# Malaria

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## Key Messages

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| **Malaria is a serious and potentially life threatening disease, transmitted through the bite of an infected female *Anopheles* mosquito.** |
| **Malaria is widely distributed throughout tropical regions of the world in Africa, Asia, Central and South America, Hispaniola, the Middle East and Oceania.** |
| **Malaria is preventable and curable if diagnosed and treated promptly. Travellers are advised to follow an ABCD approach to preventing malaria: Awareness, Bite avoidance, Chemoprophylaxis (malaria prevention tablets) where appropriate, and Diagnosis.** |
| **Travellers visiting friends and relatives (VFR) in West Africa account for the highest number of cases of malaria returning to the UK each year; every opportunity should be taken to encourage the use of malaria prevention tablets in VFR travellers.** |
| **Certain travellers are at increased risk of severe disease if they contract malaria, including pregnant women, children, older people, the immunosuppressed, those without a functioning spleen and those with complex co-morbidities.** |
| **Public Health England's (PHE) Advisory Committee on Malaria Prevention (ACMP) has updated the 'Guidelines for malaria prevention in travellers from the UK: 2018'. The 2018 update reflects the changing landscape for malaria prevention. The 2018 update of the Malaria Prevention Guidelines for UK travellers offer a substantial revision of recommendations for some countries in Central and South America, Southeast Asia, and Pakistan.** |
| **ACMP, NaTHNaC and PHE recommend health professionals stick to using one resource for country specific malaria recommendations to optimise consistency of advice. Whilst we recognise that other sources of advice are available, healthcare professionals working in England, Wales or Northern Ireland are advised to use the ACMP guidelines (which inform** |

**NaTHNaC recommendations) as their preferred source of guidance for malaria prevention.**

## Overview

Malaria is caused by protozoan parasites of the genus *Plasmodium* and is transmitted to humans through the bite of female *Anopheles* spp. mosquitoes. There are five species of *Plasmodium* that cause disease in humans; *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi*. *P. falciparum* is the most common malaria parasite on the African continent and is responsible for the most severe form of malaria and the most deaths. Outside of sub-Saharan Africa, *P. vivax* is the dominant malaria parasite in most countries. *P. knowlesi* has more recently been recognised as the fifth malaria parasite of humans, although infection is usually restricted to monkeys in South East Asia [1, 2].

In 2017, there were an estimated 219 million cases of malaria in 90 countries. Malaria deaths reached 435 000 in 2017 [3].

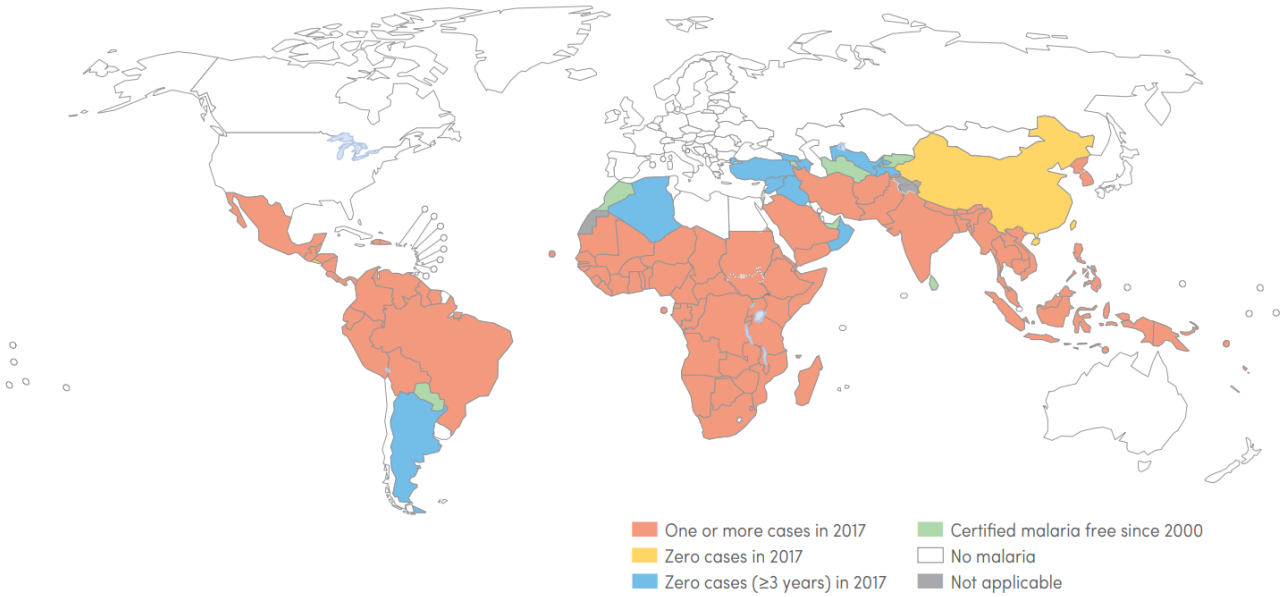
Although there were an estimated 20 million fewer malaria cases in 2017 than in 2010, for the period 2015–2017 no significant progress in reducing global malaria cases was made [4].

