

Up to this time the sole aim of campaigns in most countries was malaria control directed at the reduction of the disease until it is no longer a major public health problem. It is obvious that control of malaria must be maintained by continuous active work and the programme is, therefore, unending. In distinction, malaria eradication means the ending of transmission of malaria and the elimination of the reservoir of infective cases in a campaign limited in time.

Most malarious countries in the world have now followed the lead of W.H.O. and have adopted the concept of malaria eradication; and of some 1,330 million people living in malarious or formerly malarious parts of the world, more than 1,000 million now benefit from projects aiming at the eradication of malaria. It must be admitted that the progress towards the final goal of eradication is much slower than was envisaged at first, but it is probably reasonable to expect that with the exception of tropical Africa and possibly New Guinea, malaria will die out in 10 to 20 years.

MALARIA WORK IN THE SOUTH-EAST AFRICAN REGION

It is well known that extensive malaria control operations were started in the malarious regions of South Africa, Rhodesia and Swaziland as long ago as 1948-49, and these operations were financed entirely by the countries concerned and carried out by members of the respective health staffs without any international assistance. It must be admitted that these initial operations in which residual insecticides (mainly B.H.C.) were used met with spectacular success. Malaria incidence amongst the indigenous population in endemic and hyperendemic areas dropped to a very low figure, but in no instance was it possible to achieve eradication only by the technique of residual spraying. The original spraying technique at the early stages of anti-malaria work in this region very often lacked the accuracy and thoroughness which is absolutely essential for success, especially in areas where *A. gambiae* is the main vector. Nevertheless the high incidence of malaria amongst the indigenous population, which in some years was accompanied by severe epidemics in normally malaria-free areas, is an occurrence of the past and one cannot blame the people responsible for the operations for their optimism and hope that malaria could soon be eliminated from this region. This optimism was shared by many experts at the time when the World Health Assembly adopted in 1955 the concept of a global malaria eradication campaign. Unfortunately malaria eradication has

Some Problems of Malaria Eradication in Africa

WITH SPECIAL REFERENCE TO THE
SOUTH-EAST AFRICAN REGION

BY

O. MASTBAUM

Late Malaria Consultant, W.H.O., Salisbury.

INTRODUCTION

The adoption by the Eighth World Health Assembly in 1959 of a world-wide campaign with its ultimate objective of global malaria eradication has changed the entire concept of the fight against malaria.

not proved to be as easy as was originally anticipated, and especially in tropical Africa as well as in this region, the final goal of eradication is still a long way off.

It may be opportune at this stage to discuss the present principles of a malaria eradication campaign laid down by the "World Expert Committee on Malaria." An eradication programme should consist of four separate stages: (1) preparatory phase; (2) attack phase; (3) consolidation (surveillance) phase; and (4) maintenance.

During the first stage, which should be completed in about 18 months, all base-line data on malaria should be collected in the entire area where an eradication project is to be undertaken. This includes not only an accurate assessment of the prevalence and epidemiology of the disease amongst the indigenous people, but also an extensive and conclusive study of the vector or vectors, their ecology and behaviour. In addition, all human habitations have to be recorded and properly mapped—an operation which is known as "geographical reconnaissance." In rural African regions this is often no easy task, especially in areas with bad road communications and with a population of sometimes extremely low numbers. In the course of these operations many more details as, for instance, the habits of the population and the structure and average size of their houses have to be ascertained and studied.

During the preparatory phase it is of vital importance to train and build up the entire staff necessary for the execution of the work to be done if such a staff does not already exist in the country. Lack of trained and reliable staff is one of the commonest causes of operational failure, especially in Africa, and this applies equally to the indigenous African as well as to the European supervisory staff.

The last prerequisite for a successful campaign is the guarantee that sufficient funds will be available, not only for the present year, but for the total period of malaria eradication which, under the most favourable conditions, will be of the order of seven to eight years.

In recent years W.H.O. has stressed the importance of having a sufficient and efficient rural organisation—termed "health infrastructure"—in any country before it embarks on a malaria eradication programme. It is felt that without sufficient coverage of the entire rural population by health centres, clinics or whatever they may be called, malaria eradication is not possible. It

is quite obvious that the final stages of an eradication programme cannot be carried out unless such an "infrastructure" exists in the rural areas. On the advice of W.H.O., practically all African projects have been halted and have reverted to pre-eradication programmes, i.e., malaria eradication will only be undertaken if and when governments have established an efficient rural health organisation.

These, very briefly, are the necessary prerequisites for a malaria eradication campaign.

The second stage—the attack phase—concerns itself with the spraying of all structures, with the probable exception of churches and schools, in a given area. This operation under normal conditions will be completed in three to four years. The point to be emphasised is the use of a residual insecticide which should be used according to acknowledged standards. These operations must be carried out with the utmost efficiency, guaranteeing 100 per cent. coverage of all buildings. The dosage of the insecticide must be accurate in order to kill sufficient of the local vector/vectors for the entire period of the year in which they are active. The number of spraying cycles per year depends on local conditions of vector activity and transmission.

