PLANNING MALARIA CONTROL PROGRAMMES

Part I: Learner's Guide

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Preface

Malaria, today, is by far the most widespread tropical parasitic disease, threatening at least four out of every ten persons in the world. It is a killing disease particularly in tropical Africa where 90% of the world’s cases and deaths occur.

In endemic countries this disease must be brought under control because it undermines the general health and welfare of families, debilitating the population and straining the countries’ and people’s economic resources. In each country the national health services must be suitably primed to be able to manage malaria as a priority health problem, communities must be suitably supported to be able to take preventive action and systems need to be put in place that rapidly refer patients when needed, that monitor drug efficacy, that recognize promptly unusual epidemiological trends, that manage epidemics and that keep health workers up to date and on their toes.

During the 1990s the World Health Organization developed a Global Strategy for Malaria Control which was adopted in 1992 by the Ministerial Conference on Malaria, held in Amsterdam. Subsequently it was endorsed by the World Health Assembly (1993) and the United Nations General Assembly (1994). The Heads of State and Government of the Organisation of African Unity, composed of 53 countries, fully supported the Global Strategy and in 1997 issued the Harare Declaration on Malaria Prevention and Control in the Context of African Economic Recovery and Development.

The Global Strategy has four key elements:

- Early diagnosis and prompt treatment
- Planning and implementation of sustainable preventive measures and vector control
- Early detection, containment and prevention of epidemics
- Strengthening local capacities in basic and applied research to permit and promote the regular assessment of country’s malaria situation, in particular the ecological, social and economic determinants of the disease.

These basic elements form the fibre of any control programme. However to be effective, control programmes must be well planned based upon a good knowledge of
the situation. The approaches to be implemented must be tailored accordingly. It is for this purpose that this module has been developed. The principles embodied herewith will permit the development of meaningful programmes in any situation, which are flexible enough to take account of epidemiological variability and the availability of resources.

This training module may serve as a practical guide to planning and replanning a malaria control programme in any given situation. It is designed for health professionals and health care planners at national level who are responsible for planning, implementing, evaluating and replanning national control programmes in endemic countries. It is also useful for international partners faced with the challenge of assisting countries to establish or re-establish control programmes. Although this module centres around malaria, many of the principles of planning can be applied for the control of other parasitic diseases, especially vector-borne parasitic diseases.

The module consists of Part I, a Learner’s Guide, and Part II, a Tutor’s Guide. The learning units in the Learner’s Guide follow a suggested sequence of thought processes for logical planning. This may be difficult to follow and may need time to fully understand the process. Once the learner has had the opportunity to carry out, step by step planning in this way, at the end of the whole exercise the learner will invariably realize its value and potential applications.

Part II, the Tutor’s Guide, provides guidance to the tutors in planning the training activity ahead of time, making the necessary preparations for each unit, preparing the evaluation instruments, preparing the field work, and in the actual approach to training unit by unit. Planning can be very complex and difficult for learners to grasp especially if they are not used to thinking logically and do not have an eye for detail. The tutors therefore must not only facilitate learning but must also encourage the development of what might be for some, a new way of thinking. The easiest way to accomplish this is for each learner to work through a set of data as an exercise and to produce at the end, a control plan. At each step of the way, participants should be invited to share their work with others to generate discussion amongst themselves. This is most valuable for the tutors as well because areas of misunderstanding will become apparent and can be corrected. This is, however, time consuming and sufficient time must be allowed in the programme.
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There are many ways to plan using the methodology proposed in this module, which is based on many years of experience, and which has two basic premises. The first is that the planner is planning with the resources that are available, or can be mobilized. Thus the plan should result in a better use of existing resources. The second is that the planner is planning with the available information and data and is not expending time or money to collect new data. During the planning process described herein, gaps in information will become apparent and these should become part of the new data to be collected in the future by the information system which is an important element of the plan.

This module is thus devoted to the development of national programme plans for programme direction and which form the basis for seeking authorization for allocation of the available resources and for accountability. That is to say, the end product of the planning process is an authentic plan for the control of malaria throughout a whole country. The same process can however be applied to a state or province if the country is very large. Planning requires multidisciplinary team work carried out over a period of two to three months. Sectors outside health must be involved as malaria is not strictly a health problem but a social, economic and development issue.

The implementation process for the national plan once approved and funded will begin with microplanning for the development of implementation plans at the various administrative levels. Such plans cover an administrative area and are in much more detail including techniques and methods to be used. Unit 16 provides some guidelines on developing an implementation plan, but this is not the main purpose of this module.
Acknowledgements

The technical content and style of this training module was prepared by Dr P. F. Beales. It is based on a published article\(^1\) which has been further developed over the past 15 years whilst teaching the subject to health professionals in international training courses, many of whom were programme managers. In addition elements have been included from “A guide to planning malaria control programmes in Africa” which the author developed with Dr A. Schapira in 1994. Both the learner’s and tutor’s notes have been gradually modified over the years according to feedback from many of the participants. The author wishes to thank all the past students for their valuable contribution from which future generations will benefit.

Specific contributions from verbal discussions and in writing have been made by Dr Awash Teklehaimanot, Dr Elil Renganathan, Dr F. Rio and Dr C. Delacollette.

This is a trial edition intended to be used in practice for one or two years before final production. Comments and suggestions resulting from experience in using these materials would be most welcome and should be addressed to Human Resources Development, Division of Control of Tropical Diseases, World Health Organization, 1211 Geneva 27, Switzerland.

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Introduction

This Learner's Guide, Part I of the module on Planning Malaria Control Programmes, contains information and guidance on the planning process based on planning by objectives. It is highly recommended that you have with you a complete set of data pertaining to a malaria-endemic country or area of the country (a large state or province) that you know well and that you work with this data following the module, step by step. This will greatly facilitate your understanding of the planning process. At the end you will have developed, as an exercise, a malaria control programme plan.

Planning is a process and planning a control programme in reality will require a multidisciplinary team to be occupied for about three months. Thus one person carrying out a planning exercise with a set of data will not be able to produce a viable plan, but can learn a great deal from the exercise, and reinforce his or her understanding of the process. It remains however, only an exercise, even though the data set may be real, comprehensive and accurate.

Training based on this module is designed for health professionals who have, or will have in the future, some responsibilities for programme planning and implementation.
Objectives

At the end of a training programme based on this learning module you should have acquired the knowledge, skills, competence and confidence to:

- apply the basic principles of planning in order to develop a national programme, or modify the existing programme, to better control malaria;
- write a succinct and clear plan for malaria control;
- conduct a situation analysis in the field, analyse the data and draw conclusions pertinent to planning a control programme;
- stratify the area according to the disease problem and the means to control it based on the situation analysis data and using geographical information systems as an effective tool;
- formulate disease reduction objectives, select control measures appropriate to the local situation and design approaches to achieve the objectives set;
- identify activities and set operational targets;
- calculate costs and develop a budget;
- define evaluation methods and identify monitoring indicators;
- apply the basic principles to the development of an implementation plan.

How this subject will be taught

This subject is somewhat complex; to some it is easy to grasp, for others it may be more difficult. To make sure all can learn at the same pace the subject will be taught in such a way that you will learn not only from the tutor but also from each other in the class. You will therefore be expected to actively participate from the beginning, being given the opportunity as you work through the units, to put into practice, individually or collectively, what you have learnt.

The tutor and facilitators

The tutor has extensive experience in malaria control and in programme planning and management and will be able to give you guidance over a wide range of problems you may encounter understanding the planning process. The facilitators who work closely
with the tutor will be able to spend more time with you helping you to understand the subject better (facilitate your learning).

**Presentations**

Formal presentations by the tutor, previously referred to as “lectures” will be kept to a minimum and will take the form of sharing with you principles and basic knowledge as well as experience. However, you and other participants will be asked frequently to present your work in plenary session. This will give you experience in how to make a presentation and will enable you to learn from the observations and suggestions made by colleagues as well as by the tutor and facilitators.

**Demonstrations**

Demonstrations will be made of techniques and methods to be used in the planning process.

**Practical sessions**

There will be numerous practical sessions during the course of learning this subject, where you will have the opportunity to develop a malaria control plan, step by step, using data that you have been asked to bring with you. It would be very simple to provide you with a set of data, but it would not be as meaningful as real data from your own country or area to which you can relate.

**Small group discussions**

These will be frequently held during actual presentations by the tutor and as separate exercises after or before a formal presentation. This will enable free discussions amongst your colleagues, an open sharing of ideas, opinions and experience and the drawing of conclusions from discussions in plenary. You should take full advantage of these sessions as they can be most helpful and rewarding. Each time your working group meets, you should change the moderator and rapporteur so that each of you gains experience in managing these tasks, and to prevent any one
person from dominating the group. If you take these sessions seriously and attend full
time and actively, it will greatly facilitate your learning of this subject.

Field work

One of the objectives of this training is to provide you with the opportunity to
develop skills and competence in planning antimalaria action within the health
services. An essential basis for planning is a situation analysis and ideally this can
best be learnt by a field exercise in a health district (5 to 10 days) working in a small
team. You will be asked to assess the problem of malaria in a health service district
and prepare a situation analysis relative to the general health status.

Working as a small team in the field is both interesting and demanding for
both learner and tutor. It will be useful and helpful in many different ways, including:
helping you to become actively involved in a task (e.g. compiling data and writing a
situation analysis); developing skills in teamwork and applying knowledge to the
solution of problems. It will be your opportunity to apply your knowledge and skills
to the solution of a real life problem. Advantage should be taken whilst in the field to
go one step further in the planning process and already prepare a preliminary
stratification of the area based on your observations and information gathered.

Because time is limited and this is an exercise, a lot of preparatory work will
have been done before you arrive in the district. Each group will be provided with a
minimum set of basic general information. It will be the work of the team to identify
the detailed information needed to analyse the situation in the entire district and to ask
for this information. Data not requested will not be provided.

For this exercise, information will only be provided to the team if the
following criteria are satisfied:
a) the team is very specific about the additional information required;
b) the team states the reasons why the information is needed; and

c) the team is able to identify how the information will be used when it is provided.

Each group is expected to verify, to the extent possible, the information
provided and to be aware of limitations with respect to its interpretation. This may be
accomplished by analysing in detail a sample or by collecting information in the field
or by asking questions of the health services and malaria programme personnel. In
vivo drug sensitivity tests, insecticide susceptibility tests, malarriometric surveys and other techniques can be employed by the team. Because time is limited, the team should map out a detailed timetable of activities as soon as the members arrive in the area, and get started as soon after the briefing as is possible.

You will learn not only how to carry out a situation analysis in practice but also how to work together as a team, delegating responsibilities, accepting responsibility, meeting deadlines and making collective decisions.

Evaluation

Evaluation is a very important part of training because it helps the tutor to make the best use of the limited time available and helps you to measure your own progress and identify weak areas that you can remedy. Thus the evaluation process must be taken seriously and you should do your best to comply with the requirements and respect the conditions under which the evaluation must be carried out if it is to be valid.

Evaluation of the learners

Your progress and achievement will be evaluated by the tutor, the facilitators and yourself. This will be done in the classroom as well as by quizzes and examinations.

In situations where there may be a language difference between the mother tongue of the trainees and the training materials and the teaching, then multiple-choice type examinations are to be preferred. In such examinations you are provided with a problem situation and then asked a series of questions, to which several (usually five) answers are prepared. You have to select the correct answer(s). In the simplest of these you may be told that only one or two are correct, thus you have to choose one or two from say five possible answers. However, with this type of choice even without knowing the subject it is possible by chance, to have 20% correct. Thus a more advanced approach is not to tell you how many are correct and you have to decide, based upon your knowledge, skills and competence in the subject. In such a situation, because you could achieve 100% by marking them all as correct, it is necessary to
introduce negative marking. That means you gain marks for the correct answer, but you also lose marks for an incorrect answer.

Another reason for using multiple choice type questions is to standardize the marking, which is not so easy if essay type questions are used.

Another element of the evaluation of the learner is by judging your classroom activity, especially the way in which you present your work in plenary, the degree of clarity, how well organized you are, your technique of presenting information, how well you answer questions posed, and so forth.

**Evaluation of the training by the learner**

By means of a questionnaire and a plenary feedback and discussion session after the completed questionnaires have been analysed, the entire training activity, including the competence of the tutors and facilitators will be evaluated by you, the learner. This is most valuable not only for evaluating the training activity but for planning similar activities in the future. Thus future learners will have the chance to benefit from your experience.

The questionnaire is completed anonymously, and nobody should feel at all threatened by this process. The objective of the plenary session is not to defend anybody’s position, but to verify whether an issue raised by one or two persons has the consensus of the whole group, and to be able to better judge how important the issue might be.

In the same questionnaire you will be given the opportunity to make recommendations on how to improve the teaching and learning of this subject.

**Evaluation of the training materials**

If you are using the trial edition of these materials then invariably you will be given a questionnaire to complete, asking you specific questions, and inviting you to make constructive suggestions on how to improve this learning module.

Unfortunately the questionnaire will be rather long. It will be easier if you spend 15 minutes at the end of each day completing the questionnaire for that part of the Learner’s Guide dealt with during the course of the day. If you leave it until the end
of the course you will never remember what you did on the first day and the
questionnaire will take you many hours to complete properly.

Please take this seriously as your input will greatly improve these learning
materials for learners who will follow you.

If you are using a final published version of this module then your
observations and comments are equally valid and welcome. In that case, please write
to the head of the Division of Control of Tropical Diseases at WHO, Headquarters,
Geneva, with your constructive suggestions.

What you need for the practical exercises

One of the main aims of this training is to enable you to develop the skills and
competence necessary to plan antimalaria action in an endemic country. In this
respect, therefore, an integral part of your training will be to develop a malaria control
plan for your country, or the country you work in, or a part of it, and to present it to
your fellow participants and to the tutors and facilitators in the last days of the
training. To accomplish this you must have brought with you as much background
information as possible about the country you propose to work in after the course.
This information should include essential elements from the following listed headings
preferably for the past three years:

- **demographic data**: for example, population by age group, literacy rate, ethnic
groups, religion, income, migratory groups or "at risk" populations, political and
social problems, if any, map of country showing main roads and other
transportation networks and topographical features, agricultural areas, development
projects, location of health facilities, meteorological data (for the last three years)
including rainfall, humidity and wind velocity by month;

- **vital statistics**: for example, birth rate, crude mortality rate, infant mortality rate,
  maternal mortality rate;

- **health situation**: for example, the ten most important diseases, including cases,
  incidence, prevalence, mortality, and death rates.

