

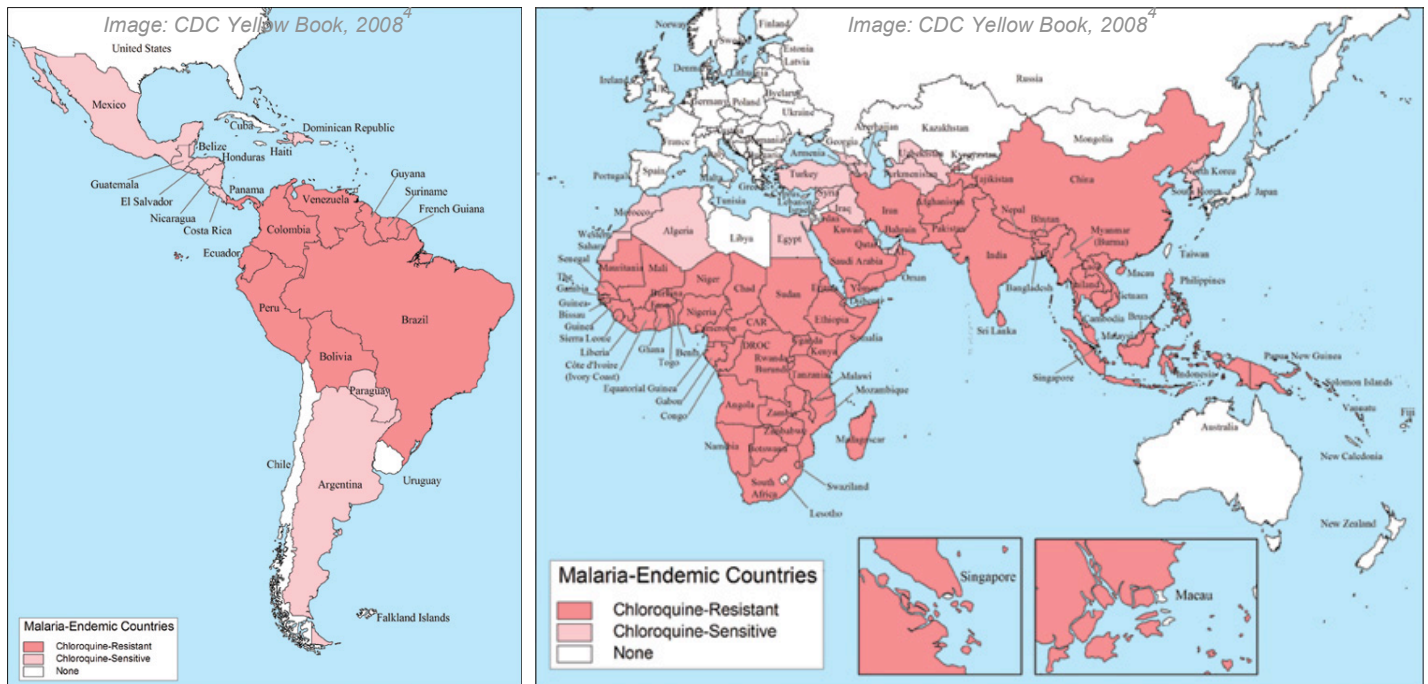
# Malaria

## Description

Malaria is a parasitic disease transmitted by mosquitoes, which kills approximately 1.2 million and affects 300 to 400 million people a year<sup>1</sup>. Every year approximately 2,000 British travellers return home to the UK with malaria.<sup>2</sup> Malaria is always a serious disease and may be a deadly illness, but it is preventable. Advice should be taken before departure as to the most appropriate antimalarial prophylaxis for the area being visited. Other measures include sleeping under an insecticide treated bed-net, covering up between dusk and dawn and using DEET insect repellent.

## Distribution

Malaria occurs in over 100 countries, and more than 40% of the people in the world are at risk. Large areas of Central and South America, Hispaniola (Haiti and the Dominican Republic), Africa, the Middle East, the Indian subcontinent, Southeast Asia and Oceania are considered malaria-risk areas.<sup>3</sup>

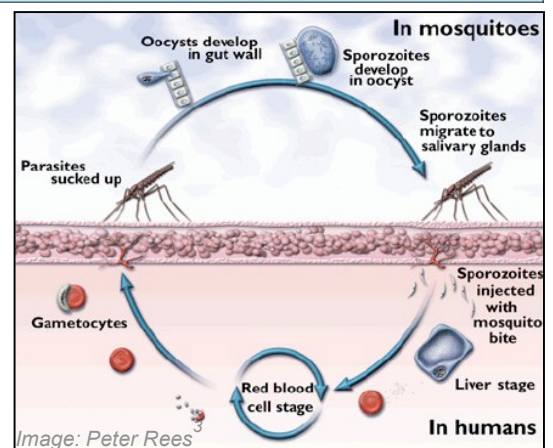


## Causative Agent

Four different *Plasmodium* parasite species cause Malaria of varying seriousness in different parts of the world. *P. falciparum* is found throughout tropical Africa, Asia and Latin America, and is the strain most likely to be fatal; *P. vivax* is found worldwide in tropical and some temperate zones; *P. ovale* is found mainly in tropical West Africa; *P. malariae* is found worldwide, but with very patchy distribution.<sup>5</sup>

## Transmission

The malaria parasite is transmitted by many species of *Anopheles* mosquitoes. Infection occurs via the bite of infected female mosquitoes that transfer parasites from human to human. Male mosquitoes do not bite. In humans, parasites multiply asexually in the liver and then are released into the bloodstream. The parasites invade red blood cells, are released and form gametocytes, which are then ingested by a feeding mosquito with a blood meal. The parasite undergoes another reproductive phase inside the mosquito before being passed on to another human.



