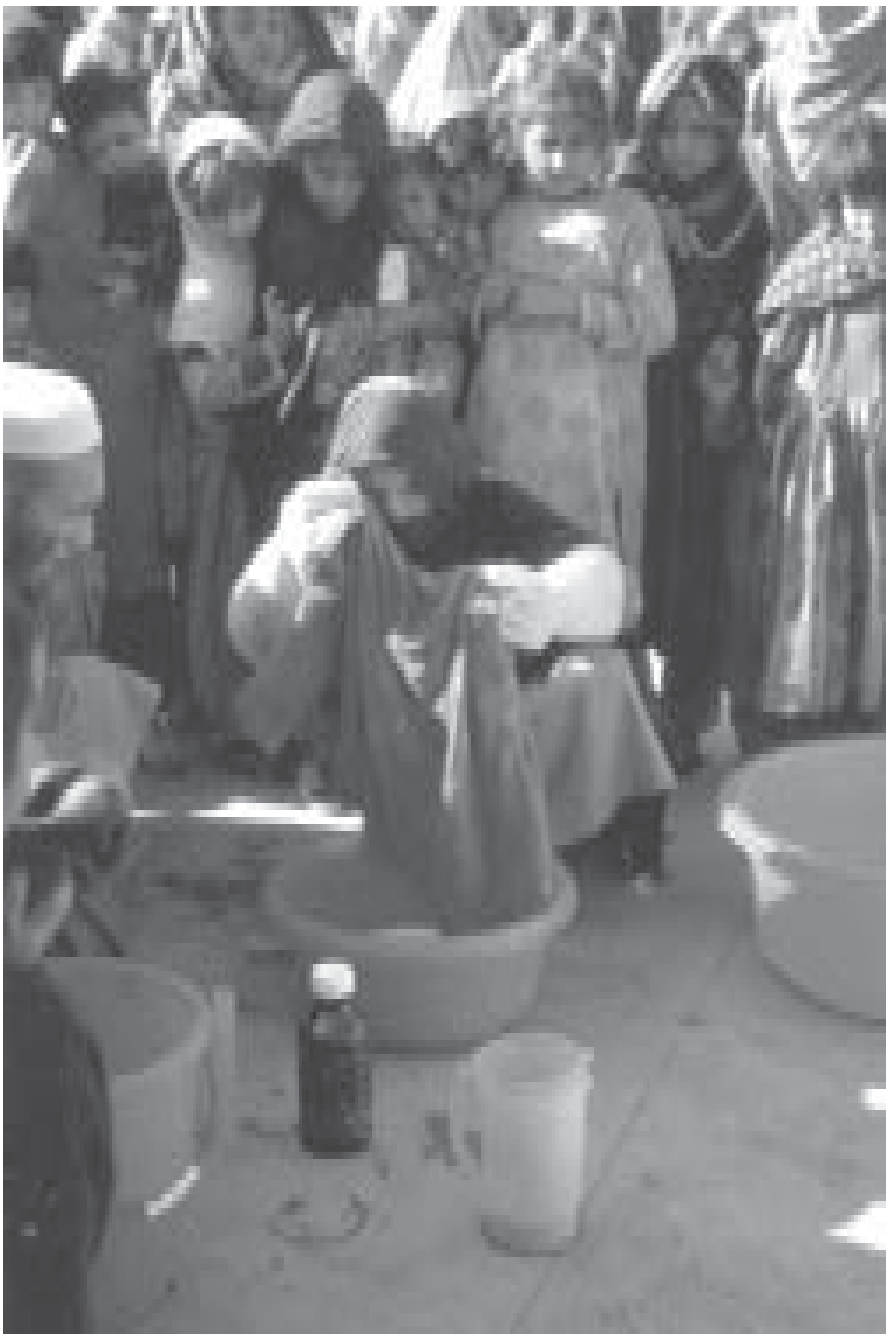
The international newsletter on implementing primary health care

Health Action



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Current challenges in malaria

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OVERVIEW

Malaria

In response to readers requests, this issue of *Health Action* covers recent developments in malaria and some of the issues facing malaria control programmes. **Richard Allan** of the **Roll Back Malaria Initiative** provides an overview of current challenges.

One in five of the world's population is at risk of malaria. Each year, there are up to 500 million episodes of malaria illness and over 1 million malaria deaths. More than 90% of these deaths are in sub-Saharan Africa. A third of malaria cases and two thirds of all malaria deaths are in young children. Malaria can cause severe anaemia, miscarriage and death in pregnant women and is responsible for almost a third of preventable low birth weight in newborns. Malaria costs US$12 billion every year in lost productivity, reduced household income, and expenditure on treatment (contact Royal Perth Hospital and Roll Back Malaria, page 12, for facts and figures on malaria).

Malaria is a growing problem, because of increasing drug resistance, climate change, and population movements. The extent to which malaria is a problem (or level of endemicity) and patterns of transmission vary between different parts of the world and within countries. Usually malaria endemicity is low in mountainous and desert areas and city centres, and high in lowland and rural areas. Some areas have high transmission all year, some have high but seasonal transmission, and others have low or moderate transmission.

In high transmission areas, such as much of sub-Saharan Africa, people who have repeated infections develop partial immunity to malaria. Immunity means that they may not get sick or develop symptoms of malaria illness if they are infected with malaria parasites. In these areas, young children and recent arrivals from areas with little or no malaria transmission who have little or no immunity, and pregnant women who lose some immunity during pregnancy, are most at risk.

In low transmission areas, such as much of Southern Asia, and areas of seasonal transmission, the whole population is at risk because of low immunity.