- **national health strategies**;

- **health service resources available**: at the central, intermediate and peripheral
  levels (number of hospitals, health offices, clinics, health personnel);
- primary health care system and community involvement;
- health information and evaluation system;
- information, education and communication (IEC) activities over the past three years;
- training facilities for the health sector;
- procurement and distribution of drugs;
- intersectoral action for health;
- the malaria problem: for example, malaria cases by type of parasite species over the past three years, presence of drug resistance, its location and degree of severity, summary of malaria surveillance in the country, present malaria control plan of action, and current antimalaria activities in the country including responsibility for diagnosis and treatment;
- malaria vector species and their distribution: including vector densities and bionomics and vector susceptibility status, if known;
- information on budget: for malaria-specific activities, national health budget and international and bilateral assistance.

Use of this Learner's Guide

This Learner's Guide is designed to help you achieve the objectives stated earlier. The guide is divided into chapters called Learning Units. Each learning unit has its own learning objectives which you personally should strive to accomplish. Usually the learning units will be used in sequence as they follow a logical process and are all interdependent. That is, you will need to have learnt the previous unit to be able to understand the subsequent unit(s).

However, based on the results of the pre-tests, the tutor may decide that you all know the subject matter very well and may omit a whole unit, or parts of a unit accordingly. Similarly, if a unit is deemed not be relevant to your work then it may be omitted from the formal training. If this should occur, then you are advised to go through the unit in your own time to refresh your memory or give you an insight of the contents.
Learning Unit 1

Introduction to planning and basic principles of planning malaria control

Learning objectives:

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

- state what planning is and is not, and why we should plan
- describe the planning process
- identify characteristics of the planning environment and take these into account when planning

Malaria control

Today, countries are faced with the difficult task of trying to control malaria in the face of severe financial limitations, high costs of commodities and labour, shortages of well trained and experienced staff, and in some areas poor response of the malaria parasites to antimalarial drugs and even resistance of the vectors to common pesticides. Thus control programmes, not limited in time, have had to be developed within the primary health care system and brought in line with the other public health problems.

Such programes have to be implemented with the resources that are available taking into account the local epidemiological situation and the socioeconomic development plans of the country and ensuring that gains achieved can be sustained in the long term. In such circumstances malaria must be approached in terms of a disease problem and not as a parasitic infection, which is the fundamental difference between a control and an eradication strategy. This undoubtedly means the continuing
presence of infection in the community, maintained by mosquito transmission, but kept to a minimum level by the maximum possible effective utilization of the available resources and technology. To achieve this, very careful pragmatic planning, and replanning are essential, the approach to which may vary depending upon whether an antimalarial programme is being implemented for the first time or whether an eradication programme is being reoriented to malaria control.

**Understanding planning**

**What planning is**

Planning is a logical process for determining what can be done and where, to reduce a disease problem and how this can be done best within the resources that are available or that can be made available. A plan is a statement of future activities (process) and a forecast of the effects these will have on the present situation.

Planning involves choice, analyzing problems, examining solutions, setting priorities, making decisions; and then developing approaches for allocating resources and organizing them into programmes for effective and efficient delivery. Planning calls for setting objectives and developing the means for measuring progress towards those objectives.

In an environment of scarcity, such as is found in many developing countries, the planning takes on all the more importance in order to get as much accomplished with what little there is in the way of staff, supplies, equipment, drugs and vaccines, transport and funds.

**What planning is not**

By initiating a planning process you can make a difference between what would normally happen if no planning took place, “business as usual”, and what can happen if through planning resources are allocated and efforts concentrated towards achieving future goals. Planning therefore:

- is not just selecting activities
- is not just forecasting what might happen
- is not just a statement of what is desirable
- is not just allocation and reallocation of resources
Why plan?

You may have heard it said that “planning does not really directly result in getting anything done”. “It takes time and energy; time and energy which could be spent in carrying out programmes and serving people”. “So why should we plan?”

There is a certain amount of truth in this and if planning is not done properly it can result in a shameful waste of scarce resources. But the answer to that question is that without some form of planning we run a risk of being busy without really getting anywhere in terms of reaching well considered objectives. Focusing on means often causes us to lose sight of the ends. When this happens, we may fall into the “activity trap” where we become so obsessed with the activity, that may have been going on for many years, that we lose ourselves in the activity itself and cannot imagine that the time, effort and resources could be usefully used for anything else.

As we fall deeper into the trap, the true objective moves away from us; it eludes us; but the activity persists and becomes a false objective. This false objective then becomes a criterion for making decisions, and our daily decision making is in terms of perpetuating the activity rather than in choosing wisely among our resources and setting priorities for objective achievement.

Hence the need for planning - for knowing where we are going and why; to make sure we are not chasing false objectives and “spinning our wheels” in an endless flurry of activity with a good likelihood of doing unnecessary and outmoded things right, rather than much needed, relevant things right.

In summary and by way of emphasis

Planning is a systematic and continuous process for allocating resources to achieve future objectives. It is a way to define why, how, when, where and by whom these objectives can be achieved.

Specifically, in health planning we are concerned with extending coverage and improving the effectiveness and efficiency of health care services. An integral part of this approach is inter-sectoral collaboration for programmes that will impact the total health environment.
The planning process

The aim of disease control is to reduce the impact of the disease on the health of the population to the lowest possible level that can be achieved within the available financial and human resources in the context of other health priorities, and according to existing technology and feasibility.

The intensity of the required disease control efforts will depend upon the magnitude of the disease problem and the objectives being pursued and may vary from one situation to another. The required action will take the form of a coordinated set of activities with targets and dates for their achievement designed to achieve well defined objectives. These objectives should be regarded as intermediate steps towards the achievement of the ultimate goal. The objectives and approaches\(^1\) decided upon will determine the form and the content of the national antimalaria action which implies the expenditure of valuable resources. It is difficult to establish meaningful objectives because of the complexity and uncertainty surrounding many of the factors that must be taken into account.

Defining the objectives, formulating approaches, and setting operational targets are closely interrelated and are best considered in a practical sequence. Setting the goal, priorities and deciding upon, and supporting, control approaches is primarily a political decision (political will). The planning process enables a logical approach to be taken to determine the appropriate combination of measures to use for control circumstances, and where and when to use them, based upon an assessment of the local situation and the technical, operational and economic feasibility. It is suggested that the planning process should consist of a situation analysis, stratification of the problem and resources, selection of antimalaria measures, formulation of objectives and approaches to achieving these objectives, critical analysis of existing malaria control problems, establishment of the operational outputs and targets, programme budgeting, and the selection and definition of evaluation methods.

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\(^1\) The term approach is used here in place of strategy, which is a military term implying a campaign. Approach is used in the sense of pursuing a particular pathway as a means of achieving the required objective.
The planning environment

There are certain characteristics of the planning environment which should be recognized and taken fully into account. They include:

Scarcity of resources

As noted earlier, health planners must work in an environment of scarcity, or at best inadequacy. Resources of all kinds may be in short supply: staff, staff accommodation, materials and supplies, facilities and equipment, drugs and vaccines, petrol, transport and communications, and so forth.

Organizing and managing health data

Another aspect of the planning / management environment is the problem of organizing and managing health data. There is no lack of data, but rather the problem is in its collection and organisation into a usable form. Also in some countries, much data is collected which is not used at all. Some of it could be eliminated; and other data should be used closer to the source of collection for monitoring, evaluation and control at lower levels in the health system (e.g. at health centres, medical field unit, mobile clinics).

This calls for intuition and creativity in approaching problems. The health planner and manager must use judgement and make educated guesses based on their experience and understanding of the local conditions. Furthermore, simple techniques should be used for sample surveys and field observation to set baseline data; and easily measured indicators to monitor, evaluate, and control health programmes should be developed and applied.

The health planner should be a good observer; know what to look for and how to evaluate information reaching the senses as he or she conducts field inspections, visits clinics, and walks through the market place and villages.

Uncertainties of planning

In countries where many aspects of life are uncertain, there persists an understandable lack of a sense of need for planning. The cynic may ask:

- Why plan when it is impossible to get timely delivery of much needed supplies?
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- Why plan when the top decision makers overturn our recommendations with *ad hoc* politically based decisions?
- Why plan when we cannot ensure we will get the needed staff?
- Why plan when we cannot rely on the timely delivery of drugs and vaccines?
- Why plan when it will be impossible to secure the transport needed to carry out the work, conduct surveys and supervise the activities?

These are hard questions to answer. But they reflect the realities of life. Perhaps the only answer is that when we are faced with such uncertainties, it becomes all the more important to plan, and to know in advance what our alternatives can be. That is, to build flexibility into our actions and be prepared for whatever may come.

Regarding those political decisions continually overriding the planning process - a well done plan based on sound policy and scientific evidence is the best defence against *ad hoc* political action.

Resistance to planning

Although we have indicated that planning can be very useful in getting things done more efficiently, effectively, and at least cost, people who do not understand the process may feel threatened by it and resist it. This is due to at least two reasons.

First, whenever we plan we affect the outcome of decisions about how to use resources - money, staff, equipment and facilities. The planning team then may have considerable influence over what is done and what is not done, and how. When something that was previously unplanned becomes planned, influence over the decisions in the organisation may be shifted, and this can be threatening.

The second reason for resistance is that the planning process may be seen as too complicated and too difficult, something which it need not be.

Planning a programme can take place at any level of a system. Usually, however, the general policies and guidelines of a health system are laid down at the ministerial level. The role of the upper level is to interpret policies, and plan the programme; the role of the middle level is to plan the implementation and oversee its realization at the local level.
During the daily round of work, planning takes place continually. Planning methods can be applied to a large programme, such as a national malaria programme, or to a small one such as health education in a village.

Determining health priorities

The successful approval and implementation of a malaria control programme is dependent upon sustained political will and support. In many endemic countries around the world, especially in Africa, malaria is a priority health problem. There are several factors which determine a disease as a health priority requiring special attention or more attention than other health problems. The most important of these factors are:

- the population groups most at risk or affected by the disease are children, pregnant women, rural populations, low-income populations and workers
- the disease impedes social and economic recovery and development
- the disease is of major concern to the population
- the disease causes death, directly or indirectly
- the disease causes complications and disability
- the disease causes personal and family expense
- the disease causes public expense
- there is a risk of epidemic disasters
- the incidence of the disease is worsening
- the disease aggravates other problems
- it receives political attention globally, nationally or locally

Think of malaria in your country or place of work and apply the above criteria to it and decide for yourself whether malaria is a priority problem requiring urgent attention.

Establishing the planning period

A plan must have a well defined time frame for starting and finishing, within which time objectives must have been achieved and an impact made on the disease problem. The planning team needs to know what this time frame is right from the outset. How then can we decide on what this period should be?
To ascertain this you should review the government policies found in official government documents such as the national development plan for health and internal policies of the Ministry of Health. Since you are not planning in a vacuum and your programme is part of the overall national health programme, then the planning period should normally conform to the period of the national health plan.

However, the planned period must be realistic and sufficiently long to allow some impact and achievement of objectives. This is normally four or five years. However, if you are planning for the first time, then you may have to develop a plan for a shorter period to take you up to the beginning of the next national health plan period or national development plan period.

The programme pyramid

In Figure 1 the steps that need to be taken to develop and implement a programme designed to achieve well defined objectives are depicted as a pyramid to facilitate learning. Like any pyramid it stands on a broad solid base, which in our case are the basic health and development policies of our countries. The planning process described above to develop a malaria control plan for national approval is built on this policy base and is part of the national health plan. The various stages of the planning process are depicted in the pyramid.

Once the national malaria control plan has been approved, including the objectives to be attained and the approaches to be taken, then implementation plans have to be developed for the lowest managerial element of the system. Once implementation plans have been developed in great detail, including the methods to be used, then these can be followed by health workers when carrying out their responsibilities. With appropriate supervision, monitoring and evaluation, the final outcomes can be measured and the extent to which the objectives have been achieved can be determined. By this process you will know if and when you have arrived at the desired degree of reduction to the disease problem.

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

You will have already been assigned to a small discussion group. As a group consider the following problem and come to a consensus on what you consider to be the most appropriate answers to the questions. You will be given 20 minutes for this exercise and then in a ten-minute plenary session one of you will have to present your results and explain why you came to that conclusion. This an exercise in logic and tests to some extent your field experience.

**The problem**

The national newspapers have reported an outbreak of malaria in a province of a tropical country which has had an antimalaria programme for many years. The main approach has been residual house spraying and case detection and treatment activities. You are the responsible health officer in that particular province and you have been asked by your central government to evaluate the situation, and to make appropriate recommendations that would permit the necessary corrective measures to be taken.

To enable you to do this you will have to make decisions as to what action to take and in which sequence. With this in mind please answer the following questions:

**Question 1**

Which **two** of the following actions would you take first?

(i) visit the area of focal malaria
(ii) visit the local health or malaria programme officer
(iii) examine all communicable disease reports from health facilities in the area
(iv) hire a consultant to evaluate the situation
(v) analyse all available malaria statistical data for this area covering the last three to five years

**Question 2**

Which **two** of the following actions would you take next?

(i) make appropriate recommendations to the basic health services
(ii) contact the meteorological station to determine the climatic conditions in the area and any recent changes
(iii) visit the area
(iv) collect information on the geography and human ecology of the area, noting any major recent changes
(v) prepare new reporting forms

**Question 3**

Assuming limited resources, which **two** of the following do you think should now be determined?

(i) the annual blood examination rate
(ii) the location of villages with a malaria problem and the amount of malaria in each
(iii) reported mortality in the province as it pertains to malaria during the last few months up to date
(iv) the number of health centres serving the population
(v) the age distribution of cases during the past three to five years

**Question 4**

Which **two** important items of information would you now require to know and for which investigations will have to be arranged?

(i) the infant mortality rate
(ii) a comprehensive analysis of the malaria situation, transmission pattern and place of transmission in each village
(iii) the number of primary health care workers operating in the area
(iv) the vector bionomics and specific prevalence rates in the area
(v) the pattern of population movements

**Question 5**

Which **two** of the following investigations would you carry out now?

(i) the presence of abnormal haemoglobins in the population
(ii) the susceptibility of the vectors to insecticides
(iii) the cholinesterase levels in the spraymen and the community
(iv) the animal to human population ratios
(v) the sensitivity of the malaria parasites to antimalarial drugs
Figure 1: TO KNOW IF AND WHEN WE HAVE ARRIVED!
Learning Unit 2

Writing the plan

Learning objectives:

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

- describe the structure of a plan for malaria control
- organize the information you have available into a realistic plan
- write a comprehensive plan for malaria control

Introduction

Whereas this entire module is concerned with the planning process, this particular Unit is designed to familiarize you with the components of a plan and to help you present the outcome of the planning process in a format that is easy to read and understand. Thus this Unit will not teach you the planning process but it will guide you in organizing the information and output for the planning exercise and in writing it up into a presentable document.