## Pathogenesis

Pathology associated with all malarial species are related to the rupture of infected red blood cells and the release of parasite material and metabolites, hemozoin (i.e. malaria pigment) and cellular debris. There is an increased activity of the liver and spleen and thus their enlargement, as evidenced by macrophages with ingested infected and normal red

<sup>1</sup> WHO Roll Back Malaria Campaign [http://www.rollbackmalaria.org/cmc\\_upload/0/000/015/372/RBMInfosheet\\_1.htm](http://www.rollbackmalaria.org/cmc_upload/0/000/015/372/RBMInfosheet_1.htm)

<sup>2</sup> UK FCO/ABTA Malaria Hotspots Campaign <http://www.malariahotspots.co.uk/theFacts.asp>

<sup>3</sup> Travel Doctor (Peter Rees B.Pharm. M.R.Pharm.S.) <http://www.traveldoctor.co.uk/malaria.htm>

<sup>4</sup> Centers for Disease Control and Prevention. Travelers' Health: Yellow Book. Health Information for International Travel 2008. Chapter 4: Prevention of Specific Infectious Diseases. Malaria

blood cells and hemozoin. Except for *P. falciparum*, the pathology associated with malaria tends to be rather benign. Several severe complications can be associated with falciparum malaria with cerebral malaria being the most notable and a frequent cause of death. Cerebral malaria presents as severe headache followed by drowsiness, confusion, convulsions and ultimately coma. These neurological manifestations are believed to be due to the sequestration of the infected red blood cells in the cerebral microvasculature. Sequestration refers to the cytoadherence of trophozoite- and schizont-infected red blood cells to endothelial cells of deep vascular beds in vital organs, especially brain, lung, gut, heart and placenta. This sequestration provides several advantages for the parasite. The major advantage is the avoidance of the spleen and its elimination of infected erythrocytes.<sup>6</sup>

## Symptoms

Malaria is an acute febrile (fever inducing) illness with an incubation period of 7 days or longer. Thus, a febrile illness developing less than one week after the first possible exposure is not malaria. Typical cycles of fever, shaking chills and drenching sweats may develop. The periodicity of these cycles depends on the species of parasite although the most harmful parasite *Plasmodium falciparum* may not show this cyclic pattern, and in all cases the fever may or may not be experienced with other symptoms. Malaria symptoms can include:

- Fever (38°C)
- Chills
- Headache
- Flu-like symptoms
- Muscle aches
- Fatigue
- Vomiting and diarrhoea

Any person developing flu-like symptoms having been in a malarial area for over 7 days, or up to 1 year after returning to a non-malarial area, should seek immediate medical attention and tell the physician their travel history.<sup>7</sup>

If not promptly treated, infection with *Plasmodium falciparum* may cause coma, kidney failure and death within 24 hours.<sup>7</sup>

## Diagnosis

Malaria is difficult to diagnose under the best circumstances. Definitive diagnosis is based on the observation through a microscope of parasites in the red blood cells of a patient. The most important step of diagnosis is to recognise the symptoms of malaria, so the patient can receive treatment.<sup>9</sup>

## Treatment

Malaria can be effectively treated with prescription drugs. The type of drugs and length of treatment depend on which kind of malaria is diagnosed, where the patient was infected, the patient's age and how severely ill the patient is at start of treatment. If the correct drugs are used all the patient's malaria parasites can be eliminated. However, the disease can persist if it is left untreated or if it is treated with inappropriate medication. Some malaria parasites are resistant to certain drugs, which renders the drugs ineffective.

Two species of malaria parasite, *P. vivax* and *P. ovale*, have dormant liver stages and may not cause symptoms for years. Left untreated, these liver stages might reactivate and cause malaria relapses after months or years without symptoms. Patients diagnosed with *P. vivax* or *P. ovale* malaria are often given a second drug to help prevent relapses. Another species, *P. malariae*, has been known to persist in the blood of some persons for several decades if left untreated. Treatment depends on the infecting species, the degree of drug-resistance and the severity of infection.

## Prevention and Control

### Avoid being bitten

- Always cover up between dusk and dawn, wear long trousers and sleeves.
- Sleep under an insecticide-impregnated mosquito net. Arrange the net so it is not leant against at night, and so the bottom of the net is secured under the mattress or sleeping mat.
- Use DEET repellent (at least 30% solution) on all uncovered areas e.g. hands and neck.
- Do *not* rely on garlic, Vitamin B, citronella, ultrasound devices or homeopathic remedies to prevent bites.

### Reduce numbers of mosquitoes

- Site your camp away from stagnant water.
- Cover or drain buckets or water pots or anywhere where water collects.
- Burn pyrethroid mosquito coils.
- Use UV lights.

### Take anti-malaria tablets (prophylaxis)

- Start before travel as guided by your travel health advisor. The regime will vary depending on the prophylaxis recommended for your destination and medical history. Some regimes start three weeks before travel and not stop until four weeks after returning.
- Take the tablets strictly according to the instructions issued by the doctor or pharmacist.<sup>10</sup>

<sup>6</sup> Tulane University Protozoology Notes <http://www.tulane.edu/~wiser/protozoology/notes/malaria.html>

<sup>7</sup> WHO International Travel Health Publication <http://www.who.int/mediacentre/factsheets/fs094/en/>

<sup>8</sup> US Center for Disease Control <http://www.cdc.gov/malaria/travel/index.htm>

<sup>9</sup> Global Reporting WHO info for journalists <http://www.globalhealthreporting.org/malaria.asp?id=222>