Last issue of Health Action

Dear readers,
Healthlink Worldwide would like to take this opportunity to thank all those who have contributed to its newsletters over the past 20 years. This is the last issue of *Health Action*. Healthlink Worldwide is starting an electronic bulletin for policy makers and decision makers in the near future, which will be of interest to Health Action readers. If you would like to receive this or other free publications by Healthlink Worldwide, please make sure that you fill in the readers' questionnaire you received with this newsletter.

Front cover photo: Treating blankets with permethrin (Mark Rowland)

Roll Back Malaria Initiative

To meet the growing challenge of malaria, the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), The World Bank and the United Nations Development Programme (UNDP) launched the Roll Back Malaria (RBM) Initiative in 1998. (See page 12 for contact details.) RBM promotes partnerships at global and national levels between governments, international agencies and donors, non-governmental organisations (NGOs), communities, the media and the private sector. RBM is also concerned with district level malaria control (see pages 4 and 5) and collaborating with the Integrated Management of Childhood Illness (IMCI) initiative to improve health worker skills and community and family practices.

RBM aims to reduce malaria deaths by half by 2010 through ensuring that, in all countries where malaria is endemic — both in normal circumstances and in complex emergency situations — the following strategies are implemented:

- access to early diagnosis and effective treatment
- prevention and management of malaria in pregnancy
- personal protection and vector control, in particular using insecticide treated nets
- epidemic preparedness and response.

Current challenges

Prompt treatment of malaria relies on early diagnosis using accurate methods. However, health workers can only diagnose malaria if people come to see them when they have symptoms. In many countries, access to health services is poor. Even where access is good, malaria patients often seek treatment late, having first seen a traditional healer or self-treated using over-the-counter drugs. The article on page 8 highlights the importance of effective approaches to diagnosis and of understanding what communities believe and do about malaria.

Effective treatment depends on using antimalarial drugs that kill malaria parasites. However, drug resistance to the most commonly used antimalarials is widespread in Asia and increasing in Africa. Resistance is forcing many countries to switch from single drug treatment (monotherapy) to more expensive combination drug therapies (see page 9). Another constraint to effective treatment is patient adherence. Delivering single dose drugs in combination with

an artemisinin drug may slow the development of resistance, but requires 3 days of therapy. Ensuring people keep to a multi-day drug regimen is a challenge, especially in complex emergencies or situations where access to health care is limited.

Improving malaria prevention is also a challenge, in particular making sure that all those at risk of malaria have access to and use insecticide treated nets (ITNs) and that households, communities and health authorities implement effective vector control activities (see pages 6 and 7). An important aspect of prevention is reducing the risk of malaria in pregnant women. All pregnant women with malaria symptoms need prompt treatment with an effective antimalarial. However, in high transmission areas, pregnant women with partial immunity can be infected with malaria parasites without showing any clinical symptoms. These asymptomatic infections still pose a risk to the mother and the unborn child, so just diagnosing and treating symptomatic cases is not sufficient. Regular preventive treatment (prophylaxis) with effective antimalarial drugs has been the standard way to prevent malaria in pregnant women, but is difficult because of problems of drug resistance and poor patient adherence. In pregnant women with partial immunity, an alternative approach is intermittent preventive treatment with a single dose of sulfadoxine-pyrimethamine (SP) given at the start of the second trimester of pregnancy and again at the start of the third trimester. However, in areas of high resistance to SP, alternatives are needed. In view of these challenges, it is important to ensure that all pregnant women at risk of malaria use insecticide-treated bed nets, and are aware of malaria symptoms and the need to seek early treatment (see Lives at Risk resources, page 12, for more information on malaria and pregnancy).

Malaria is a significant problem in complex emergencies. Emergencies are often characterised by very high rates of malaria death and illness, and effective treatment of malaria in malnourished children is especially difficult. Malnutrition appears to reduce intestinal absorption of chloroquine, and more research is needed to identify the best drugs, and the best way to give these drugs, for treating malaria in children with malnutrition. Malaria control in emergencies is discussed on pages 10 and 11.

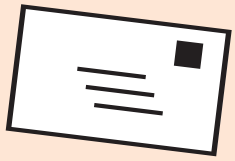
Richard Allan, Complex Emergencies Advisor, Roll Back Malaria (see page 12 for contact details)

Basic facts about malaria

What causes malaria and how is it transmitted?

Malaria is caused by *Plasmodium* parasites, which are transmitted by the bite of the female *Anopheles* mosquito. *Anopheles* mosquitoes usually bite at night. Mosquitoes that carry malaria parasites are called malaria vectors. Of the four *Plasmodium* species (*P. falciparum*, *P. vivax*, *P. malariae*, and *P. ovale*) that affect humans, *P. falciparum* causes most severe malaria illness and death. Different species are more common in different parts of the world. For example, *P. falciparum* predominates in sub-Saharan Africa. The relative importance of different species also varies. For example, in the Democratic Republic of Congo, 95% of malaria is caused by *P. falciparum* and 5% by *P. ovale* and *P. malariae*, but in Afghanistan, 85% is caused by *P. vivax* and 15% by *P. falciparum*.

Mosquitoes have four main stages in their lifecycle: **egg, larva, pupa** and **adult.** Adult female mosquitoes lay their eggs on water. Each egg hatches into a larva, which feeds and grows. In the tropics, mosquitoes can complete the larval stage in only 7 days. The larva develops into a pupa. The pupal stage lasts 2-3 days. The adult mosquito comes out of the pupa, and females produce eggs 2-3 days after feeding on blood. *Anopheles* mosquitoes become infected with malaria parasites by feeding on a person with malaria. The parasites develop in the mosquito and are transmitted to another person during a future mosquito blood meal. Adult female mosquitoes live for 10-14 days on average. It takes at least 10 days for malaria parasites in a mosquito to become infective to humans, so only mosquitoes living longer than this can transmit malaria.