The aim of this operation is to break transmission. This can only be ascertained by continuous entomological, malariometrical and epidemiological investigations. Past experience has shown that the total elimination of the vector is in most countries impossible to achieve. This is certainly the case with *A. gambiae*, the main vector in this region of Africa. But it is possible to reduce to the point of almost absence the contact of an *infected* vector with man. If residual spraying has attained this object and if this state of affairs can be kept stationary over a number of years, one can be reasonably sure that no fresh *indigenous* cases of malaria will occur, and as malaria is, generally speaking, a self-limiting disease, it will die out.

One of the most important points during the attack phase is to ascertain with the highest possible degree of accuracy if and when transmission has been interrupted and when one may safely discontinue spraying operations. It is often not easy, especially in rural African conditions, to answer this question accurately. It can only be done if the malariologist/epidemiologist has at his disposal an organisation which is able to detect all parasite-positive cases in the area. These case-finding techniques, which have been developed in recent years, must operate and

work efficiently before the final decision of discontinuation of spraying is taken.

The third phase of malaria eradication, the consolidation phase, will then supersede the attack phase. Without discussing the many technical and logistic problems in detail, the aim of this operation is to detect all parasite-positive cases in the shortest possible time and to treat the individual case effectively. This can only be achieved by a properly trained and reliable field staff working under the strictest supervision. It is their duty to visit all and every human habitation, aiming at monthly visits, to see the inhabitants and enquire about recent illnesses amongst the indigenous population. At the same time they have to take blood slides from all those people who may at the time of their visits or have recently shown symptoms which may be suggestive of malaria. In addition they take blood slides from apparently healthy people and from those who show no signs of recent illness. The last procedure, although not adopted in all parts of the world, is thought to be essential in African conditions on account of the so-called "asymptomatic carriers," i.e., those Africans who do not exhibit any clinical symptoms, although they may harbour some parasites, and especially gametocytes.

These cases, if undetected and untreated, may give rise to a new focus in the presence of a potent vector in an area where the use of insecticides has been discontinued. In the course of these case-finding operations as many indigenous people as possible should be examined annually. In the pilot project now in operation in Rhodesia an annual blood examination rate (A.B.E.R.) has been kept at about 30 per cent. of the total population.

It is needless to emphasise the importance of an efficient laboratory service which can cope with the work of slide examination in the shortest possible time. Without such a service these operations cannot be carried out satisfactorily.

Should a parasite-positive case be discovered in the surveillance area, complete epidemiological investigation done without undue delay is essential to ascertain where and when this person had contracted the infection. In addition, the investigating officer will take slides from all people who live within a radius of approximately five miles of the detected positive case. This investigation around a positive case is thought essential because it will reveal any possible additional parasite-positive case or cases which may not have been discovered by the officer visiting the district during his routine monthly rounds.

In the pilot project of surveillance in Rhodesia we have introduced still another method of checking the sensitivity of the case-finding operations. During the non-transmission season, i.e., during the winter months, districts are selected in the surveillance area where during the preceding months of the transmission season *no* parasite-positive cases were detected and also districts where some cases had previously occurred. From these relatively small districts the blood of all, or nearly all, people is taken and examined. Should additional cases of parasitaemia come to light this would be proof that the method adopted for case detection is not sensitive enough for the discovery of all parasite-positive cases.

These surveillance operations should continue until no *indigenous* case of malaria has been discovered for at least two years. Should this have happened it is justifiable to assume that eradication has been achieved. At this point the activities of the malaria eradication organisation have come to an end and the maintenance phase will be carried out by the existing public health staff of the territory. It is obvious that only a well-established rural health infrastructure and its staff will be able to carry out the duties. A constant watch must be kept for a possible introduction of imported parasite-positive cases to prevent the establishment of a new malaria focus. The staff of the rural health posts will and can perform other duties connected with the improvement of the general health of the rural population. The vigilance service for a possible introduction of malaria has to be kept alive until the final aim of global malaria eradication has been achieved.

SPECIAL PROBLEM OF ERADICATION IN THE S.E. AFRICAN REGION

From a purely technical point of view it is in the writer's opinion possible to achieve eradication in this region of Africa. The opinion is based on many years of experience of malaria eradication work in Swaziland, the Republic of South Africa and, for the last five years, in Rhodesia.

