2 - Awareness of Risk

2. Awareness of Risk

2.1 What is malaria?

Malaria is a serious febrile illness due to infection of red blood cells with a parasite called *Plasmodium*. It is transmitted by mosquitoes.

Four species of *Plasmodium* commonly infect humans; see table 1 below.

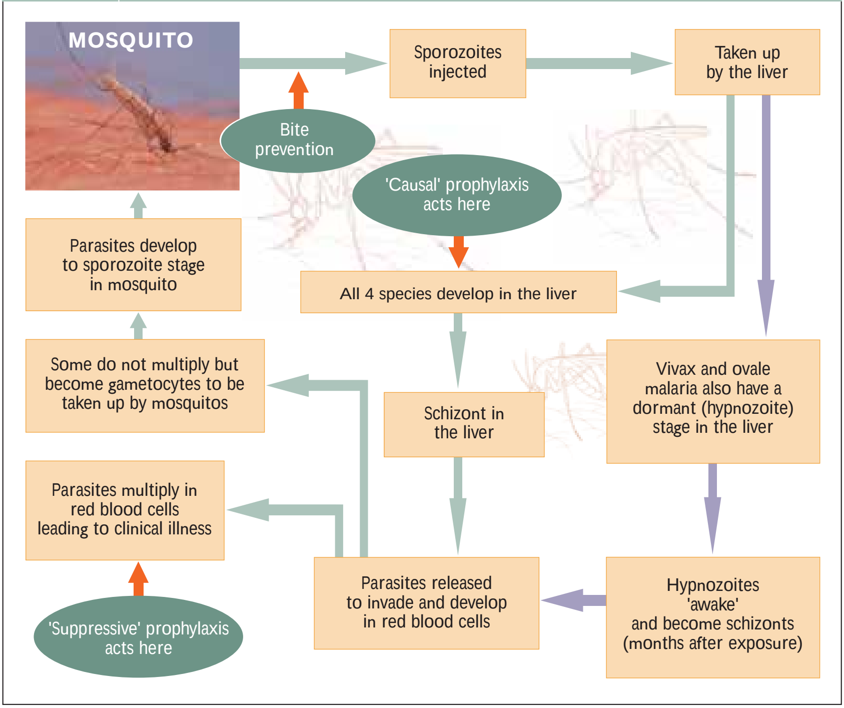
TABLE 1 PLASMODIUM SPECIES WHICH INFECT HUMANS

SPECIES	COMMENT	NUMBER OF CASES REPORTED IN THE UK IN 2005 OUT OF 1754
Plasmodium falciparum	The most dangerous, responsible for the vast majority of malaria deaths worldwide	1338 (76%)
Plasmodium vivax	A relapsing malaria See life cycle	258 (15%)
Plasmodium ovale	A relapsing malaria See life cycle	116 (7%)
Plasmodium malariae	The species least commonly seen in the UK. May present with late recrudescence after many years	29 (2%)

Mixed infections with more than one species of malaria parasite are not commonly reported (10 in 2005).

FIGURE 1 THE MALARIA LIFE CYCLE

The places in the life cycle targeted by the various preventative measures are shown.



2.2 *Life cycle*

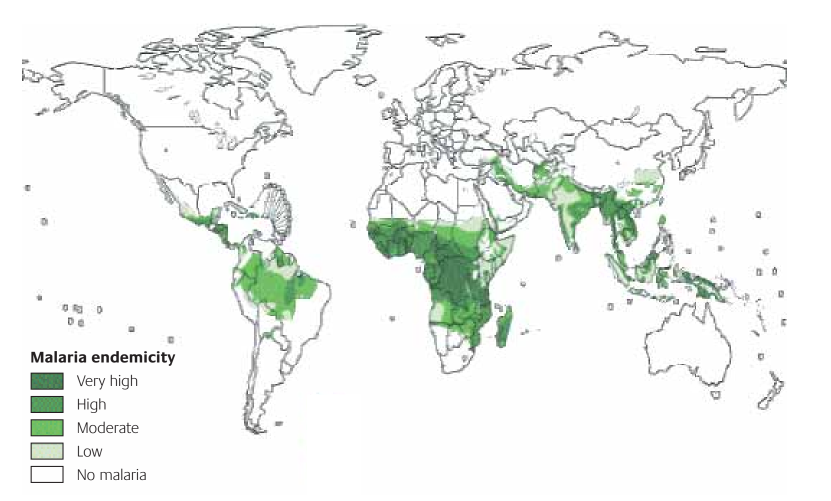
An infected mosquito inoculates 10 to 15 sporozoites when it bites. Each sporozoite introduced into a human and successfully entering a liver cell develops in the case of *P. falciparum* in five to seven days into a schizont containing approximately 30,000 offspring (merozoites) which are released into the bloodstream when the schizont ruptures. Each merozoite has the potential to infect a red blood cell. Once inside the red cell, the malaria parasite grows and divides over 48 hours (*P. falciparum*, *vivax* or *ovale*) to 72 hours (*P. malariae*) to form between 8 and 32 parasites whereupon the red cell bursts to release them to infect new red cells. These cycles in the red cells continue, increasing the numbers of parasites in the infected person and leading to clinical illness. Some parasites in the red cells do not divide but form sexual stages (gametocytes) which mate if taken up by a biting female mosquito and thus complete the malaria life cycle. Figure 1 shows the points in the life cycle at which antimalarial preventive measures are targeted.