There are many ways in which your plan could be presented, and in the following pages one suggested outline is proposed for you to adapt as necessary and if appropriate. For instance all the fields probably cannot be completed and some may not even be relevant to the circumstances prevailing in your geographic location.

Another point to make is that the sequence of writing up the plan does not necessarily follow the same sequence, or thinking, as the planning process itself. So please do not confuse or equate the structure of the written plan with the planning process itself. Also in writing up your plan you should be guided by the requirements of your government as to the suitability of the format. You should be careful though not to follow the format of any one development agency, as each agency has its own
format and interests. The format being proposed here is comprehensive and the sequence is logical. The information contained therein can always be extrapolated to complete the formats that may be required of a development agency for funding purposes. If, however, you follow the format for one agency your plan may not contain all the information required of another. Remember also that the prime use of the document describing your plan is to secure national approval and allocation of resources to enable implementation plans to be developed at the mid-management level.

Suggested outline

This outline has thirteen major sections, some of which are obvious and self-explanatory. Others require some explanation. Think about each element carefully and if you are not certain that you understand it please consult your tutor or one of the facilitators.

Introduction

- importance of malaria as a public health problem in the country
- importance of malaria as a socioeconomic problem in the country
- place of malaria in the National Health Programme
- brief description of present antimalaria programme and how it relates to other programmes
- planning period and reason for selecting this period.

Situation analysis

Country profile

- demographic data in total and by sub-areas (capital, other urban, rural - area in square metres, population and density, sex ratio, growth rate, general demographic rates)
- geographical features emphasizing major characteristics of the area covered by the plan including forested, desert and coastal areas
- meteorological data (past three years) such as rainfall, rainy days, temperature
- economic development - macro-economic indicators (GDP), subsistence agriculture and environment and development
- social and cultural aspects including education, literacy, housing and sleeping habits

The health care system

*Health Care Providers*
- government
- households
- private sector (profit)
- private sector (non-profit)
- traditional medicine

*Health services*
For public, private and community-based information on:
- organization
- human resources
- facilities and their distribution
- supervisory system
- accessibility and coverage
- drug supplies and pharmacies
- general supplies system
- training and education infrastructure

*Other health programmes*
- vector-borne disease control
- programmes targeting the sick child
- maternal health
- child health
- laboratory services
- TB
- Health Information Systems (HIS)
- Health education
**Intersectoral links**
- environment
- media and education
- Universities and research institutions

**The malaria problem**

*History of the malaria problem*
- epidemiological picture before services and drugs
- past epidemics
- special risks that might reappear
- changing trends

*Past and current malaria control activities*
- policy and legislation
- status of the programme and current control activities
- human resources
- buildings, equipment and supplies
- budget
- major control activities in the past and the results
- current organizational chart and responsibilities
- past significant field research activities and the outcome of current field research activities

*Current malaria problem*
- spatial and temporal distribution of malaria including recent epidemics
- drug resistance and efficacy
- distribution, ecology, bionomics and susceptibility of vectors
- identification of major epidemiological types
- basic epidemiological data showing regional and seasonal differences, distribution by age, sex, occupation, social status
- intensity and status of malaria
- estimation of burden of disease
• outstanding problems and major constraints
• priority groups

Conclusions

Priority
• the place of malaria among other priority health problems
• important trends in parasite resistance, incidence of severe disease and childhood anaemia

Opportunities for malaria control
• intersectoral links
• intrasectoral links
• renewed political commitment
• technological development
• availability of funding
• revitalization of health services
• economic development projects
• opportunities for changes, especially in the context of primary health care
• need for a new or revised plan of action

Stratification
• identification of epidemiological (including entomological), geographical, operational and socioeconomic and other major factors responsible for peculiarities of the malaria problem
• a stratification of the malaria problem based upon the above identified factors after analysis and collation with due consideration to geographical distribution and socioeconomic characteristics
• identification of easily identifiable markers of major distinguishing characteristics of one area from another
• demarcation of the boundaries of each strata in which distinct control (and evaluation) approaches may be applied
• identification of additional data required to be able to refine and up-date stratification for improved programme implementation

National goals
• national economic and development goals, objectives and targets and geographical areas to which they pertain
• national health goals, objectives and targets
• government health policies

Objectives
• existing national country-wide malaria control objectives (if any)
• proposed malaria control objectives by stratum (quantified in space and time)
• statement of relationship between the above existing and proposed objectives (if any) and which will be modified or replaced, and why

Approaches
• summary statement of the approaches to be adopted (detailed components) by stratum and for each of the proposed new objectives stated above
• list of activities to be implemented (compiled from the approaches to be adopted)

Research needs
• major knowledge and information gaps (applied research needs) identified from the problem analysis
• applied research projects being proposed in the plan

Operational targets
• tabulation of the operational outputs for each approach
• operational targets (quantification) necessary to achieve each objective
• time frame for achieving targets
Operational milestones

Plans for new services or expansion of existing services

- additional services (such as diagnostic, treatment)
- additional staffing
- additional facilities such as laboratories, stores, office space

Specify the time schedule for their introduction and implementation and note the geographical distribution

Training of staff

- basic training
- upgrading of staff by refresher training and distance learning
- time schedule of courses to be given

Organization and responsibilities

Results of a study of the current organizational charts and responsibility of:

- the malaria services
- the health services (malaria related activities)
- intersectoral antimalarial action
- community services
- private sector (in relation to malaria)

For each of these describe your proposed:

a) organization of systems and services
b) distribution of responsibilities by primary health care level
c) coordination mechanisms

Evaluation plan

Parameters and indicates

Short-term evaluation

a) operational
b) epidemiological
c) others
Long-term evaluation

a) socioeconomic
b) health impacts
c) others

Information system

- data and information to be reported
- levels of reporting, by whom and to whom
- frequency of reporting
- type of evaluation and level of responsibility
- analysis of information, level of responsibility and degree of authority
- decision-making mechanism based on an analysis and interpretation of information

Supervision

- supervisory mechanisms by activity, level and by system (e.g. specialized services, general health services, community)
- periodicity

Resource requirements

These must be quantified but not necessarily in monetary terms and should be reflected in the costing and budget item, below.

- facilities such as new clinics, insectarium
- personnel
- fixed equipment
- supplies and expendable equipment
- maintenance requirements
- training requirements
- fellowship requirements

Costing and budgeting

- salaries and allowances
- expenses for organizational activities
- supplies and equipment
- training costs
- miscellaneous expenses
Where possible use charts, tables, maps and graphs. These can be in the text or as annexes. Remember that decision makers have little time to read large documents. A one page executive summary will be essential for the ministerial levels but by putting as much data and information into annexes the body of the plan can be kept to a minimum. Write clearly and to the point, and do not forget to state clearly the effective period of the plan, (allowing at least one year for it to be approved) and the date the plan was formulated, the names and designation of the planning team members.

After you have costed the approaches and activities go back and review the objectives and targets to see if they are realistically achievable within the available resources. If not then adjust them accordingly. You may find it easier to develop a large table showing the strata, features and problems, objectives, approaches, activities, targets, cost of each target and indicators for evaluation of programme efficiency and effectiveness. This will greatly assist you to review the entire plan.

Remember when drawing graphs that photocopies are in black and white and ask yourself if the different lines or columns in the graph can be easily distinguished in black and white.

When putting the plan together ensure that the margins are wide enough to allow binding recto-verso. Tables graphs and charts in landscape (horizontal) format should be inserted in the document with the top closest to the binding. Therefore leave ample room at the top for binding. Make sure that all pages are numbered as they may become out of order whilst photocopying. All figures (drawings, tables, maps and graphs) should be well labelled, numbered and referred to in the text.

Please read carefully the next Unit of this module before commencing the session to which it relates.
Learning Unit 3

Situation analysis

Learning objectives:

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

- analyze the malaria situation in an area
- write in a logical manner part of the plan for malaria control relating to analysis of the malaria situation

Introduction

The situation analysis forms the basis for planning any disease control programme, but in the case of malaria, it is particularly crucial because of the complexity of this disease and its impact on the populations. This is the first step in our planning process (see the pyramid in Learning Unit 1). The following sections describe the contents and process of analyzing the malaria problem and the means for its control.

Country profile

Demography

The description should normally include:

- area of the country, total population and population density
- the administrative divisions of the country
- distribution of the population between the capital, other urban areas, and rural areas
- female/male ratio, crude birth rate, general fertility rate, death rate, growth rate, infant mortality rate and juvenile mortality rate; (the juvenile death rate is the death rate in children aged 12-59 months)

These data are available for all countries in the world, and are found in publications and reports prepared by ministries, government offices and international organizations. Unfortunately, the validity of these indicators is often low. They should be assessed critically, and the consistency between them should be checked.
The age distribution of the population may be broken down as follows: 0-11 months, 12-59 months, 5-14 years, 15-44 years, 45 years and older. In the absence of information on the age distribution, standard data will be sufficiently accurate in most cases.

An attempt should be made to determine the trends. Is the population’s grown rate increasing or decreasing? Is a family planning policy implemented? Is it successful? Are there any important internal or cross-border migration? What is the net growth rate of the cities? What is the government’s policy in relation to increasing urbanization?

Already at this stage, it may be opportune to characterize populations which should perhaps be the object of special attention by the Malaria Control Programme.

Geography and climate

A brief description of the country’s geography should allow an understanding of:

- the presence of areas which may not be malarious, or which are likely to have unstable malaria.
- accessibility of different areas of the country by air, land and river transport.

Meteorological data can be obtained from the Meteorological Bureau, the Ministry of Agriculture or Aviation. The description should focus on monthly rainfall, the number of rainy days per month, average monthly temperatures and relative humidity. It is particularly important to identify areas with highly irregular rainfall patterns, and trends in average temperatures in highland fringe areas.

Economic development, including agriculture, development projects and urbanization

Macro-economic indicators

The most important indicators in relation to the health sector are: Gross Domestic Product (GDP), which represents all the products and values created in the country, and government expenditure with breakdown by sectors and activities. National income and other economic and social indicators may be considered as well. The
following general indicators may be calculated and their trends could be assessed, taking into account the inflation rate ("constant price"):

- current GDP per capita
- government expenditure per capita
- government health expenditure per capita
- government health expenditure per patient (all in- and out-patient attendances)
- total external development assistance to the country
- proportion of health expenditure in the total external development assistance

This information should normally be readily available in official documents. The international agencies produce annual reports on the situation in each country.

Subsistence agriculture

Patterns and trends of subsistence agriculture should be noted. This includes an assessment of the trend of household economy in different rural areas. From a different angle, in areas with zoophilic vectors, changing patterns of cattle breeding may increase or decrease transmission.

Environment and development

Agricultural and other development projects which may have implications for:

- the environment
- population movement

This information must be obtained from the relevant ministries, offices and agencies. See also potential and active intersectoral links, p. 48. Urbanization must be assessed qualitatively to determine which kind of urban or semi-urban environment has been or is being created. Note official environmental policy, legislation and signing of conventions, and note public practice in relation to the environment, which may be different from the stated policy.

Social and cultural aspects

An unlimited number of factors could be considered. Among the most important are:
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- Levels of literacy and schooling. Schooling of females is of paramount importance for child survival. What are the quantitative and qualitative trends in schooling? Note the access to schools in rural areas.

- The role of women's groups and many other forms of social organization, in particular, in relation to mobilization and mass communication.

- Cultural, religious and particularly linguistic obstacles and opportunities in relation to effective communication. (Example: stricter seclusion of women may appear as an obstacle to communication, it may also provide opportunities for them gaining greater autonomy to deal adequately with sick children). The coverage of mass communication media is of importance for planning health education.

- Type of housing and sleeping habits should be examined, especially if vector control is considered. Note that some people move away from their usual houses at certain periods of agricultural activity. In the hot season, people may prefer to sleep outside their dwellings. This may make it more difficult (but not impossible) to use bednets. The availability of electricity and fans enhances the possibilities for avoiding mosquito bites.

- Available knowledge on treatment-seeking behaviour, home treatment and habits of personal protection against vectors should be considered.

The health care system

Health care providers and funding of services

Government

The expenditure on health in percentage of GDP is an indicator of the government’s commitment to providing health care. In some parts of the world, such as in Africa, recurrent expenditure on health often has third place with around 20% of the total recurrent expenditure, after the education and defence sectors, which often account for 25-35% each. The assessment should take into account expenditures on health outside the Ministry of Health.

The investment budget is often financed by foreign contributions and may be subject to strong variations from one year to another. In many countries, the
A proportion of health expenditure within total government expenditure tended to diminish during the 1980s and has stabilized at a low level in the early 1990s.

**Households**

The contribution of households has increased steadily and in many countries now accounts for 60 to 75% of recurrent health expenditures. This is related to the efforts for cost-recovery for services and products. The hope is that, with time, these systems will lead to better coverage in peripheral areas.

**The profit-making private sector**

The implications of the rapid expansion of the private sector in third world countries are still uncertain. In the industrialised countries, prices of drugs and medical services are regulated in an interaction of public and private interventions and insurance and social assistance systems. The absence of regulation often results in a weakening of public services and increasing use of the profit-making private sector. These developments may be accompanied by aggravation of the already inequitable distribution of health services between urban and rural areas. Health-related activities are also undertaken by mining companies, and farming enterprises, and by other government agencies (Ministries of Agriculture, Industry and Mining, Defence). The collaboration between the different providers should be described.

**The non-profit-making private sector, NGOs and community-based services**

Nongovernmental organizations (NGOs) often operate services benefiting the most underprivileged populations. Primary health services are re-appearing as community health centres, with physicians working in big villages and private and community-based village pharmacies. The creation of central facilities for drug procurement and importation for the private sector (profit-making or not) with the objective of importing essential drugs at low price may have important implications for malaria control.

**Traditional medicine**

It is important to gather as much information as possible about the role of traditional medicine in relation to malaria treatment:
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- what are the patterns of usage of traditional medicine in comparison with allopathic ("western") medicine?
- are traditional practitioners officially organized?
- what traditional and allopathic drugs do they use?