Feedback...

In this last issue of **Health Action (HA),** we have tried to include feedback from as many readers as possible. We would also like to thank all readers who have shared their comments and ideas over the past few years.

Transport for primary health care

Abdoun Chande from Tanzania, commented on issues raised in *HA* 25. He described the situation in his district, where lack of transport makes regular supervision of peripheral primary health care facilities very difficult, and emphasised the need to develop appropriate means of transport for primary health care workers with disabilities, to enable them to carry out their work.

NGO's roles and responsibilities

In response to *HA* 23, Magumba wa Magumba from Tanzania, highlighted the important role that NGOs play in providing health services to poor communities in remote, under-served areas. However, he also identified the need for NGOs to improve skills for collaborating with other organisations. Adugna Kebede from Ethiopia suggested that, to change negative government perceptions of NGOs and build partnerships, NGOs must demonstrate transparent project management and accounting.

Improving rural health

Responding to *HA* 23, Titus Kadilo Dena from Kenya suggested that improving rural health requires increasing resources allocated to rural dispensaries and health centres, and ensuring that these facilities have adequate supplies of drugs, equipment and commodities such as mosquito nets and delivery kits. Ian Couper from South Africa, wrote to say that information about rural health is available on the Centre for Rural Health in Australia website at www.med.monash.edu.au.

Planning for malaria control

Key steps in planning malaria control activities at district level.

Partnerships for change and communication: Guidelines for malaria control

Most national malaria control strategies contain the four main strategies advocated by Roll Back Malaria (see page 2). These are usually supported by some cross-cutting strategies, including **Information, Education and Communication (IEC) initiatives** and **social mobilisation, strengthening of technical and institutional capacity, monitoring and evaluation,** and **operational research.** Districts have the challenge of adapting global or national guidelines to their local situation.

The approach districts take to planning and implementing malaria control activities will depend on the health system, for example the degree of decentralisation. In most situations district managers will need to take account of national policy and guidelines, and to be aware of nationally planned activities, for example, training for laboratory technicians or communication campaigns, as well as of support available from the Ministry of Health.

When planning malaria control activities, issues to consider include:

- how much priority to give malaria within district health plans
- which malaria control activities to carry out within the overall framework provided from the centre
- what malaria control activities to prioritise at community, primary health care and referral levels
- how to work with other sectors, such as education and environment, and partners who can contribute to malaria control.

Many countries have district planning guidelines. The following steps, which focus on planning malaria control, are intended to complement existing guidelines.

1 Collect information

The first step is to gather information to help assess the malaria situation and determine what malaria control activities will be most effective and feasible.

Some of this information will already be available. But often it will not be, or it will be of poor quality. Information gaps do not always need to delay action. For example, data from health facilities may be more available than community data. Districts can plan activities with the information they have and include community studies as part of the plans.

Finding out about malaria in Uganda

Uganda has recently carried out a baseline survey about malaria in a cross-section of districts. This and other surveys have shown that very few people seek treatment for their children within 24 hours of a fever starting. When they do take action many treat at home and very few go to a health facility. Ugandan districts are now prioritising strategies to improve home management of fever. Since these strategies are new, monitoring and evaluation and operational research are being built into plans so that the most effective practices can be identified.

Examples of information for planning

ENVIRONMENTAL

Altitude – this may affect mosquito survival and malaria transmission.
Surface water and land use – *Anopheles* mosquitoes usually prefer to breed in unpolluted water.
Urbanisation – malaria is often less of a problem in urban centres, but changes in land use may increase or decrease suitable mosquito breeding sites.

DEMOGRAPHIC, SOCIAL AND ECONOMIC

Population – total population and population of vulnerable groups, for example, children under five and pregnant women, and population trends and distribution.
Community – knowledge, attitudes and practices about malaria, and health seeking behaviour.
Socio-economic status – household income, expenditure on health care, availability of cash, for example, to purchase mosquito nets.

EPIDEMIOLOGICAL

Malaria transmission, vectors and parasites – endemicity and seasonality, local mosquito species and behaviour, proportions of different parasite species and their sensitivity to available drugs.
Mortality and morbidity – overall and malaria-specific across the district in different at-risk groups and during different seasons, case fatality rates for malaria admissions.

HEALTH SERVICES

Coverage and use – coverage by public and private health services, information on under-served areas and population groups, and utilisation of health services.
Health and laboratory personnel – in service and in training, and existing skills in malaria control.
Equipment, supplies and drugs – availability, quality and reliability of supplies.

FINANCIAL

Current resources – public, NGO and private, for health overall, for malaria specifically and for malaria-related activities outside the health sector.
Potential new sources of funding.

2 Assess the situation

Information collected can be used to assess needs and potential malaria control activities, and to take a critical look at current activities (see checklist of questions below).

WHAT NEEDS TO BE DONE?

- What are the major risk factors for malaria in the district?
- What areas and population groups are at highest risk?
- What specific interventions are appropriate for each area or group? Which of these interventions are likely to have the most impact?
- Who should implement these activities, e.g. district health team, health facilities, communities, NGOs, private sector?
- How will these activities be co-ordinated?
- Is research needed to provide more information? What monitoring and evaluation activities are required to measure progress and inform future planning?

WHAT IS CURRENTLY BEING DONE?