Most malaria cases in 2017 were in the WHO African Region (200 million or 92%), followed by the WHO South-East Asia Region with 5% of the cases and the WHO Eastern Mediterranean Region with 2% [4].

Fifteen countries in sub-Saharan Africa and India carried almost 80% of the global malaria burden. Five countries accounted for nearly half of all malaria cases worldwide: Nigeria (25%), Democratic Republic of the Congo (11%), Mozambique (5%), India (4%) and Uganda (4%) [4].

## Risk areas

**Countries with indigenous cases in 2000 and their status by 2017** Countries with zero indigenous cases over at least the past 3 consecutive years are considered to be malaria free. All countries in the WHO European Region reported zero indigenous cases in 2016 and again in 2017. In 2017, both China and El Salvador reported zero indigenous cases. *Source: WHO database.*




WHO: World Health Organization.

Source: World Health Organization

Please check our Country Information pages for individual country recommendations.

Malaria is widely distributed throughout tropical regions in Africa, Asia, Central and South America, Hispaniola, the Middle East and Oceania. In 2017, there were an estimated 435 000 deaths from malaria globally, compared with 451 000 estimated deaths in 2016, and 607 000 in 2010. Children aged under 5 years are the most vulnerable group affected by malaria. In 2017, they accounted for 61% (266 000) of all malaria deaths worldwide [4].

The global prevalence of malaria species differs. While there is overlap, *P. falciparum* is most common in Africa, Hispaniola and Papua New Guinea and *P. vivax* is more common in the Indian subcontinent and Central America. South America and South East Asia have both species. *P. ovale* and *P. malariae* are less common, but are mostly reported in Africa. *P. knowlesi* occurs in South East Asia with cases widely distributed in Sabah and Sarawak in Malaysian Borneo, and peninsular

Malaysia. Cases have been reported from a number of other countries in South East Asia, and in travellers [5, 6].

Malaria-endemic areas can be classified into areas of stable and unstable malaria transmission. In stable areas, for example many countries of sub-Saharan Africa, malaria transmission is year-round with high rates of infection. The population, particularly adults, may therefore develop a degree of immunity and the majority of clinical cases occur in infants and children. In areas of unstable malaria, for example India, transmission tends to be seasonal with short epidemics of varying intensity. Malaria transmission in these unstable areas is less sustained, therefore communities have poor immunity and all age groups may be affected.

## Risk for travellers

All travellers visiting malaria endemic regions are at risk of acquiring malaria. Migrants to the UK who were born in malaria risk areas and return to visit friends and relatives in their country of birth, may be at higher risk as they may believe they are immune to malaria and therefore do not seek pre-travel advice or take malaria prevention measures [7, 8]. Any immunity travellers may have acquired in their country of origin wanes rapidly on migration to a country with no risk of malaria, such as the UK; their UK-born children will have no protection from the disease.

Certain travellers are at increased risk of severe disease if they have malaria such as: pregnant women, the immunosuppressed, those with an absent or dysfunctional spleen, those with complex co-morbidities, children and older travellers [2]. Pregnant women are advised to avoid travel to malarious areas where possible, as they are particularly attractive to mosquitoes, have an increased risk of developing severe malaria and a higher risk of death compared to non-pregnant women [2]. Those who have no spleen or whose splenic function is severely impaired are also advised to avoid travel to affected areas where possible [2].

The risk of malaria varies according to season, geographic location, activities, type of accommodation, and the use of malaria prevention tablets and bite avoidance measures.

Guidelines for malaria prevention in travellers from the UK developed and published by Public Health England's (PHE) Advisory Committee for Malaria Prevention (ACMP), are updated annually and provide country specific malaria risk information. Detailed advice relating to specific groups of travellers is also included. An individual risk assessment should be performed for each traveller to determine the appropriate preventative advice. Travellers should be reminded that even in lower risk malaria areas where 'bite avoidance and awareness' alone are usually recommended, special attention should be given to bite prevention and febrile illness must be taken seriously and investigated promptly [2].