Health services (public, private and community-based)

Organizational charts and responsibilities
Malaria control programmes have their place within public health systems which operate from central units responsible for policy definition through to the public health nurse, the health assistant and the village health worker in the periphery. An understanding of the ways in which responsibilities are defined and the direction in which supplies, directives and reports flow, is essential for a malaria control programme to define its manner of action. Organization charts are helpful for illustration.

Human resources
As the main task of most contemporary malaria control programmes is to train and supervise general health personnel, it is necessary to describe: the numbers of health workers of different categories; the competence of each category; and their distribution in relation to area and population. This should include private, religious, non-governmental organizations and community-based services, if possible. The future trends expected by the ministry of health’s planning department should be considered also.

Facilities and their distribution
The description of personnel may be closely linked to the description of the facilities. In addition to all levels of general curative facilities, this should include preventive facilities, such as the sanitation and hygiene units found in some cities and provinces, which may be a potential institutional resource base for malaria control programmes. It is necessary to consider to what extent the facilities are actually functional. Planned expansion or reorientation should be considered.
Supervision systems

In curative health services, supervision is the principal way of assuring quality. Describe the definition and delimitation of supervisory responsibility, which in most countries is closely linked to and dependent on the district medical officer. Some of the key areas to check would be:

- are other specific (categorical) programmes already supporting, district supervision?
- do norms for supervision exist?
- do supervisors understand their role correctly, i.e. as being first and foremost one of continuous on-the-spot training?
- is supervision carried out systematically within facilities. e.g. district hospitals?
- are district medical officers themselves supervised?
- is supervision used for data collection for monitoring and evaluation?
- how is supervision funded (especially transport)?

In laboratory services quality assurance may be even more crucial (see p.46).

In preventive services, quality is usually systematically assured when the services are organized by a malaria or vector-borne disease control programme. If preventive services including vector control are run by municipalities or provincial health authorities, quality assurance is often deficient, because the supervisors have so many tasks that they cannot be fully conversant with technical norms for vector control. Remedying this is a challenge to a planning group.

The quality of epidemiological services is also important, whether they be malaria-specific or general for health.

Accessibility, and coverage

This assessment is related to human resources and facilities and their distribution. The use of a Geographical Information System (GIS) (see Learning Unit 4) may allow calculation of the proportion of the population living within 5 km walking distance from a health care unit. For malaria control, it may be of equal interest to assess the population having easy access to sale outlets for standard antimalarial drugs.

Another approach is to assess the number of curative out-patient attendances per person per year. An average figure of one is normally considered a criterion of
acceptable coverage. Usually, the distribution of human resources and facilities is
grossly unequal to that of the population, with thinly populated rural areas nearly
always being underserved.

Drug supplies and pharmacies
In many countries the current tendency, after some years of severe shortages of drugs,
is to base continuous supplies on cost-recovery systems. The performance of these
systems in terms of recovering the costs and using them for buying new supplies is
variable. These efforts may be linked to essential drug policies which aim to improve
the availability of essential, affordable drugs, to promote rational use of drugs, and to
contain costs.

The interest of the planning team is to obtain as much information on the
utilization of antimalarials as is possible. It is necessary to know the distribution of
pharmacies in the country. The pharmaceutical sector is normally only able to
provide information from the official public and some private importers on quantities
imported and their distribution to the intermediate level (province). The information
below can usually be obtained partially in the planning phase, e.g. from surveys
conducted by an essential drugs programme, and partially during implementation,
through monitoring and field research:

- the share of private and public supplies of antimalarials
- provider and consumer compliance with recommended use of drugs
- pricing and affordability; it may be useful to compare the prices for antimalarial
treatments to the income of subsistence farmers and government employees
- distribution, prices and quality of antimalarials on the "parallel" markets
- patterns of drug use outside the pharmacies and formal health services.

Supply systems for other commodities
This is mainly of interest in programmes running preventive services with their own
supply system, which should be examined in the context of the programme. If the
programme plans distribution of insecticides on a large scale without establishing its
own supply system, it may examine how other sectors in the ministry of health have
solved their logistics problems.
Training and education infrastructure

A careful examination should be made of existing pre-service and in-service training facilities, activities and plans. It is particularly important to identify those who will train and supervise health workers.

Health programmes having affinities with malaria control

Vector-borne disease control

The epidemiological realities of a country will determine whether a vector control component of a malaria control programme (if any) should be part of a vector-borne disease control programme. Attention is drawn to the increasing importance of mosquito-borne arbovirus infections in some countries. In planning, it is important to be aware of the possibilities for recruiting needed entomological expertise from other programmes or sectors.

Programmes targeting the sick child

The necessity of integrating training and supervision regarding malarial disease management with that of programmes for control of diarrhoeal diseases and acute respiratory diseases is well recognized. Integrated training materials are under elaboration by WHO. The malaria control programme should recognize the resources and local experience of these programmes, as well as tuberculosis, leprosy control, immunization, and others, as a potential support for its own development.

Maternity and child health

The antenatal care services are essential if prophylaxis or chemosuppression in pregnancy is being considered. Answers to the following should be sought:

- what is the coverage of these services?
- how frequently do the women attend?
- do they already include malaria prophylaxis? If so, what are the experiences?
- what are the possibilities for epidemiological surveillance, i.e. systematic recording of birth weight by parity.

While it should be possible for an antenatal care service worthy of its name to take responsibility for delivery of antimalarial drugs for prevention, the potential role of
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traditional birth attendants probably needs to be assessed country by country, or
district by district. The Maternal and Child Health Programme should be in a position to provide this assessment.

Well-child clinics may be an important vehicle for health education targeting mothers. The following questions need to be examined:

- what is the coverage of the service?
- what health education is provided?
- what is the experience with health education?

Laboratory services

The planning of malaria control should include a thorough examination of all aspects of the country’s clinical laboratory services. Unless it has recently been done for some purpose, a field survey may be required. This is a demanding task, and it may be wiser to build this assessment into a control programme’s plan of action. Laboratory services are often in a state of neglect. In some countries excellent research laboratories co-exist with clinical routine laboratories which are poorly maintained.

The main questions to be answered are:

- what is the coverage of laboratories performing malaria microscopy (with and without electricity) in relation to health care facilities?
- are thin or thick films used routinely?
- how are the services used compared to how they should be used?
- how are the waiting times?
- what are the systems of training, supervision, quality assurance (including quality control)?
- what are the systems of logistics?
- what is the state of the microscopes?
- what is the quality of the examinations?
- how are the services perceived - by health care staff and patients?
- do patients pay? how much?
- is the staff reasonably salaried?
is a reference laboratory functional? for malaria?

In cases where the situation is relatively satisfactory, the possibility for expanding laboratory services, for example by offering training to general health care staff in peripheral units, may be considered.

Tuberculosis

The state of the tuberculosis control programme is of interest from the following viewpoints:

- management of reserve drugs
- supervision of general health service staff
- support to the laboratory services - sometimes the combined action of malaria and tuberculosis control programmes may revitalize the ailing microscopy arm of laboratory services

Health information systems (HIS)

The main issues to examine are:

- how soon does information arrive where it is needed?
- is it used in the periphery? at district level?
- does the HIS cover the real number of attendances? (the planning team may compare the quantities of antimalarial drugs consumed by a service with the number of cases reported by it. However, the case definition in use may not imply that every patient treated with an antimalarial is classified as malaria/fever).
- what use is made of the information at central level?
- are feedback bulletins produced? Are they used by those to whom they are directed?

Health education

Health education capability may be the most important human resource for a planning team to look for. It may be found in a specific programme, or in other programmes, for example AIDS. The malaria control programme should not only take advantage of such a resource but also try to elicit the experience of others in this important and difficult field.
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Potential and actual intersectoral links

Environment

Institutions involved in development projects (forestry, water and soil conservation, irrigated agriculture, water resources development schemes, road construction, mining) can bring about major ecological changes that may lead to increased malaria transmission. Donors, international agencies and NGOs also fund development projects which may bring about negative health impacts if health safeguards are not incorporated. Refugee and settlement programmes may lead to increased malaria transmission.

Media and education

The most important intersectoral link in contemporary malaria control may be with those who are in a position to relay information quickly to the general public. If there is a strong health education programme in the ministry of health, the malaria control programme can contact media through this. Otherwise, it will have to establish its own links. Often, information may be available about the coverage on a population-basis of television, radio, newspapers and this is of obvious value for planning. Use of such channels for purposes of training health workers is untraditional but should be considered. Schools are an important entry-point for education of the general public.

Universities and research institutions

Universities and research institutes may be involved in training various categories of health workers, and in operational and basic research relating to health systems development, disease prevention and control. They may also be involved in quality control for diagnosis, monitoring for the efficacy of drugs and insecticides, and evaluating the impact of interventions. Thus it will be essential to note the input of such establishments and of their relationship with the general health services in general and the Malaria Control Programme in particular.
The malaria problem

History of malaria, including epidemics

Most historical data is not very useful for planning malaria control programmes, as it focuses almost exclusively on parasitological and entomological data. However, undertaking field studies to obtain information which is already on paper should be avoided.

A brief review of older reports could concentrate on:

- the epidemiological picture, before the introduction of general health services, and the wide availability of antimalarial drugs
- special risks, which might reappear
- identification of long-term trends related to, e.g. urbanization, changed agricultural patterns or cyclical rainfall patterns

In some countries, it may be worthwhile to assign a graduate student to write a purposeful review of the country's malaria literature.

Past and present malaria control

Examination of past control should concentrate on what lessons have been gained in the country regarding technical effectiveness and operational feasibility, including sustainability and costs of specific interventions, and an evaluation of the institutional arrangements for their implementation.

Present malaria control may be reviewed under the following headings:

- **existing legislation and policies**: laws and regulations related to malaria control, such as notification of cases, prevention of breeding, regulations on insecticides, drug policies, and the extent to which they are applied
- **status of any specific malaria control programme**: the existing organization and its relation to other agencies of the government, training and scientific institutions, as well as bilateral and international agencies
- **human resources**: If there is a large organization, an organization chart will be helpful, as well as a table showing the number and type of personnel, in "headquarters" and in peripheral units. Existing arrangements for training.
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Availability of personnel and the outputs of educational institutions compared with the needs of the programme

- **buildings, equipment and supplies**: material assets assigned for the present programme should be enumerated. These could include buildings, laboratories, office supplies, insecticides, spraying equipment, drugs, etc. Their state and anticipated residual life.

- **budget**: The total budget allocated for malaria activities including a breakdown of contributions from various sources

  A summary should be given of activities carried out during the latest five years giving the methods and resources used, the coverage in relation to population and services, the outcomes and impact attained as well as any problems of implementation.

  Attention should be given to describing what is known about antimalarial drug distribution and patterns of antimalarial drug use.

Present malaria situation, its variability and trends

**Overview**

An overview should provide a description of:

- the spatial and temporal distribution of malaria, including recent epidemics
- drug resistance and efficacy
- distribution, ecology and insecticide susceptibility of vectors
- identification of major epidemiological types

If possible, a description should be given by administrative or sanitary divisions. Mapping may be helpful. On a page facing the maps it is then useful to summarize data on total malarious area or localities, total populations at risk, malaria by season (curves), vectors and health facilities.

**Available epidemiological data**

The following sources should be considered:

- general health services
- malaria control programme
- research and teaching institutions
Explain the case definitions applied for the terms used, e.g. "clinical malaria" "presumptive malaria", "suspected malaria", "fever" or "fever with no obvious cause", "confirmed malaria" or "parasitological results of surveys". Obviously, data sets applying different case definitions and different data collection methods must be analyzed separately. Hospital-based data should be examined.

Data derived from health services could be used:

- without denominator,

and for calculation of:

- incidence rates (with a total population denominator)
- proportional rates (with an all-patient denominator), and
- case fatality rate (with a malaria patient denominator)

in order to detect:

- regional differences
- seasonal differences
- year to year differences and trends
- age-group and gender distribution

Data on drug resistance are often available from research institutions and publications.

Data on anaemia in young children and pregnancy and data on use of blood transfusions (time trend) provide important supplementary information. Data on low birth weight may be an important indicator of the malaria problem if the difference between first-born and later babies is examined. Such data may be available from Maternal and Child Health Services and from special surveys.

In many countries, a wealth of data are available but waiting for malaria control planners and managers to be analyzed. The great importance of such data is in targeting control activities, and sometimes even designing them. If one area of the country has higher malaria mortality than others, this area should have priority for action.

**Entomological data**

Data relating to vector species, their bionomics and distribution can often be obtained from research or teaching institutes. One way to trace entomological literature is to
check the compilation produced for WHO in the World Development Report: Investing in Health, 1993, covering up to 1985, and to search for later literature. Time should be invested in searching detailed entomological literature only if vector control measures are contemplated.

**Estimation of the burden of malarial disease, including costs**

Routine health information system data are useful for assessing trends, but they are normally not sufficiently representative to allow an estimation of the burden of malarial disease. Investigations, mainly in children under 5 years, have made it possible to formulate estimates of typical levels of malarial morbidity and mortality in Africa.

The following estimates were used for WHO's contribution to the World Bank's World Development Report 1993. The total population of the countries in Africa south of the Sahara was 529 571 000 (1990 figure). Of this population, 90% was assumed to be at risk of malaria, i.e. 494 000 000. No differentiation was attempted between stable and unstable malaria. It was assumed that at least 95% of clinical malaria attacks are caused by *P. falciparum*; that in young children, 3% of malaria attacks become complicated, while in persons over 5 only 1%; and that the case fatality rate of severe malaria is 25% in all age-groups. "Complicated" malaria includes severe anaemia caused by malaria.

<table>
<thead>
<tr>
<th>Age group</th>
<th>% of population</th>
<th>Incidence of malarial disease per 1000 x year</th>
<th>Malaria mortality per 1000 x year</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 years</td>
<td>18.6</td>
<td>1500 - 3000</td>
<td>11 - 23</td>
</tr>
<tr>
<td>5-14 years</td>
<td>27.5</td>
<td>480 - 730</td>
<td>1.2 - 1.8</td>
</tr>
<tr>
<td>15-44 years</td>
<td>41.2</td>
<td>290 - 430</td>
<td>0.7 - 1.1</td>
</tr>
<tr>
<td>&gt;44 years</td>
<td>12.9</td>
<td>150 - 230</td>
<td>0.4 - 0.6</td>
</tr>
</tbody>
</table>

The uncertainty of these estimates is particularly great for adults in whom few studies have been performed. The distribution of incidence and mortality is not even, over the first 5 years of life; a study from a rural area in The Gambia published in 1987
found that malaria caused 6.3 deaths/1000 person-years in infants and 10.7
deaths/1000 person-years in children aged 1 to 4 years.

