Learning Unit 6

A critical analysis of existing malaria control problems

Learning objectives:
By the end of this Unit you should be able to:

• define a problem relative to the control of malaria in your area of work
• identify and prioritize major problems impeding malaria control
• analyze a major problem and list its underlying causes
• construct a network of cause and effect and identify feasible intervention points to overcome the core problem

Introduction

In countries which already have an ongoing malaria control programme, this step is pivotal in the planning process. A critical analysis of existing malaria control problems may be conducted as follows:

• identify and characterize the priority malaria control problems and determine the underlying causes
• identify which underlying causes can be impacted and which kinds of remedial action will be most effective and cost-efficient
• identify the research that may be needed of the highest priority
• compare the action being taken in the existing programme with those identified above and examine the reasons for any differences
Problem identification and underlying causes

What is a problem

A problem is a perceived gap between what is and what should be. It is important to recognise that people look at, perceive, or feel about, problems differently. The following illustrates this.

A village has a contaminated water supply resulting in outbreaks of diarrhoea. This is the current status. If the villagers do not recognize that the water is contaminated or that it is responsible for diarrhoea, then, to the villagers this is not a problem. But the health worker “sees” or “perceives” the gap between what is and what could be. This gap is a problem to the health worker who knows the water supply needs to be improved so that the outbreaks of diarrhoea can be lessened.

It is important to define a problem clearly, otherwise an attempted solution may be wrong. Many health problems have several causes. It is easy to mistake a cause for a problem. Then the cause may be removed without solving the problem.

Consider the following statements:

a) Many people have diarrhoea.
b) The sanitation is poor.
c) There are no toilets.
d) The well water is contaminated.
e) There are too many flies.
f) The people need health education.

The problem is “many people have diarrhoea”. All of the other statements are possible causes of the problem. If the problem is stated as “sanitation is poor”, and the effort at solving the problem is concerned only with improved sanitation, the diarrhoea will not disappear. It may be spread by flies or contaminated water.

Problem analysis

In analyzing problems:

- define what the problem is
• find all possible underlying causes of the problem. A problem may have many unlikely causes the remedy of which may solve the problem
• there can be causes from the environment and causes from behaviour of the community
• look for ways to remove all underlying causes or those causes for which measures applied will have the greatest impact on the problem
• the most direct causes (factors) may not be the most important
• a network of underlying causes (factors) will help identify potential intervention points.

To select important problems it may be useful to group problems under the following headings for which a few examples are provided. You may want to add to this list based on experience in your own country:

**Disease or health problems**
- Malaria
- Malnutrition
- Respiratory diseases
- Diarrhoea

**Health service problems**
- Insufficient drugs
- Lack of qualified personnel
- Difficulty in visiting outlying areas

**Community problems**
- Inadequate water supply
- No primary education
- People have to go a long way for health care
- Poor harvest two years running
- Male population leaving the land to work in industry

The health worker is always faced with more than one problem at a time and cannot solve all of them at once. So the problems are studied and those having the most impact on health are given priority. The health worker has to decide which problems will be tackled first. Resources will be used mainly for these priority problems.

However, many problems are outside the control of the health sector but are important because they affect health in the community. The health worker can have
health education of the people as a priority, to inform them about problems and teach
them how to prevent and overcome them. He may cooperate with the teacher in the
school, or with the literacy programme, to prepare materials so that people learn about
health at the same time as they learn to read.

Synthesis of the malaria problem

Before proceeding to the selection of objectives and approaches and evaluation
methods, a synthesis is required for each of the epidemiological strata which have
been tentatively identified. It involves more or less concurrent carrying out of the
following:

- a critical review of the information gathered
- identification for cause and effect relationships between the problems identified
  and the underlying causes. This process is intended to formulate as clearly as
  possible networks of causes and may benefit from graphic methods used in systems
  analysis. Figure 7 is an attempt to construct a network of causes responsible for a
  relatively narrow and precisely defined problem, namely low effectiveness of
  residual spraying in a given environment. Figure 9 is a similar attempt to ‘explain’
  malaria mortality in relation to the diagnosis and treatment of cases. Like Figure 7
  it is mainly intended to illustrate an approach and, to be of use, such a figure should
  be constructed or reconstructed by those directly concerned with the problem. It
  may be useful to enlarge some parts of the system, for instance, Figure 9 does not
  distinguish between the public and private sectors of health care delivery, nor
  between its different levels of sophistication.
- evaluation of the relative importance of the underlying factors identified, that is to
  say their qualitative impact on the problem. However it is not always the most
direct factors (those closest to the endpoint) that are the most important. The
relative importance of different factors will vary from place to place
- a review of the network of factors with the purpose of identifying as many potential
intervention points as possible and of making a preliminary evaluation of the
intervention in terms of feasibility, acceptability and probable impact. This merges
into the selection of approaches described in Learning Unit 11
• the eventual identification of information, if any, that is both missing and indispensable for proceeding, and the definition of methods for obtaining such information

Small group exercise

Working in your assigned small group you will find the following exercise interesting and helpful in better understanding problem definition and analysis.
• in each group discuss the outstanding malaria problems in each of the areas or countries represented by members of the group
• in each group select one problem common to more than one area or country represented in the group or choose a challenging problem
• on an overhead transparency or on a flip chart, (to save time) construct a network of underlying causes responsible for the selected problem. Choose a relatively narrow problem. Be sure to define the problem precisely
• on the network chart place an arrow at the point where intervention will have the biggest impact on the problem
• one member of the group will be invited to present a list of all the problems that were considered by the group and a network chart of the causes for one of the problems showing the point of intervention
• discussion will follow after each group has presented the outcome of their group’s work

Please read carefully the next Unit of this module before commencing the session to which it relates.
Figure 7: Tentative listing and correlation of factors leading to low effectiveness of a spraying programme

- Bed bug problem
- Unpleasant sight
- Unpleasant smell
- Weariness
- Ignorance
- Custom
- Resistance of population (refusals)
- Replastering
- Low coverage
- Low efficiency of spraying operation
- Resistance of vector to insecticide
- Low effectiveness of spraying programme
- Exophily of vector
- Exophily of man

- Social evolution
  - Lack of discipline
  - Lack of supervision
- Poor conditions of employment (lack of incentive)
- Lack of training
- Ignorance of natural pattern of transmission
- Carelessness and lack of motivation
- Lack of staff
- Ignorance of procedures
- Neglect of natural pattern of transmission
- Utilization of poor insecticide preparations
- Defective equipment
- Physical inaccessibility
- Poverty, social, military, political unrest
- Wrong timing (incl. delays in completing spraying)
- Shortage of insecticide
- Shortage of equipment
- Low dosage
Figure 8: Example of a problem analysis

1. Environmental factors:
   - Poor drainage
   - Seasonal vectors
   - Poor housing, hygiene, and sanitation
   - Unsafe water

2. Disease:
   - Malaria
   - Protein calorie malnutrition
   - Gastroenteritis
   - Children's diarrhea

3. Symptoms:
   - Fever
   - School days lost
   - Work days lost
   - Death
   - Work days lost
   - School days lost

4. Consequences:
   - Insufficient rural staff
   - Poor staff training
   - Inadequate funds
   - Operating funds

5. Health services aspect:
   - Inadequate spray coverage
   - Insufficient case finding
   - Low educational attainment
   - Low productivity
   - Under-development tourism
   - Low rate of investment

6. Socio-economic factors:
   - Low family income
   - Low educational attainment
Learning Unit 7

Development and implementation of a national antimalarial drug policy

Learning objectives:
By the end of this Unit you should be able to:

- define a national antimalarial drug policy
- state its purpose
- enumerate the essential components
- formulate an antimalarial drug policy
- enumerate actions for implementation

Drug resistance

Definition
The resistance of the malaria parasite to antimalarial drugs has been defined as “the ability of a parasite strain to survive and/or to multiply despite the administration and absorption of a drug in doses equal to or higher than those usually recommended but within the limits of tolerance of the subject”. This definition is a useful reminder that (i) resistance is a characteristic of parasites and (ii) a parasite strain which is somewhat less sensitive than usual to a given drug is only said to be resistant if it can survive the usual therapeutic doses of the drug.

Distribution
Among the countries with endemic falciparum malaria, only those in Central America and the Caribbean have not recorded resistance of *P. falciparum* to chloroquine. Chloroquine resistance of various levels is now found in practically all endemic countries in Africa, and in many of them, especially in eastern Africa, high levels of resistance pose increasing problems for the provision of adequate treatment. In
western and middle South Asia, as well as in Malaysia, Indonesia, the Philippines and Oceania, the levels of chloroquine resistance are variable.

Resistance to sulfadoxine-pyrimethamine is widespread in South-East Asia and South America, but is uncommon in other parts of the world. Resistance to mefloquine is less widely reported. There is commonly cross-resistance between halofantrine and mefloquine.

In several countries in South-East Asia as well as in Brazil, where quinine plus tetracycline is now the standard treatment for uncomplicated malaria, the sensitivity to quinine is diminishing. Consequently, artemisinin and its derivatives are being deployed for first-line treatment in certain areas. Resistance to this group of drugs has not been documented in field studies, but in vitro studies indicate that it could develop.

Resistance of *P. vivax* to chloroquine was first documented in 1989 in infections acquired in Papua New Guinea. Further observations have confirmed the presence of chloroquine-resistant strains of *P. vivax* in Indonesia, Myanmar and Vanuatu. In some areas of Papua New Guinea and Indonesia, 20-30% of patients infected with *P. vivax* now have recurrences of parasitaemia 1 to 3 weeks after a course of 25 mg chloroquine-base/kg. Cross-resistance of *P. vivax* to other 4-aminoquinolines, such as amodiaquine, is sometimes, but not always observed. Resistance of *P. vivax* to sulfadoxine-pyrimethamine has been reported years ago. Resistance of *P. vivax* to mefloquine or quinine has not been reported.
Some relevant genetic characteristics of the malaria parasite

The genetic mechanism of parasite resistance to antimalarial drugs varies according to the drug. In the case of pyrimethamine for instance the resistance is caused by a single locus mutant which confers total resistance. This is not believed to be the case with chloroquine in which probably several genes are required to confer resistance to a single drug. Two locus mutants always increase at a slower rate than one-locus mutants because they are continuously broken down by recombination. Therefore it is better to use multiple drugs simultaneously rather than sequentially. Furthermore high transmission rates promote the spread of drug resistance rather than hinder it.

In man

The parasite is haploid and therefore multiplies by division without exchange of genetic material. Thus the genetic composition of the products of division are identical. However, isolates in man are invariably mixtures of different parasite populations with different genetic characteristics. Each host typically carries between one and four genetically distinct parasite types at any one time, the number per host tends to be higher in high transmission areas. Thus drug pressure in man will select out existing parasite populations carrying drug-resistant mutant genes by eliminating sensitive strains and leaving behind resistant strains to multiply by division. However, since schizontocidal drugs, with the exception perhaps of the artemisinin compounds, have no significant gametocytocidal properties against *P. falciparum*, a mixture of gametocytes - sensitive strains and strains with resistance of varying amounts - may result. By underdosing parasites with mild resistance will survive as well as highly resistant strains to produce gametocytes carrying a varying degree of resistant gene mutations.

In the mosquito

The malaria parasite is diploid in the mosquito and genetic transfer occurs at the time of exflagellation of the male gametes to female gametes which may have arisen from different genetic populations. Hence the resulting sporozoites can have increased mutations for resistance and the mosquito can transmit a higher degree of resistance than was in the original host from whom the blood meal was taken.
Practical implications
Changes in the frequency of resistance are very slow at low frequencies, thus giving a long lead-in time (hundreds of generations) before drug selection brings a new mutation to a detectable frequency. However once the frequency reaches about 10%, the rate of increase is extremely rapid and, if drug pressure is not interrupted, it can reach a frequency of 90% within 20 to 60 generations (approximately two to five years in areas of high transmission). Thus strategies to prevent the drug resistance problem increasing further should be implemented as soon as possible after the problem has been detected.

Treatment of infected patients can only select for the highest level of genetic mutation already existing or that occurs in the isolate and in many instances, especially in highly endemic areas, eliminates the infection completely. Passage of the parasite through the mosquito can influence the degree of resistance and diversity of the isolate. Man-biting and man-vector contact influence the frequency of resistance, whilst treatment in man selects for drug resistance and influences the genetic cross-over in the mosquito. The rate of multiplication of the parasite influences the chances of mutation to occur and for selection under drug pressure.

Mosquito longevity is an important factor in drug resistance and thus mosquito control that effectively reduces longevity will have an impact on drug resistance.

Full treatment doses of a schizontocide will eliminate many parasites with low levels of resistance leaving the highly-resistant ones, however, since most schizonticides do not affect P. falciparum gametocytes, new genetic components will be similar to the original infection, that is, a mixture of sensitive and resistant. When taken up by the mosquito, dilution of genes can occur by the presence of sensitive strains. If, however, a gametocytocide is linked with the original schizontocidal treatment then on recrudescence pure strains of resistant gametocytes may well result which, when passed through the mosquito will produce very high levels of resistance. Gametocytocides, if used at all, should probably be used for recrudescent attacks and not the initial attack.
Drug policies

Antimalarial drug policies (i.e. recommendations and regulations concerning the use of antimalarial drugs) must cope with the situation outlined above. There are numerous constraints which can be grouped into three main categories:

- **policy formulation.** There may be uncertainty about what is the most rational drug policy
- **implementation.** Programmes are confronted with rising costs, the logistics of distribution, and the large number and variety of persons and institutions involved.
- **updating.** This may be imposed by the changing situation, but is hampered by a limited capacity to monitor change and to react.

Most endemic countries will have to recognize the unavoidability of some resistance to the antimalarial drugs being used for uncomplicated falciparum malaria. A drug policy must therefore include at least two lines of treatment and possibly also a third line. An increasingly ineffective first-line treatment should be either changed before it leads to significant increases in incidence of malaria-associated morbidity and severe disease or alternative approaches be strictly implemented to prevent the latter.

