1. Basic facts

- Malaria is a parasitic disease caused by protozoan parasites of the genus *Plasmodium*.
- Only four plasmodium species develop in humans: *P. falciparum* (causing the life-threatening form of malaria), *P. vivax*, *P. ovale* and *P. malariae*. Of these, only *P. vivax* and *P. ovale* have persistent liver forms that may lead to relapses after the initial blood infection has been cured.
- *P. falciparum* and *P. vivax* are the main species of public health importance.
- Malaria is transmitted from person to person by *Anopheles* mosquitoes, which mainly bite between dusk and dawn.
- The incubation period in humans is the time between the infective bite and the first appearance of clinical signs, of which fever is the most common. It varies according to *Plasmodium* species, being the shortest for *P. falciparum* (9–13 days) and the longest for *P. malariae* (years). The minimum period of time between the initial infection of the mosquito and the development of clinical symptoms in humans is 3-4 weeks.

2. Clinical case definitions

- In *uncomplicated malaria*, the patient presents with fever or history of fever within the last 48 hours (with or without other symptoms such as nausea, vomiting and diarrhoea, headache, back pain, chills and myalgia).
- In a *high malaria risk* area or season, children with fever and no general danger sign or stiff neck should be classified as having malaria. Although a substantial number of children will be treated for malaria when in fact they have another febrile illness, presumptive treatment for malaria is justified in this category given the high rate of malaria risk and the possibility that another illness might cause the malaria infection to progress.
- In a *low malarial risk area* or season, children with fever (or history of fever) and no general danger sign or stiff neck are classified as having malaria, and given an antimalarial only if they have no runny nose (a sign of ARI), no measles, and no other obvious cause of fever (pneumonia, sore throat, etc.).
- In *severe malaria*, patients present with symptoms as for uncomplicated malaria, and also drowsiness with extreme weakness and associated signs and symptoms related to organ failure, such as disorientation, loss of consciousness, convulsions, severe anaemia, jaundice, haemoglobinuria, spontaneous bleeding, pulmonary oedema and shock.

3. Diagnosis

- Laboratory diagnosis is by demonstration of malaria parasites in a blood film (thick or thin smear).
- Laboratory diagnosis may not be possible in the acute phase of an emergency where laboratory services are unavailable. In this situation, diagnosis must depend on clinical symptoms combined with knowledge of the risk of malaria. This is generally not very accurate, and an attempt should be made to at least define the percentage of malaria patients among all those with fever. Rapid diagnostic tests can be useful, particularly in emergency settings.

4. Treatment

*Plasmodium falciparum*

- Treatment policy should be based on knowledge of drug resistance patterns in the area. This is particularly important as displaced populations are especially vulnerable owing to low immunity
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(from malnutrition or lack of previous exposure to malaria) and to the risk of being unable to seek re-treatment if treatment fails. Local, up-to-date information on drug resistance is essential for developing an appropriate treatment policy. Local health authorities, which may have the information already, and operational agencies should collaborate in obtaining the information. Other causes of treatment failure, such as non-compliance, vomiting and poor-quality drugs, should always be monitored. Drug efficacy monitoring should follow standard procedures as developed by WHO\(^1\). As drug resistance is rapidly developing, it is also important to evaluate second-line or future treatments prospectively. The first-line treatment may need to be changed if drug resistance studies show that the national policy is ineffective (i.e. with 15% resistance to therapy).

- Combinations of artemisinin derivatives (such as artesunate, artemether, dihydroartemisinin) and various other antimalarials are increasingly being used as first-line treatment policy.\(^2\) Artemisinin-based combination therapy (ACT) has distinct advantages: the artemisinins produce rapid clinical and parasitological cure; there is as yet no documented parasite resistance to them; they reduce the gametocyte carrier rate and thus reduce transmission; and they are generally well tolerated. This option includes, for instance, artesunate plus amodiaquine, artesunate plus sulfadoxine-pyrimethamine (SP) and artemether–lumefantrine (Coartem\(^\text{®}\)). A drawback of artemisinins is the limited data on safety in pregnancy. Artemisinin compounds are not recommended in the first trimester of pregnancy and currently quinine is used as an alternative.

- ACT may be used in the second or third trimester of pregnancy if there is no better alternative. The lack of data for the use of the 6-dose regimen of Coartem\(^\text{®}\), under 10 kg body weight currently limits its use in small children who should be treated with quinine. The use of daily intramuscular artemether is operationally preferable to 8-12-hourly quinine administration for the management of severe malaria in emergencies and other situations with limited nursing care.

**Plasmodium vivax**

Chloroquine is the treatment of choice in areas where only *P. vivax* occurs. Owing to compliance and operational constraints, wide-scale use of 14-day primaquine anti-relapse treatment is usually not feasible in emergency situations. Anti-relapse treatment is not useful for patients living in endemic areas with unabated transmission. Where *P. falciparum* and *P. vivax* co-exist and microscopy is not available, *P. vivax* generally responds well to the drugs used for *P. falciparum*. The exception is SP, which is not suitable for treatment of *P. vivax*. Thus, in countries such as Timor-Leste, where there is a relatively high percentage of *P. vivax* infections among malaria cases and where *P. falciparum* has become increasingly resistant to chloroquine, the first-line policy for clinically diagnosed cases is now a combination of SP (against *P. falciparum*) plus chloroquine (against *P. vivax*). These policies stipulate that patients with microscopically confirmed malaria receive either chloroquine or SP, depending on the species identified. Localized *P. vivax* resistance to chloroquine has been reported from several countries in Asia and the Americas.

### 5. Chemoprophylaxis and intermittent preventive treatment

- Malaria chemoprophylaxis is essential for non-immune expatriate staff working in camps and communities in *P. falciparum*-endemic areas. It should be combined with rigorous protection against mosquito bites. The choice of drugs is between chloroquine + proguanil, mefloquine, doxycycline and atovaquone + proguanil. In *P. vivax*-only areas, chloroquine prophylaxis may be used to prevent malaria. The recommended prophylaxis regimen varies by area; details are available in *International travel and health* at [http://www.who.int/ith](http://www.who.int/ith).

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6. Prevention and control measures
The main methods of preventing malaria and reducing transmission in emergency situations are:
- Rapid diagnosis and effective case management – important in reducing malaria mortality.
- Indoor residual spraying of insecticide (“house spraying”) – the method of control most often used in emergency situations.
- Insecticide-treated mosquito nets (ITN) – where the population is sensitized and shelters are appropriate for hanging nets.
- Space spraying with pyrethroids-based insecticides twice a week may be considered in the emergency in the camps and temporary shelters and highly populated settlements.
- Permethrin-sprayed blankets, sheets and chaddars (proven efficacy in Asia and undergoing field trials in Africa under highly endemic conditions).
- Permethrin-treated outer clothing worn in the evening or in bed (effective in south Asia).
- Environmental control – difficult during the acute phase except on a local scale, and impact is often limited.
- Insecticide-treated plastic sheeting (undergoing field trials but one may consider using it in the emergency camps and temporary shelters)