- How are malaria control activities currently planned and managed?
- Who is involved in planning and implementation?
- What is the cost? Is the share of resources allocated to malaria appropriate?
- Are areas and population groups at highest risk given priority?
- Do staff have adequate skills, resources and equipment?
- What has been the impact of current activities on malaria death and illness?

If current activities are not having the desired effect, why is this? What, realistically, can be done about problems?

- What research, monitoring and evaluation is currently underway? Is this answering the questions that need to be addressed?

3 Decide what to do next

Assessment of the situation should help district managers to identify what is not being done that should be done, as well as what is being done that does not need to be done. It will also clarify achievable objectives and activities, and the resources required to carry out these activities.

In many districts, there are insufficient resources to do everything. This often means making difficult choices between activities that will yield faster results but that may not be sustainable, and activities that may take longer to have an impact.
In some settings, it may be possible to advocate with decision makers for more resources. Where this is not possible, involving other sectors and partners in the planning process can help to maximise practical and financial contributions.

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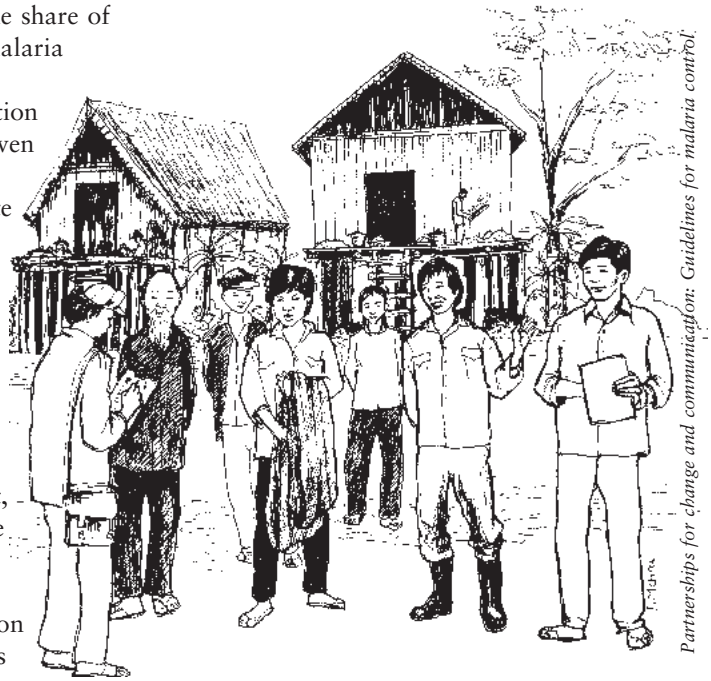

Partnerships for change and communication: Guidelines for malaria control

Preventing malaria

Jo Lines *describes what can be done to prevent malaria.*

Malaria is transmitted to humans through the bites of *Anopheles* mosquitoes. Killing these mosquitoes, or protecting oneself against their bites, are the best ways of preventing malaria. It is also possible to attack the larvae in the breeding sites, but in rural areas this is generally less successful than attacks on the adults.

What households can do

Anopheles mosquitoes bite at night, and most important malaria vectors bite later rather than earlier in the night. Methods that protect against mosquito biting include mosquito nets, window screens, aerosol sprays, repellent coils, and mats that produce an insecticide vapour.

In Africa, the main malaria mosquito breeding sites are temporary puddles/pools of unpolluted (but often muddy) water. In towns these are often associated with the cultivation of rice (top photo) and sweet potato (above).

Net use in Afghanistan

One project found that ITNs were only used during the hot months of the year when people sleep outside, but when the temperature falls people sleep indoors without nets. However, the cooler months coincide with peak transmission of *P. falciparum*, so people were not protected when they were most at risk from severe malaria.

Source: Insecticide treated mosquito nets. A handbook for managers.

Table 1 Personal protection methods

METHOD	**Insecticide treated mosquito nets**
Advantages	♦ Protects against mosquito bites mosquito nets even if the net is torn ♦ Repels mosquitoes and kills those that come into contact with the net ♦ Kills other pests such as headlice and bedbugs ♦ Can reduce the number of mosquitoes and proportion infected with malaria parasites if the whole community uses treated nets ♦ Requires less insecticide than IRS ♦ Good value for money in the long run
Disadvantages	♦ Requires re-treatment every 6 or 12 months, more often if nets are washed frequently
METHOD	**Mosquito nets**
Advantages	♦ Provides some protection against mosquito bites ♦ Good value for money in the long run
Disadvantages	♦ Mosquitoes can bite through the net, and can enter torn nets
METHOD	**Window screens**
Advantages	♦ Prevents mosquitoes entering a room ♦ Protects the whole room
Disadvantages	♦ Mosquitoes can enter if there are holes in screens, and may be trapped ♦ Expensive
METHOD	**Coils and vapourising mats**
Advantages	♦ Repels mosquitoes and provides some protection against mosquito bites ♦ Protects the whole room ♦ Low unit cost
Disadvantages	♦ High annual cost if used regularly ♦ Temporary effect
METHOD	**Aerosol sprays**
Advantages	♦ Kills mosquitoes and provides some protection against mosquito bites ♦ Protects the whole room
Disadvantages	♦ Very high annual cost if used regularly ♦ Temporary effect

Net treatment with insecticide

Nets treated with a pyrethroid insecticide are twice as effective as untreated nets, because the insecticide repels and kills mosquitoes. Synthetic pyrethroids (which mimic the insecticidal activity of natural pyrethrum) kill mosquitoes but do not harm humans. Treating a net involves dipping it in insecticide solution. Any kind of mosquito net can be treated, but the insecticide must be specifically for net treatment. Suitable insecticide products are available as a liquid or tablet that is diluted in water to make a solution. People who treat many nets should wear protective clothing to prevent temporary side effects such as skin irritation. After soaking thoroughly in the solution, the net is dried.