A drug policy needs to take into account not only drug resistance and drug efficacy, but also the target population’s immunity, compliance with treatment, cost, availability and side-effects of the drugs and the characteristics of local health services. However, the standard *in vitro* tests are ill-adapted for drug policy decisions and the revised *in vivo* test, although still far from satisfactory, is a considerable improvement pending a standardized method which incorporates clinical as well as parasitological outcomes of treatment. The results of such an assessment of therapeutic efficacy, together with knowledge on safety, costs and other pertinent factors, can be used as a basis for the development of relevant and effective drug policies.

**Definition of a national antimalarial drug policy**

The national antimalarial drug policy is the set of recommendations and regulations concerning antimalarial drugs and their use in a country. It is part of the National Drug Policy and of the National Malaria Control Policy.
The policy requires continuous evaluation, regular review and updating when appropriate. This is normally the responsibility of the National Malaria Control Programme. The policy may not necessarily be uniform throughout the country. It will benefit from harmonization with the corresponding policies of neighbouring countries.

**Purposes**

**Primary purpose**

This is to ensure prompt, effective and safe treatment of malaria disease through the selection of optimal regimens for different clinical situations.

There are at least three definitions of effective treatment which might be meaningful in different contexts:

- clinical remission, which is the clearance of signs and symptoms
- clinical cure, which is clinical remission plus prevention of clinical recrudescence, as indicated by no reappearance of signs or symptoms within 14 days following the end of treatment
- parasitological cure (or radical cure), which is the elimination of all parasites from the body which will invariably result in clinical cure as defined above

For the purposes of developing a national drug policy, effective treatment means clinical cure, but in certain malaria control programmes, parasitological cure (or radical cure) may be the objective (see tertiary purpose below). The relationship between clinical and parasitological cure varies with the epidemiological situation. In areas of intense transmission and high population immunity, infected adults are often asymptomatic and, when symptomatic, can often achieve clinical cure without parasitological cure. In areas of low transmission and low population immunity, asymptomatic infections are rare and clinical cure can rarely be achieved without parasitological cure.

The effective protection of special groups at high risk, such as pregnant women, through chemoprophylaxis or preventive treatment, should be included in the primary purpose.
Secondary purpose

This is to minimize the selection pressure for drug resistance. This is important because there are few antimalarial treatments available and the widespread use of the newer treatments is often restricted by cost, side-effects, and complexity of the dosage regimen. The pursuit of this secondary purpose is, however, seriously constrained by:

- the absolute priority of the primary objective
- limited knowledge concerning the relationship between patterns of drug utilisation and selection of resistance
- limitations in controlling drug utilisation patterns

Currently, drug policies pursue this secondary purpose through:

- restricting the use of chemoprophylaxis (to pregnant women and temporary visitors)
- restricting the indications and distribution of specific antimalarials
- recommending only the use of fully curative doses

It is possible that the uniformity of treatment recommended by a drug policy favours the selection of resistance against that treatment, but the alternative may well select resistance to many drugs simultaneously.

Tertiary purpose

In certain countries, or strata within countries, there may be a third purpose for having a national antimalarial drug policy. This is the early complete parasitological cure (radical cure) of all malarial infections, with the purpose of reducing the reservoir of infection. It may involve the inclusion of primaquine, as a gametocytocidal drug, in the first-line treatment to reduce transmission potential. Such a purpose would be unrealistic in areas of intense transmission with high population immunity and a high proportion of asymptomatic infections but may be realistic for epidemic control and in some areas of low transmission, preferably in conjunction with vector control. In the latter areas, clinical cure can rarely be achieved without parasitological cure (radical cure) so that there is little practical distinction between the two.
First- and second-line treatment

The terminology “first-, second- and third-line treatments” has been well established for many years, and in malaria only applies to the management of non-complicated malaria cases and not severe malaria, which has special therapeutic indications. First-line treatment is the treatment routinely recommended in a given antimalarial drug policy for a case of uncomplicated malaria. The second-line treatment is the treatment recommended in a given drug policy for treating either a case which has not been cured by the first-line treatment or one for which the first-line drug is contraindicated. Sometimes, the second-line treatment may need to be supported by a third line treatment for uncomplicated malaria.

The essential requirement for a second-line (and third-line) treatment is that it is therapeutically superior to the first-line (or second-line) treatment for cases which have failed to be cured by the latter. The use of first-, second- and third-line treatments need not imply that the second and third-line treatments can only be available at higher levels of care.

The definition of a second-line treatment (and a third-line) in a drug policy does not necessarily imply that this particular treatment will one day become the new first-line treatment (or second-line), once the old one becomes ineffective. In such situations, the range of alternative drugs should be considered carefully.

Essential components of a national drug policy

Antimalarial drug list

A list of antimalarial drugs registered for use in the country is required. This should include their specifications and identification of those classified as essential drugs. Essential antimalarial drugs are included in the WHO’s model list of essential drugs issued annually.

Guidelines on use

Guidelines for treatment and prophylaxis with recommended antimalarial drugs need to include information on indications for use, drug regimens and dosages, and the
routes of administration. They need to specify side-effects associated with each drug and define risk groups for whom the drugs are contraindicated. Guidelines must include diagnostic criteria, which often vary with the capabilities of the different levels of the health services. Guidance on treatment outside the formal health services should also be included. With increasing recognition of the importance of integrating guidelines for the management of the main childhood diseases, therapy decisions may be based on simple classifications which cover a number of childhood conditions.

The recommended treatment will vary according to:

Characteristics of the disease:
Guidelines should include treatment for uncomplicated malaria as well as for severe and complicated malaria. In some instances, a particular treatment may be included for malaria and anaemia or malaria and acute respiratory diseases in children. Treatment may be species-specific if parasitological diagnosis is feasible.

Response to treatment of the individual patient:
The first-line treatment may fail so that the policy should specify the second-line treatments to be used in such cases. In certain situations, it may be necessary to specify a third-line treatment for uncomplicated malaria.

Pregnancy:
Malaria in pregnancy is a serious risk and requires very effective treatment with the lowest possible risk of clinical failure. It may, therefore require a first-line treatment that is different from the one used in the general population.

Regulations for prescription and provision
Regulations are required to define who is authorized to prescribe or sell the specified antimalarial drugs. Such regulations should cover both the public and the private sectors, and may vary according to the level and kind of health services, e.g. village health workers, dispensary, health centre, peripheral hospital, reference hospital. Decision-making is mainly determined by the diagnostic and therapeutic facilities expected at different levels, and by the possibility of referral.
Pricing regulations
This is to ensure that the recommended antimalarial drugs are affordable by the persons who need them. In many situations, this will require subsidized pricing of the more expensive drugs. Antimalarial drugs are, unfortunately, often overpriced. Their actual cost to the consumer could be an indicator of the national political will to control malaria.

Regulations on supply, distribution and quality assurance
The policy should specify regulations and laws, if appropriate, concerning:
(i) manufacture; (ii) importation; (iii) quality control; (iv) distribution; and (v) quality of antimalarial drugs.

Responsibilities
The national malaria control programme is normally responsible for the formulation and updating of the national antimalarial drug policy, and for ensuring its adoption and promulgation by the national body vested with the appropriate authority. Where a national malaria control programme does not exist, the need for an antimalarial drug policy may stimulate its creation, otherwise, the responsibility has to be undertaken by the communicable disease control division or a similar division in the Ministry of Health.

The participation of several other sectors will be required, especially for implementation.

Within the health sector
General health services, private health care, traditional healers, private and public health insurance, pharmacies, drug manufacturers, drug importers, unlicensed drug sellers, medical schools, pharmaceutical schools, other health professionals’ schools, health education.

Outside the health sector
The general educational system, the media, industry, agriculture and tourism.
Implementation

The implementation of a national drug policy is confronted with several constraints such as the logistics of distribution, the large number and variety of persons and institutions involved and, commonly, rising costs. Appropriate planning is, therefore, essential, particularly so in the period of transition from an old to a new policy when there is a danger of confusion for those who have to implement it. In many countries, ministries of health will have to arrange national symposia for the development and implementation of national malaria control policies, including those related to antimalarial drugs. Such a mechanism is extremely useful for obtaining input from experienced health staff, and for creating a sense of ownership among those expected to implement policies.

The following are important actions required for the implementation of the drug policy:

Treatment and services

The distribution and accessibility of the different types of treatment (first-, second- and third-line treatments of uncomplicated malaria, treatments of severe malaria), needs to be reviewed taking into account that the development of severe malaria is often very rapid (1 to 2 days) and that the transportation of patients present logistic and financial constraints. The role and quality of self-care, particularly in countries where this is being widely practised, needs to be evaluated.

Cost implications

Cost is normally an important factor in developing or changing any policy. A number of implications beyond direct costing assessments however, may also require consideration such as price regulation, the cost to be borne by government, other partners and the consumers, the availability of government funds and the possibilities for social marketing.
Guidelines

The policy must be translated into detailed guidelines for case management and for protection of pregnant women at different levels of service. These guidelines should include criteria for diagnosis, for changing individual treatment and for referral.

Training and education

A systematic process for advising and informing providers of care, including health services personnel, private medical practitioners, pharmacists, traditional healers, shopkeepers and the public at large is required. The information should be in the form of guidelines and sometimes it is most effectively conveyed through peer groups such as professional and local associations. Advocacy towards the private sector, including drug importers, who may not be controlled by regulatory measures, should also be considered. Information to the general public is best given in a form and through channels adapted to the local culture. The media and schools are potentially effective partners.

Drug supply

The availability of a regular supply of drugs of the required quality must be assured through a reliable distribution system. This is a stumbling block for many programmes. Regular procurement and distribution of antimalarial drugs, through the Essential Drugs Programme has, for some countries been supportive. Where such programmes function irregularly, alternative channels of distribution must be sought.

Adequate availability of a second- and third-line drugs is essential. Past restrictions of such drugs at the periphery, compounded by difficulties in the accessibility of referral centres, has resulted in the practice of repeated first-line treatments when it has been ineffective. This has caused in Africa cases of chronic malaria-associated illness such as anaemia in children, the most vulnerable group. Second-line treatment should, therefore, be deployed at the most peripheral levels of the health services, accompanied by effective instructions and monitoring. Particular emphasis needs to be given to the careful assessment of treatment failures and the
seeking of other causes of illness. For children, training materials addressing this are being developed in the context of integrated management of the sick child.

Monitoring and evaluation

Certain variables require continuous or regular monitoring. These include:

- the efficacy and effectiveness of the recommended treatment, the latter of which requires an understanding of the incidence of compliance
- the tolerance and safety of the recommended treatments, including mild effects as well as severe and life-threatening adverse effects
- process and outcome indicators which describe important steps in the management of malaria disease. These include the availability and utilization of drugs and treatment guidelines, the conformity of the treatments prescribed to treatments recommended, and the cost of drugs to the consumer

Impact indicators are desirable but the relationship between drug policy and data on morbidity and mortality are confounded by a number of factors and may be misinterpreted. Nevertheless, changes in the effectiveness of treatment practices of uncomplicated malaria on a population basis are likely to be reflected in changes of the ratio of the incidence of severe malaria (or of the incidence of hospitalized malaria used as a proxy) to the incidence of uncomplicated malaria. The impact of antimalarial interventions during pregnancy such as on haemoglobin status of the mother and the incidence of low birth weight in primiparae are other examples.

Other variables, especially those whose determinants are amenable to intervention, may require ad hoc assessment when the need arises. These include:

- compliance and its determinants
- drug utilization patterns and treatment-seeking behaviour and their determinants

Policy review

The policy requires periodic critical review and updating in order to remain relevant. A mechanism for such review and updating is, therefore, required.
Please read carefully the next Unit of this module before commencing the session to which it relates.
Primary health care: its meaning and malaria control

Learning objectives:

By the end of this Unit you should be able to:

- clarify what is meant by Health for All
- define primary health care
- visualize Health for All in the 21st century
- place malaria control in perspective in the context of primary health care

Historical background

In May 1977 the Thirtieth World Assembly adopted a resolution in which it declared that the main social health goal of governments and of WHO in the coming decades should be the attainment by all the people of the world of a level of health that will permit them to lead a socially and economically productive life. Popularly known as "Health for all ". Subsequently, an international conference on primary health care which took place in Alma-Ata, USSR in September 1978 concluded that primary health care is the key to attaining health for all. While the Alma-Ata definition of primary health care developed from a growing accumulation and synthesis of ideas and experience from around the world, it marked a significant turning point, the dawn of a new vision on how to achieve better health for the people of the world. But ideals or visions can be interpreted differently, and it became clear that in the process of implementing primary health care, a number of confusions have emerged about what it really means.

While it is expected that the range of circumstances in different countries would necessitate some variations in interpretation of the concept, differences in
definition of the concept itself suggest a need for greater clarification of what we mean by primary health care in the light of experiences.

The meaning of health for all

The objective of WHO as defined in its Constitution is "the attainment by all people of the highest possible level of health". The goal of health for all embodies that objective. It emphasizes "highest possible", leaving it open to countries to improve the health of their people in keeping with their social and economic capacities.

As a baseline, the level of health of individuals and communities should be such as to permit them to exploit their potential economic energy and to derive the social satisfaction of being able to realize whatever latent intellectual, cultural and spiritual talents they have.

Health for all does not mean that doctors and nurses will provide medical repairs for everybody in the world for all their existing ailments; nor does it mean that nobody will be sick or disabled. It does mean that there will be a more even distribution among the population of whatever health resources are available. It means that people will use better approaches for preventing diseases and alleviating unavoidable illness and disability. It means that health begins at home, in schools and in factories where people live and work. It also means that essential health care will be accessible to all individuals and families, in an acceptable and an affordable way, and with their full participation. It means that people will realize that ill-health is not inevitable. To achieve this, people must understand what health is all about, and it is the duty of those who know to help others to understand.

The meaning of primary health care

The Alma-Ata Conference described primary health care as essential health care based on practical, scientifically sound and socially acceptable methods and technology, made universally accessible to individuals and families in the community through their full participation and at a cost that the community and the country can afford to maintain at every stage of their development.

Primary health care reflects and evolves from the economic conditions and sociocultural and political characteristics of the country and its communities. It
includes at least eight elements, one of which is the prevention and control of locally endemic diseases. Thus wherever malaria is endemic, it becomes an essential component of primary health care. However, primary health care must form an integral part, both of the country's health system and of the overall social and economic development of the community.

