Malaria

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Key messages

- **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; the African region reports the majority of cases.**
- **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, young children, older people, the immunosuppressed, those without a functioning spleen and those with complex co-morbidities.**
- **The United Kingdom Health Security Agency Advisory Committee on Malaria Prevention (UKHSA ACMP) and NaTHNaC 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.

In 2022, there were an estimated 249 million cases of malaria worldwide and 608,000 deaths in 85 countries [1]. Children aged under five years are the most vulnerable group affected by malaria and the World Health Organization (WHO) estimates that since 2015 they account for 76 percent of all malaria deaths worldwide every year [2].

Most malaria cases in 2022 were in the WHO African Region, with 233 million cases (94 percent) and 580 000 (95 percent) of malaria deaths in the region. Children under five years old accounted for about 80 percent of all malaria deaths in Africa [1, 2]. In 2022, WHO Southeast Asia Region reported 3 percent of malaria cases worldwide, with India accounting for 66 percent of cases in the region [2].

Of the 86 countries that were malaria endemic in 2022, 29 accounted for 95 percent of malaria cases globally. Four countries accounted for nearly half of all malaria cases worldwide: Nigeria (27%), Democratic Republic of the Congo (12%), Uganda (5%) and Mozambique (4%) [1, 2].

There are five species of *Plasmodium* that regularly 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 in the World Health Organization (WHO) regions of Southeast Asia, the eastern Mediterranean and Western Pacific. This parasite is responsible for the most severe form of malaria and the most deaths. In the WHO region of the Americas, *P. vivax* is the dominant malaria parasite [1]. *P. knowlesi* has more recently been recognised as the fifth malaria parasite of humans, although infection is usually restricted to monkeys in the Asia-Pacific area [3, 4].

Risk areas

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 (Dominican Republic and Haiti), the Middle East and Oceania (islands in the Pacific Ocean between Asia and the Americas).

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 Southeast Asia have both species. *P. ovale* and *P. malariae* are less common but are mostly reported in Africa. *P. knowlesi* occurs in Southeast 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 Southeast 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 with the majority of clinical cases occurring 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.

Worldwide malaria cases and deaths increased in 2020, with the most serious situation seen in Africa, especially West Africa. Contributory factors include reduced or delayed diagnosis and clinical care, shortage of medical resources, disruption to control measures and availability of malaria medication. This resurgence of malaria also has major implications for travellers as Africa is the continent that most travellers from the United Kingdom (UK), diagnosed with malaria, report having visited [4].

Climate change may influence the distribution of mosquitoes and malaria parasites and thus alter the areas where malaria is a risk; the United Kingdom Health Security Agency Advisory Committee for Malaria Prevention (UKHSA ACMP) regularly reviews their malaria advice for UK travellers [4].

Malaria guidance and recommendations on TravelHealthPro follow UKHSA ACMP recommendations and is updated in line with any UKHSA ACMP changes.

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. These include pregnant women, the immunosuppressed, those with an absent or dysfunctional spleen, those with complex co-morbidities, young children, and older travellers [4].

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 [4]. See our Pregnancy factsheet for more information.

Travellers who have no spleen, or whose splenic function is severely impaired, are at particular risk of severe malaria and are advised to avoid travel to malarious areas [4]. If travel is essential,

antimalarial tablets are advised in both high and low risk areas, (see the 'chemoprophylaxis' below for further information) together with rigorous bite avoidance and awareness of the need for prompt medical attention if symptoms develop. See our Asplenia factsheet for more information.

Different recommendations for antimalarial tablets may be appropriate for travellers considered to be at increased risk (see 'chemoprophylaxis' below and the Country Information pages).

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 UKHSA 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 any febrile (fever) illness must be taken seriously and investigated promptly [4].

Malaria in travellers from the United Kingdom

In 2021 a total of 1,012 cases of imported malaria were reported in returned travellers in the UK [7, 9]: 954 in England, 29 in Scotland, 21 in Wales and eight in Northern Ireland. This is 79% higher than numbers reported in 2020 (564 cases) and 29% below the mean number of 1,425 cases reported annually between 2012 and 2021. There were three UK deaths from malaria reported in 2021, all from falciparum malaria acquired in Africa [7].

Between 2012 and 2021 UK travellers visiting friends and relatives in their country of origin accounted for 84 percent of cases in those where reason for travel was known [9].

In 2021, when there was a recorded travel history, 94% of UK travellers with malaria became infected in Africa [4].