With current insecticide products, nets must be re-treated every 6 or 12 months, or after 2-3 washes. In a few places, health services or NGOs provide net treatment services. In others, net treatment kits are sold in shops for home use. Several manufacturers are developing 'long-lasting' nets treated with a wash-resistant insecticide formulation. These nets will retain their insecticidal activity for several years, even after regular washing, and re-treatment will not be necessary.

Studies in Africa have shown that sleeping under ITNs reduces malaria illness and death in young children. Promoting wider use of ITNs is a key challenge for malaria control programmes, as is promoting consistent use of ITNs.

What communities can do

Attacking malaria breeding vector sites is rarely successful in rural areas. *Anopheles* breeding sites tend to be numerous, scattered and shifting. Also, adults can fly several kilometres, so breeding sites must be removed over a large area in order to protect a single village. Breeding site control is much more feasible in very arid and urban areas, where breeding sites are limited and fixed. The main *Anopheles* species in Africa prefers to breed in open, unpolluted water, so vector control measures should be targeted to areas where wet crops, such as rice, sweet potato and yam, are cultivated, rather than drainage ditches or containers.

What health authorities can do

Indoor residual spraying (IRS) needs to be organised by national or local authorities. Lack of capacity means it may not be feasible in parts of Africa, but in many areas of Asia and Latin America IRS is one of the most efficient and cost-effective methods of malaria vector control.

IRS reduces malaria transmission by decreasing the number and lifespan of the local mosquito population (malaria can only be transmitted by female mosquitoes that live longer than 10 days). Killing adult mosquitoes in this way is generally more effective than destroying breeding sites, especially in rural areas. IRS can also be targeted to communities most at risk, which is important where the intensity of malaria transmission varies between communities and from year to year.

National and local authorities can also encourage households and communities to use effective methods of protection, in particular ITNs. This does not mean that the Ministry of Health should provide free nets or sell nets to the general public, as experience suggests that this is not sustainable or efficient. It is better for authorities to work in partnership with the private sector, and to focus on creating demand – for example, through health education – and on supporting the development of a commercial market for nets and insecticide – for example, through removing tax and tariff barriers that make it expensive for local manufacturers to import raw materials and/or netting.

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Table 2 Vector control methods

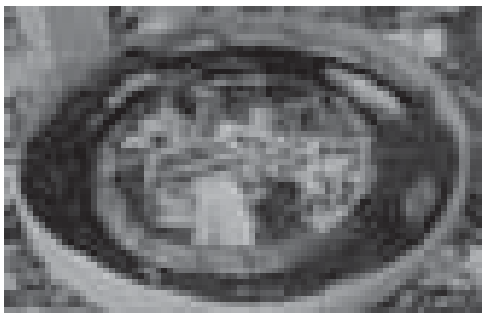
APPROACH	**Indoor residual spraying (IRS)**
Method	Spraying inside walls to kill resting mosquitoes
Disadvantages	♦ Resistance to insecticides ♦ Needs good infrastructure, logistics, well-equipped and trained workforce
APPROACH	**Larviciding**
Method	Killing mosquito larvae using chemicals in breeding sites
Disadvantages	♦ Not feasible in many areas due to large numbers and shifting and scattered nature of breeding sites ♦ Requires good knowledge of preferred breeding sites of local *Anopheles* mosquito species to ensure correct targeting ♦ Too expensive for many malaria control programmes
APPROACH	**Source reduction**
Method	Identifying and destroying vector breeding sites
Disadvantages	♦ Has the same operational difficulties as larviciding
APPROACH	**Biological control**
Method	Biological insecticides, e.g. *Bacillus thuringiensis israelensis*
Disadvantages	♦ Has the same operational difficulties as larviciding

NOTE Clearing vegetation around houses does not help to control malaria. It can also result in destruction of food crops, such as maize and bananas, which do not provide breeding or resting sites for malaria vectors.

Expanding ITN coverage in Tanzania

Until recently, few people in Tanzania used nets and net treatment was unknown. During the 1990s, however, demand was stimulated by numerous small ITN projects and in 1994, local manufacturers began to make nets for the mass market. Now, net treatment kits are also available in shops. Tanzania is one of the few countries to have adopted a taxation policy to promote net availability and affordability, and this policy has further stimulated commercial investment in net production. In 1999, local manufacturers sold 1.5 million nets. More than 70% of households in Dar es Salaam and more than 20% in rural areas have at least one net.

In some countries, governments provide free or subsidised nets for pregnant women and children under five, and maternal and child health clinics play an important role in targeting distribution to these vulnerable populations. In other countries, such as Vietnam, households are expected to buy their own nets, but local authorities provide free insecticide treatment services.



Net re-treatment in Vietnam

In Vietnam, over 10 million people now use insecticide treated nets. Almost all these nets are bought from the commercial sector, although the government provides limited numbers of free nets to the poorest communities. Insecticide treatment of nets is regarded as an alternative to house spraying, and is provided free of charge to targeted communities by the National Malaria Control Programme.

Contrary to popular belief, malaria mosquitoes do not breed in small containers like the half-tyre (top photo) or in organically polluted water, such as a blocked drain (left).

Diagnosis, treatment and local beliefs

When diagnosing malaria, it is important to understand community beliefs and practices.