The primary health care philosophy

Equity

At the international level, primary health care is inevitably linked with concerns for economic equity, balanced world development and international peace. More importantly, successful implementation of primary health care will, to a large extent, be dependent on improvements in international economic relationships which promote a more even distribution of resources among the nations and peoples of the world. But primary health care is also about the equitable satisfaction of health needs. It is concerned with reducing gaps between those who have access to health care and those who do not; gaps between high and low child mortality rates in different groups; gaps between those with safe water or adequate food supplies and those who lack these essentials for good health. It is about an equitable and just distribution of available health resources and the need to reallocate existing resources in such a way as to preferentially meet the health needs of those whose needs are greatest.

Interrelationship of health and development

Another tenet of the philosophy of primary health care reflects a broader understanding of the concept of health. It recognizes that health is the outcome of a complex set of socio-cultural and economic, as well as physical, or biological, factors. This leads logically to the recognition that health will only be realized in the context of overall development and specifically to a pattern of development which gives high priority to social goals in addition to economic ones. This is very relevant to malaria control and to sustaining the gains achieved.
Individual and community self-reliance

A third component of the philosophy of primary health care is that of self-reliance and individual self-realization. It is necessary for people to become the main actors in health activities: health cannot be "delivered" to people.

The primary health care strategy

Primary health care grew out of the recognition in the 1970s that previous strategies for health have resulted in major inequalities in health care and inappropriate and costly services in most countries. Furthermore, these strategies often ignored the social and economic origins of ill health. In contrast, some countries, notably China, had developed a radically different approach to solving health problems with significant success.

The primary health care strategy which gives expression to the principles outlined above has three main interrelated components:

- changes in the health care system
- the development of individual and collective responsibility for health
- health linked more concretely with overall development strategies through intersectoral action for health. In considering the primary health care as an approach, it has to be emphasized that this is a dynamic concept defining a process of change as the means to be used to promote health, as well as a substantial broadening of health goals.

The health care system

In many countries, the health care system provides coverage to only a small portion of the population, usually urban elites, using sophisticated technology. This is often done at the expense of meeting the priority needs of the population as a whole. The primary health care approach aims to reverse this state of affairs. It redirects the entire system by giving priority to meeting the needs of the majority. Thus total coverage with essential health care, which is both relevant to needs and effective in meeting them, becomes the new priority and main thrust of the whole system.

A health system based on primary health care is therefore an integrated system. This is true for activities within and outside the health sector, and for
integration of essential health activities at the local level with referral and support functions throughout the system. The importance of involvement of communities as co-partners in health development is also an essential feature.

Another important feature of the type of health system required for the primary health care approach is the way in which it uses and controls resources. Resources need to be allocated in a way which provides the greatest benefit at the lowest cost to meet the health needs of entire populations. This will be true regardless of the total amount of resources available for health within a particular system. Increasing control of resources by the people whom they are intended to benefit is another feature of such a system.

The development of such a health system based on primary health care may require a variety of changes. Redistribution of existing resources for health is a key change which has been referred to as the "litmus test of political commitment" to primary health care. Legislative changes may be required to effectively implement necessary innovations. Existing health manpower may require reorientation to new goals and tasks in pursuit of the PHC approach. And finally the design, planning and management of the health system will often require change and improvement.

Individual and collective responsibility for health

In addition to changes within the health sector, the second major thrust of the primary health care strategy is the promotion of individual and collective responsibility for health. There are two parts to this concept of community involvement. The first is a political issue. The more governments are socially accountable to their people, the greater is the potential for real community involvement, in health as in other matters. Decentralization of decision-making allows for social control (in contrast to technical supervision) of action for health at various levels of the health system.

The second aspect of community involvement recognizes that if individuals are to realize their potential as self-reliant individuals, they must take personal responsibility for their own and their families' lives. This means adopting changes in behaviour and life styles, and understanding and, as far as possible, controlling their social and biological environment, in partnership with collective organizations and
their governments. The political and administrative processes of governments need to be supportive for this.

For both aspects of community involvement, it is important for the public to be informed and motivated. A major effort is therefore needed to inform and motivate and to communicate creatively.

**Intersectoral action for health**

The third component of the primary health care strategy involves making health goals a high priority in the overall development process. The primary health care philosophy gives explicit recognition to the fact that ill health is related to poverty and overall socioeconomic situations. Land and food availability all the year around, existence of social infrastructure, social services such as water, schools and health facilities, which are geographically and economically accessible, the level of literacy. These are important health determinants. The practical application of this tenet of the primary health care philosophy involves the steering of overall economic development more consciously and directly towards the maximization of health, and sharpening awareness about the costs and benefits to health and human development from alternative economic development policies and programmes. What would be the net health impact, for example, of a rise in food prices, a new factory, an irrigation project, a social security scheme? Who benefits and who loses in health terms? In terms of choice of interventions and choice is important as resources are limited - the most dramatic health benefit might be achieved, for example, by an adult literacy campaign for women.

Another practical application of this philosophy is in the importance of the health care system itself to articulate with other sectors at the appropriate level. For example, a health centre responsible for a defined population would need to work closely with the agricultural services in identifying nutrition problems and in finding appropriate solutions, or in analyzing seasonal inter-relationships between agricultural labour demands and disease incidence and supply and distribution problems, or in mitigating and controlling occupational health hazards from resettlement programmes or irrigation schemes. At the community level, it may not be appropriate to set up special health structures if health matters can be dealt with effectively by existing
social organizations such as a village development committee. As one moves towards the centre, disaggregation of sectors becomes inevitable and special mechanisms are needed to maintain the links between the health activities and objectives and those of other sectors. Unfortunately, this has so far been difficult to achieve in most countries to date. Even where formal mechanisms exist, they rarely function effectively.

The control of malaria affords an excellent example of the need for and usefulness of intersectoral action. In developing malaria control strategies, it is important to identify action required in other sectors, such as in education and agriculture and in water resource development schemes. It is also necessary to convince those responsible in these sectors to carry out the measures required and ensure the allocation of funds for these activities.

The level of primary health care

The term primary health care has historically been used to mean the most peripheral level of organized health care, the point of contact between the community and the health system. The Alma-Ata Declaration states that this level is an "integral part of the national health care system of which it is the central function and main focus". Thus the primary health care approach recognizes that development and activities at this level are both crucial and likely to have great impact in the effort to provide essential care to everyone. Further, it is clear that this level of care, as it involves communities, families and individuals, is important irrespective of the level of socioeconomic development. In countries where the major hazards to health are associated with poverty, poor nutrition, diarrhoea and other preventable infectious diseases, there is clearly action which can be taken at this level to alleviate some of these health problems, even within the serious economic constraints which are operative. On the other hand, in countries characterized by a predominance of diseases associated with urbanization and industrialization, there is important action to be taken at the primary care level in promoting life style changes and a more healthy environment, as well as better adaptation to the chronic problems prevalent among older populations.

One of the main differences between previous and current concepts of the primary health care level is that the former tended to stop at the local health unit while
the latter extends into the community (including activities carried out by community health workers), into the family (mothers are the most providers of primary health care for children) and to individuals (self-care is important for primary health care). While the names of local and first referral health units vary greatly between countries, some clarification of what we mean by these terms may be helpful. Names commonly used for local health units include clinics, posts, dispensaries, sub-centres, health centres, GPs' offices, outpatients and polyclinics. First referral units may be health centres, district or general hospitals, or other units with defined responsibility for referral of problems from local health units.

Questions are more commonly raised about where the PHC level ends - the interface with more specialized levels of care - than about where it begins - with individuals, families and communities. This question is especially pertinent for purposes such as monitoring shifts in resources allocation towards primary health care in accordance with stated priorities. For example, are resources for first line hospitals providing essential surgery to be included as primary health care together with health centres, health posts and community activities? The answer to this question will depend on country specific definitions and models of health care and specifically on what is defined as "essential" care in a particular country. "Essential" care for this purpose must be defined as that care which is to be made available and readily accessible to all citizens. This should be distinguished from more specialized care which should be available to those citizens who need it through an effective referral system, but which may have to be restricted in its application because of resource limitations or other constraints.

The exact boundaries will be defined differently in different countries. However, as long as the PHC level is closely linked with and supported by the rest of the health system, the position of this boundary is not of great importance.

**Changing determinants of health**

The world has seen substantial gains in health in the past 50 years. People are living much longer while the impact of infectious diseases, such as measles, leprosy and polio has declined tremendously.
Unfortunately, more people live in poverty today than 20 years ago. Since poverty has a dramatic impact on health, its consequences will be translated into negative health outcomes. Since gaps are widening both in income and wealth, the health status will reveal increasing disparities.

Demographic trends like ageing and urbanization are accelerating particularly in developing countries. Urbanization has been accompanied by the collapse of social structures and safety nets, and by overcrowding, increasing the spread of infectious diseases, mental disorders and violence. The ageing of populations will, together with changes in consumption patterns (including smoking), further facilitate the epidemic of noncommunicable diseases in the coming decades.

New pandemics like AIDS and TB have emerged and will, in many countries, have a devastating impact on health, social structures, economic growth and human development.

Though progress has been made in health status, some gains have not been sustainable. Life expectancy and other indicators have fallen in countries where health care systems have collapsed. Furthermore, future systems have to address the new demographic and epidemiological changes and the negative health consequences of development policies and actions of other sectors. In effect, "health systems often have to pay the price for the lack of political will to invest in health determinants".

The speed, mode and variety of international exchanges have risen exponentially over the past decades. Globalization of trade, travel, technology, and the liberalization of markets have turned the world into a global village. The strong emphasis on market economies has facilitated uneven economic growth resulting in poverty and marginalization of large parts of the population.

The role of the state is changing. Globalization and the regionalization on one hand and decentralization and privatization on the other require a rigorous rethinking of future tasks of the State.

Industrial practices and uncontrolled energy use have put a heavy burden on the environment and health. The quality of the local environment, in terms of safe water and sanitation, is still crucial for health. In particular, many of the poor live in environments where inadequate housing, water and sanitation facilities, unsafe food, and increasing pollution have devastating impacts on their health on a daily basis.
The current and future determinants of health require a broad approach, considering the health sector itself, but also acknowledging and focusing on determinants that are outside the direct scope of the health sector.

First of all, this approach needs to be based on a strong and sound value system that is both theoretically consistent and practicable in its implementation.

Secondly, a culture of health has to be established recognizing that health is central to development and is subsequently both an indicator and a crucial input for human development. Finally, sustainable health systems have to be developed that are able to meet the challenges of the 21st century.

A universal health for all value system

A health for all value-system will emphasize the importance of the right to health, including the right access to adequate housing, education and nutrition and quality health care, the right to information and autonomy, and the right to be protected from harmful factors such as violence and environmental threats.

Equity has to be a leading principle for all policies operationalized in the universal access to quality can and be a basis for international cooperation. Consequently, people, populations and countries that are most in need and have the highest burden of disease and ill-health should be favoured.

A gender perspective will be implemented which will stimulate gender analysis and awareness. While policies and interventions should be tailored to the specific need of women and men, the contribution of women in the development and implementation of policies will be particularly targeted.

Ethics also need to be an integral part of the development and implementation of policies, the provision of health services, and of science and technology.

Health central to development

A culture of health needs to be established placing health at the centre of human development and at the top of the development agenda. Health, operationalized in the form of health status indicators, provides an excellent tool to assess development. Particularly disaggregated data (i.e. by sex, geographic area, race and age) constitute an enormous opportunity to evaluate both health and development policies.
Ill-health and poverty are strongly linked. To address both, equitable policies based on a sound collaboration between health, agriculture, finance trade, food, education and industrial sectors have to be developed.

Health should be promoted in these sectors and in all settings in which people work, and live requiring new and stronger partnerships.

**Sustainable health systems**

Health systems will play a crucial role in the 21st century. Embedded in a strong Health for All value system they have to address a wide variety of current and future challenges.

Seven essential functions have to be fulfilled, which form the skeleton of every sustainable health system. The state has to ensure that these functions are met according to certain performance standards.

These functions are to:

- provide guidance
- ensure continual vigilance and assessment
- ensure quality care across the lifespan
- protect health by preventing and controlling disease
- foster science and technology
- build and maintain human resources for health
- secure adequate financing for sustainable health systems.

Guidance has to be provided by developing policies that underscore the needs of the people. These policies should incorporate the values of equity and have a gender perspective. Standards have to be set that will reflect the crucial dimensions and outcomes of health systems. Regulation and legislation will be key mechanisms to support policies for better health.

Vigilance and assessment are continuous processes. They have to be translated into ongoing monitoring and action, at the global, national and local level. Particularly, the transformation of information into adequate decision making has to be strengthened. More active and proactive assessment and responses to transnational threats, violations of global equity and human rights have to take place.
Consequently, the implementation of international instruments for health has to be facilitated and monitored.

Health care settings should guarantee quality care across the lifespan. A stronger focus on the participation and capabilities of human beings and communities will be emphasized. A wider range of services in community settings, which are responsive to local needs, have to be established. Long-term care will increasingly be provided through non-institutional and home-based care, encompassed within a system in which health, social and environmental services are fully integrated.

Disease prevention and control activities need to stress community based prevention interventions. A life-span approach has to be implemented, acknowledging the impact of early ill-health on the potential of personal development, and requiring tailored interventions from ante-natal care until the end of life.

Worldwide approaches, coordinated by WHO and supported by a global alliance of partners for health, have to be designed and implemented to combat diseases such as AIDS, malaria, tuberculosis, tobacco related diseases and the consequences of violence. Maternal mortality and mortality from childhood diseases and malnutrition demand global action, which will require continuous investments.

Appropriate utilization of technology will be a decisive factor for gains in health and development. Barriers that impede the use of available technologies need to be broken down. New technologies, particularly in communication and information, constitute tremendous opportunities for health care systems, for training and education, and for monitoring and evaluating policies.

The development and strengthening of human resources should be a priority. This will be achieved by creating new cadres of people capable of linking health with other disciplines. Skills in health promotion and communication have to be strengthened. Knowledge needs to be upgraded continuously, addressing the changes in demographic and epidemiological conditions.