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 are highest for older travellers, tourists, and those attending for medical help in areas of the UK where malaria is less regularly seen and treated [10].

Failure to take malaria prevention tablets is associated with most of the malaria cases in UK travellers who visited malaria risk areas [7].

More information about imported malaria in UK travellers is available from UKHSA .

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.

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.

Anopheles mosquitoes can be active during the day, at dawn and dusk, and throughout the night depending on species and geographical location. Dawn and dusk are higher risk generally, but risk can occur at other times of the day; daytime biting in forested areas or overcast days for example. Both indoor and outdoor biting can occur, including inside vehicles. Biting at an airport on arrival, transiting or while waiting for luggage and onward transport should also be considered a risk.

Malaria rates are generally higher in rural areas, especially in Africa where intensity of transmission is on average about eight times higher in villages than in towns. However, as Africa becomes increasingly urbanised, there is also a risk in certain cities and urban areas [4].

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 a 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 arises 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 sprayed with insecticide to try and eliminate insects (disinsected). This is sometimes called 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 [3]. 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 [4].

P. knowlesi infections are usually uncomplicated but at least 10 percent of patients develop severe malaria 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 area 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 [4]. 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 routine use of RDTs for self-diagnosis by travellers [4].

Preventing malaria

The prevention of malaria involves several steps that have been termed the 'ABCD' of malaria prevention [4]:

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)

There is currently no commercially available malaria vaccine for travellers [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 regular use and reapplication of a 50 percent DEET-based (or alternative if DEET is not tolerated or unavailable) insect repellent, well maintained insecticide treated mosquito nets (unless accommodation has functioning air-conditioning which is in use), appropriate loosely fitting clothing and sleeping in screened (windows and doors) accommodation.

Please see our insect and tick bite avoidance factsheet and the guidelines for malaria prevention for more detailed information.

Regardless of whether antimalarial tablets are recommended, effective bite prevention measures should be the first line of defence against malaria. Using effective bite prevention methods will also help to protect against infection with other vector-borne diseases.

Travellers should depart on their journey already equipped with mosquito protection measures appropriate to their particular circumstances and carry insect repellent in their hand luggage [4].

Chemoprophylaxis (malaria tablets)

Proguanil has been discontinued in the UK

Both Paludrine (proguanil hydrochloride) and Paludrine/Avloclor (proguanil hydrochloride, chloroquine phosphate) Anti-Malarial Travel Pack have been discontinued in the UK. Once current stocks are exhausted, no further supplies will be available. This means that proguanil will no longer be available in the UK. This will impact on the malaria recommendations for a small number of countries where the combination of chloroquine and proguanil was recommended for malaria prevention.

Supplies of Avloclor (chloroquine phosphate) and atovaquone plus proguanil combination preparation are not affected.

If chloroquine plus proguanil was recommended previously, an alternative malaria chemoprophylaxis regimen (such as atovaquone plus proguanil combination preparation or doxycycline or mefloquine) may be selected [4].

Choice of chemoprophylaxis to prevent malaria depends on the parasite species at the destination, if there is resistance of *P. falciparum* to chloroquine or other drugs in the area to be visited and the traveller's medical history, including any medication.

Chloroquine remains effective against *P. ovale* and *P. malariae* [4].

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

[4].

Individuals without a functioning spleen are at high risk of overwhelming infection from malaria. Travel to malarious areas should be avoided. However, if travel is unavoidable, rigorous mosquito bite avoidance measures and antimalarial medication should be taken, even in 'low risk' malaria areas, where bite avoidance and awareness alone are recommended for other travellers. While antimalarial medication is not required for travel to areas classified as 'very low risk', rigorous bite precautions should be taken along with awareness of the need for prompt medical attention if symptoms develop, see Country Information pages for specific recommendations on risk areas.

ACMP also recommends that antimalarials are considered for other travellers at increased risk of malaria such as those on long stays visiting friends and family, or those at increased risk of developing severe or complicated malaria such as older travellers (over 70 years), the immunosuppressed, those with complex co-morbidities, pregnant women, infants and young children, when visiting an area of 'low risk' for malaria, after individual risk assessment [4]. See Country Information pages for specific recommendations on risk areas.

Diagnosis

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

Resources

- ACMP Guidelines for the prevention of malaria in travellers from the United Kingdom
- British Society for Haematology: Guidelines for the laboratory diagnosis of malaria
- ACMP UK malaria treatment guidelines
- Children's antimalarial dosage tables
- Insect and tick bite avoidance
- NHS: Malaria
- UK Health Security Agency: Malaria

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