2.3 The malarial illness

Malaria can neither be confirmed nor excluded by clinical features alone. The common symptoms and signs are shown in Table 2. There may be no physical signs apart from fever but it must be noted that even the absence of fever itself does not exclude the diagnosis in an ill patient. There is a risk of misdiagnosing malaria as influenza or other viral illness: viral hepatitis (if jaundice is present), gastroenteritis (if diarrhoea is evident) or lower respiratory tract infection (cough can be a non-specific symptom).

TABLE 2	CLINICAL SYMPTOMS AND SIGNS OF MALARIA (from the ACMP Malaria Treatment Guidelines)
	NON-SPECIFIC SYMPTOMS OF MALARIA
	Fever/sweats/chills *Malaise (vague discomfort)* *Myalgia (muscle pain, tenderness)* *Headache* *Diarrhoea* *Cough*
	MAJOR FEATURES OF SEVERE OR COMPLICATED FALCIPARUM MALARIA IN ADULTS
	Impaired consciousness or seizures *Renal impairment (oliguria < 0.4ml/kg bodyweight per hour or creatinine >265µmol/l))* *Acidosis (pH <7.3)* *Hypoglycaemia (<2.2mmol/l)* *Pulmonary oedema or acute respiratory distress syndrome (ARDS)* *Haemoglobin ≤8g/dL* *Spontaneous bleeding/disseminated intravascular coagulation* *Shock (algid malaria)* *Haemoglobinuria (without G6PD deficiency)*
	MAJOR FEATURES OF SEVERE OR COMPLICATED MALARIA IN CHILDREN
	Impaired consciousness or seizures *Respiratory distress or acidosis (pH <7.3)* *Hypoglycaemia* *Severe anaemia* *Prostration (inability to sit or stand)* *Parasitaemia >2% red blood cells parasitized*

FIGURE 2 GLOBAL DISTRIBUTION OF MALARIA AS ASSESSED BY THE WORLD HEALTH ORGANIZATION IN 2003



2.4 Where is malaria found?

Figure 2 shows the global distribution of malaria as assessed by the World Health Organization (WHO) in 2003[2].

In-country maps of prophylactic advice linked to malaria distribution are available in the web-based version of these guidelines for use when advising individual travellers. The likelihood of malaria transmission may vary considerably within one country.

2.5 Level of risk of exposure to malaria and what affects it

Exposure of individual travellers to malaria is influenced by the number of infectious bites received. Conditions affecting number of infectious bites received are given below.

Temperature, altitude and season

- The optimum conditions for malaria transmission are high humidity and an ambient temperature in the range 20 to 30°C[3].
- Malaria transmission does not occur in regions with temperatures below the 16°C isotherm (line on a weather map joining all the places that have the same temperature).
- Parasite maturation in the mosquito cannot take place at altitudes greater than 2000 metres.
- Seasonal rainfall increases mosquito breeding.

Rural versus urban location

- Malaria prevalence is generally higher in rural than in urban areas, especially in Africa where the intensity of transmission is on average about 8 times higher in villages than towns[4] but the risk of contracting malaria in African or other cities of malaria-endemic areas must not be discounted[5].

Type of accommodation

- An impregnated bed net should be used unless the accommodation is fitted with functioning air-conditioning and windows and doors which are sufficiently well sealed to prevent mosquito entry.
- Backpackers staying in cheap accommodation have a higher risk of being bitten compared to tourists staying in air-conditioned hotels.
- The traveller should embark on their journey equipped with mosquito protection measures appropriate to their particular circumstances.

Patterns of activity

- Being outdoors between dusk and dawn when *Anopheles* mosquitoes bite increases the risk.

Length of stay

- The longer the stay, the higher the risk of contracting malaria.

2.6 Distribution of drug resistant malaria

- Chloroquine resistant falciparum malaria is now widespread. *P. falciparum* has also developed resistance to a variety of other agents in certain areas. Further comment on the extent and severity of drug resistance is given in tables 7-12 in chapter 4.
- There is currently no recorded drug resistance to *Plasmodium ovale* and only one report of drug-resistant *P. malariae* (to chloroquine)[6].
- Chloroquine-resistant *P. vivax* is found in Papua New Guinea and Irian Jaya; with sporadic reports from elsewhere in Oceania, Asia, South America, Ethiopia and Somalia.
- *P. vivax* with reduced susceptibility to primaquine (the Chesson strain) is found in South-East Asia and Oceania and higher doses of primaquine are required to achieve radical cure of this parasite.