Initial diagnosis of malaria is based on clinical signs and symptoms. In some settings, this is the only method used for diagnosing malaria. However, relying only on clinical signs and symptoms can result in inaccurate diagnosis because

- clinical presentation of malaria varies from region to region.
- signs and symptoms of malaria often overlap with those of other diseases, especially in young children. For example, pneumonia and measles can also cause fever.

For these reasons, suspected malaria cases should be confirmed by parasitological diagnosis. This can ensure that malaria cases receive prompt treatment and reduce unnecessary treatment of patients without malaria.

In **low transmission areas,** adults and children have little acquired immunity and do not carry malaria parasites in their blood. So the presence of parasites means that malaria is likely to be the cause of clinical symptoms. However, in these areas, parasitological diagnosis can produce a 'false negative' result (a negative result even if the patient has malaria).

In **high transmission areas,** most adults will have some immunity and carry malaria parasites in their blood. So the presence of parasites does not necessarily mean that malaria is the cause of clinical symptoms. Confirmatory tests are more useful in children, because they usually have little acquired immunity. If confirmation of clinical diagnosis in children is not possible, health workers should use Integrated Management of Childhood Illness guidelines and treat a child with a fever for malaria, if no other cause of the fever can be identified.

Understanding community beliefs and behaviour

Community beliefs about malaria can be different from medical understanding. However, people rarely seek treatment for the 'cause' of the disease. Instead they seek treatment for the symptoms, such as fever and headache. Fevers are quickly noticed but fever itself is rarely seen as serious. Initial treatment for fever usually includes home treatment with drugs purchased from a local pharmacy or shop, and sometimes tepid sponging.

People may only seek care from a health centre when other treatment has failed, if the symptoms do not go away or new symptoms appear. Many malaria cases that present at a health facility have already received some form of treatment, including antimalarial drugs. Home management of fever before coming to a health facility affects the clinical presentation and management of malaria.

So health workers need to know how communities interpret malaria

Methods of diagnosing malaria

METHOD	Clinical diagnosis
Uncomplicated malaria	fever, history of fever, nausea, vomiting and diarrhoea, headache, cough, chills, muscle pains
Severe malaria	symptoms as for *uncomplicated malaria,* with disorientation, coma, multiple convulsions, severe anaemia, jaundice, haemoglobinuria, abnormal bleeding, pulmonary oedema, shock
METHOD	**Parasitological diagnosis**
Microscopy	examining a blood smear under a microscope to detect the presence of malaria parasites in the blood
OR Rapid diagnostic tests	using a dipstick or test strip to detect the presence of malaria parasite antigens in the blood

Local perceptions

A project in South-west Uganda found that 'omushwiza' (the local term most closely related to malaria) was believed to be caused by wrong food and drink, weather conditions, and mosquitoes and flies. However, these beliefs had little influence on behaviour related to seeking a cure. Even though the symptoms (fever and headaches) were thought to be caused by the sun diluting the blood, people still thought the best cure was Chloroquine, bought from a shop or a health clinic.

Source: Maize malaria and mangoes: A descriptive research into local perceptions of malaria in South-west Uganda.

symptoms, and to find out what treatment a patient has already received. It is important to ask in a non-judgmental way about any treatment or care that has been given before visiting the health facility. If people think they will be blamed for doing the wrong thing, they may not reveal this information.

Effective treatment depends on patients taking antimalarial drugs as prescribed. Health workers must explain, using appropriate language, how often and for how long to take the drugs, possible side-effects, what effect the treatment should have, and when to return if it does not work.

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Antimalarial drugs

Resistance to antimalarial drugs is increasing. In Latin America and Asia, malaria parasites are partially resistant to most antimalarials. In Africa, there is widespread resistance to the cheapest, most commonly-used drugs. Many countries that have relied on monotherapy (single drug treatment) are being forced to change treatment policies in response to growing drug resistance. The challenge is to identify combinations of current antimalarials or new drugs that are effective and affordable.

Current treatment

Chloroquine is safe, cheap, rapidly effective against sensitive malaria parasites, and has a short treatment course. It remains the treatment of choice for malaria caused by *P. vivax*, *P. ovale* and *P. malariae*, the majority of cases in Asia and Latin America. *P. falciparum* parasite resistance to chloroquine is widespread and chloroquine is no longer useful for falciparum malaria, which causes most cases in Africa.

Sulfadoxine-pyrimethamine (SP), while not as rapidly effective as chloroquine, is safe, cheap and given as a single dose. SP has replaced chloroquine as the treatment of choice for falciparum malaria in Africa, but resistance is spreading.

Quinine is used to treat severe malaria cases in Africa and, in combination with SP or a tetracycline, uncomplicated malaria in non-immune patients in other parts of the world. Resistance to quinine is only a problem in South-east Asia. However, using quinine to treat non-severe falciparum cases in Africa may not be feasible, as it is relatively expensive, has a longer treatment course and unpleasant side effects.

Mefloquine and halofantrine are similar to quinine. Both can be taken as rapidly effective short courses. In rare cases, mefloquine can cause mental health problems and halofantrine can cause heart problems. Resistance to both is widespread in South-east Asia, and increasing in other parts of Asia. Resistance is not a problem in Africa, but these drugs are too expensive for public health services.

Amodiaquine, which is similar to chloroquine, is a potentially useful antimalarial in Africa. Experience with chloroquine suggests that resistance could develop rapidly if amodiaquine is used for monotherapy.

Primaquine – While chloroquine is an effective treatment for most cases of *P. vivax* malaria, it does not kill hypnozoites (parasites at the dormant stage in the liver), which cause relapses. Standard anti-relapse treatment is a course of primaquine given after finishing chloroquine treatment. However, primaquine is potentially dangerous in people with a genetic abnormality called G6PD deficiency, and primaquine resistance is emerging in Asia.