Adequate levels of financing have to be guaranteed by the state. It is crucial that access to essential health system functions is ensured and that the costs will be fairly distributed across the population. Financial systems which have the potential to enhance equity for the sick and the poor must be supported by the better-off members.
of society. Cost containment, equity and efficiency are more likely to be achieved in systems where the State is the main funder of the health system.

The attainment of sustainable health systems demands a stronger local governance, interlinked with national and global systems of governance. It will need local participation in planning and implementation, a regulating State, responsible for an equitable distribution of resources effective cooperation of all partners, and with global guidance from WHO.

The successful control of malaria in these countries affected is essential for the achievement of health for all. However, to be effective, due to the complexity of malaria transmission:

- control of this disease must be carried out with a certain degree of efficiency;
- monitoring and supervision should be built into the plans of malaria control, whether carried out by a paid malaria worker or by a volunteer;
- evaluation of antimalaria work is vital. Both efficiency and effectiveness must be independently evaluated and the worker must be accountable. Failure of any aspect of the scheme must entail replanning;
- certain specific functions of the malaria programme require the maintenance or, in certain instances, even the strengthening of a specialized service;
- all workers, voluntary and professional, must be trained for the specific tasks for which they are responsible. They must be given the time, means and incentive required for performing the tasks adequately.

The respective functions and responsibilities of the specialized service and of the general health services need to be spelt out at each operational level to ensure an efficient operation of the programme, clearly defining the detailed lines of responsibility, authority and supervision. The planning and operational process will need to take into account the specific epidemiological, cultural, administrative and socio-economic patterns.

It is clear that the integration of antimalaria activities with the general health services, through the primary health care concept, is essential and it is incumbent upon all of us to ensure that this is carried through in a proper manner providing the highest possible level of efficiency and effectiveness.
The problems of coordination between a malaria services and other levels of the health system have been discussed for many years under the term “integration”.

In fact, all antimalaria services are part of the health services. What varies is the degree and the level at which the responsibilities apply. Administratively all antimalaria programmes are part of the health services. Functionally, antimalaria activities may be the responsibility of the health services at the peripheral level but it may be either partial or complete.

Technically, however, there remain some ill-defined areas concerning the level of specific competence required, the lines of command, the areas of responsibility and the degree of supervision to be exerted throughout those levels of the health services organization responsible also for malaria control. Different patterns of responsibility have been envisaged or applied, depending on the different epidemiological, socioeconomic, cultural and structural variants in the health services and malaria services respectively, producing a diversity of requirements for effective malaria control in each country.

Unrealistic planning produced in the past an overburdening of the peripheral health workers who had malaria duties to be performed without a clear definition of the level or person responsible for issuing instructions, receiving reports and supervising the work. The concept of primary health care provides the antimalaria programmes with a structure of agents at the village level that is essential for securing community involvement, obtaining epidemiological perception and for the application of control measures. However, recent experiences have shown that insufficient definition of the lines of competence, supervision and responsibility may adversely affect the control of malaria.

**Primary health care and malaria control**

The following are essential issues that must be considered when planning malaria control programmes in the context of primary health care:

- diagnosis and treatment of malaria should be the responsibility of the general health services
• the process should be a gradual one - local health services assuming new responsibilities for the management of malaria disease as their capabilities and resources are strengthened

• emphasis is on planned, sustainable capacity building - the modalities will vary according to each country's circumstances and structures

• malaria control, control of diarrhoeal diseases and of acute respiratory infection share the same priority target group - young children - and some approaches to control. Close collaboration on training, supervision and monitoring are essential

• strengthening of laboratory services should include malaria, TB, sexually transmitted diseases, and other tropical parasitic diseases

• the social, economic and environmental problems posed by malaria exceed the jurisdiction and capabilities of ministries of health. A national intersectoral coordinating group may be instituted to perform essential functions regarding implementation of malaria control activities

• health and environmental impact assessment is essential for all proposed development projects especially those that might engender malaria

• malaria, its transmission and control lends itself for inclusion in the school curriculum

**Conclusion**

It should now be clear that the meaning of the term "primary health care" has evolved considerably in the light of recent experience. From a narrow point of contact between individuals and the organized health system, it has taken on a broader meaning as the first level of health care interweaving several components of the traditional health care system, including the first referral and support levels, with communities, families and individuals, and with other sectors at the local level.

But more importantly, primary health care represents an approach to improving health for everyone, focused especially on action at the primary health care level. However, it has broad implications for changes in the entire health system, in the role of communities and individuals in health care, and in the relationships between health and other development sectors.
Furthermore, this approach is based on a concern for equity at all levels, recognition of the important role of socioeconomic factors in health and the need to promote individual and community self-realization and control over their own situation as an important factor in health.

Sustainable health systems developed in the 21st century will bring about a radical change in the principles of global malaria control. The tools and the know-how are available today to control malaria anywhere in the world, but unless suitable health systems are in place and fully functioning as described above, the levels of malaria control achieved will never be sustained. There is a need to plan for the progressive integration of malaria control into national health programmes in such a way as to build up the country’s capabilities for long-term sustained control.

The process of planning antimalaria action allows full advantage to be taken of future change in health systems. The fulfilment of the seven essential functions described above will strengthen malaria control. However, programmes should not wait for this to happen but in the planning of malaria control this should planned as part of the change process to make it happen.

Please read carefully the next Unit of this module before commencing the session to which it relates.
The social and economic aspects of malaria control

Learning objectives:
By the end of this Unit you should be able to:
• define the relationship between malaria and social factors and economic development
• identify human behavioural aspects relative to malaria transmission in your place of work
• develop appropriate materials and programmes for the education of the community
• develop activities that will improve the communication between community and health services and the health services and other related sectors for sustainable malaria control

Introduction
It has been observed over time that in malaria endemic areas there is a certain interdependence between this disease, social factors and economic development. It has however rarely if ever been quantified to any degree of satisfaction.

There has been general agreement that endemic malaria is a substantial constraint on productivity and general development and this has given rise to malaria control programmes and eradication campaigns in the past in the belief that control of the disease was a prerequisite for the successful implementation of development projects. On the other hand retrospective analysis indicates that a malaria control programme can have little prospect of lasting success unless there are clear signs of general economic development. There is, however, a fundamental difference between the two concepts of malaria eradication and malaria control; the former tending to assure control of the disease under all conditions and the latter denying any possibility of successful malaria control unless social and economic development has already got under way.
Past experience

We should not discard past experience but try to learn from it and use this to plan better programmes. Reviewing briefly past experience with respect to anti-malaria programmes and economic development projects, five different situations emerge:

Malaria eradication facilitated by development

Classically the countries of Northern Europe (England, Holland) and the southern United States were freed from malaria as a result of social and economic development such as land reclamation in Holland. However, these areas remain receptive at certain times when climatic conditions are favourable and thus transmission may occur depending upon the vulnerability.

Malaria eradication or control preceded development

These are areas where the reduction or eradication of malaria preceded - and probably facilitated - social and economic development. A large number of agricultural areas (often the most fertile) that were once abandoned or never cultivated because of a very high risk of malaria have undergone economic expansion accompanied by a radical transformation of their ecology as a result of the reduction or elimination of that risk. Among the most significant examples are southern Italy and its islands (Sicily and Sardinia), Greece, Iran (Caspian Coast Region), Algeria (north-eastern region), parts of Thailand and parts of Afghanistan.

The reduction or eradication of malaria, achieved by various anti-malaria measures stimulated the spontaneous settlement and development or resettlement and redevelopment of these areas. Thus it became possible to transform uncultivated areas into cultivated land, to transform extensive single-crop farming into intensive and diversified agriculture, to set up small handicraft and industrial enterprises and in several cases to develop tourism.

The ecological and socioeconomic transformation of these areas brought about changes in the environment which reduced the malaria potential. Consequently, the epidemiological benefits proved to be lasting in many instances, despite high and persistent vulnerability in some of these areas.
Malaria resurgence in the absence of development

These are areas where malaria was reduced or eradicated by anti-malaria activities but where economic development did not occur or was very slow to develop and where a massive reinvasion of malaria occurred. Past experience has shown that successful malaria control campaigns in which malaria transmission has been interrupted may end in failure on account of a massive reinvasion of malaria favoured by a reduction in the naturally acquired immunity level of the populations concerned. This has occurred for example in some countries of the Indian subcontinent (India, Pakistan, Sri Lanka, Nepal) and Latin America.

In these areas the reduction in the malaria risk was not followed by far-reaching ecological changes arising out of economic growth. Social and economic development was taking place relatively slowly. The types of crops and agricultural systems remained traditional. The rural and living environment did not change at all. There were no significant changes in the composition and behaviour of the anopheine population and the vector densities soon regained new pre-operational levels. Under these circumstances the parasitic pressure exerted either from outside the country or from residual foci within, it, was soon able to revive the transmission of malaria, which in several of these countries reached epidemic proportions. Moreover, endemic malaria reached the suburbs of the cities, helped by badly planned urbanization and by a population concentration that was difficult to supervise. In several cases towns have been the starting point for resumption of transmission in rural areas.

The return of malaria to the endemic state had severe economic repercussions because it led to the loss of all the expenditure on the control and eradication activities, to an increase in hospitalization rates (20% in Sri Lanka), to increased mortality (where *P. falciparum* was able to re-establish itself), to a reduction in family income on account of less working time and to a doubling of absence from school.

In some of the countries the stagnation of social and economic development was not the only factor responsible for the massive reinvasion of malaria. Another contributing factor was the lack of a health infrastructure capable of preventing it or containing it in good time. Two examples of the positive contribution to malaria prevention which can be made by an adequate health infrastructure (both quantitatively and qualitatively), even in the absence of an appreciable social and
economic change, are the islands of Cyprus and Reunion. These are now free from malaria as a result of appropriate vigilance and vector control measures carried out by the respective general health services.

Development disregarding malaria

These are areas where economic development projects were implemented without taking the local malaria situation into account, resulting in a dramatic outbreak of the disease which threatened the projects with partial or total failure. There have been many past examples of national development projects having been designed and implemented whilst ignoring or underestimating the malaria problem. Perhaps the most classical is the malarious district of Ostia Antica near Rome in Italy where at the end of the 19th century a project for intensive settlement and development of the land was launched. This project failed completely because of an epidemic of malaria which struck down the new settlers who had little or no immunity. The epidemic caused hundreds of deaths and forced the settlers to leave the district within a few years.

Another example is the failure of a project to introduce settlers into the Sicilian "latifundium" around 1930. The agricultural villages and rural dwellings that were built at considerable expense - in traditional malarious districts of the island, in the expectation that the land under extensive single-crop agriculture could be farmed more productively, was abandoned by the population (in spite of the generous facilities offered to them) on account of fear of malaria and the villages eventually fell into ruin.

In the 1980s Turkey (Çukurova-Amikova region), in the Sudan (Gezireh region) and in Afghanistan (Jallalabad and Kunduz regions) large-scale irrigation and agricultural development projects were implemented, bringing with them a massive population influx, partly settled and partly migratory according to the seasonal labour requirements. The means of production used was sometimes spectacular, and involved considerable economic sacrifice; the full resources of modern technology were mobilized, including the mechanization of agriculture, mineral fertilizers, selected seeds and spraying of very expensive pesticides. These efforts were not always rewarded by production figures in keeping with expectations, because a precarious health situation reduced the productivity of the working population. A common
feature of these projects was the failure to take into account not only malaria but also the other communicable diseases which are commonly associated with an indiscriminate population increase and poor hygiene.

In the Çukurova region (Turkey), the annual parasite incidence rose from 0.1 to 45.0 per 1 000 within a few years: in the Gezireh region of the Sudan the prevalence of malaria among children aged 2-9 increased from 2.9% to 9.7% in a similar period. These epidemics were not without their repercussions on productivity. In Gezireh, for example, the mean annual production per hectare of cotton, wheat and sorghum in 1975 was only 0.5-2% of the expected figure, the high number of febrile patients among the working population seriously hampering the harvest. In the Kunduz region of Afghanistan, regarded as one of the richest parts of the country the annual production per hectare of wheat, cotton and rice was only half what would have been achieved under normal conditions.

Development taking into account malaria

These are areas where economic and social development projects were designed, planned and implemented jointly with well planned malaria control activities and where complete success was achieved in both respects. This reflects an ideal state of affairs, of which there are unfortunately few examples although this is now becoming the norm. Mention could be made here of the "complete reclamation" of the Pontine marshes and the Maremma (Italy) and the intensive malaria control campaigns in Israel and Cuba. In all these cases, economic development was planned and carried out alongside soundly applied malaria control campaigns.

The substantial capital investment required, seemingly out of proportion to the immediate benefits but undoubtedly worthwhile in the long-term, has certainly limited such projects to situations where they were developed and backed up by a strong political determination. Whether the projects were major sanitation programmes (as in Italy) or large-scale malaria control campaigns with integrated community development (as in Cuba and Israel), the final result was always the same, i.e. a radical transformation of the environment which not only made it possible to halt malaria transmission but also ensured that the state of eradication could be permanently maintained.
Human behaviour and communicable diseases

Attached to this Learning Unit as an annex is a list, under a few headings, of the spectrum of human behaviour, many elements of which can affect parasitic disease epidemiology and control programmes. This list does not encompass the elements that underline and govern human behaviour.

With respect to malaria perhaps the most important headings are subsistence, housing and land use associated with population migration. There have been various attempts to categorize types of population mobility, for example: labour migration, religious movements (pilgrimages), nomadic pastoralism, seasonal movements by cultivators, long-term movements by cultivators (sometimes voluntary, sometimes involuntary as a consequence of development projects) and movements of people, often as refugees, because of shifting political circumstances. (To this list can be added the movements of traders, tourists and other travellers). This classification is based upon the forces or motives that result in population movements. An understanding of these forces may be important in planning and in estimating the impact of benefits of a control programme. Unlike the readily observable facts of human movement, however, motives must be uncovered by careful inquiry and interviewing.