The estimates are less applicable to cities. In urban environments, the
incidence and the case fatality rate tend to be lower; morbidity and mortality are
spread more evenly over the age groups. In rural areas with unstable malaria,
morbidity and mortality are also spread more evenly over the age-groups, but the case
fatality rate may be higher; in epidemic-prone areas there may be no malaria at all for
several consecutive years, but during epidemics, incidence and mortality may be many
times higher than the standard estimates.

An alternative approach to the estimation of mortality is to examine the
proportional malaria mortality rate in different age-groups found in sentinel hospitals,
and apply it to the total mortality rates in the same age-groups which have been
estimated on the basis of population censuses and other investigations. The problem
is that hospital data are rarely representative for rural populations.

The two approaches should, taken together, give an idea of the true malaria
mortality. Such data may be useful for estimating the potential gains of malaria
control. "Reduction of malaria mortality by 25% over a period of 10 years" is a
correct way of formulating an (impact) objective. But this does not say much if it is
not accompanied by an estimate of the present malaria mortality. Only if it is possible
to calculate how many deaths (or disease cases) the programme is expected to prevent,
is it possible to estimate the cost-effectiveness.

Such estimates are also important for comparing actual drug consumption
with estimated needs. Studies in children indicate that about 50% of the fever cases
seen in health facilities and treated with antimalarial drugs are actually parasitaemic.
If this can be generalized (again we have too few studies on adults), the total number
of patients who must be treated is twice the number of estimated true cases. This can
then be used to calculate the total antimalarial drug needs. Based on the total number
of estimated cases, the total antimalarial drug need, the actually recorded antimalarial
drug consumption, and the number of recorded cases in the health services, it is
possible to calculate:
the proportion of cases needing treatment which are treated with antimalarials in
the general health services (the services for which the drug consumption is
recorded)

the proportion of cases treated with antimalarials in the general health services
which are recorded as malaria or fever cases. (If a restrictive case definition is
applied for the notification of malaria cases, then it is not necessarily desirable that
the number of cases treated is identical to the malaria cases recorded).

These indicators are useful for assessing the coverage of curative and
epidemiological services. Regional differences may justify differential priorities and
approaches of the programme.

Underestimating the number of tablets needed by adults may have serious
consequences if drug supplies are based on central planning, because one adult case
needs far more tablets than one child. Some experienced managers recommend
assuming that each child under 5 years needs treatment for 5 fever episodes per year,
and each person over 5 for 1 episode.

In most African countries, malaria is an important factor in pneumonia and
anaemia in young children, as well as in relation to maternal deaths and low birth
weight. Thus, the burden of malaria may greatly surpass the number of cases and
death traditionally classified as malaria.

Only an estimate of direct costs (i.e. the expenses incurred by the public,
families and individuals as a result of the disease, but not the economic losses of
work-days lost) could be required for programme planning. In a number of African
countries, especially francophone, surveys have documented the considerable
household expenditures on protection from insects. These are not exactly "costs of
malaria", but their assessment is of importance for a programme contemplating
promotion or deployment of personal protection methods.

Conclusions

The place of malaria among other priority health problems

The most straightforward way of comparing malaria with other health problems is
probably by examining hospital-based proportional mortality rates and "proportional
hospitalization rates" of malaria with those of other diseases. Certain donors are exclusively interested in deaths in childhood, while national authorities and other agencies normally place at least as much emphasis on death in the productive age groups.

Documentation of trends is important. In many African countries, drug resistance is worsening; in urban areas, the incidence of severe cases is on the increase, and in rural areas, childhood anaemia may be increasing. The cost of treating malaria may greatly increase when it becomes necessary to use other drugs; malaria control programmes should provide ministries of health with the technical basis for regulation of antimalarial drugs, which should ensure that costs for users and the public are contained, the incidence of severe disease is reduced, and the necessity of introducing expensive drugs on a large scale is delayed. In assessing the human and economic importance of malaria control, it is therefore not enough to look only at present epidemiological data.

Opportunities for malaria control

Factors which might be helpful for malaria control should have been identified through the above situation analysis. They range from intersectoral and "intra-sectoral" links to renewed political commitment, availability of donor money and technological developments.

Particular attention should be given to the revitalization of health services now taking place in many countries. In some of these, drug supplies have improved, physical structures are improved, and personnel are starting to receive (better) salaries.

The implementation of "integrated" programmes for the management of disease in young children requires the collaboration of malaria control staff for training of clinical staff. Also, the adaptation of the "sick child" approach requires certain epidemiological assessments and guidance on use of antimalarials which are a specific responsibility of malaria control programmes.

Economic development projects, even if not associated with special malaria problems, may have a role in malaria control because of the funds available or the social organization established for trying out new approaches such as environmental
control or impregnated bednets; experiences gained could later be applied on a wider scale.

Please read carefully the next Unit of this module before commencing the session to which it relates.
Learning Unit 4

Stratification

Learning objectives:

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

- define stratification and state its purpose
- stratify the malaria problem in an area or country based upon a situation analysis
- describe the characteristics of each stratum
- present the information in the form of maps and tables using GIS as a tool

Introduction

Attempts to relate malaria to particular types of climatic and topographical conditions were made long before its causative organism and mode of transmission became known. Even the name of the disease reflects this relationship. Already 2000 years ago in Ancient Greece and in Rome physicians and non-medicals related the abundance of the disease to low, moist and hot areas, in particular those with swampy terrain. Some of them went even further by recommending to divide areas according to natural boundaries such as mountain ridges, seas and rivers, rather than in a random fashion. Studies on the relationship between the occurrence of malaria and various climatic and physiographical features received additional impetus after the discoveries of Laveran and Ross.

While earlier work between 1900 and 1940 was aimed at revealing certain regularities in transmission patterns with no reference to controlling malaria, attempts at malariological stratification beginning in 1947 have supported the target of controlling the disease. The nation-wide malaria control campaigns launched during the early 1950s aroused interest in stratification in a number of countries and led to a number of major studies, in particular a study on malaria distribution and stratification over the entire global area.
The concept of stratification

- Malaria is a focal disease and thus the distribution of malaria may vary considerably from area to area, and among different population groups.
- The same degree of reduction in the malaria problem cannot be achieved simultaneously throughout a national territory due to administrative, operational, technical and financial constraints and due to the heterogeneity of the epidemiological situation.
- It may be possible to identify regularities underlying the heterogeneity and to use this knowledge to delimit areas, populations or situations which have similar identifiable characteristics relevant to control. Stratification is the process by which this could be done. Malaria control objectives should be set for each stratum and control approaches formulated to achieve these objectives.
- During the process of stratification readily identifiable markers need to be found (e.g. association of slow running rivers with the malaria vector) in order to facilitate the practical implementation of the activities in each stratum.
- The various strata selected need to be weighted for importance/priority. This might be according to the magnitude of the malaria problem or may be independent of the malaria problem and related say to areas of economic development.
- The smallest operational unit needs to be determined in order to implement control activities.
- Initially a broad stratification might be carried out followed by a finer stratification depending upon need.
- Total resources need to be stratified for planning and operational purposes (manpower, money, facilities, community organization).
- Receptivity and vulnerability need to be taken into account for surveillance purposes.

The definition of stratification

Malaria is a complex disease. Multiple anopheline vectors whose ecology varies profoundly transmit parasites whose biology is far from simple, to a host whose genetic, social and cultural diversities surpass those of the parasite and the vector. This system in turn operates and is further modified by the non-uniformity of the earth
and its climate. Reduction of this complexity can be accomplished by stratification. Thus stratification may be defined as a process to reduce, simplify and understand better, a complex problem and to facilitate the formulation of solutions and the implementation of remedial measures.

In practice, stratification is the process of uniting areas, populations or situations which have certain relevant characteristics in common, thereby distinguishing them from other areas, populations or situations. In malaria control, stratification consists of the characterization and delimitation of the malaria problem within an area or a population, in which distinct approaches may be appropriate. There exist various kinds of stratification, differing in content. These include physiographical, biogeographical, economico-geographical, medico-geographical, and so on.

Stratification includes the information, methodology and the end result. It is above all a dynamic process, accommodating expected and unexpected changes, and subject to periodic revision.

**Characteristics of stratification**

- Identification of distinct forms of the malaria problem for example, endemicity, epidemicity, species, resistance
- It is oriented to a better management of the disease through a simplification of the problem, identification of solutions and implementation of action in a manageable way to reduce the disease problem.
- It is an ongoing process, with inevitable changes and not a phase in planning.
- It requires the recognition that malaria and malaria risk is:
  - focal in some places countrywise, provincewise and even villagewise
  - seasonal in some places
  - affects certain social groups more than others
- It is necessary because of a considerable variation in:
  - the epidemiology of the problem
  - resources for its control
  - the feasibility of successful application of control measures relative to the starting level of the problem, (holo-, hyper- or meso-endemicity)
Some components of stratification

Stratification consists of:
- a classification of different strata of the malaria problem and possible solutions
- a set of indicators to allow recognition in the field of these different strata
- guidance for grouping into areas where certain interventions can be carried out

Grouping of variants

As the name implies stratification is a layering of information so that areas of concentration of more than one variant are apparent giving rise to the demolition of different malaria types requiring different control measures. The key to stratification is therefore to identify what might be the variants to be used. The following paragraphs identify variants that might be considered in the stratification process.

Macro-ecological and social variants

More permanent broadscale characteristics such as land, people, geographical features (latitude, climate), ethnic, cultural and sociopolitical.

Epidemiological variants

Mortality (general and specific), morbidity (incidence, prevalence), parasite species, vector species, man-vector contact, vector behaviour, adaptation to ecological niches, increased risk of epidemiological problems (who, when, where and how), drug and insecticide resistance.

Micro-ecological variants

This is on a microscale and is therefore more subject to change and perhaps even greater variation. Such information can give guidance to the need for and approaches to health education. This includes the relationship between specific flora and vector species, the existence and location of permanent and temporary vector breeding sites, agricultural products such as cotton and rice which might support the vectors, and so on.
Anthropological variants

This is fixed in terms of frequency of genetic traits such as G-6-PD deficiency, the reaction to drugs such as primaquine, and sickle-cell trait.

Health services organization

This is important from the point of view of implementing antimalaria action. This would be in terms of network of institutions, facilities and capabilities.

Specific antimalaria activities

It will be important to identify the specific antimalaria activities already being carried out and to obtain some idea of the success of these measures and reasons for failure and success.

The practical implications of stratification

It is well known that antimalaria measures produce different effects upon the disease in different areas, from a complete and stable eradication to an almost complete refractoriness. It is clear that the malarious areas of the world are highly heterogeneous in their responsiveness to malaria control measures. The experience of the last 50 years in the field of malaria eradication and control has once more underlined the fact that malaria is a focal disease and that there is a need for constant adjustment of existing control measures to local epidemiological, social and economic conditions in the broad context of changes that take place in the process of socioeconomic development (including the health sector). As it stands now, stratification for planning antimalaria action should include identification of malarious areas having similar epidemiological and socioeconomic features, including availability of health services and organized malaria control activities, their characterization in various terms (including response to different control measures) and the development of malaria control approaches which are both appropriate and feasible.

The potential of malariological stratification is rather broad: it makes possible the revision of objectives and approaches adopted by modern malaria control programmes (operational stratification), and, at the same time, provides a basis for
Planning malaria control programmes: Learner's Guide

outlining a course for research and development of prospective programmes aimed at sustainable control.

Operational stratification is the subdivision of malarious areas into homogenous strata having similar epidemiological, geophysical, socioeconomic and ecological characteristics which will allow the formulation of appropriate objectives approaches and targets and the selection of intervention measures specific to each stratum.

Essential features of modern control programmes

Modern long-term control programmes should incorporate the following major principles:

- precise formulation of objectives, approaches and targets and operational flexibility appropriate to the local situation and available resources
- selection of appropriate measures based on stratification of the malaria problem and geographical areas, taking into consideration epidemiological, operational, socioeconomic criteria and administrative and financial capabilities of the country
- ready access to antimalaria treatment based on total coverage in space and time for every inhabitant of malarious areas
- methods for monitoring interventions and carrying out impact assessment of the control approaches adopted in relation to the objectives, approaches and targets
- appropriate diagnostic and treatment activities conducted through the primary health care delivery system and preventive activities carried out through the specialized antimalaria epidemiological services within the overall structure of the health services
- epidemiological services, with applied research and training components, which are capable of identifying and defining problems, planning control activities, monitoring and evaluating operations based on the principle of appropriate selective coverage in time and space. The peripheral structure of epidemiological services should correspond to malaria status and its potential instability including the risk of epidemics and re-establishment of transmission in areas where it has been interrupted
- a built-in response capability to meet emergency situations (a reserve for outbreaks)
• community participation in antimalaria operations

Criteria for stratification

The specific criteria to be used for stratification will vary depending upon the country or area to be stratified and the perceived nature of the malaria problem thereof. Consequently, this elaboration of the criteria is restricted to general categories and important features to be considered. The general categories for criteria are:
(i) epidemiological, (ii) operational, (iii) socioeconomic. The intent of stratification will be to explore the diversity of each selected or relevant criterion and to order the malaria problem according to those perceived to be most relevant.

Epidemiological criteria

• initial endemicity levels
• the present situation including current endemicity levels, levels of incidence, morbidity and mortality, seasonal distribution
• the species of malaria parasite present
• the distribution of various vector species both primary and secondary with at least a qualitative assessment of density
• the instability potential which is the tendency of the situation to change or to maintain its endemic level irrespective of the continued presence or absence of control measures
• the rate of resurgence in situations where malaria had been reduced to a low level (during previous eradication or control campaigns)
• the degree and extent of parasite resistance to antimalaria drugs being used
• the distribution of insecticide resistance among each of the vector species
• basic physiographical strata including hydrologic, climatological, topographical and ecological regions
• ecological interventions that may result in a change of malariological potential (urbanization, irrigation, deforestation)

Operational criteria

• coverage in case detection and treatment
• coverage in antivector measures
• effect of antivector measures
• effect of antiparasite measures
• accessibility to operations
• cost of various types of measures per 1000 population
• representation of coverage in terms of density per person or area of general health services, primary health care workers, malaria-specific health workers (both drug and vector control operations)
• the structure of logistic support and administrative services in terms of the probability of logistic constraints and the potential for administrative flexibility
• a plan for improvement and expansion of antimalaria operations

Socioeconomic criteria

• the impact on various socioeconomic groups
• the seasonality of migration in relation to local transmission
• the present status of health services and plans for national health development
• major economic activities, national development plans and priority geographical areas
• the resources (including financial manpower, equipment, infrastructure, communications) available or mobilizable and their geographical distribution

The process of stratification

Operational stratification is a process of analysis and synthesis of available information on all aspects mentioned above. This should lead to the selection of homogeneous strata, for which specific objectives, approaches, targets and achievement dates must be established and methods of intervention chosen accordingly.