New developments

Artemisinines – The two most important artemisinin drugs are artesunate and artemether. Used in Chinese traditional medicine, they are derived from sweet wormwood. These drugs are highly effective, well tolerated and appear safe. They can be used to treat uncomplicated and severe malaria and, in severe cases, are as effective as quinine. However, they must be used in combination with another drug to prevent relapse, and are more expensive than chloroquine or SP.

Atovaquone-proguanil (Malarone) is a new drug that can treat malaria caused by multi-drug resistant parasites and cases that relapse after treatment with commonly used drugs. It is safe and effective, but is too expensive for countries with limited public health budgets.

Chlorproguanil-dapsone (Lapdap), which is similar to SP, is being developed specifically for Africa. This drug is cheap and effective but, as with SP, resistance could develop rapidly if it is used for monotherapy.

Tafenoquine, a new drug, appears to be more effective than primaquine in killing *P. vivax* hypnozoites, but there is no data on its safety in people with G6PD deficiency.

Combination therapy

Combination therapy (two drugs given together) has proved to be very effective and also has the potential to delay the spread of drug resistance. Experts are currently debating whether or not all drugs for malaria treatment should be given as combination therapy.

Combination therapy is already standard practice in many Asian and Latin American countries, and combinations that include an artemisinin are now first-line treatment in much of South-east Asia. The use of combination therapy in Africa, if SP resistance continues to spread, is being considered. However, this would significantly increase costs, because recommended combinations are significantly more expensive than current first-line treatment, and there are concerns that this could result in under-treatment and prevent the poorest people from obtaining treatment.

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Malaria and complex emergencies

One third of all malaria deaths occur in countries experiencing complex emergencies. This article explains why malaria is such a problem in emergencies and what can be done.

Malaria is often the commonest cause of death and illness in complex emergencies in malarious areas. In the acute phase, 50-90% of outpatient consultations and 50% of deaths may be due to malaria.

Complex emergencies increase malaria death and illness because of

- the breakdown of health services and malaria control programmes.
- **population movement through or to malaria-risk areas.** In 1994, many Rwandan refugees who settled in a camp in a low transmission area in Tanzania died from malaria because they had passed through an area of high transmission on the way. In 1993, there were many malaria deaths when people were displaced from non-malarious mountainous areas of Rwanda to the central region, where malaria transmission is high.
- camps being sited in places where mosquitoes breed. In 1994, one of four Rwandan refugee camps in eastern Democratic Republic of Congo (DRC) was sited close to lowland marshes. Malaria prevalence in this camp was 30-40% compared with 5-15% in the other camps, resulting in high mortality rates.
- weakened immunity, due to malnutrition and multiple infections.
- difficulty reaching affected populations because of security problems or because people flee to remote areas.

Spraying the inner surfaces of canvas tents (Mark Rowland)

Priorities for malaria control

Priorities for malaria control in emergencies are

- early diagnosis and prompt treatment with effective antimalarial drugs.
- preventive interventions, such as residual spraying of shelters with insecticide and use of insecticide treated nets and other materials, as well as preventive intermittent treatment in pregnant women.
- effective and timely responses to outbreaks.

Ideally, interventions should be consistent with national policies and services normally available to the population. However, this is not always possible and interventions may need to be adapted in emergency situations. Priorities, and what can be done, also depend on the phase of the emergency.

Diagnosis and treatment

In the acute phase of an emergency, international agencies and NGOs may take a different approach to diagnosis and treatment to that of health services in stable situations. For example:

- If microscopy services are not functioning, agencies may decide to use rapid diagnostic tests to confirm malaria cases.
- If there is a risk of resistance to the standard antimalarial drug, agencies may decide to treat with combination therapy to prevent the disease recurring after being apparently cured or progressing to severe malaria.

These methods may be justified in the acute phase, when the priority is to reduce high death rates from malaria. However, they may be too expensive for external agencies or governments to sustain in the longer-

Definition of a complex emergency

A complex emergency is **a situation affecting large civilian populations with war or civil strife, food shortages and population displacement** resulting in **excess mortality and morbidity.** The main emergency phases are:

- **Acute phase** Immediate (0-4 weeks) followed by stabilisation (4-10 weeks). The acute phase is characterised by sudden population movement, high death rates (>1:10,000 per day), and poor access to food and health care. External agencies often provide health services because of lack of national capacity to respond.
- **Chronic phase** Recovery (several months) followed by resettlement or repatriation (several months or years). In this phase, basic needs are met and the health situation is better controlled.

The timescale of these phases can vary and emergencies do not always go through them in sequence. The long-term chronic emergency in Sierra Leone, for example, has deteriorated periodically into new acute phases, because of renewed conflict.

Earthquake site in East Timor (Merlin)

term. As the situation stabilises, priority should be given to rebuilding the capacity for microscopy and assessing local resistance in order to identify effective antimalarial drugs.

Prevention

In the acute phase, if malaria transmission is very high, it may be necessary to use approaches to prevention such as indoor residual spraying (IRS) with insecticide. IRS works well provided displaced populations are living in huts or houses, mosquito vectors are known to rest indoors, and there is good co-ordination between agencies and timely delivery of insecticide. Spraying of canvas tents (inner surfaces only) with a pyrethroid insecticide will also provide protection against malaria vectors for up to a year. Spray campaigns using permethrin succeeded in ending malaria outbreaks in Afghan refugee camps. In many emergencies, agencies now provide plastic sheeting, which is cheaper than canvas tents. Current research in Afghan camps is assessing the effectiveness of plastic sheeting that has been impregnated with insecticide during manufacture.