This list displays some of the manifold forms of behaviour that can or might be considered in a particular disease research and/or control programme. As a single indication of the complexities that behavioural research entails "water contact" is woven into the list as it intersects with other categories. Any study of contact with fresh water must take into account, at the very least, a dozen categories of behaviour, as indicated in the list and elaborated here: water consumption (drinking, cooking uses, etc.); excretion and post-excretory ablutions in the water; bathing for hygienic reasons and laundering; swimming and other play in the water; ritual bathing; health education efforts to minimize water contact through changes in behaviour; technical efforts to minimize water contact by providing alternatives, e.g. bridges, safe laundry sites, latrines, fishing, agricultural practices involving water use and contact, washing and watering of domestic animals, and travel practices, especially stream crossing and boating, that require contact with water.
A careful and quantitative study of all such behaviour is feasible. The final product is a detailed description of a behavioural pattern, ideally specifying the relative importance of each water contact practice. It is only with such a description at hand that a rational programme can be designed to minimize water contact in a specified cultural-ecological setting. However, in so far as the programme may require change in human behaviour it will not suffice to have only this detailed description. A further series of studies, essentially anthropological and psychological will be needed in each situation to specify why people behave as they do, where and when. Although bridges, latrines and laundry sites can indeed be built without such studies there is no assurance that these facilities will be used (and much experience to show that they may not be). Any effort to change human behaviour must rest on such studies. Without them there is little point in proceeding with extensive manipulation of the physical environment.

Finally, it needs to be stressed that behavioural research, even if directed toward a single disease for the purposes of a particular project, should always be conducted with a trans-disease perspective. While at work in the community the investigator should seize every opportunity to observe or discuss activities, beliefs and attitudes that may be relevant to diseases other than that of primary concern. Forms of behaviour often affect the transmission of several agents, e.g. sanitary practices and schistosomes, many intestinal nematodes and enteric bacteria. It would be short-sighted to ignore everything but schistosomiasis in the course of such an investigation.

**Malaria, community responsibility and health education**

In planning malaria control programmes, a reordering of priorities in the selection of control methods for each circumstance had to occur. Priorities in malaria control have to be based upon epidemiological factors, adverse effects on health and economy, the level of priority among other health problems, technical feasibility, cost/effectiveness, financial resources, human resources (here meaning staff for malaria control operations "organized as a routine activity of the general health services under the direction and supervision of a special antimalaria unit") and "the level of effectiveness of the health services with which malaria control must be integrated or coordinated".
Equally as important, if not more so, is the extent to which the method(s) in a given circumstance can be adopted and employed as a local (community) responsibility. In some countries - for the control of other diseases as well as malaria - this has already become a major criterion, that is, that high priority and substantial budgetary support be given to that method or combination of methods which is least complicated, least expensive, offers the greatest prospect of community acceptance (because of cultural coherence) and, if adopted, the best chance that administration and operations can be undertaken largely by local people within their own communities. At present, this approach seems to offer the best prospects for circumvention of at least some of the control constraints facing countries.

Factors that have hindered greater community participation and assumption of some share of the responsibility for malaria programmes are first, a striking neglect of intercommunity human factors in all phases of malaria research; second, little emphasis by health educators on research except in the area of educational methodology and the conduct of knowledge, attitudes and practices surveys; and third, seemingly limited recognition in the health education profession that education itself should not be primarily a professional activity but instead the responsibility of the community.

It appears that the following steps are necessary if community participation in malaria control is to be expanded:

- relevant behavioural research, coordination with epidemiological surveys or other planning research, must be conducted prior to and during the planning stage of a malaria control programme
- these studies will provide a basis for final decisions on choice of control method(s)
- these studies will also provide the essential behavioural and attitudinal data for initiation of a programme of health education

For malaria control, the methods of choice would include: personal protective measures and mosquito proofing; environmental measures to eliminate vector breeding sites; the use of bio-environmental control methods; and continuing community-based health education to ensure that other measures, once initiated, are continued. In some situations a programme of larviciding might also be operated by members of the community.
Following the preliminary studies and final decisions about control methods, the next and most critical step is the selection of local people for training in techniques or to work as educators. In this the behavioural investigator can take a central role, drawing on knowledge of the community and its people acquired during the preliminary studies. Once the control programme is underway it is essential that a continuing technical and health educational consultation service be available to the people on request. A mechanism must also be set up for regular epidemiological (and behavioural) monitoring of the programme.

Conclusions

The foregoing leads to a number of considerations of a general nature.

- The feasibility of malaria control and the maintenance of the results achieved is governed by two basic factors:
  - the level of the prospects for socioeconomic development
  - the existence, operation and level of coverage and penetration of the basic health infrastructure

The examples given seem to indicate that the lack or inadequacy of one of these two factors makes it difficult to achieve the objectives and even more difficult to maintain the progress achieved. "The level of socioeconomic development of a given region is undoubtedly a very important condition, particularly for consolidating the results of malaria control, nevertheless, it does not seem to be indispensable per se in cases where adequately developed and functional health infrastructures can ensure that progress is consolidated, even in an environment where socioeconomic development is still weak. It also seems that under favourable political circumstances which permit the motivation and active participation of the population, large-scale malaria control can be launched without necessarily waiting for the start of the economic development process, provided that an adequate public health structure has already been set up. A thorough evaluation of these two factors must be regarded as decisive when selecting the objectives for malaria control; these objectives cover a whole range of possibilities from mere reduction of the harmful effects of the disease (specific mortality) to complete eradication."
The economic benefits arising out of effective malaria control are such as to encourage any government to undertake such efforts. It has been shown that in geographically and climatically similar situations where the available means of production are about equal, productivity is distinctly higher in areas where malaria has been eradicated or effectively controlled. In some cases the eradication of endemic malaria may have accelerated the socioeconomic development process; the latter in turn helps considerably to keep a given region free from malaria. When planning malaria control, however, over-optimism must be avoided; many programmes which had almost achieved their objectives have met with troublesome setbacks because the feasibility factors were underestimated. The economic consequences of a massive reinvasion of malaria are much more serious than the simple loss of the capital invested; they also lead to heavy losses because of the increase in social benefit costs and in the mortality and morbidity rates. The failure of malaria control also leads to a loss of credibility for its organizers and makes their task extremely difficult in the future.

As regards the choice of approaches, the ideal method of controlling malaria permanently would seem to be a combined health, economic and social campaign. This linking of community development and malaria control must begin early in the programme planning and continue harmoniously throughout and into the implementation phase. In the specific case of agricultural development projects, with or without irrigation, it has been proved that if they are implemented without taking the health aspects into account they often lead to disasters in the public health field (particularly on account of malaria), with serious repercussions on productivity and general development. The application of appropriate preventive measures, which are undeniably expensive, does of course increase the implementation costs, but these are less than the recurrent expenditure necessitated by deterioration in the epidemiological situation.

**Small group exercise**

Working in your assigned small groups, select a discussion leader and a rapporteur, preferably persons who have not yet had the opportunity to take on these roles. As a group, discuss and highlight your personal knowledge and experience regarding one
of the following topics and develop good examples (case studies) to illustrate the consensus opinion of the group.

**Group 1**

**Topic:** The relationship between malaria and economic development

**Activity:** Based on the exchange of knowledge and experience between members of the group on this topic, develop one good example (case study) to illustrate the relationship of economic development and malaria and show what action was taken to avoid or minimize any adverse effects that malaria had on the development process and that the development process had on malaria (1 hour).

**Outcome:** One member of the group (discussion leader or rapporteur) to present the case study in plenary (10 minutes) to be followed by questions and discussion (10 minutes).

**Group 2**

**Topic:** Human behaviour relative to malaria transmission and its control

**Activity:** Discuss human behaviour relative to malaria transmission. As a group systematically analyze the annex to this Learning Unit which lists some determinants of human behaviour. As a group decide on the elements of human behaviour that influence the epidemiology of malaria and which impede or promote its control and give examples (1 hour).

**Outcome:** One member of the group (discussion leader or rapporteur) will present in plenary specific examples of how human factors have affected, both positively and negatively, the epidemiology of malaria and its control (10 minutes) to be followed by questions and discussion (10 minutes).
Group 3

**Topic:** Human behaviour amenable to change in favour of malaria control.

**Activity:** Discuss how human behaviour relates to malaria transmission and its control. As a group, systematically analyze the annex to this Learning Unit which lists some determinants of human behaviour. Identify those human behaviour factors which would be amenable to some form of change that would favour malaria control. Illustrate the conclusions with examples (1 hour).

**Outcome:** One member of the group (discussion leader or rapporteur) will present in plenary specific examples of attempts to, or ideas on how to, alter human behaviour in a way which would reduce risk as well as enhance the success of control measures (10 minutes) to be followed by questions and discussion (10 minutes).

---

**Please read carefully the next Unit of this module before commencing the session to which it relates.**
Annex to Learning Unit 9

Human behaviour

Human behaviour in general is influenced by many factors, some determinants are listed below:

The human life cycle

Pregnancy, childbirth, postpartum/confinement practices, child rearing/infant and toddler behaviour (water contact), adolescent behaviour, including sexual behaviour, courtship, marriage contract, marriage, adult behaviour, including reproductive and non-reproductive sexual behaviour, age roles, funeral practices, "social morbidity and mortality" - war, massacre, homicide, suicide and abortion.

Psycho-physiological well-being

Dietary and nutritional practices, water consumption (water contact), sanitary behaviour, excretory wastes (water contact) and other refuse, personal hygiene (water contact), comfort-related behaviour, including cooling, heating, clothing, biting vector avoidance, exercise, recreation, play (water contact), artistic behaviour, personal adornment, clothing.

Religion

Personal ritual (water contact), group ritual and other communal behaviour.

Medicine

Curing, supportive care, rehabilitation, both traditional and "modern", prevention and health promotion, traditional and "modern" control, short- and long-term eradication, administration and planning, health education (water contact), environmental hygiene (water contact), public health and engineering.

Subsistence

Hunting, fishing (water contact), cultivating (water contact husbandry, nomadic and non-nomadic (water contact).
Housing and land use
House design and construction, defining the community, defining land and property ownership, urbanization - planned and unplanned.

Development (including environmental change)
Water-related agricultural and otherwise (water contact), non-water related.

Population movements
Cause (nomads, refugees, labourers) mobility, migration, travel patterns, local (water contact) and regional.

Social structure
Stratification, classes, groups, castes, individualism, communal orientation, norms and sanctions.

Economics
Poverty, wealth or intermediate conditions of economic status as determinants of many forms of behaviour, home (cottage) industry, trade, other industrial development, extractive and productive.

Legal behaviour
Crime and delinquency, law enforcement and legal sanctions.

Education
Level, duration, type, mixed or separated, continuous or broken, free or bought, state or private, religious or non-religious.

Politics
Type (democratic, dictatorial), political will, political commitment, political concern.
Formulation of disease reduction objectives

Learning objectives:
By the end of this Unit you should be able to:

• define an objective and distinguish it from a goal
• define a process for setting objectives

The next stage of the planning process (refer to the pyramid Learning Unit 1) is the important and difficult task of setting the objectives that will have to be achieved within the timeframe of the plan. It is these objectives and the approaches designed to achieve them which will form the nucleus of the national programme around which the resources will be allocated and expended and against which the programme will be evaluated.

The analyses that precede this central point of the planning process are designed to clarify the existing situation and to guide the planners towards an understanding of what needs to be done and how best this could be achieved. The programming steps that follow prepare for the development of the approaches that will finally be implemented.

Definition
Goals, objectives and targets are all aims of a programme. Goal is the most general of the three, target the most specific and objective intermediate between the two.
Planning malaria control programmes: Learner's Guide

Goal

A goal is an ultimate desired state towards which actions and resources are directed. Goals are not constrained by time or existing resources, nor are they necessarily attainable. An example of a reasonable goal is the elimination of malaria mortality.

Objective

An objective is a measurable and attainable state that is expected to occur as a result of the application of selected approaches (see Learning Unit 11) and the expenditure of allotted resources. It should include a quantitative description of the desired state, when it is expected to be attained and a specification of the population to which it refers. The word objective may be used interchangeably with impact objective, denoting the concern with impact on the disease problem. In malaria control programmes, the objectives are generally formulated as a certain reduction of the disease problem. An objective to reduce, for example, malaria mortality by a certain percentage in a specified population group within a certain time period is only meaningful if indicator data for mortality is available at the start of the period. A programme may have several objectives which may be the same or different in different strata, and which should be logically related to the goal.

By definition an objective is specific and the timeframe is also specified. Therefore, terms such as specific, general, short-term, intermediate and long-term sometimes used to describe an objective are totally redundant.

In theory a quantified objective (e.g. reduce malaria mortality among children under 5 years by 20% by 1999) is preferable to an unquantified objective (e.g. to reduce malaria mortality). In practice, however, the first objective may be unrealistic since the outcome of intervention is intrinsically dependent on a variety of factors many of which are unpredictable. A realistic compromise might be to express the objectives in terms of variables that are measurable, and to ensure that they are indeed measured; however, given the difficulty and cost of measuring some of the most essential variables (and malaria mortality on a population basis is a good example), one may have to settle for indirect or substitute measurements (shadow indices) and for assessment on a sample basis.
Planning being a dynamic process, allows for the revision of objectives after reasonable attempts have been made to achieve them. The finally determined objectives set the level and intensity of the malaria control effort required for achieving the goal at some time in the future. For this reason it is essential to look ahead beyond the achievement of the objective and assess whether the gains could be maintained at a reasonable cost and within the foreseeable resources or what additional resources would need to be mobilized for the purpose. If in fact it is foreseeable that the gains cannot be maintained then the objective should be discarded, drastically modified, or reduced to a realistic level.

For setting objectives the planning group needs to re-examine the results of the feasibility analyses conducted in the light of the possible ranges of accomplishments that were identified. A guiding principle should be some pragmatic combination of optimism with realism. Past experiences should be taken into account along with a careful assessment of the prevailing expectations of high-level national decision-makers, the future national economic development plans, as well as plans for further development of the health services.

The achievement of the objectives in a given time depends on the development of appropriate approaches. Each major activity within a given approach will have specific targets which are usually defined annually for the planned period. These targets may be revised periodically according to the progress made and the prevailing constraints (see Learning Unit 12).

