



IN THIS ISSUE: MALARIA

Malaria Vaccine, Testing, & Diagnosis

Introduction

The World Health Organization (WHO) estimated 229 million cases of malaria occurred in 2019, resulting in 409,000 deaths, the majority (67%) occurring among children under the age of 5.¹ Although nearly half of the world's population is at risk for malaria, sub-Saharan Africa disproportionately represents nearly all cases of malaria worldwide, with 94% of reported cases and deaths.¹

While malaria is typically curable if diagnosed and treated promptly and correctly, much of the population impacted by malaria does not have easy access to healthcare resources compared to more developed nations.

In early October of 2021 the WHO approved the first malaria vaccine for children, a much-celebrated victory in reducing burden of disease among vulnerable populations.

Epidemiology

Malaria is an illness caused by *Plasmodium* parasites (*Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi*) which develop inside mosquitos and can be transmitted to humans through the bite of an infected female *Anopheles* mosquito.^{2,3} There are over 70 *Anopheles* species that can transmit *Plasmodium* parasites to human hosts.³ *P. falciparum* and *P. vivax* are the most common malarial infections, while *P. falciparum* is present in nearly every malarial region, *P. vivax* is commonly found in Central and South America, as well as in the WHO designated Eastern Mediterranean Region.³

These parasites live in red blood cells; therefore, transmission is also possible through blood transfusions, organ transplants, sharing of used needles or syringes, and from mother to fetus during gestation and/or childbirth. Transmission **does not** occur from person-to-person through respiratory droplets, casual contact, or sexual activity.²

Although not endemic to the United States, approximately 2,000 cases of malaria are reported in the U.S. each year. The majority of cases occur among persons with recent travel to or immigration from countries where malaria is endemic.²

The following link provides an overview of malaria spread in each country, detailing during which seasons and at which elevation the disease occurs, as well as the different species, drug resistance, and recommended chemoprophylaxis:

https://www.cdc.gov/malaria/travelers/country_table_a.html

Prevention

Vector Control

Prevention for malaria involves effective mosquito control such as larvicides and insecticides, in addition to barriers and repellants including insecticide-treated mosquito netting, protective clothing, and indoor residual spraying.

Medication

There are several preventive pre-exposure prophylactic antimalarial drugs on the market which interfere with different stages of development in the parasite life cycle. In the United States, antimalaria drugs for preventing infection are intended for travelers to endemic areas. Many of the antimalarial medications require several days to weeks of oral administration prior to and after being in a region with malaria. Additionally, there are certain ages and at-risk groups for whom the preventive drugs are not recommended.⁴

A table with drug types and considerations is available here:

<https://www.cdc.gov/malaria/travelers/drugs.html>

Vaccination

Over the past two years, Ghana, Kenya, and Malawi Ministries of Health, with the support of partners, have been leading the introduction of RTS,S/AS01 through routine immunization programs. The pilot program key findings include:⁵

- More than 2.3 million doses of the vaccine have been administered and there has been a 30% reduction in deadly severe malaria.

- The percentage of at-risk children reached through either vaccine or insecticide-treated nets (ITN) increased to 90%.
- Vaccine has not displaced the use of ITNs in regions where ITNs are used, nor have there been decreases in other childhood vaccinations.

The WHO recommends “widespread use of the RTS,S/AS01 (RTS,S) malaria vaccine among children in sub-Saharan Africa and other regions with moderate to high *P. falciparum* malaria transmission...RTS,S/AS01 malaria vaccine should be provided in a schedule of 4 doses in children from 5 months of age”.⁶

Signs & Symptoms

The incubation period for malaria is usually between 10 days to four weeks, ranging from seven days to one year after being initially infected before symptoms develop. For malaria infections caused by *P. vivax* and *P. ovale*, parasites may remain dormant in the liver for several months up to four (4) years after initial infection. Additionally, *P. vivax* and *P. ovale*, cause illness that can occur again, referred to as relapsing malaria.²

Initial symptoms in an uncomplicated malarial infection include fever, sweats, chills, headache, malaise, muscle aches, fatigue, nausea, and vomiting. The symptoms may present in the following progression over a 6 to 10 hour “attack”:⁷

- Cold stage: sensation of cold and shivering
- Hot stage: Fever, headaches, vomiting, seizures (in young children)
- Sweating stage: sweats and return to normal temperature, tiredness

In more severe cases malaria can cause anemia and jaundice due to loss of red blood cells, and if not promptly treated can rapidly progress to include kidney failure, seizures, mental confusion, severe anemia, acute respiratory distress syndrome, hypoglycemia, deafness, blindness, coma, and death.²

Diagnosis & Testing

Malaria is uncommon in the United States; however, travel history is the most important epidemiologic criteria for testing those who present with clinically compatible symptoms. Delay in diagnosis and testing is a leading cause of malaria deaths in the U.S.⁸

Parasites can be identified through microscopy, the gold standard for malaria testing in the U.S. Blood specimens can be collected for antigen point of care

testing, however positive specimens should be confirmed by microscopy. Antibody testing may be used, however the amount of time for antibodies to develop and become detectable renders this testing modality impractical for acute diagnostic purposes.

Complete blood counts and routine chemistry panels should also be ordered in addition to diagnostic testing.

Treatment

The earlier malaria is detected, and treatment is initiated, the better the chances of survival. The drug regimen should be selected based on the species of malaria and the location in which the disease was likely acquired. As with most prescribing practices, the cases’ pregnancy status, age, and drug allergies should be taken into consideration. Additionally, there are certain species of malaria which have developed drug-resistance; therefore, the following links should be accessed to guide decisions regarding treatment.

- https://www.cdc.gov/malaria/diagnosis_treatment/clinicians1.html
- https://www.cdc.gov/malaria/resources/pdf/Malaria_Management_Algorithm.pdf
- https://www.cdc.gov/malaria/resources/pdf/Malaria_Treatment_Table.pdf

References

- 1 World Health Organization. Malaria. Accessed October 2021 <https://www.who.int/news-room/fact-sheets/detail/malaria>
- 2 Centers for Disease Control and Prevention. Malaria. Frequently Asked Questions (FAQs). Accessed October 2021 <https://www.cdc.gov/malaria/about/faqs.html>
- 3 Autino, B., Noris, A., Russo, R. & Castelli, F. (2012). Epidemiology of Malaria in Endemic Areas. *Mediterranean Journal of Hematological Infectious Disease*, 1(4). doi: 10.4084/MJHID.2012.060
- 4 Centers for Disease Control and Prevention. Malaria. Malaria and Travelers. Accessed October 2021 <https://www.cdc.gov/malaria/travelers/drugs.html>
- 5 World Health Organization. Scientists share data from first WHO-recommended malaria vaccine. Accessed December 20021 <https://www.who.int/news/item/19-10-2021-scientists-share-data-from-first-who-recommended-malaria-vaccine>
- 6 World Health Organization. WHO Recommends groundbreaking malaria vaccine for children at risk. Accessed October 20021 <https://www.who.int/news/item/06-10-2021-who-recommends-groundbreaking-malaria-vaccine-for-children-at-risk>
- 7 Centers for Disease Control and Prevention. Malaria. Disease. Accessed November 2021 <https://www.cdc.gov/malaria/about/disease.html>
- 8 Centers for Disease Control and Prevention. Malaria. Malaria Diagnosis (United States). Accessed November 2021 https://www.cdc.gov/malaria/diagnosis_treatment/diagnosis.html