When spraying is not feasible or when populations are on the move, blankets or other materials that have been treated with an insecticide such as permethrin are more suitable. In Afghan camps, treated blankets were shown to provide over 60% protection against malaria for 4 months. This approach could provide short-term protection to people in all types of shelters during natural disasters, epidemics and in newly established refugee camps, and is also cheaper and logistically easier than IRS or ITNs.

The usefulness of insecticide treated nets (ITNs) in the acute phase is dubious. Procuring large orders of nets takes time and they often arrive too late to control an outbreak. People may not use ITNs, because they have no previous experience of nets or because shelters are not suitable. Health education to ensure that people know how to use them correctly is rarely feasible in the acute phase. Free distribution during the acute phase can also create longer-term sustainability problems. For example, in Tajikistan, people were unwilling to pay for nets when emergency aid ended.

ITNs may be more appropriate once the situation stabilises, when people are living in more permanent shelters and are more receptive to information about prevention. As people find employment or develop livelihoods, it may be possible to encourage them to pay for nets and insecticide treatment. In some chronic emergencies, international agencies and NGOs have worked with governments to promote and distribute ITNs through social marketing programmes; for example, HealthNet International in Afghanistan. In post-conflict situations, efforts have focused on creating demand, to encourage a commercial market for nets and insecticides; for example, WHO has taken this approach in Cambodia. In other settings, post-conflict efforts are focusing on developing a comprehensive national vector control strategy. In East Timor, for example, the Ministry of Health has commissioned HealthNet International to conduct research studies to support the development of evidence-based policies for malaria prevention.

Emergency response to malaria in Sierra Leone

Ten years of civil war has resulted in internal displacement of 1.2 million people and high rates of disease and malnutrition. The war has destroyed health infrastructure and laboratory capacity, and many skilled personnel have left the country.

Malaria is a significant cause of illness and death, and over 4 million people are at risk. In October 2000, in and around Kenema town, the medical relief agency Merlin estimated malaria prevalence to be 41% in the general population and 75% in children under five. In October and November 2000, 47% of patients at functioning primary health care units were confirmed as having malaria.

Merlin implemented emergency malaria control activities, including facility-based diagnosis and treatment, with partners including the Ministry of Health and Oxfam. In Kenema, Merlin extended activities to communities to protect vulnerable population groups. This included distributing ITNs to families with young children, indoor residual spraying, health education in camps for internally displaced people, developing standardised case definition and treatment protocols and related training. Merlin has also conducted research to assess malaria prevalence, community knowledge attitudes and practices, and resistance to chloroquine. These activities have helped to increase community awareness of malaria, to encourage use of preventive measures such as ITNs, and to improve the response to outbreaks.

Roll Back Malaria and complex emergencies

To strengthen the response to malaria in complex emergencies, the Roll Back Malaria (RBM) Technical Support Network is

- developing a practical manual on malaria control in emergencies.
- providing updated malaria epidemiology and drug efficacy profiles for affected countries, on the RBM website.
- developing new training materials on malaria control in emergencies.
- providing technical support to international and national emergency partners.

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With thanks to Jane Moore, Merlin www.merlin.org.uk

Resources

Websites

ROLL BACK MALARIA
www.rbm.who.int/
Includes up to date information about malaria, RBM technical strategies, plans and activities, country profiles and updates, events, training materials and technical assistance. WHO RBM documents, including many of those listed below, can be viewed or downloaded from the site.

MALARIA CONSORTIUM
www.lshtm.ac.uk/itd/dcvbu/malcon
Includes information about the Consortium, its research and technical assistance activities, and links to other useful sites.

MALARIA FOUNDATION INTERNATIONAL
www.malaria.org
Includes general information about malaria, global and regional initiatives, networks and events, scientific and information resources.

ROYAL PERTH HOSPITAL
www.rph.wa.gov.au/labs/haem/malaria/index.html
Includes educational material in English, French and Spanish on diagnosis, prevention, treatment and an interactive self-assessment module. The website content is also available on CD-Rom free of charge to institutions with or without limited internet access.
Available from: Royal Perth Hospital.

Publications

Prevention
Insecticide treated mosquito nets Chavasse D et al, 1999 A handbook for managers.
Available from: Malaria Consortium.

Guidelines on the use of insecticide-treated mosquito nets for the prevention and control of malaria in Africa WHO, 1998
Available from: CDS Information Resource Centre.

Diagnosis and treatment
Bench aids for the diagnosis of malaria WHO, 2000
Available from: WHO Marketing and Dissemination.

Malaria diagnosis: new perspectives WHO, 2001 WHO/CDS/RBM/ 2000.14
Available from: CDS Information Resource Centre.

Management of severe malaria: A practical handbook WHO ISBN 9241545232
Available from: WHO Marketing and Dissemination.

Drug efficacy
A practical handbook for antimalarial drug therapeutic efficacy testing for the district health worker WHO, 1999
Available from: WHO Regional Office for Africa.

Community participation
Partnerships for change and communication: guidelines for malaria control Mehra S and Meek S, 1996
Available from: Malaria Consortium.

A manual for community health workers (Part 1: Introduction and training; Part 2: General information about malaria; Part 3: Recognition and treatment of malaria) Kouznetsov R, 2000 WHO
Available from: CDS Information Resource Centre.

Stop press
A handbook on malaria and complex emergencies will shortly be available from WHO RBM. For more information contact the RBM Complex Emergencies Coordinator at WHO.

The Malaria Consortium will publish a practical manual on malaria prevention, diagnosis and treatment later this year.

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