The process of setting objectives

The hierarchy of problems (problem tree see Learning Unit 6) is transformed into a hierarchy of objectives (objective tree) and the objective analyzed.

The first step is to analyze the problems and prioritize their underlying causes. Working from the top downwards rework disease related problems, making them into disease reduction objectives, including the core problem of the original analysis. Difficulties in rewording indicate deficiencies in the analysis of the problems, in which case re-discuss the problem. Ensure that the objectives as worded are sensible, practical and ethical. The following should be noted about objectives:

- specific high risk groups may be identified in the objective
strata and geographical location in which objectives are to be achieved should be
stated

different, quantified objectives may have to be established within the country
according to different strata

objectives should be realistic and not beyond the programme’s capabilities

objectives should be acceptable and understandable by the population, policy
makers and implementing staff

objectives should be relevant and pertinent to the country’s priorities and policies
(purposeful)

objectives should be quantifiable to permit programme evaluation

objectives should be dated

Quantification of objectives

In setting an objective it is necessary to quantify and assess the relationship between
operational outputs (services) and malaria reduction. This is a difficult task which can
only be done by taking into account the present malaria situation and problem, the
results of any actions that may have been taken in the past, experience in other places
with similar malaria epidemiology, and the resources that are available. Past
experience of what can and cannot be accomplished in a given timeframe is essential
for quantification. If you are planning a programme for the first time do not hesitate
to quantify it, it can always be adjusted after one or two years of implementation and
evaluation.

The selected objectives need to be examined for determining which index or
which set of indices can be used as a measure of accomplishment (see evaluation
methods, Learning Unit 14). In selecting indices, ease of measurement must be
considered to avoid indices that have little chance of being measured. On the other
hand, important objectives should not be left with only a vague notion as to how their
achievement will be measured. Measurable indices closely related to the objective
should be sought and monitored.

The quantification of objectives is clearly a technical matter, but the political
nature of this step should not be overlooked.
Since the objectives that are finally set will form the basis for evaluating the malaria control effort it is preferable to have several well defined objectives limited to a single aspect, than to have one or two ill-defined compound objectives, mixing for instance the reduction of mortality and morbidity. It is particularly important to note that objectives are stated in terms of improving the health situation prevailing in the concerned area. They do not include what could be classified as operational targets such as improving the quantity of surveillance or strengthening the national malaria training capabilities (see Learning Unit 12).

Different, quantified objectives may have to be established within the country according to the different strata. To achieve them may require different approaches or conversely different approaches may be required in different strata to achieve the same objectives.

It is worth remembering that:

- the aspect of the disease problem for which some reduction is desired should be selected for objective setting
- the aspect of the disease problem must be measurable
- important aspects of the disease problem should not be avoided because they are not easily quantifiable. They may possess a shadow index that can be monitored (e.g. age specific general mortality instead of malaria specific mortality or malaria case fatality in selected hospitals)
- the direct indices (or shadow indices) chosen for objective setting should be listed
- the activity to monitor and evaluate change in levels of the indices is important and should be borne in mind when developing the monitoring and evaluation systems
- at the end of the planning process it is useful to come back to the objectives and review their quantification in the light of a total plan and the resource distribution.

Please read carefully the next Unit of this module before commencing the session to which it relates.
Development of approaches to achieve objectives

Learning objectives:

By the end of this Unit you should be able to:

- define an approach
- list the elements of an approach
- formulate realistic approaches to achieve the objectives set for malaria control

This stage of the planning process is very closely related to setting the objectives (Learning Unit 10) and is as crucial.

Definition

An approach is a set of broad lines of action designed to achieve a stated objective, in which all major positive and negative aspects are accounted for.

An approach may sometimes be referred to as a strategy. This term has been avoided in this module because it has military implications and so as not to cause confusion with the global or regional malaria control strategies, which are very broad and not directly related to stated objectives.

The positive aspects include suitable entry points for collaborative action, involvement of other sectors, integration with other disease control activities and relevant political, social, economic, managerial and technical factors. The negative aspects include obstacles and constraints.

An approach in the context of malaria control may be regarded as a group of interrelated curative, preventive and other health related measures, and the mechanisms for their implementation, designed to achieve stated objectives. They are broad lines of action with all the major positive and negative aspects accounted for.
Formulating approaches

The aim of outlining approaches is to explain and justify the use of specific antimalaria measures in the light of the objectives that have been set. Each approach in its most elemental form should include the following items:

- the objective to be achieved, in general terms
- the general philosophy including justification
- the general measures and techniques to be employed
- the relationship of the antimalaria approach to the national primary health care approach
- the relationship to other antimalaria approaches, if any
- the population group(s) addressed
- the special categories of staff that might be required
- the facilities required including training
- the essential support requirements
- the degree and nature of community involvement required
- the identification of risk elements beyond the control of the programme
- critical actions such as legislative or policy changes
- the general cost estimates related to varying levels of coverage

The end product should be a concise statement of the approach incorporating the above elements and other relevant details.

The central issue of any approach is the specific antimalaria measures required to achieve the desired reduction of the problem. For example, timely and effective treatment to prevent deaths, effective antivector measures to reduce prevalence, and sensitive epidemiological surveillance methods to detect early and control epidemics. Often these measures cannot be easily implemented without complementary and supportive action. Thus, for example, timely and effective treatment requires the availability of drugs, adequate skills on the part of responsible health workers and awareness on the part of the public of the signs and symptoms of malaria, the importance of seeking treatment early and the necessity of following the drug regimen prescribed. This may be further complicated in the presence of parasites resistant to antimalaria drugs. In this situation, the public should be aware that some medications
may not work and that a different course of treatment may be required. Health workers need to know how to recognize the possible presence of drug resistance and have access to diagnostic and treatment referral services which can verify the necessity for alternative treatment methods. This example illustrates that an approach is a composite of actions required to assure that the determined antimalaria measures can effect the desired impact.

Table 3, in a highly simplified form, outlines the principal approaches that may be required to achieve some major objectives.

In situations where a well-established on-going antimalaria programme exists, it is likely that replanning and reorientation will be necessary to establish a close relationship between the programme and national endeavours aimed at implementing primary health care. The results of such replanning would need to clearly indicate:

- how past and present antimalaria experience and programmes can contribute as entry-points to establishing primary health care
- how the existing antimalaria programme needs to be reoriented in order to ensure that it contributes most effectively to the realization of national policies and the building up of primary health care
- how other programmes initiated as a consequence of these policies and approaches can contribute to antimalaria activities

Criteria for selection of feasible approaches

There may be more than one feasible approach to achieving the same objective and they will vary not only by composition but also in the expected impact on the problems (achievement of the objective), the time it takes to achieve the objective, and the cost. Each approach needs to be carefully reviewed and selected, taking into consideration the following criteria:

- probability that the objective can be achieved in the timeframe
- likelihood that important obstacles would be eliminated or avoided
- the number and effects of the remaining unavoidable obstacles
- the degree to which the approach adheres to the budgetary limitations
- the predicted ease of implementation
• the presence of design features likely to be acceptable to the decision-makers, professional groups and the population

Example of an approach

To help understand the importance of an approach and its relationship to the epidemiological stratum and objective, the following example is provided for your consideration. In addition, we have gone one step beyond to derive the major activities that the approach implies. This is the first step in developing operational targets, milestones and in costing for budgetary purposes.

The stratum

Wet savannah, plain area, rural population, traditional agriculture, poor communications, little movement of the population, poorly developed health infrastructure, very high perennial transmission, population about 2 million with 45% children under 5 years of age and 45% of the remaining population women of child bearing age. High mortality in children and primiparae women. Some RI resistance of *P. falciparum* to chloroquine. Two vectors *A. funestus* and *A. gambiae* which are both susceptible to DDT.

The objective

To reduce the age specific malaria mortality rate in children under 5 years by 60% by 2002. This may be evidenced by a reduction in the reported cases of severe malaria in this age group, a reduction in the age specific general mortality rate and a reduction in the trend of age specific malaria deaths in sentinel hospitals and referral institutions.

The approach

The provision of chloroquine treatment at 25 mg per kg body weight to all children under 5 years of age within 24 hours of developing a fever no matter what the cause. Follow up of all treated children within 48 hours to detect those failing to respond adequately to the drug and which will be referred for diagnosis, and if positive for malaria, then treated with an alternative antimalaria drug. The choice of drug will depend on the government policy and clinical condition of the patient. Recognition
and referral of severe and complicated cases of malaria. Improved management of severe and complicated malaria in all referral institutions.

Measures to implement the approach

The central issue of any approach is the specific antimalaria measures required to achieve the objective. Implementation of these measures requires supportive action. For example timely and effective treatment requires the availability of drugs (logistics), adequate skills among health workers (training), and awareness on the part of the population. The following are the main activities needed to implement the approach described above

- logistics
- education and awareness to mothers
  - in maternal and child health clinics
  - by village awareness classes
  - to include the use of antimalarial drugs
  - to emphasize the dangers of fever and the need for prompt treatment
- selection and training of community health workers and communicators
- advocacy to urge the government to improve the distribution of health facilities based on a needs assessment
- training of all health workers in the follow-up of treated cases
- training microscopists in all referral institutions
- providing all referral institutions with microscopes, other equipment and supplies of alternative antimalarial drugs
- training all medical personnel in the management of treatment failures and severe and complicated malaria

Declaration of the malaria control policy

It is recommended that the main technical and normative elements of a plan be presented in a document, possibly a declaration of the malaria control policy, which is a succinct statement from the appropriate governmental authority on what is to be attained and through which approaches. The most important element of a national
Planning malaria control programmes: Learner’s Guide

Malaria control programme in Africa is the national malaria control policy. Adoption of the policy by those in and outside the health system whose collaboration will be needed will ensure unity of purpose and coordination of efforts. Such adoption may take place by a national symposium including district medical officers, other health workers, representatives of the pharmaceutical industry, and others.

Please read carefully the next Unit of this module before commencing the session to which it relates.
Table 3: Objectives, principal intervention approaches, essential support measures and suggested indicators for malaria control

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Principle intervention approaches</th>
<th>Principal support measures including epidemiological and operational research</th>
<th>Suggested indicators for monitoring and evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depending upon the prevailing epidemiological situation, availability of resources, feasibility, and in order of priority:</td>
<td>1. General Health education and community involvement to ensure population awareness of malaria as a disease, the importance of its early and complete treatment, and the utilization of self-protection measures.</td>
<td>General education of the population especially regarding personal hygiene and general sanitation.</td>
<td>All or some of the following indicators may be used depending upon the objective selected and available resources. 1) Age specific general mortality rates</td>
</tr>
<tr>
<td></td>
<td>2. Measures for the prevention of death Early diagnosis and prompt appropriate management of acute <em>P. falciparum</em> malaria through the establishment of diagnostic and treatment services readily accessible to the target population and with appropriate technical support to ensure that the correct effective drugs are in the right place at the right time.</td>
<td>Specific health education materials and activities directed towards the prevention and control of malaria.</td>
<td>2) Malaria mortality trends overall and in the different target populations</td>
</tr>
<tr>
<td></td>
<td>3. Measures for the prevention and reduction of morbidity - The provision of appropriate antimalarial drugs to all suspected and diagnosed (clinically or parasitologically) malaria cases through the ready availability of effective antimalarial drugs and their administration in appropriate dosages. - The provision of appropriate chemoprophylaxis during pregnancy through the maternal and child health services. - The provision of prompt treatment for fever with antimalarials for infants at risk from the fourth months of life up to one year of age through education of the mother and utilization of MCH services. - Improved nutrition in the at-risk population through the nutrition, health education and agricultural extension services. - Vigorous and prompt treatment of infection.</td>
<td>Training and supervision of health workers at all levels of the system.</td>
<td>3) Malaria case fatality trends in sentinel hospitals</td>
</tr>
<tr>
<td></td>
<td>4. For the reduction of disease prevalence. In addition to the foregoing:</td>
<td>Appropriate referral mechanisms with diagnostic and treatment capabilities.</td>
<td>4) Malaria morbidity trends overall and in the different target populations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drug sensitivity testing and monitoring capabilities.</td>
<td>5) Trends in fever cases as a percentage of total cases presenting to community health workers, health workers and referral posts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insecticide susceptibility testing and monitoring capabilities.</td>
<td>6) Trends in referrals.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adequate logistics systems for supplies and equipment including drugs, insecticides, etc.</td>
<td>7) Trends in percentage of fever cases found to be due to malaria.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equipment maintenance services.</td>
<td>8) Malaria disease incidence and prevalence rates.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9) Occurrence of epidemics and the rapidity and degree with which they are brought under control.</td>
</tr>
<tr>
<td>Objectives</td>
<td>Principle intervention approaches</td>
<td>Principal support measures including epidemiological and operational research</td>
<td>Suggested indicators for monitoring and evaluation</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>– The promotion of individual and community measures to reduce man vector contact and eliminate or treat accessible known vector breeding sites.</td>
<td>Adequate information concerning extent of disease problem, coverage of antimalaria measures implemented and results achieved, and early warning of unusual increases in the disease and possible impending epidemics.</td>
<td>10) Mortality rates in epidemics. 11) Occurrence of indigenous cases in malaria free receptive areas.</td>
</tr>
<tr>
<td></td>
<td>– The utilization of appropriate antivector measures such as residual insecticide spraying, larviciding and bioenvironmental measures, which are suitable to the local epidemiological situation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. <strong>For the prevention and control of epidemics.</strong> In addition to the foregoing:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– The establishment of simple but appropriate epidemic early warning systems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– The development of a state of preparedness to ensure the rapid mobilization of essential resources.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– The utilization of available technologies to reduce rapidly mortality, morbidity and suffering through the mass utilization of appropriate antimalarial drugs confined to the target population and for a short, sharply limited period of time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– The utilization of available technologies to reduce rapidly the overall vector population density and man vector contact.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. <strong>To sustain epidemic malaria free areas.</strong> Within the general communicable diseases epidemiological surveillance, the careful vigilance of malaria and its prompt radical treatment including active preventive measures, where appropriate and necessary.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. <strong>For the elimination of the disease.</strong> Full-scale time-limited elimination methodology.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Learning Unit 12

Setting operational targets

Learning objectives:

By the end of this Unit you should be able to:

- define a target for programme planning purposes
- list the components of a target
- define a process of setting targets
- relate targeting to disease reduction (impact) objectives

Characteristics of some malaria control interventions

The description of some epidemiological strata (Learning Unit 4) provided you with a framework for decision making starting with a recognition of local characteristics. Before considering operational targets we will review some of the characteristics of the different malaria control interventions relevant to this stage of the planning process.