One of the most important points which influences malaria eradication in this region is the peculiar behaviour of the main vector, *A. gambiae*. It has been established that two or possibly three genetically different species of the vector are present. The first, the well-known anthropophilic and endophilic *A. gambiae*, is a very potent vector and is responsible for heavy transmission at whatever period of the year it is active. This vector disappears almost completely

after the use of residual insecticides and can be found only in insignificant numbers in areas which have been subjected to residual insecticides, but the other race of *A. gambiae*, which is predominantly exophilic and zoophilic, still remains in significant numbers in a sprayed area. The question arises if this type of *A. gambiae* is capable of maintaining transmission. It has to be understood that anthropophily and zoophily in nature is probably never 100 per cent., i.e., it is quite possible that in certain conditions a zoophilic/exophilic vector may shelter inside human habitations and take a blood meal from humans. In this case it is quite conceivable that this type of *A. gambiae* may maintain a low level transmission in an area. It is, of course, also possible that this vector bites outside if, for example, it is the habit of people to sleep out of doors during the hot months of the year, making an easy contact of man-mosquito possible. However, investigations into the habits of this type of *A. gambiae* have persistently shown that its food preference is animal blood and not human. Pre-cipitin and host-preference tests have revealed a human blood ratio of usually below 1 per cent. In any case a low level transmission, usually not exceeding 5 per cent. (and very often much lower), persists in the sprayed area, and as this vector is predominantly exophilic it is somewhat doubtful if continued use of residual insecticides will achieve complete interruption of transmission. To achieve this end the liberal use of chemotherapy is indicated. This method has been tried out in the surveillance pilot project in Rhodesia with considerable success. There is little doubt that the judicious use of modern anti-malaria drugs in the final stages of malaria eradication will lead to complete interruption of transmission. The drug of choice is usually a 4-aminoquinoline, like "Chloroquine," which can be supplemented by an 8-aminoquinoline, like "Primaquine." This combined treatment has given excellent results and not one of the many follow-up observations of a positive case, which are routinely carried out, has shown a persistence of trophozoites or gametocytes.

The main technical difficulty in achieving malaria eradication in this African region is still the detection of *all* parasite-positive cases in a rural area, whether they may be overt cases of malaria or asymptomatic carriers who usually only harbour a few parasites. Much thought has been given to this problem and much field work has been done in recent years. The techniques to overcome the problem have been perfected and an extremely high sensitivity and efficiency of case detection has been attained.

Bearing the foregoing technical considerations and achievements in mind, the question arises: Why has the progress towards malaria eradication been so slow? The answer can be summarised in three main deficiencies. Firstly, there is still a lack of well-trained personnel, mainly of the supervisory categories. These officers, who have a high responsibility, should have a sound knowledge of all operational duties and, more important, they should give the organisation a continued service. Naturally they must be assured of attractive and permanent service conditions. Only too often, especially in Rhodesia, a field supervisor resigns as soon as he is fully trained, and this takes about several months. With such a temporary and floating personnel no continuity of work can be expected and this makes malaria eradication difficult, if not impossible.

Secondly, the provision of necessary funds for an entire malaria eradication campaign often proves difficult for the governments concerned. It must be clearly understood that the eradication of malaria is expensive, although time-limited. According to past experience, expenditure has to be based on about 60 to 70 American cents or about four to five shillings per head of protected people per annum. Although international agencies such as W.H.O., UNICEF, etc., are usually assisting eradication projects by seconding advisory staff and supplying equipment, governments have to bear most of the costs. It should further be realised that eradication must be planned for the entire territory; it is impossible, and has in the past led to many disappointments, especially in the African region, to set aside a portion of a territory for eradication. This does not mean to say that eradication has to start in the entire territory at once, but operations can be done by stages, dividing the country into several zones and commencing work in the first most suitable zone. It is, however, impossible and entirely wasteful to try and eradicate malaria from, say, Zone I and hope that this will be achieved before advancing to the next zone. Under such conditions surveillance operations in Zone I will have to be continued indefinitely or at least until the remaining zones have reached the same level of eradication. Therefore, should a country decide on a malaria eradication project, a well-defined timetable or plan of action, setting out the entire operation, must be drawn up and adhered to.

The third deficiency which is delaying eradication is the absence of inter-country co-ordination in this region. During the first inter-country conference held in Lourenço Marques in 1958,

which was attended by representatives from Moçambique, South Africa, the Federation of Rhodesia and Nyasaland, Swaziland and Bechuanaland and also representatives of W.H.O. regional office, all countries agreed on a combined effort of malaria eradication and on regular inter-country co-ordination board meetings. This was thought essential to discuss and inform the individual countries of the progress being made by the member States towards eradication. Except for one co-ordination board meeting held in Salisbury in 1961, no further progress has been made. Although the Republic of South Africa and Swaziland have attained a level of near-eradication, the work in other territories, especially Bechuanaland and Moçambique, has either not started at all or is still far behind in its efforts. It should be understood that it is impossible for one country to achieve eradication if the surrounding countries are not doing likewise. The well-known customary migration of the African and the influx of people suffering from malaria or exhibiting asymptomatic parasitaemias are of such a magnitude that surveillance operations would have to be continued indefinitely in a territory which has reached the consolidation phase.

Unless and until these three major problems have been overcome it is doubtful if eradication of malaria in this region can be achieved in the foreseeable future.