Annual evaluation of the results obtained in particular areas should allow a more precise determination of the volume of work needed for the next year, depending on the dynamics of malaria. This ensures implementation of the feedback principle, a characteristic feature of the system approach to organizing measures based upon the stratification data.
In countries with long-term, well-developed malaria control programmes

- collection of pertinent data
- processing of data for each criterion
- grouping of data should be first done in matrix format with each basic unit (i.e. village, district, country) united to its set of characteristics
- interpretation of data
- setting the stratum limits, displayed to express and facilitate understanding of the overall stratification result
- field testing
- performance analysis and re-stratification if needed

In countries where there have been no large-scale long-term vector control activities (mainly tropical Africa)

The process of stratification of the country for malaria control will include the following:

- analysis of available local information with emphasis on geographical distribution
- comparison of that analysis with the general kind of broad malaria typology (or classification system) proposed for Africa (see below)
- on the basis of the above, an interim operational stratification (or re-stratification); this combines the approaches “from below” (the local information) and “from above” (the typology); it includes the identification of relevant strata from among those included in the typology, as well as of other locally relevant subdivisions
- identification and performance of required additional analyses of available information, if any
- planning for the collection of relevant information (i.e. information allowing, refinement and updating of the stratification) as part of the planned control activities
- identification and collection of required additional data, if any
General remarks on the stratification process

In theory, the stratification of an area (e.g. a tropical African country) could be from above, starting from a predetermined classification, or from below, starting from local observations without predetermined classification; in practice, a flexible combination of the two approaches is apt to be most useful.

While the determinants of stratification can be placed in a logical sequence, the actual process of stratification cannot be placed into a sequence of discrete steps; it is rather a synthetic process, taking into consideration more or less simultaneously all relevant factors, starting with a gross synoptic view, progressively refined where and when required and possible.

The process is dynamic, i.e. subject to revision both on the basis of real changes in the epidemiological situation, the existing methods and tools, and the resources available, and on the basis of better information about the situation.

Aspects related to data analysis

Once the different criteria (that is, properties that are attached to the situation being analyzed) are identified and - hopefully - given a certain weight, there are many ways that the actual information about them can be processed in order to perform stratification. What follows does not pretend to be either a presentation of technical possibilities or a list of all possible procedures available; it is intended to serve only as an indicator of the wide range of potential ways of performing analysis for stratification.

- primary procedures
  - descriptive tables (organized data presentation)
  - synthesized tables (with some sort of quantified amalgamation of information)
  - descriptive maps (medical cartography by single characteristics)
  - superimposed maps (compounding of geographical maps)
  - synthesized mapping (cartographic presentation of quantified amalgamation of information)
- statistical procedures
  - simple statistical analysis (statistical dispersion measures, correlation, regression)
  - multivariate analysis (numerical taxonomy, principle component analysis)
- exploratory data analysis (EDA)
- mathematical procedures
- information theory classification
- probability distribution analysis
- Fuzzy-set theory
- mathematical modelling

The separation between “statistical” and “primary”, as well as between “statistical” and “mathematical” is for convenience. There will be borderline cases, probably sharing two types of procedure. Furthermore databases and databanks, used in conjunction with the powerful database management programs available, can also be of help in stratification.

**Aspects related to presentation of strata**

This can be done in several ways but the most practised is to depict the information on maps and by graphical means and overlay the maps. Thus by superimposition of maps with different variables it would be possible to identify deficiencies and excesses.

Thus the simplest approach is to take several copies of a map of the area and on each add the data relating to one or two variables. When all variables have been mapped, make transparencies of the maps and superimpose them one on top of the other (layering). By this means it will be possible to see the topographical features in the high transmission areas, the communications (roads, rail) the availability of health facilities, the villages, the population, etc. Very often through this process it will be apparent that the highest malarious areas have little or no communications, few health facilities, and high populations.

A more modern approach is the use of Geographical Information Systems (GIS).

**About HealthMap**

(GIS) is a computer aided database management and mapping technology which provides an excellent means of analyzing epidemiological data, revealing trends, dependencies and inter-relationships that would be more difficult to discover in
tabular format. Because of this capability it lends itself ideally to the stratification process. Whereas in the days of malaria eradication in the 1950s and 1960s, every malarious village was mapped by means of a sketch drawn and kept up-to-date by the army of malaria field staff on the basis of a geographical reconnaissance, today this can be accomplished using GIS technology.

The WHO/UNICEF HealthMap Programme - a joint programme on data management and mapping, based in WHO, CTD Geneva, was established in 1993 and now has geographic and other base-line data for more than 20 countries and over 80 000 villages in sub-Saharan Africa. This data includes villages populations, school and health infrastructures and water supply systems. The system has been designed so that it can be used by many disease control and public health programmes.

The programme provides a broad scope of services and products related to the production and use of maps to support public health administration, through a programme coordination unit based at WHO Geneva, facsimile no. +41-22-791 4777. It provides three categories of services: database management, map production and technology transfer. Because the programme is moving very fast it may well be that this facility is already available in your country. You should enquire if this is the case.

The use of GIS for stratification

As you have seen from the situation analysis, there is a considerable amount of information necessary to be able to understand the malaria problem in a given area and to begin to develop feasible approaches for its control in the long term. Analyzing the data and depicting it by means of charts, graphs and maps greatly facilitates that understanding. Moreover, during the implementation phase changes in the epidemiological status and progress made in control needs to be carefully monitored. Information is therefore needed for the smallest structure which is the community/village. GIS enables localities to be depicted on a map according to geographic coordinates with an accuracy of 100 metres horizontally and 156 metres vertically. It can allow you to visualize a wealth of information about that locality separately or in any combination (Figure 2), and can depict disease distribution over time relative to control measures (Figure 3).
Getting started with GIS

It is not the intention of this module to teach you how to use GIS, but to ensure that you are familiar with the basics and its potential value in your work. If you already have a malaria programme in your country or area then you may already have much of the following information. However probably for many areas you will be lacking information. The aim is to cover the whole of the area for which you are responsible.

Begin by compiling a list of names of endemic villages and cross check the names with official lists held by various ministries such as interior, and water resources, and various institutes such as geographic and cartographic. In this process you will soon learn whether GIS information is already available for your area. The second step is to compile the geographic coordinates of these villages from existing services (those mentioned above) and from official maps if available. You will then be left with some villages for which you have no coordinates. To arrive at the coordinates of these villages and to ascertain the coordinates of any locality where for instance an epidemic has occurred, a Global Positioning System (GPS) should be used.

Carrying out a GPS survey

Very small, convenient GPS navigators are available and are very precise and easy to use, and come with clear instructions. A GPS is a satellite-based navigation system developed by the United States Department of Defence to provide a consistent, accurate method of simplifying navigation. It provides 24-hour worldwide navigation coverage with an accuracy to 15 metres. The unit works by scanning for the signal emitted from twenty-four satellites circling the earth and locks onto seven signals. Data received from four satellites allow the GPS unit to calculate latitude, longitude and altitude, while data from three satellites allows calculation of latitude and longitude only. It can then determine how far away the satellite is by measuring the time it takes to receive each signal. It can then calculate your position on earth by using a technology called satellite ranging. As you move, so it will continually update your position.

These electronic units allow you to select the country you are in and then will tell you where you are, and if you are moving will tell you to the direction you are
heading and how fast you are going. The position, which is what we are interested in, for this purpose is given in terms of geographical coordinates of longitude and latitude. It will also provide you with altitude.

The minimum information required for each village is its name, classified by administrative divisions, the coordinates, population, availability of a health facility, type of health facility, schools, and type of school, number of safer water points (wells, cisterns, piped from reservoirs, etc.).

Data-entry and system requirements

Having collected the data either from official sources or from a GPS survey it has to be entered into a database that is compatible with the GIS system, such as dBaseIII and IV or FoxPro. It is recommended that a person familiar with village names and administrative boundaries be given this task. Data should be validated where possible.

The preferred minimum computer requirement is a 486 processor, 66 Mhz speed 8 Mb Ram, 250 Mb hard disk drive, and an SVGA colour display. The preferred printer is HP Laser IV with 8 Mb Ram. A colour printer such as HP DeskJET 1200C/PS with 18 MbRam is optimal but not essential.

The preferred minimum software is DOS 6.2, Windows 3.1, with FoxPro database management system and Excel V spreadsheet. The GIS software to use is AtlasGIS 3.0 for Windows, or Arcview 3.0 for Windows.

Digital base maps

Digital base maps are required to fully exploit the potential application of mapping technologies. The WHO HealthMap program maintains a library of digital base maps which include administrative boundaries for the country level and three levels below, for a total of four advanced levels. For some countries, especially for most African countries, other information may be available such as rivers and roads. Thus you can build up the maps according to the criteria established for stratification purposes. The end result may be a map such as can be seen in Figure 4.
Strata likely to be meaningful for malaria control in tropical Africa

In a first approach it has proven relevant to stratify most malaria situations in tropical Africa according to:

- the efficacy of various treatments of falciparum malaria; this is essential in relation to disease management. Disease management is an unconditional part of malaria control. Stratification according to treatment efficacy will be a determinant of drug policy

- certain qualitative and quantitative characteristics of transmission, together with some of their social and ecological causes and their epidemiological consequences; this is mainly relevant for transmission control. This is the basis for stratification according to epidemiological types

Stratification according to characteristics of transmission

The tentative listing which follows attempts to take into account the experience accumulated by many malariologists in control programmes and research projects in Africa. An effort has been made to define each stratum by a few important characteristics, without trying to be exhaustive or systematic. The characteristics used include some environmental, epidemiological, social, economic and demographic factors. Two characteristics are common to all the strata: the dominant parasite is *P. falciparum*, the dominant (or exclusive) vectors are highly effective fresh-water breeders, mainly dependent directly or indirectly, on rainfall. Transitions between strata tend to be gradual, even though for control purposes a clear-cut delimitation may eventually be required. Furthermore, as strata may be geographical areas and/or population groups, this allows for some overlap between strata.

**Stratum I - Savannah malaria**

Rural areas with traditional agricultural systems and stable perennial transmission. This situation is typical of rural areas within the equatorial forest belt. Incidence and prevalence of infection are high while morbidity and mortality are concentrated in infants and young (pre-school) children. Anaemia is sometimes the main expression in very young children (6-36 months). Cerebral malaria is comparatively rare. Adults
are relatively immune clinically. Their malaria attacks are almost always benign and self-limiting. Towards the coastal areas and estuaries the situation may be modified by the presence of salt-water vector species, although the importance of their contribution to transmission is not well known and may be only minor. Towards the savannah, this stratum merges into the next.

**Stratum II - Savannah malaria**

Rural areas with traditional agricultural systems and stable seasonal transmission. This situation is typical of savannah areas, merging towards the equator into the situation of perennial transmission of the previous stratum. Incidence and prevalence of infection and disease are similar to those of the previous stratum, with the addition of seasonal variation but do not disappear completely at any time of the year. Cerebral malaria is more common and anaemia somewhat less. Vector populations and entomological inoculation rates typically build up fast to high peaks in the wet season. Infants are affected less, and slightly older children more. Away from the equator, this stratum merges into the desert-fringe malaria.

**Stratum III Desert-fringe malaria**

Arid rural areas with traditional agricultural systems and unstable transmission, the instability being due mainly to aridity. Morbidity (illness) may extend into adult age groups and may vary greatly from year to year. There exists the possibility of recurrent epidemics of malaria when meteorological conditions (rainfall) are favourable for transmission, sometimes with a cyclical pattern. Traditional oases and nomads (which may expose themselves by moving to other strata) are part of this stratum. The population exposed are often small and outbreaks may never be noted by health services, except in the case of refugees. Use of personal protection measures may be high, especially in populations which are livestock breeders. There are often obstacles to organized malaria control activities, related to low population density, impracticable roads in the rainy season and poorly developed health services.

**Stratum IV Highland fringe malaria**

High altitude rural areas with traditional agricultural systems and unstable transmission. In this situation also there exists the possibility of recurrent epidemics related to population movements, temperature, rainfall and changed agricultural
patterns. Traditional use of personal protection measures is variable. Population density is often high.

**Stratum V Nomads**

Populations of nomadic pastoralists. They may form (or belong to) more than one stratum. Some are fully nomadic pastoralists, moving over wide areas following erratic rainfall while others move in and out of settled areas (e.g. areas included in strata II, III and VI) in which they may reside and engage in agriculture for part of the year.

**Stratum VI Development projects**

Modern irrigation schemes in regular operation. These may have special features such as extension of the transmission season which becomes longer as distance from the equator increases. Frequently, insecticides may be used for agriculture, thereby usually reducing transmission but at the same time selecting for insecticide resistance. Generally there is season migration of labour; this may increase the parasite reservoir and/or the supply of susceptible individuals, depending on the local risk and the origin of the labourers as well as on the location, the shelter and drainage conditions of their settlements, since the latter often promote man-vector contact.

**Stratum VII Temporary development projects**

Temporary development projects and the associated aggregation of labour. These may present special risk features such as an increase in vector breeding and man-vector contact, immigration of non-immune labourers and mortality.

**Stratum VIII Urban malaria**

Urban and suburban areas. Transmission is highly variable within a short distance. Morbidity and mortality extends into young adults, and pregnant women are often victims of severe disease. Access to treatment is relatively good and this limits overall mortality. People are victims of the marketing of unneeded, expensive drugs, and drug resistance levels may be high.
Stratum IX

Non-immune visitors to endemic areas or temporary residents (nationals or expatriates) in endemic areas. Risk of severe disease and death.

Stratum X

Stratification according to the response of *P. falciparum* malaria to antimalarial drugs. This cuts across the strata listed above. The strata to be distinguished with respect to drug response will include at least:

- areas where *P. falciparum* continues to be fully sensitive to chloroquine
- areas where *P. falciparum* exhibits a low level and/or a low frequency of chloroquine resistance and where there is an enhanced alertness regarding possible drug failures
- areas where *P. falciparum* has a high level and/or a high frequency of resistance to chloroquine
- areas where, in addition to the foregoing, *P. falciparum* is also resistant to the sulfadoxine/pyrimethamine combination. There are, however, no generally accepted quantitative criteria on which to base such a stratification.