Disease management

Diagnosis

Diagnosis may be clinical or supported by biological examination. Clinical diagnosis has been greatly refined through the sick child initiative. This should be complemented by the creation of clear guidelines on criteria for antimalarial treatment in adults:

"Febrile disease (history of fever or presentation with fever) with no other obvious explanation".
In many countries, especially in Africa, there is an urgent need for expanding the coverage and quality of malaria microscopy. If this is planned, the following key points should be considered:

- providing guidance on criteria for malaria microscopy
- establishment of quality control and supervision
- ensuring supplies
- recruitment and training of staff
- remuneration of staff

Guidance of criteria for malaria microscopy is necessary because it cannot be expected that a slide can be examined from all patients suspected of having malaria. Also, the importance of the result is limited in young children in highly endemic areas. Priority should therefore be given to treatment failures and severe cases. As much as possible, these activities should be part of a general programme for strengthening the laboratory network. As a minimum, the work should be coordinated with the development of other programmes, e.g. tuberculosis control. For quality assurance the establishment of reference laboratories can be crucial. It may sometimes be sustainable and cost-effective to place this function in existing research institutions. While, at least temporarily, the costs of supplies and even training may be borne by external inputs, this should not be the case for staff remuneration, which often is the crucial limiting factor in strengthening laboratory services. Planners may need to discuss this with the department personnel. It should be mentioned that microscopy could save money for the health services, especially in areas of relatively low malaria risk and in adults in general, by reducing the consumption of antimalarial drugs.

**Treatment, advice and referral**

Advice and referral are well covered by the sick child charts. The management of adults can be easily deduced and extrapolated. The selection of drugs must be determined according to assessments of treatment efficacy and other pertinent factors in the country. The production and updating of an appropriate, accepted, authorized and applicable national antimalarial drug policy is the first duty of a national malaria control programme. It is a responsibility which does not belong to any other
department and a *sine qua non* for development of malaria control. In this context, the following definitions apply:

- *appropriate* means that the policy is technically sound and based on local information
- *accepted* means that representatives of those who are going to implement the policy must be involved in the decision-making; an advisory group including prominent clinicians may prepare a draft, and a broad representative group adopt the final policy
- *authorized* means that it is given the strongest possible endorsement and subject to national legislation, regulatory status by a minister or high level official
- *applicable* means that the guidance it includes is clear, straightforward, and easily translatable to user-friendly treatment guidelines for different levels of health care

**Logistics, pricing and cost-recovery**

Malaria control programmes should normally not assume the responsibility for procurement and distribution of antimalaria drugs. This is the responsibility of the pharmaceutical sector, the central government stores and in particular the essential drugs programme. Time-limited exceptions may be made for groups needing special attention, epidemic preparedness and reserve drugs which are only needed in certain facilities. There are limitations in the availability of antimalarial drugs. Those more commonly available, their action and an indication of cost are listed in Learning Unit 14, Table 5.

In many countries, revitalization of the health services has not, in the immediate term, been accompanied by better availability of drugs at health services facilities, although in recent years the situation has been improving on the basis of cost-recovery schemes. However, under the cost-recovery schemes of some countries, antimalarial treatment is becoming so expensive that the drug cost may be an obstacle to treatment for the poorest. This is even more true for the treatment of severe malaria. In such situations, lowering the profit margin, eliminating import duty and sales taxes would enable the government to sell at a lower price and increase coverage.
It is possible to carry out precise studies on the demand of antimalarials according to price, in order to determine what price is perceived as “too high” and to propose a ceiling. Household studies will enable an analysis of the tendencies to use public sector or official or unofficial private sector health services.

In most countries, most antimalarial drugs are acquired outside the health services. Malaria control programmes have an important responsibility in assessing and evaluating this system, delimiting the priority problems and taking any possible remedial and corrective action. One approach is, in collaboration with the essential drugs programme and/or the private sector, to market and promote a generic standard antimalarial drug formulation of good quality at a low price. Such a formulation could be packed in single adult dose packs, accompanied by a slip of paper indicating dose in relation to age-group. This could be combined with social marketing, if this is necessary to attain a sufficiently low price.

Chemoprophylaxis

The only group for which chemoprophylaxis is currently considered as part of a national programme is pregnant women, and in most areas only primigravidae and secundigravidae. Unfortunately the subject of prophylaxis in pregnancy has become controversial as a result of the following issues: decreasing efficacy of chloroquine, concerns about side-effects of alternative drugs and increasing realization of the obstacles to compliance. Positive results of studies on intermittent regimens suggest that pregnant women may be protected by methods which are more feasible than weekly prophylaxis, in particular a single dose at first visit to antenatal clinic, at 28 weeks and again at 32-34 weeks. This regimen is particularly important for HIV seropositive pregnant women irrespective of gravidity.

The main criteria for using drugs to protect pregnant women are epidemiological:

- is malaria in pregnancy a local problem which cannot be sufficiently reduced by early adequate chemotherapy applied to fever cases?
- is the health care infrastructure adequate for providing prevention in pregnancy in terms of adequate coverage of antenatal services or traditional birth attendants who could learn to apply this measure safely?
Personal protection

Among a range of personal protection methods, insecticide-impregnated mosquito nets and other materials have attracted considerable attention as a relatively cheap method which can be applied in a broad range of situations. Impregnated mosquito nets have proven highly efficacious, at least in the short term, for reducing the incidence of malarial disease and mortality in areas with:

- short transmission season
- a high level of use of mosquito nets before intervention.

Correctly used mosquito nets will afford some reduction of entomological inoculation rate, whatever the intensity and duration of transmission, but the extent to which this translates to a long-term reduction of morbidity and mortality seems to be variable. This technology may be used simply for personal protection of the family or more seriously to impact the epidemiological equilibrium.

A health promotion programme using impregnated nets for personal protection would aim at a change in attitudes and behaviour, and also at a certain coverage, but usually modest. Such a programme may target a large population. Its activities are mainly Information, Education and Communication (IEC). The provision of mosquito nets is usually left to the private market, though impregnation may be carried out by the health services. Normally, all costs of commodities need to be recovered in one way or other, but the malaria control programme would pay the costs of IEC. Such a programme would be appropriate in any situation in which the method is or could become acceptable and popular, and where the population could be expected to derive some health benefit, at least a reduction in nuisance arthropods.

A programme aiming to impact the epidemiology of malaria using impregnated mosquito nets would need to ensure a certain coverage of a given population within a given timeframe and thereby attain a certain reduction of morbidity and mortality. The coverage should be so high that the entomological inoculation rate measured on unprotected people is reduced. Such a programme may need to ensure the logistics for nets, equipment and insecticide. It should normally have some cost-recovery, but the costs may be heavily subsidized. It may be considered in an area where an epidemiological impact (on morbidity and mortality) could be expected with great certainty.
A national programme may implement a high coverage programme in one area, perhaps as a demonstration project, and a promotional programme in others. A programme should never be started without an assessment of existing attitudes and practices and the possibilities of community participation for implementation and cost-recovery. If a given population does not use mosquito nets, knowledge-attitude-practices (KAP) studies should be carried out to obtain basic information before undertaking any promotion of mosquito nets or other impregnated materials.

Three pyrethroid insecticides can be used to impregnate nets:

- permethrin, at a concentration of 200-500 mg/m²
- deltamethrin, at a concentration of 10-25 mg/m²
- lambdacyhalothrin, at a concentration of 10-25 mg/m²

These insecticides have a lethal action not only against mosquito vectors, but also against nuisance insects (flies, bedbugs, fleas, other mosquitos, cockroaches, and others). This effect is of great importance for the acceptance and active participation of the community.

Vector control

The term vector control is used here to include all forms of control of malaria transmission other than personal protection measures.

Larval control

Larval control methods can be applied under specific ecological conditions: well-defined and limited larval sites (cisterns), limited areas (oases, islands). It can be included in large-scale environmental or sanitation projects (drainage of swamps, clearing of drains, flushing, drying out, road construction) or in community level activities (clearing around houses, filling holes). Larval control can also be included in planning hydro-agricultural projects (agriculture, fish culture, dams) which may cause increased transmission.

Chemical (Table 4) or biological (Bacillus thuringiensis) insecticides have limited application because of the high labour costs of repetitive applications. It is recommended that malaria control programmes not use the same insecticides for larviciding as those used for residual spraying. Temephos (Abate®) is preferred as a larvicide against anophelines for reasons of its safety and broad efficacy. The general
rate of application is approximately 55 g/ha for clear water to 110 g/ha if the aquatic vegetation is dense. Biological methods such as larvivorous fish (*Tilapia*, guppy, *Gambusia*, *Aphanius*) have limited application in arid zones with few large breeding sites.

It is commonly thought that some kind of larval control is appropriate for urban malaria. The reality is that anophelines (in contrast to culicines) are rarely found in polluted water collections in highly urbanized areas. They are however found in fresh water tanks and these are amenable to preventive measures. In Africa, periurban areas may prove excellent breeding grounds for both *An. funeetus* and *An. gambiae*, but then these are rarely amenable to larval control. Geographical reconnaissance and entomological and epidemiological assessment are absolutely necessary before larval control is considered in any area.

In some countries, national malaria control programmes promote filling, draining and eliminating peridomestic water collection. In many instances such action will have little impact on the populations of anophelines, but it may reduce the nuisance from culicines, and in some cases also the risk of such diseases as dengue fever and filariasis.

**Control of adult anophelines**

Control of adult vectors is possible through use of residual insecticides such as DDT or insecticides with a “knock-down” effect such as pyrethroids.

The choice of insecticide(s) (Tables 4a and 4b) depends on a number of factors: Susceptibility of the vectors, biotopes, construction material (type of walls), resources available, and so forth. The variation in price of the insecticides is large (see Learning Unit 14 Table 6) and comparative costs of residual spraying excluding operational costs are given in Learning Unit 14, Table 7.

Insecticides for house spraying must meet standard specifications and packing requirements. The range of equipment for spraying is also large, and standard specifications have been defined. Pressurized sprayers can be used for wall spraying, for treating breeding sites, and for large-scale impregnation of nets.

All vector control activities place high demands on technical competence, organization and finances. To this must be added the considerable problems of acceptability, especially for house spraying which may become unpopular in the long
term, and, linked with this, sustainability. Residual spraying is an important intervention for preventing and curbing epidemics.

Control of epidemics

In the planning stage, it is important to make provision for control of malaria epidemics, if they are known to occur in the country. Conversely, if epidemic-prone situations are judged to exist, but malaria epidemics have not been documented, the situation in the epidemic-prone areas should be subjected to surveillance, assessment or field research to document what goes on.

Definition of a target

At this stage of the planning process objectives have been set and the level to which selected aspects of the malaria problem have to be reduced are known. These must now be reviewed and realistic operational targets set which will define the kind and level of activity to be carried out in order to achieve the objective.

A target is a desired result of certain activities. It may be described as a short-term purpose which is always quantified and dated.

Targets are concerned with the underlying causes of a problem, whereas objectives are concerned with the problem itself. They represent measurable and attainable aims which are necessary and sufficient for the attainment of the objectives. For each objective, there should be a number of targets which should be measurable and refer to a specific timeframe. They may be set on an annual basis up to the date when the objective should be attained.

In malaria planning it is convenient to refer to targets as operational targets, because these are the end results that the work force has to achieve and to which the human and financial resources will be directed.

Achieving the target to the desired level which is set each year will ensure that the objective is achieved within the timeframe set. The level of the target must therefore be adjusted annually to make sure this is the case.

You should be aware that more recently this notion has been further complicated by a distinction being made between outcome targets (objectives) and process targets (objectives). Outcome targets refer to states to be attained, and are usually expressed as percentages. They often refer to quality and coverage of services
or interventions. The coverage may have the target population or services as the
denominator. Process targets refer to the execution of programme activities and
should not be expressed with a denominator.

Irrespective of the terminology, a target has two components, the operational
output (patients treated, families protected) and a unit of measurement which can be a
number or a ratio (percentage). For example an operational target such as: “by the end
of 1998 to increase to 40% the proportion of primiparae pregnant women who take
malaria chemoprophylaxis in accordance with the national policy” has
chemoprophylaxis in primiparae pregnant women as the operational output and the
percentage of known primiparae during 1988 as the unit of measurement. To achieve
that target many activities will have to be carried out, on a routine basis, up to
established standards. Targets may be relatively flexible and modified on an annual
basis according to progress and resource availability.

The process of establishing targets

♦ Carefully review the objectives which should have been established on the basis of
available information and should be realistic (not beyond the programme capabilities),
acceptable and understandable by the population, and the policy makers, relevant and
pertinent to the country priorities and policies (purposeful) and quantifiable to permit
programme evaluation.

♦ The approach to achieve the objective has already been elaborated, now review the
principle measures to implement that approach.

♦ The principle measures will form the basis for choosing the operational outputs for
which indicators of achievement will be determined.

♦ Complete the target by quantifying the components of the indicator based on a
knowledge of what can reasonably be achieved with the resources available within
one year.

♦ Realistic (technically feasible) targets should be established which are relatively
narrow, specific and quantified.

♦ A decision should be made as to which targets are relatively fixed and which can
be more easily adjusted when unresolved difficulties or obstacles arise.
The date by which each target should be achieved should be stated; in practice targets should be set annually although some may have to be achieved within a 2-year timeframe, depending on the budget allocation period to which targets should be invariably linked.

It is important to clearly specify the area (stratum) and the objective to which the targets apply as different strata may have different objectives, different approaches, and have different targets.

**Some interventions and targets**

During the planning process it might be helpful to keep in mind some targets that might be applied to the interventions previously discussed. Whereas the targets are derived from the main interventions identified in the approaches to achieving the objectives, numerous activities will be necessary to be able to achieve the targets. Some of these are also listed below as a guide only.

