *P. malariae* was found to be the most common in Kombewa and Kendu Bay in younger individuals less than 15 years of age. Among the symptomatic patients, a high percentage of *P. malariae* were in infants or very young children of less than 5 years of age (Lo et al., 2017).

The team found that *P. malariae* is most common among infants and young children than adults. Senegal, West Africa had 91% cases of clinical *P. malariae* that occurred in children between the ages of 5 to 9 years (Lo et al., 2017). Although they found that children are most vulnerable to the parasite *P. malariae*, it is not associated strictly with age. The writers expressed, “Chronic nephrotic syndromes attributed to *P. malariae* have been reported and shown to be associated with significant illness from anemia in young children.” Further investigations have to be made due to the lack of their hematologic data that they have obtained.

In Africa, the standard medication to treat for *P. malariae* mono-infection is Chloroquine, which is an anti-parasite and immunosuppressive drug. *P. malariae* increases the development of *P. falciparum* gametocytes, which

can endure without proper antimalarial treatment. The morphology of *P. malariae* and *P. falciparum* ring form are very similar to each. (Lo et al., 2017). They emphasize the need for sensitive methods of improvement to specifically diagnose *P. malariae* and provide systemic epidemiologic data in order to avoid any misdiagnosis.

## Plasmodium Malariae

Malaria is gram-negative severe and sometimes-fatal disease caused by parasitic protozoa that infects anopheles mosquitos, which feeds on humans. There are four different species that cause malaria, which are *P. ovale*, *P. vivax*, *P. malariae*, and *P. falciparum*, being the most dangerous for humans. In the plasmodium life cycle, the female infected anophetes mosquito injects sporozoites into the host's blood stream. (Bauman, 2018). These sporozoites travel quickly into the host's bloodstream invading their liver cells and undergoing a process known as schizogony.

Approximately two weeks from the bite, the liver cells rupture and release about 40, 000 merozoites into the blood, which completely damages the host's liver (Bauman, 2018). These merozoites then penetrate through the host's erythrocytes, where they become a trophozoite showing in its ring (Bauman, 2018). During this invasion, merozoites are released and break through the host's erythrocytes, which occur every 48 to 72 hours depending on the type of *Plasmodium*. Lastly, they are released into the body taking over the host's immune system.

## Morphology

The morphology of *P. malariae's* rings has a sturdy cytoplasm and a large chromatin dot. Their trophozoites have compact cytoplasm and a large chromatin; some brown pigments that can be seen through observation in the microscope (CDC, 2018). *P. malariae's* schizonts have 6 to 12 merozoites with large nuclei being clustered around a mass with brown pigments, with their gametocytes shapes are oval to round with scattered brown pigmentation (CDC, 2018).

There are approximately 5, 000 genes that encode for traits in malaria that assist in pathogenicity (CDC, 2018). The virulence factors associated with *P. malariae* include malaria secretome injecting toxins into the body changing the body chemistry, having the mosquitos detect the host's sweet blood, to attract more. The reproductive cycle hides the parasite and merozoites form within the host's vesicles affecting the immune system's ability for detection (Bauman, 2018). There are certain traits that increase the resistance to this disease such as the presence of the sickle-cell gene, lack of Duffy antigen on erythrocytes, and the presence of two genes for hemoglobin C (Bauman, 2018).

### Growth Conditions

According to the Centers for Disease Control and Prevention, malaria is found depending on the climatic factors such as humidity, temperature, and rainfall. This parasite is transmitted in tropical and subtropical areas where the anopheles mosquitos can survive and duplicate (CDC, 2018). This parasitic protozoon causes more than 1 million deaths yearly. Malaria does not occur everywhere around the world, it is more intense in warmer regions

closer to the equator, where this parasite is transmitted year-round. This mainly occurs in Africa South of the Sahara and some parts of Oceania, where New Guinea and Papua is located, where *P. falciparum* is transmitted most (CDC, 2018). In cooler climates such as Europe and the United States *P. vivax* is more prevalent because of the tolerance of lower ambient temperatures (CDC, 2018).

### Diagnosis, Treatment, and Prevention

Although *P. malariae* is not as common as *P. falciparum*, it should still be taken as serious and be recognized and treated promptly. It can be a challenge diagnosing a patient with malaria since this is not an endemic in the United States anymore. Many health care providers may forget to consider the possible chances of their patient having this disease.

Technicians may oversee or lack the experience to detect the parasites when undergoing examination through blood smears under the microscope (CDC, 2018).

It is emphasized to pay close attention to the patient's symptoms such as fever, chills, headaches, nausea, muscle aches, fatigue, anemia, and vomiting. These factors are flu like symptoms and common viral infections, but malaria should also be considered as a possible diagnosis. To identify malaria parasites, laboratorians collect droplets of blood from the infected patient to undergo a blood smear on a microscope and are stained using the Giemsa stain procedure to determine it's diagnosis (CDC, 2018).

Some Plasmodium strains are resistant to antimalarial drugs, so drug resistance tests must be performed to assess the susceptibility of the

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parasite. The parasites are cultured in vitro tests to analyze the drug concentration that suppress the parasite growth (CDC, 2018). The increase of malaria being drug resistant poses a major threat in the increase statistics of morbidity and mortality. According to the Center for Disease Control and Prevention, it is unknown if *P. malariae* is resistant to any antimalarial drugs as of yet (CDC, 2018). Malaria can be severe and increase the risk of becoming a fatal disease. Treatment should be considered and initiated immediately. There are many antimalarial drugs, and most are active to fight against the parasite, such as chloroquine, quinine, doxycycline and atovaquone-proguanil (CDC, 2018).

It is important to help prevent this disease from spreading, especially in developing endemic countries such as Africa. Educating people on this parasite and controlling the Anopheles mosquitos from entering in their homes by providing bed side nets and insect repellent containing DEET. For those who travel outside of the United States, it is crucial to take antimalarial dugs to prevent the signs and symptoms of malaria. Currently, there is no antimalarial vaccination approved on the market, but Bill and Melinda Gates Foundation have developed a vaccine that has so far been accurate on 15 subjects that were tested on (CDC, 2018). Giving hope, this vaccination will soon be approved and decrease the morbidity and mortality of this disease.

## Conclusion

According to the article, malaria still remains a major public health concern in countries, where this disease is transmitted most often. Specifically, young children, pregnant women, and immune compromised patients are at a

higher risk for malaria. There are many malaria-controlled strategies that are in affect, but most are not affordable in all regions. *P. malariae* is very crucial to analyze through the microscope because of the similarity of *P. falciparum* , which is usually overlooked at many times, underestimated and misdiagnosed. The more education there is on the prevention of this disease, the less endemic cases there will be around the higher risk regions. It is crucial to take this into account on this local epidemiological case of malaria and the levels of resources that should be available for the regions that are at higher risk.

#### Reference

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