Use of various control measures in different strata and within the framework of primary health care

The measures currently available for malaria control will be described in Learning Unit 5. The possible choices of malaria control measures for each particular stratum identified for tropical Africa alone are outlined in Table 1. The final choice of malaria control measures should only be made after an evaluation of the particular local epidemiological and socioeconomic conditions, the state of development of the health services, including their primary health care component, and the resources which could be mobilized for their support.

In all strata and in all circumstances, the prevention of mortality due to malaria by the timely administration of appropriate treatment should be the first priority for antimalaria action.

The use of other antiparasite and various antivector measures should be considered when the capability to deal with the first priority of malaria control (i.e., the prevention of mortality) has been developed and in areas where the
epidemiological situation, the availability of resources and the malaria control objectives warrant it and permit the continued maintenance of gains achieved.

Exercise

Working in your assigned group, spend ten minutes discussing the definition and potential value of stratification for malaria control making sure that everybody in the group fully understands the concept of stratification. Share experiences in carrying out stratification amongst the group. Then for each area represented in the group:

- List the relevant, useful and practical variables (criteria) that you would use to stratify the malaria situation
- Arrange the variables in order of priority importance
- Based on the identified criteria and knowledge of the area in which each member of the group is working describe in detail one stratum for each area that you think could be identified

Using overhead transparencies describe for each area represented in the group:

- The variables that could be used for stratification listed in order of priority
- One stratum that could be identified in practice
- The variables used to determine the described stratum

One person from each group will be invited to present the group’s work in plenary session and will be expected to respond to any questions raised.

Please read carefully the next Unit of this module before commencing the session to which it relates.
<table>
<thead>
<tr>
<th>Strata</th>
<th>Antiparasite measures</th>
<th>Vector control measures</th>
<th>Control of mosquito breeding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment of suspected or confirmed malaria cases</td>
<td>Reduction of human-mosquito contact</td>
<td>Spraying with insecticides</td>
</tr>
<tr>
<td>I. Rural areas with stable perennial transmission</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>II. Rural areas with stable seasonal transmission</td>
<td>+</td>
<td>+</td>
<td>-</td>
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<tr>
<td>III. Rural areas with unstable transmission and possibility of recurrent epidemics including oases</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>IV. Rural areas at high altitude with unstable transmission and possibility of recurrent epidemics</td>
<td>+</td>
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</tbody>
</table>

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>Treatment of suspected or confirmed malaria cases</td>
<td>Chemoprophylaxis</td>
<td>Mass drug administration</td>
<td>Screening of suitable houses</td>
<td>Use of repellents</td>
</tr>
<tr>
<td>V. Populations, nomadic pastoralists moving from strata to strata</td>
<td>+</td>
<td>+1,2</td>
<td>+3</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>VI. Modern irrigation schemes</td>
<td>+</td>
<td>+1</td>
<td>+3</td>
<td>+3</td>
<td>+</td>
</tr>
<tr>
<td>VII. Temporary development projects associated with aggregations of labour</td>
<td>+</td>
<td>+1</td>
<td>+3</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>VIII. Urban and suburban areas</td>
<td>+</td>
<td>+1</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>IX. Non-immune visitors or temporary residents in endemic areas</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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</tr>
</tbody>
</table>

1 = only for pregnant women
2 = for groups moving from strata 3 and 4 to strata 1 and 2
3 = in case of epidemic or epidemic threat
4 = for new settlements
5 = for camping
6 = water level fluctuations, intermittent irrigation, sluicing and flushing
7 = salinity regulation, vegetation clearance, reforestation or deforestation
8 = when applicable
Figure 2: Locality, information provided by GIS
Figure 3: Distribution of Guinea Worm 1992 to 1995, Burkina Faso

Distribution of Guinea Worm 1992 to 1995, Burkina Faso

1992

1993

1994

1995

Number of cases by village

- 1 case
- 2-10 cases
- 11-100 cases
- >100 cases

Source: Direction de l’Hygiène Publique et de Santé/CFER, Burkina Faso
Map: Institute of Geography, University of North Carolina, 1996
Figure 4: Example of a GIS base map
Learning Unit 5

Selection of malaria control measures

Learning objectives:
By the end of this Unit you should be able to:
- list the available antimalaria measures
- select measures that can physically be implemented, are technically effective and which suit the local epidemiological conditions
- assess the feasibility of a measure

The epidemiological approach

There is no general prescription of antimalaria measures applicable to all ecological conditions. The available chemical, biological and environmental methods cannot be applied universally. Instead, a thorough understanding is needed of the prevailing epidemiological and ecological characteristics in order to achieve a reduction of mosquito density, parasite density and man-vector contact, leading ultimately to a reduction of transmission in respective areas. Such an epidemiological approach in malaria control entails the selection and application of antimalaria measures appropriate to the natural pattern of transmission and local ecology in the area involved. Without an epidemiological approach, no substantial progress can be expected, and this is one of the underlying confounding difficulties of malaria control.

Whilst planning and replanning action against malaria, those responsible should make a careful analysis of available information, prepare a detailed study of the present and past malaria situations, fill gaps in knowledge as far as possible and eventually stratify the areas involved according to their specific epidemiological pattern which can notably differ from place to place.
Factors leading to epidemiological diversity in different areas

The epidemiological picture and the transmission pattern in a specific malarious area are known to be determined by a number of variables such as temperature, humidity, rainfall, topography, parasite and vector species and their bionomics, as well as by a number of socioeconomic factors.

The stratification process will be more effective if it is based on certain qualitative factors that have a highly significant effect on the transmission of the infection, for example areas above a certain altitude which are free of malaria and high transmission in certain parts of the country where extensive irrigation is being developed for agricultural purposes, or on factors that influence the control measures such as distribution of a vector with certain behavioural characteristics. Stratification based on these factors, which are good guides for such a process, will reveal the epidemiological characteristics and provide insight for the selection of control measures.

However, the intensity and pattern of malaria transmission in a specific area is often the result of a compounded inter-action of all the relevant factors which vary from place to place, even between areas stratified into the same category, and within the same place at different times. Consequently, epidemiological diversity is expected not only in different places but also in the same place at different times.

Feasibility and cost-effectiveness considerations

While the decision on whether or not to apply disease prevention, and the choice of preventive measures (including those required for control of epidemics) is to a large extent determined by stratification using an epidemiological approach, it is still necessary for decision-making, to assess to what extent a given intervention could be expected to be effective, how much it would cost under the local circumstances, and how it could be applied.

The most important criteria for the choice of preventive measures are stated below:

- **The expected effectiveness.** Results of studies will be helpful, but the critical importance of coverage, timing, intensity of transmission and period of effect, must be kept in mind
• **Comparison of effectiveness and costs leads to cost-effectiveness.** There must be evidence that more measurable health impact can be gained through the planned malaria control activity than through alternative use of the same resources. In planning the control of epidemics, where impact is not easily measured compared to that of other programmes, cost-effectiveness is difficult to determine. Yet it is becoming increasingly necessary to make tentative projections of the expected benefits to be able to justify specific allocation when competing with other demands on the system.

• **The long-term economic advantage.** This depends mainly on infirmity and deaths prevented, but also on productive time saved and other benefits. It is rarely possible to calculate economic advantage precisely. It is a different issue from cost-effectiveness, which is concerned with the cost per life saved, or per case prevented.

• **Side-benefits.** Institutional development or the direct control of other diseases, such as leishmaniasis.

• **Operational applicability.** This relates to the geographical situation (accessibility), logistics (availability of essential supplies), social acceptance and climatic factors.

• **Safety** to people and the environment.

• **Suitability for the local conditions** considering, for example, climate, the materials, house design, and so forth.

• **Acceptability by the population.**

• **Administrative applicability.** This invokes questions related to the organizational structure, planning and evaluation, recruitment and personnel practice, training, financing, transportation, legal support, professional direction and public information.

**Stratification of malarious areas and selection of general antimalaria measures**

Stratification of malarious areas and selection of antimalaria measures according to the epidemiological characteristics of each area is an important step towards an epidemiological approach to malaria control.
Stratification into broad epidemiological zones

In malaria stratification, the first step is to delineate the country or the area into malarious and non-malarious areas. The latter are then sub-divided into receptive areas in which the introduction of infected persons is likely to lead to local transmission and non-receptive areas in which the introduction of infected persons is unlikely to lead to local transmission.

The malarious areas are, in turn, sub-divided into broad epidemiological zones. It is difficult to offer general rules regarding epidemiological stratification. However, if an elaborate study of available information and a careful analysis of the malaria situation are carried out, stressing the importance of variables that have a significant impact, then it may not be difficult to divide the malarious areas into broad epidemiological zones each with its characteristic features.

Selection of antimalaria measures in different epidemiological zones

The Global Malaria Control Strategy, which is an overall or integrated approach to tackle the malaria problem, has been adapted by most countries and basically involved applying a combination of antimalaria measures among which are:

a) disease management including the elimination of the source of infection, i.e. treatment of malaria cases; and

b) disease prevention by reducing the density, or even elimination, of vectors, reduction of man-vector contact, and strengthening personal protection.

It has also become recognized that the epidemiological pattern and socioeconomic status differ greatly in different malarious areas as well as at different times in the same place. Therefore in malaria control the antimalaria measures have often been modified and adapted to the local conditions. This means that the so-called "combined measures" in the integrated approach are not applied mechanically but flexibly. Emphasis is laid on certain aspects depending upon the place where and the time when the antimalaria measures are being taken. In other words, the principles of an epidemiological approach are applied when implementing antimalaria activities.
Re-stratification of malarious areas

Epidemiological stratification and selection of antimalaria measures are continuous processes. They should be carried out repeatedly in the course of planning, implementation, evaluation and replanning of malaria control. With time, the nature and endemicity of malarious areas undergo notable changes.

A gradual change in some other field may, in some instances, change the nature of transmission in a specific malarious area. For example, the disappearance of a vector may be related to the change in agriculture from a single to a double crop paddy system since in the latter case insecticides are used more intensively.

Certain advances in knowledge, such as the demonstration of the presence of short and long incubation period \textit{P. vivax} malaria and of chloroquine-resistant \textit{P. falciparum} and \textit{P. vivax} may also indicate a need for re-stratification and re-definition of antimalaria activities.

Sub-stratification and selection of specific antimalaria measures

While stratification of malarious areas into broad epidemiological zones helps in the selection of antimalaria measures in general, the diversity of the epidemiological situation in different places requires the "sub" stratification of zones into finer areas to identify the differences in specific local features, thus making it possible to define and select more relevant antimalaria measures. If the information is available, it is preferable to perform a relatively fine epidemiological stratification, even if the final stratification is expected to be simple; the finer initial stratification may assist later on in understanding the non-uniform response to control and in the subsequent re-planning of remedial measures for areas showing a poor response.

Selection of antimalaria measures according to epidemiological diversity

Depending on the vectors it may be possible to further divide areas according to differences in intensity and stability of transmission. Sub-stratification in this way demonstrates further local epidemiological features. For practical purposes, stability of an area may be related to the level of fluctuation over the last 15 years. This
fluctuation in incidence is a reflection of the dynamics of the epidemiological as well as of the social and economic factors of the area involved. The following are just some examples of diverse conditions and the control measures that might be applied in these circumstances.

**Areas with low endemicity and high stability**

In such areas, malaria transmission may have been consistently low for a number of years with little fluctuation and little likelihood of a resurgence despite the intensive breeding and high density of vector species in the area. This may be due not only to the better social and economic status of the area but also to the following relevant factors:

- better housing conditions and no habit of outdoor sleeping
- better protection against mosquito bites due to the popular use of mosquito nets
- serious attitudes towards being sick and personal initiative in seeking medical care
- poor vectorial capacity
- intensive use of insecticides such as in cultivating double crop paddies

Control measures may include:

- providing radical treatment to diagnosed malaria cases
- establishing the capability to diagnose and treat malaria cases in all suitable health institutions
- monitoring population movement

**Areas with low transmission but still unstable**

The intensive application of control measures may lead to annual decreases in malaria incidence, but the factors leading to high transmission, such as poor housing, outdoor sleeping, lack of mosquito nets, and passive attitudes towards medical care, although improving may not have been changed fundamentally; and consequently resurgence of malaria is likely when conditions become favourable for transmission or when control measures are neglected.

Control measures may include:

- treatment of clinical cases and parasite carriers
- clinical treatment of malaria cases
• management of severe cases
• anti-relapse treatment of *P. vivax* during the latent period
• radical treatment of relapsed cases during the pre-transmission period
• establishment of passive case detection and treatment capabilities in all health institutions
• examination of blood slides where possible for all suspected malaria cases
• establishment of a surveillance capability in each district to monitor
  – the incidence and prevalence of the disease
  – the vector, including changes in density, man-biting rate and longevity
  – changes in the number of large domestic animals
  – changes in the agricultural system
  – meteorological changes
• establishment of capabilities for malaria epidemic control
• health education and health promotion activities to improve housing conditions, encourage the use of mosquito nets, change the habit of sleeping outdoors and treatment seeking behaviour, and so forth.

**Areas with moderate or high transmission and a relatively stable malaria incidence**

These are usually areas around rivers and lakes or lowlands with efficient vectors, numerous breeding places and a relatively poor level of social and economic development. Paddy fields are often abundant. Malaria transmission remains relatively high. There may be some fluctuations but never to any great extent. The population may be aware of and equipped against mosquito bites (e.g. the use of mosquito nets) but, due to the high vector density and the extent of human outdoor activity, the amount of man-vector contact remains high.

Control measures include:
• provision of clinical diagnosis and treatment aiming at total coverage
• treatment of sick persons (disease management)
• clinical treatment, especially during the transmission season
• treatment and referral of severe cases
• anti-relapse treatment during latent periods
• radical treatment of relapse cases during the pre-transmission period
• establishment of diagnostic and treatment capabilities in all health institutions
• protection of high-risk groups (e.g. children, pregnant women and non-immune labour forces)
• individual and community organized personal protection

Malaria control in the context of primary health care

Malaria control activities, in areas where they are needed, should be implemented as an integral part of the overall health activities of the health system.

First-line contact with the community is at the village level where the community health workers carry out antimalaria activities. They are monitored and supported by the second-level Government health workers who in turn are supervised and supported by the district-level or equivalent health officers whose responsibility is stratification and planning.