**Disease management**

If the objectives relate to reductions in mortality and the incidence of severe malaria, appropriately quantified and related to a timeframe, and differentiated by population groups (age) and areas, then possible targets are:

- % of patients of target groups will be managed in accordance with national policy
- increase to % the proportion of health workers who provide correct disease management to patients of target groups with fever
- increase to % the proportion of mothers who ensure correct disease management in accordance with national policy for children with fever
- increase to % the proportion of referral facilities with functional microscopy
- increase to % the proportion of health facilities with the resources needed to provide disease management for malaria in accordance with national policy
- increase to % the proportion of individuals with fever who have access to the antimalarial drugs as specified in the national policy
The activities required to attain the operational output could be the following:

- production and dissemination of guidelines
- training of clinical and laboratory staff (pre-service and in-service)
- supervision and quality assurance
- information-education-communication (IEC)
- supplies of laboratory reagents and equipment
- regulation of drug supplies and pricing
- in special situations, drug supplies
- advocacy, promotion and negotiation to ensure adequate supplies and use of adequately priced drugs

As can be seen, many of these activities are not resource-consuming, but depend on the leadership qualities of malaria control staff.

**Chemoprophylaxis in pregnancy**

Objectives, appropriately quantified and timed, could be:

- reduction of the proportion of low birth weights
- reduction of the prevalence of anaemia in pregnancy
- reduction of the incidence of acute malaria disease in pregnancy

Possible target is:

by —, increased to —% the proportion of primiparae who take chemoprophylaxis in accordance with national policy.

The activities required are similar to those required for disease management, except for the diagnostic component. If chemoprophylaxis or preventive treatment will be applied in the programme, the implementation activities should be linked closely with those for disease management.

**Personal protection**

Related objectives, suitably quantified and scheduled, might be:

- reduction of the incidence of malarial disease
- reduction of the incidence of severe malaria
- reduction of mortality due to malaria
Particularly good results could be expected for young children, as they usually go to bed earlier than adults and older children.

One possible target is:

By —, increase —% the proportion of households targeted for use of nets using at least one impregnated mosquito net.

The activities required to attain this operational output could include:

- the collective or individual impregnation of mosquito nets by soaking or spraying. The techniques are easy to learn and do, so that the method can be easily spread to the most peripheral level by workers of the national health service, voluntary associations, and others
- training of defined categories of health workers. Often hygiene and preventive staff will normally train and supervise village health workers, but they must also be supervised
- educational messages which should be developed on the basis of the information obtain in the local KAP survey and on social, cultural and economic factors.
- diffusion of messages which must be adapted to the needs of the programmes and the local possibilities and opportunities
- regular evaluation of the susceptibility of the malaria vectors and other major domestic nuisance insects to the insecticides used.

Vector control

Related objectives, suitably quantified and scheduled, might be:

- reduction of the incidence of malarial disease (severe and non-severe) and reduction of malaria mortality
- maintenance of the incidence of malarial disease below a defined threshold
- interruption of transmission

An appropriate target might be:

By —, to have sprayed —% of targeted houses with residual insecticide.

The activities required to attain this operational output could include:

- determine local efficacy of the method
- geographical reconnaissance of the area
- procurement of insecticide to be delivered on time
- recruitment of temporary staff
- training
- personnel management
- supply management
- information management
- supervision

Epidemic control

Related objectives, suitably quantified and timed could include:

- reduction of malaria mortality in epidemics
- reduction of incidence of malarial disease in epidemics

Appropriate targets might be:

By — timely vector control measures will be deployed to control —% of epidemics forecasted or detected in the country.

By —, —% of health care units in epidemic prone areas are prepared to cope with malaria epidemics.

By —, —% of epidemics recorded in a year were forecasted or detected in time (to be defined).

By — weeks after forecasting or detecting an epidemic —% of habitations in epidemic prone areas are protected by vector control measures.

Activities that need to be carried out include:

- identification of epidemic prone areas
- surveillance
- epidemic preparedness plan
- prepared to take action when needed
- preventive interventions
- curative measures for epidemic control
### Table 4: Insecticides suitable for interior treatment against mosquito vectors

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Chemical type&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Dosage of a.i.&lt;sup&gt;b&lt;/sup&gt; (g/m²)</th>
<th>Duration of effective action (months)</th>
<th>Insecticide action</th>
<th>Toxicity: c oral LD&lt;sub&gt;50&lt;/sub&gt; of a.i. for rats (mg/kg of body weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha-cypermethrin</td>
<td>PY</td>
<td>0.02-0.03</td>
<td>4-6</td>
<td>contact</td>
<td>79</td>
</tr>
<tr>
<td>Bendiocarb</td>
<td>C</td>
<td>0.1-0.4</td>
<td>2-6</td>
<td>contact &amp; airborne</td>
<td>55</td>
</tr>
<tr>
<td>Carbosulfan</td>
<td>C</td>
<td>1-2</td>
<td>2-3</td>
<td>contact &amp; airborne</td>
<td>250</td>
</tr>
<tr>
<td>Chlorpyrifos-methyl</td>
<td>OP</td>
<td>0.33-1</td>
<td>2-3</td>
<td>contact</td>
<td>&gt;3000</td>
</tr>
<tr>
<td>Cyfluthrin</td>
<td>PY</td>
<td>0.02-0.05</td>
<td>3-6</td>
<td>contact</td>
<td>250</td>
</tr>
<tr>
<td>Cypermethrin</td>
<td>PY</td>
<td>0.5</td>
<td>4 or more</td>
<td>contact</td>
<td>250</td>
</tr>
<tr>
<td>DDT</td>
<td>OC</td>
<td>1-2</td>
<td>6 or more</td>
<td>contact</td>
<td>113</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>PY</td>
<td>0.01-0.025</td>
<td>2-3</td>
<td>contact</td>
<td>135</td>
</tr>
<tr>
<td>Etofenprox</td>
<td>PY</td>
<td>0.1-0.3</td>
<td>3-6 or more</td>
<td>contact</td>
<td>&gt;10,000</td>
</tr>
<tr>
<td>Fenitrothion</td>
<td>OP</td>
<td>2</td>
<td>3-6</td>
<td>contact &amp; airborne</td>
<td>503</td>
</tr>
<tr>
<td>Lambda-cyhalothrin</td>
<td>PY</td>
<td>0.02-0.03</td>
<td>3-6</td>
<td>contact</td>
<td>56</td>
</tr>
<tr>
<td>Malathion</td>
<td>OP</td>
<td>2</td>
<td>2-3</td>
<td>contact</td>
<td>2100</td>
</tr>
<tr>
<td>Permethrin</td>
<td>PY</td>
<td>0.5</td>
<td>2-3</td>
<td>contact</td>
<td>500</td>
</tr>
<tr>
<td>Pirimiphos-methyl</td>
<td>OP</td>
<td>1-2</td>
<td>2-3 or more</td>
<td>contact &amp; airborne</td>
<td>2018</td>
</tr>
<tr>
<td>Propoxur</td>
<td>C</td>
<td>1-2</td>
<td>3-6</td>
<td>contact &amp; airborne</td>
<td>95</td>
</tr>
</tbody>
</table>

<sup>a</sup> C = carbamate; OC = organochlorine; OP = organophosphate; PY = synthetic pyrethroid

<sup>b</sup> a.i. = active ingredient

<sup>c</sup> Toxicity and hazard are not necessarily equivalent
Table 4a: Insecticides suitable for application as cold aerosol sprays or thermal fogs for mosquito control

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Chemical</th>
<th>Dosage of a.i.(^b) (g/ha)</th>
<th>Toxicity: (^c) oral LD(_{50}) of a.i.(^b) for rats (mg/kg of body weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cold aerosols</td>
<td>Thermal fogs(^d)</td>
</tr>
<tr>
<td>Bendiocarb</td>
<td>C</td>
<td>4-16</td>
<td>-</td>
</tr>
<tr>
<td>Bioresmethrin</td>
<td>PY</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>OP</td>
<td>10-40</td>
<td>150-200</td>
</tr>
<tr>
<td>Cyfluthrin</td>
<td>PY</td>
<td>1-2</td>
<td>2</td>
</tr>
<tr>
<td>Cypermethrin</td>
<td>PY</td>
<td>1-3</td>
<td>-</td>
</tr>
<tr>
<td>Cyphenothrin</td>
<td>PY</td>
<td>2-5</td>
<td>-</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>PY</td>
<td>0.5-1.0</td>
<td>-</td>
</tr>
<tr>
<td>Dichlorvos</td>
<td>OP</td>
<td>150</td>
<td>200-300</td>
</tr>
<tr>
<td>D-phenothrin</td>
<td>PY</td>
<td>5-10</td>
<td>-</td>
</tr>
<tr>
<td>Etofenprox</td>
<td>PY</td>
<td>10-20</td>
<td>10-20</td>
</tr>
<tr>
<td>Fenitrothion</td>
<td>OP</td>
<td>250-300</td>
<td>270-300</td>
</tr>
<tr>
<td>Lambda-cyhalothrin</td>
<td>PY</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Malathion</td>
<td>OP</td>
<td>112-693</td>
<td>500-600</td>
</tr>
<tr>
<td>Naled</td>
<td>OP</td>
<td>56-280</td>
<td>-</td>
</tr>
<tr>
<td>Permethrin</td>
<td>PY</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Pirimiphos-methyl</td>
<td>OP</td>
<td>230-330</td>
<td>180-200</td>
</tr>
<tr>
<td>Propoxur</td>
<td>C</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Resmethrin</td>
<td>PY</td>
<td>2-4</td>
<td>-</td>
</tr>
<tr>
<td>Zeta-cypermethrin</td>
<td>PY</td>
<td>1-3</td>
<td>-</td>
</tr>
</tbody>
</table>

\(^a\) C = Carbamate; OP = Organophosphate and PY = Synthetic pyrethroid

\(^b\) a.i. = active ingredient

\(^c\) Toxicity and hazard are not necessarily equivalent

\(^d\) The strength of the finished formulation when applied depends on the performance of the spraying equipment used.
Table 4b: Insecticides suitable as larvicides for mosquito control

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Chemical type</th>
<th>Dosage of a.i. (g/ha)</th>
<th>Formulation</th>
<th>Duration of effective action (weeks)</th>
<th>Toxicity: oral LD50 of a.i. (mg/kg of body weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>B. thuringiensis</em> H-14</td>
<td>MI</td>
<td>[a] 1</td>
<td>AQ, GR</td>
<td>1-2</td>
<td>&gt;30,000</td>
</tr>
<tr>
<td><em>B. sphaericus</em></td>
<td>MI</td>
<td>[f] 1</td>
<td>GR</td>
<td>1-2</td>
<td>&gt;5,000</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>OP</td>
<td>11-25</td>
<td>EC, GR, WP</td>
<td>3-17</td>
<td>135</td>
</tr>
<tr>
<td>Chlorpyrifos-methyl</td>
<td>OP</td>
<td>30-100</td>
<td>EC, WP</td>
<td>2-12</td>
<td>&gt;3000</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>PY</td>
<td>2.5-108</td>
<td>EC</td>
<td>1-3</td>
<td>135</td>
</tr>
<tr>
<td>Diflubenzuron</td>
<td>IGR</td>
<td>25-100</td>
<td>GR</td>
<td>2-6</td>
<td>&gt;4640</td>
</tr>
<tr>
<td>Etofenprox</td>
<td>PY</td>
<td>20-50</td>
<td>EC, oil</td>
<td>5-10</td>
<td>&gt;10,000</td>
</tr>
<tr>
<td>Fenitrothion</td>
<td>OP</td>
<td>100-1000</td>
<td>EC, GR</td>
<td>1-3</td>
<td>503</td>
</tr>
<tr>
<td>Fenthion</td>
<td>OP</td>
<td>22-112</td>
<td>EC, GR</td>
<td>2-4</td>
<td>586</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>-</td>
<td>h</td>
<td>soln</td>
<td>1-2</td>
<td>negligible</td>
</tr>
<tr>
<td>Malathion</td>
<td>OP</td>
<td>224-1000</td>
<td>EC, GR</td>
<td>1-2</td>
<td>2100</td>
</tr>
<tr>
<td>Methoprene</td>
<td>IGR</td>
<td>100-1000</td>
<td>Slow release suspension</td>
<td>2-6</td>
<td>34,600</td>
</tr>
<tr>
<td>Permethrin</td>
<td>PY</td>
<td>5-10</td>
<td>EC</td>
<td>5-10</td>
<td>500</td>
</tr>
<tr>
<td>Phoxim</td>
<td>OP</td>
<td>100</td>
<td>EC</td>
<td>1-6</td>
<td>1975</td>
</tr>
<tr>
<td>Pirimphos-methyl</td>
<td>OP</td>
<td>50-500</td>
<td>EC</td>
<td>1-11</td>
<td>2018</td>
</tr>
<tr>
<td>Pyriproxyfen</td>
<td>IGR</td>
<td>5-10</td>
<td>EC, GR</td>
<td>4-12</td>
<td>&gt;5000</td>
</tr>
<tr>
<td>Temephos</td>
<td>OP</td>
<td>56-112</td>
<td>EC, GR</td>
<td>2-4</td>
<td>8600</td>
</tr>
<tr>
<td>Triflumuron</td>
<td>IGR</td>
<td>40-120</td>
<td>EC,WP</td>
<td>2-12</td>
<td>&gt;5000</td>
</tr>
</tbody>
</table>

[a] Pyrethroids are not normally recommended for use as larvicides because they have a broad spectrum impact on non-target arthropods and their high potency may readily potentiate larval selection for pyrethroid resistance.

[b] IGR = insect growth regulator; MI = microbial insecticide; OP = organophosphate; PY = synthetic pyrethroid

c a.i. = active ingredient

d AQ = aqueous; EC = emulsifiable concentrate; GR = granules; soln = solution; WP = Wettable powder

e Toxicity and hazard are not necessarily equivalent

[f] Dosage according to the formulation used.

g The lowest levels are recommended for fish-bearing waters.

[h] Apply at 142-190 l/ha, or 19-47 l/ha if a spreading agent is added.

Please read carefully the next Unit of this module before commencing the session to which it relates.