## Malaria in travellers from the United Kingdom

In 2017 1,792 cases of imported malaria were reported in the UK (1,708 in England, 50 in Scotland, 24 in Wales and 10 in Northern Ireland), compared to 1,618 in 2016 and 1,558 between 2008 and

2017 [7,9]. There were 6 deaths from malaria reported in 2017, the same number as in 2016 and 2015. These were all from falciparum malaria acquired in Western Africa (3), Eastern Africa (2), and South-Eastern Asia (7). The majority of cases in the UK continue to be caused by *P. falciparum*, the most severe form of malaria [7]. Travellers visiting friends and relatives in their country of origin (VFR travellers) accounted for 80 percent of cases in those who travelled from the UK [7]

Failure to take malaria prevention tablets is associated with the majority of cases of malaria in those travelling to malaria risk areas from the UK [7].

While most UK travellers acquiring malaria are of African heritage visiting friends and relatives, a UK study in 2012 identified that the risks of dying from malaria, once acquired, are highest in the elderly, tourists, and those presenting for medical help in areas of the UK where malaria is less regularly seen and treated [10]. Further information about imported malaria in UK travellers is available from Public Health England.

## Transmission

Malaria is transmitted to humans through the bite of an infected female *Anopheles* mosquito. The female mosquito requires protein from blood for her eggs to mature.

*Anopheles* mosquitoes generally bite between sunset and sunrise and are attracted to humans by several factors including heat, odour and carbon dioxide expired during breathing. The sporozoite stage of the malaria parasite migrates from the mosquito gut to the salivary glands, and is injected into humans when the mosquito takes a blood meal. Although the salivary glands can contain as many as 60,000 sporozoites, only a few are inoculated during feeding.

Once sporozoites enter the human they are rapidly carried to the liver where they infect liver cells and develop into a schizont which contains approximately 30,000 offspring (merozoites). Once the schizont ruptures it releases the merozoites into the blood stream. Each merozoite can infect a red blood cell, and once inside the red cell the malaria parasite divides over a period of time, after which the red cell bursts to release them to infect new red cells. These cycles continue, leading to the symptoms of malaria. Two species of malaria, *P. vivax* and *P. ovale*, can persist in the liver for several months in a dormant state (hypnozoite).

In order for malaria to infect a new person, sexual forms of the parasite termed gametocytes, must develop in infected red blood cells and be taken up by an *Anopheles* mosquito when it feeds. These develop into sporozoites in the mosquito, and the life cycle is completed.

### Other routes of transmission

Cases of malaria may occur in non-endemic areas without an apparent travel history (cryptic malaria) [11].

Rarely, person to person transmission of malaria can occur directly without mosquito bite e.g.

mother to child during pregnancy, following receipt of malaria infected blood or tissue, or through needle stick injury . Nosocomial infection i.e. acquired in the hospital setting, may occur, for example, where there is a breach in infection control or as a result of a medical procedure.

If conditions are favourable for the malaria parasite transmission cycle to be maintained, sporadic outbreaks of locally acquired malaria may occur when an imported case of malaria occurs in a non-endemic area and is bitten by a mosquito that can transmit malaria to another person. This is called ‘introduced malaria’. This usually results in a small cluster of one or two cases although larger outbreaks may sometimes occur.

If climatic conditions allow, malaria may also result if an individual is bitten by an infected mosquito that has been imported to a non-endemic area. This can happen around airports (airport malaria) or from a mosquito that has stowed away in hand baggage if aircraft have not been effectively disinsected (luggage or baggage malaria) [11].

## Signs and symptoms

The incubation period of malaria (the time from injection of sporozoites to the onset of clinical symptoms) in *P. falciparum* is 7- 14 days, but can be longer where there is partial immunity or where the parasite has been suppressed by antimalarial tablets. In *P. vivax* or *P. ovale* infection, the incubation period is usually between 12 and 18 days, but can be several months or, rarely, years due to the emergence into the bloodstream from the liver of latent liver hypnozoites.

Malaria begins with non-specific symptoms characterised by fever, headache, fatigue, abdominal discomfort and muscle aches [1]. Cough and diarrhoea can also be seen. Symptoms can progress to high fever and severe muscle aches and pains.

Although symptoms of malaria from all species can be disabling, illness with *P. falciparum* can progress rapidly and develop serious life-threatening complications if prompt treatment is not given. The most serious complication of falciparum malaria is malaria affecting the brain which can lead to coma and death. Other complications include kidney failure, low iron levels in the blood, low blood sugar, uncontrollable bleeding, low blood pressure, and excess fluid in the lungs.

*P. knowlesi* infections are usually uncomplicated but at least 10 percent of patients develop complications and 1–2 percent of cases have a fatal outcome [12].