It is well recognized that antimalaria measures such as residual spraying, case detection and treatment exert a direct and immediate impact on malaria transmission. Yet other measures, that are indirect, will have a profound influence on malaria such as:

• environmental modification to improve irrigation, re-arrangement of paddy fields and of animal shelters relative to human habitats, and so on
• better housing conditions, better ventilation, better siting of human settlements
• changing human habits such as from outdoor to indoor sleeping
• generalizing the use of mosquito nets
• individual initiative in seeking medical care

Improvement in the application of the above measures, together with further socioeconomic development, should greatly facilitate control of the malaria problem. Health education and health promotion activities are important elements of primary health care, and performance of these functions by the community health workers is no less important than that of direct field operations. Moreover, coordination of different sectors and community participation in a primary health care approach facilitate the progress of health activities. Therefore, malaria control in the context of
primary health care can be expected to achieve more and contribute a great deal to bettering the health and improving the quality of life of the population in areas under a malaria risk.

Referring to the different malaria types (Learning Unit 4) and different epidemiology strata, the main characteristic and control priorities are proposed in Table 2.

Safety to people and the environment

At all times, careful consideration must be given to the safety of the population, including the health workers, and the environment when using chemical methods of control. Guidelines are available on emergency measures in cases of pesticide poisoning. However, prevention is paramount and this begins with procurement of quality products in the right amounts, careful handling, appropriate storage conditions, short periods of storage before use and safe handling when mixing pesticides and applying to houses or impregnating materials.

Pesticides may produce local effects when they come into contact with the body, or more widespread general effects after they have actually entered the body, which they can do in three ways. Through the skin, so protect skin and eyes and wash well if contaminated and after handling. By swallowing, so keep them in original well-labelled containers out of reach of children. By breathing dust or fumes, so stay out of the spray mist and note wind direction.

If poisoning occurs get medial help or take the patient to appropriate facilities for medial care. Give first aid treatment which includes removal from source of contamination, wash patient with plenty of clean water and soap for 10 to 15 minutes (especially the eyes). Place the patient on side especially if unconscious, keep warm with blanket or cool off with tepid spraying and fanning, maintain free airway, place pack between teeth if convulsing.

The disposal of unused pesticide must be done with caution so as not to contaminate ground water and the environment. Careful calculation of requirements will be more cost-effective and will avoid this problem. Washing out equipment should also be done with due regard to safety and to the environment.
Table 2. Main characteristics and control priorities in different malaria situations

<table>
<thead>
<tr>
<th>Malaria type (main occurrence)</th>
<th>Characteristics</th>
<th>Priorities for control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Epidemiological</td>
<td>Operational</td>
</tr>
</tbody>
</table>
| Savannah malaria (e.g. Africa, Papua New Guinea) | - intense and constant transmission, but increasing seasonal variation away from equator  
- morbidity and mortality concentrated in young children and pregnant women  
- increasing problems of drug resistance | - insufficient coverage by health services  
- malaria control programmes most often rudimentary | - needs expansion through formal and informal general health services  
- capacity for management of complicated malaria and treatment failures in health services must be strengthened | - potential role of impregnated bednets and curtains must be examined from epidemiological and operational viewpoints  
- chemoprophylaxis indicated for pregnant women. |
| Malaria of plains and valleys outside Africa (e.g. Central America, China, Indian subcontinent) | - moderate, variable transmission  
- *P. vivax* may predominate  
- strong seasonal variation  
- risk of epidemics | - often large-scale house spraying programmes  
- inadequate disease management in focussed programmes  
- insufficient general health services, mainly private in some areas | - responsibility for disease management should be assigned fully to general health services  
- epidemiological information systems require collaboration between malaria programme, general health services and other sectors | - reorientation for better targeting of vector control  
- impregnated bednets (proved useful in China)  
- environmental management possible in some areas |
<table>
<thead>
<tr>
<th>Malaria type (main occurrence)</th>
<th>Characteristics</th>
<th>Priorities for control</th>
</tr>
</thead>
</table>
| Highland and desert-fringe malaria (e.g. African and South-east Asian highlands, Sahel, southern Africa) | Epidemiological  
- risk of epidemics as non-immune populations are exposed because of climatic aberrations or changing agricultural practices in normally malaria-free areas or because of migration to malarious areas  
- terrain, distances and precipitation may present obstacles to vector control  
- presence of health services variable  
- preparedness for management of malaria cases may be poor in habitually malaria-free areas | Operational  
- disease management  
- education of health services personnel in malarious areas  
- active detection and treatment of fever cases may be justified  
- health services must be aware of risk of outbreak  
- must be established rapidly | Disease management  
- prevention  
- house spraying can often rapidly curb transmission and sometimes restore malaria-free status |

| Agricultural and water development project (e.g. Asia, South America, Africa) | Epidemiological  
- attraction of non-immune labourers  
- irrigation increases transmission in some circumstances | Operational  
- some financial resources  
- often insecticide resistance in cotton-growing areas | Disease management  
- services for early treatment required | Prevention  
- environmental management to be considered in planning  
- siting and screening of dwellings  
- impregnated bednets  
- larvivorous fish in some rice-growing areas  
- house spraying or chemoprophylaxis if needed |
<table>
<thead>
<tr>
<th>Malaria type (main occurrence)</th>
<th>Characteristics</th>
<th>Priorities for control</th>
</tr>
</thead>
</table>
| **Urban and peri-urban malaria** (e.g. Africa South America, South Asia) | - transmission and population immunity highly variable over short distances  
- epidemics caused by specially adapted vectors in southern Asia  
- high population density  
- breeding sites identifiable | - main need is often for standardization or harmonization of treatment practices  
- larval control by environmental and hygienic measures; in some situations chemical larviciding  
- personal protection, including improved quality of housing |
| **Malaria of forests and forest fringes** (e.g. Southeast Asia, South America) | - focally intense transmission  
- often occupational risk groups  
- severe multi-drug resistance | - facilities must be established where needed; may need to be specialized for malaria  
- treatment protocols must be continually adjusted on basis of operational research  
- personal protection measures  
- impregnated bednets should be considered  
- house spraying and larval control usually useless |
| **War zone malaria** | - displacement of parasite-carrying or non-immune populations  
- environmental degradation causing increased mosquito breeding  
- interruption of vector control operations  
- breakdown of curative services, which may later be replaced by humanitarian action and sale or distribution of drugs | - drugs for treatment and advice on their use must be provided through available channels  
- refugees and soldiers may be protected by personal protection measures and/or chemoprophylaxis  
- environmental measures important for refugee camps  
- space spraying may be applied for emergency situations in camps |
Figure 5: Measures applicable for malaria control

1. Modification of human attitudes and behaviour
   - Health education
   - Community mobilization and organization
   - Legislation

2. Prevention of deaths
   - Early diagnosis
   - Monitoring parasite sensitivity to drugs
   - Chemoprophylaxis in pregnancy
   - Individual chemoprophylaxis in non-immunes
   - Prompt treatment of acute P. falciparum with an appropriate schizontocide

3. Prevention and reduction of morbidity
   - Vigorous and prompt treatment with appropriate schizontocide(s) of all clinically and parasitologically diagnosed cases
   - Special management of high risk groups (pregnant women and infants)
   - Establishment of simple but appropriate epidemic early warning systems
   - Development of a state of preparedness

4. Prevention and control of epidemics
   - Utilization of available technologies to rapidly reduce mortality, morbidity, suffering
   - Utilization of available technologies to rapidly reduce vector population density and man vector contact
   - Utilization of available technologies to rapidly reduce the parasite reservoir
Approach to the selection of malaria control measures

From the foregoing it is clear that there are no general prescriptions of antimalaria measures applicable to all ecological conditions. They have to be "tailored" to the prevailing condition. This requires human knowledge and skills and the ability to judge the value of different methods under different conditions, although the measures which are applicable to malaria control are quite limited (see Figure 5, on pp. 93 & 94). It is therefore as much how, to what extent, where and when to apply measures as it is to the selection of the measures themselves. The various antimalaria measures that are available today should each be carefully considered paying pertinent attention to the indications which determine when and in what circumstances they can best be used, as well as to the methods of utilization.

For guidance, there is a need to analyze which measures were successful in the past and to understand where and under what circumstances this occurred. This will contribute to an understanding of the technical feasibility; that is what we can expect technically from a given measure. Furthermore for stratification to be useful it needs to be simple and based on variables which are easily observable and measurable and which have an epidemiological and/or operational importance.

One approach to selecting malaria control measures is as follows:

- refer to the measures that are available for malaria control
- select measures that can be physically implemented (operational feasibility)
- select measures that are technically effective (technical feasibility)
- select measures to suit the local epidemiological conditions
- assess costs of recommended measures to find the lowest cost and most effective methods or combination of methods
- determine what can be expected from those measures that are feasible

Application of the malaria control strategy

The resurgence of global malaria in the 1970s necessitated the reformulation of malaria control strategies and at that time four general approaches, or "tactical variants" were adopted by the Thirty-first World Health Assembly in 1978 and further developed by the seventeenth meeting of the WHO Expert Committee on Malaria in
1979. The report of the 31st World Health Assembly suggested that these four tactical variants might be used in the classification of malarious areas according to attainable goals, in the long-term planning of programmes starting with the first variant and then changing to other variants as the scope of the programme broadens, and in situations where different variants may be applied in different regions of the same country. The 17th Expert Committee on Malaria stressed that the variants were only illustrative of the major possibilities of malaria control.

The experience in implementing this approach was reviewed by the 18th meeting of the WHO Expert Committee on Malaria in 1985 and a number of problems were noted. In particular there had been a tendency to view the variants as mutually exclusive compartments, rather than as a flexible series of steps on which one or more methods might be placed depending on the local requirements as revealed by epidemiological stratification. Thus the variants, while serving to highlight the need to view malaria more as a disease problem than a parasitic infection, had not inspired countries to develop flexible approaches suitable to their individual needs.

Thus the 18th Expert Committee in 1985 proposed an alternative strategic approach based on the recognition that methods of attacking the problem can be graded according to their complexity and that these methods require a range of different resources and development activities to ensure the long-term maintenance of any results obtained.

Instead of considering four scenarios such as the tactical variants we should consider a spectrum of possible objectives taking into account possible limitations imposed by the available resources and the capability of the infrastructure. This spectrum is depicted in Figure 4 for which appropriate measures could be considered. In the future only the measures for reducing mortality have been considered.

Two substantially different approaches, aimed at attaining the objectives at both ends of the spectrum may be identified:

- improvement in the general health services to ensure adequate diagnosis, accessibility to health care, treatment of malaria, provision of adequate protection for the population at risk and the promotion of personal and community protection. This includes objectives such as reduction in mortality, general malaria morbidity and in duration of sickness;
• establishment of the capability for the long-term control of malaria transmission. This will require the planning of specific antimalaria actions designed to change the epidemiological equilibrium. This includes objectives such as the prevention of epidemics, reduction of foci of *P. falciparum* malaria and transmission control in selected areas or the entire country.

Between the two extremes are a range of objectives which will require the progressive strengthening of the referral system and the development of meaningful information systems, as well as epidemiological surveillance with appropriate recognition of abnormal situations, determination of problem areas, and the provision of an adequate response. It will include monitoring problems such as drug resistance and evaluation of the response to control measures.

The applicable antimalaria measures are categorized in Figure 5, pp. 93 & 94 according to the spectrum of possible objectives (Figure 6), and are cumulative. That is to say the minimum antimalaria objective in any programme is to modify human attitudes and behaviour, then in addition to that the next would be also to prevent deaths and so on as the national capacity is developed.

**Feasibility analysis of measures**

We need to select measures which can be feasibly implemented under the prevailing circumstances. The measure of feasibility can be based on the following approach:
a) specify the situation(s) in which the measure is expected to be applicable;
b) identify the underlying technical limitations of the antimalaria measures included in the approach;
c) identify major operational, administrative and socioeconomic factors which determine applicability of the measures
d) identify major problems and obstacles, and underlying causes and possible remedies;
e) identify major obstacles requiring special attention;
f) identify additional supportive measures required to ensure applicability of measures.
Figure 6. Spectrum of malaria control objectives

Objectives

<table>
<thead>
<tr>
<th>Change attitudes</th>
<th>Prevent and reduce mortality</th>
<th>Reduce morbidity</th>
<th>Control epidemics</th>
<th>Reduce transmission</th>
<th>Interrupt transmission</th>
<th>Eliminate the malaria parasite</th>
<th>Eliminate vector species</th>
<th>Prevent re-establishment</th>
</tr>
</thead>
</table>

Corresponding activities

- Early diagnosis
- Prompt treatment
- Appropriate drug
- Appropriate dose
- Prompt referral of severe cases
- Manage severe disease

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1 These are not exhaustive, just an illustrative range.
2 Only one example is given, that for mortality.
This approach therefore not only determines the feasibility but also progress that solutions be found to obstacles that might stand in the way of successful implementation. This is done by means of an obstacle analysis.

Identification of obstacles, underlying causes and possible remedies

The purpose of this analysis is to predict what might stand in the way of applying the measure and achieving the objectives. The end product is a list of obstacles and their underlying causes (true potential obstacles) which can be grouped and ranked according to frequency and a list of made ideas and suggestions for reducing or avoiding these obstacles.

Real and potential obstacles to implementation can be identified based on a thorough knowledge of:

- political and government structures
- organization, especially of the health services
- operations already being carried out against malaria or some other health problem
- social and cultural attitudes of the population
- available resources

By:
- discussions with persons involved in implementing the measures at all levels (top, bottom and across the government and private medical sector)
- identification of current operational difficulties
- examination of present outputs and target achievements

The outcome from such an approach is a list of operational difficulties and problems already experienced or potentially. These should now be:

- grouped into categories
- carefully analyzed to determine underlying causes (which may or may not be remedied)
- the underlying causes divided into those requiring resources to remedy and those for which resources will not be required
Exercise

Working in your assigned group, consider the objective “to prevent and reduce malaria mortality” and carry out the following:

- list the measures you would take to achieve this objective
- choose one of these measures and identify as many real and potential obstacles to its implementation based on the experience of the members of your group
- select one of these obstacles and list all the possible underlying causes
- divide the underlying causes into those which are resource dependent and those which are not
- for each underlying cause identify possible remedies

Tabulate on an overhead transparency the outcome from this exercise in a format showing objective, all measures, the selected measure, obstacles, the selected obstacle, underlying causes, resource and non-resource dependent causes and possible remedies. One person in the working group to present the outcome in plenary session and defend it.

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