The fever pattern in patients with *P. vivax* or *P. ovale* malaria may become cyclical, recurring every 48 hours. There are cold and hot phases: the cold stage with shivering lasts 15 to 60 minutes, and the hot stage lasts two to six hours, followed by profuse sweating. Although *P. vivax* can cause severe symptoms, fatalities are uncommon [13].

All travellers should be aware of the signs and symptoms of malaria and should be advised to seek immediate medical attention if these occur either whilst abroad or up to a year after their return.

## Diagnosis and treatment

*P. falciparum* malaria can progress to severe life-threatening illness if not diagnosed and treated promptly. All travellers who present with fever and a history of travel to a malaria risk areas should be evaluated urgently for malaria. Clinical diagnosis is usually by thick and thin blood smears, which are examined by microscopy. An EDTA-anticoagulated venous blood sample should ideally be received in the laboratory within one hour of being taken [2]. Results should be confirmed on the same day and if positive, the patient should be referred to a specialist centre. If blood tests for malaria are negative, tests should be repeated daily for a further two days.

Infection with any species of malaria should be treated promptly. *P. falciparum* malaria is a medical emergency especially if complications have developed, and patients often require intensive therapy. Treatment of malaria should be in accordance with the ACMP malaria treatment guidelines [14] in consultation with an infectious disease or tropical medicine unit.

The choice of drug treatment depends on the causative species and the likelihood of resistance of *P. falciparum* to chloroquine or other drugs. Travellers with *P. falciparum* malaria should be admitted to hospital where they can receive careful evaluation and monitoring. Malaria is a notifiable disease in the UK.

Travellers who develop malaria overseas in remote areas where appropriate supervised treatment may not be available, can consider self-treatment with emergency standby medication. Emergency standby treatment is intended for travellers who believe they have malaria whilst overseas; it is not a replacement for malaria prevention tablets. Such travellers should still seek medical assistance as soon as possible if they develop a fever, in order for definitive diagnosis and treatment to be made. Guidelines for the use of emergency standby treatment are available in the ACMP Malaria prevention guidelines for travellers from the UK.

Rapid Diagnostic Tests (RDTs) have been given to travellers for help in the diagnosis of febrile episodes during remote travel. However, they are often not used correctly [15] and the ACMP does not recommend their use by travellers [2].

## Preventing malaria

The prevention of malaria involves several steps that have been termed the **A, B, C, D** of malaria prevention [2]:

**A** - Awareness of the risk
**B** - Bite prevention
**C** - Chemoprophylaxis (appropriate choice of antimalarial medication and compliance with the regime)
**D** - Diagnosis (prompt diagnosis and treatment without delay)

Despite many decades of research and development efforts, there is currently no commercially

available malaria vaccine [16].

## Awareness of risk and bite prevention

For some destinations, advice for travellers is to have an awareness of the risk of malaria together with bite prevention measures. This includes the use of DEET-based insect repellents, insecticide treated mosquito nets, wearing appropriate clothing, and sleeping in screened accommodation. Please see our Insect and tick bite avoidance factsheet and the guidelines for malaria prevention for detailed information.

Bite prevention measures are important in the prevention of malaria, but will also to help protect against infection with other vector-borne diseases.

## Chemoprophylaxis

The choice of chemoprophylaxis to prevent malaria depends on the parasite species and whether or not there is resistance of *P. falciparum* to chloroquine or other drugs in the area to be visited.

Chemoprophylactic agents are either causal (directed at the liver phase of the malaria parasite life cycle) or suppressive (directed at the red blood cell phase of the malaria parasite life cycle).

No regimen is 100 percent effective, but the combination of preventive measures will provide significant protection against malaria.

Choice of antimalarial medication should be tailored to the individual, taking into account possible risks and benefits to the traveller. As part of a careful individual risk assessment, it is essential that a full clinical history is obtained, detailing current medication, significant health problems and any known drug allergies. A suggested risk assessment template is included with the ACMP Guidelines [2].

For travellers at increased risk of developing complicated malaria, the ACMP suggests antimalarials should not be offered routinely for malaria risk areas where bite avoidance only is recommended. However, this may be considered in exceptional circumstances after the individual risk assessment [2].

ACMP, NaTHNaC and PHE recommend health professionals use one resource for country specific malaria recommendations to optimise consistency of advice. Whilst we recognise that other sources of advice are available, healthcare professionals working in England, Wales or Northern Ireland are advised to use the ACMP guidelines (which inform NaTHNaC recommendations) as their preferred source of guidance for malaria prevention.

# Resources

- ACMP Guidelines for the prevention of malaria in travellers from the United Kingdom

- ACMP UK malaria treatment guidelines
- Children's antimalarial dosage tables
- Insect and tick bite avoidance
- Public Health England: Malaria

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