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Integrated malaria control achieves results in Mayotte

A malaria control campaign in the island territory of Mayotte has achieved remarkable success owing to the integration of activities with the general health service and to the high degree of decentralization practised.

Mayotte is a tropical island territory in the Comoros archipelago to the north of the Mozambique Channel. The 70,000 inhabitants are of African, Malagasy and Arab origin and live in some 70 villages, mostly near the coast. A hot, wet season from November to March alternates with a dry, cooler season. Agriculture is based on seasonal crops and involves a substantial movement of the population during the rainy season and the establishment of temporary farming villages for several months.

The health service in Mayotte is divided into seven sectors, each covering about 10,000 people and responsible for integrated preventive, educational, and curative activities. The staff are local people trained to deal with local needs. The central office of the health service is responsible for planning, coordination, and evaluation and for providing technical support.

Malaria control has been carried out since 1976, and a recent survey suggests that the parasite may shortly be eradicated (1). The campaign has benefited greatly from decentralization and the integrated character of its activities.

The malaria control campaigns

The vectors of malaria in Mayotte are *Anopheles gambiae* and *A. funestus*. The proliferation of the former depends on its ability to adapt to a wide variety of larval breeding sites. The most common are connected with human activity—wheel ruts, roadside gutters, damaged water piping, areas around standpipes, etc. Road building has provided favourable conditions along the flat coastal areas, where the roads are built on embankments that hamper natural water runoff.

Such breeding sites have become common throughout the island and are tending to replace the natural breeding sites in river estuaries with offshore bars, which are becoming increasingly polluted. These natural breeding sites are now used only by *Culex quinquefasciatus*, the vector of lymphatic filariasis. *Plasmodium falciparum* is the only parasite found today in Mayotte, and it does not yet appear to be resistant to chloroquine (2).
The malaria in Mayotte is of the African type, in which premunition quickly develops. This accounts for the traditional resistance of the native population and the susceptibility of the European and Arab groups lacking this immunity, which was noted as early as 1870. Premunition has undergone a steady decline over the past five years, to the extent that it is now seen only occasionally, among older people.

Vector control includes control of the vectors of Bancroft’s lymphatic filariasis, which is hyperendemic in Mayotte. After an education campaign among the population, the spraying of the interior of houses with DDT and malathion was begun in 1976 and has continued ever since, except for the substitution of fenitrothion for malathion in 1984 owing to the incipient resistance of *C. quinquefasciatus* to malathion. Spraying is carried out four times a year.

The biological control of mosquito larvae by larvivorous fish (guppy) is in general use and this is complemented by applications of temephos in places inaccessible to the fish.

The mass chloroquine prophylaxis of children under 14 was initiated in 1972 but has gradually been abandoned. Passive case-finding and the presumptive treatment of febrile cases has been the practice since 1977.

**Decentralized vector control**

Each of the island’s seven rural and preventive health sectors has specialized personnel and materials to carry out vector control. The entire staff of the sector, however, is to some extent involved in malaria control in one way or another. A daily programme is established and coordinated by the central administration so as to ensure consistency between the activities of the different sectors.

Spraying cycles last for three months, and the temporary farming villages are given special treatment during the rainy season. Daily records of the number of houses sprayed and spot checks on the amounts of insecticide used in the areas sprayed serve for evaluation in quantitative terms. The efficacy of the operation, in terms of its impact on the longevity of the vector, is evaluated by a mobile entomology team, which carries out mosquito trapping at night.

In the urban areas, however, people have begun to display a certain weariness, because they have to clear the walls of their houses and clean all plastic surfaces immediately after spraying.

Larval control is carried out in the vicinity of houses and is directed against *C. quinquefasciatus*. It has been extended to the rural areas (building sites and irrigated fields) where it is directed at *A. gambiae* in anticipation of the discontinuance of household spraying. Both chemical and biological means are used.
Liquid or granulated temephos is added to small pools of water to kill the larvae of anopheline mosquitoes, an operation carried out in scheduled control rounds once a fortnight. Biological control is based on the use of larvivorous fish, which were imported from Réunion in 1980. Fish-breeding ponds were established near several dispensaries in 1984; health personnel were given some training in this work, and, after a campaign to create awareness among the population, all the natural or domestic water collections where guppy can survive were stocked.

In spite of some initial doubts, the public now regards this type of control very favourably, even in domestic or “sensitive” breeding sites such as mosque pools, and is even helping to disseminate the fish.

Improvement of the environment is an integral part of the malaria control programme and is one of the objectives of the intersectoral activities carried out jointly by municipalities, departments of agriculture, departments of public works, etc. Preliminary impact studies are required before any agricultural developments or public works can be started.

Sanitation works have been carried out in the villages to prevent the development of breeding sites without interfering with people’s life-style—for example, the drainage of standpipe areas, the introduction of proper washing places, and the maintenance of piped water supply networks.

Health education is part of the school curriculum and is also given by the media and reinforced by primary health care workers and mobile teams. Educational materials are produced locally and are renewed at frequent intervals so as to avoid repetition.

Chloroquine prophylaxis was found to be of limited efficacy when applied en masse, and since 1986 it has been confined to pregnant women so as to obviate the selection of chloroquine-resistant strains, in accordance with WHO recommendations.

Medical staff have increased their efforts to detect passive cases during consultations (1200 smears were taken in 1986), and suppressive treatment is given to any suspected case. Comprehensive active case detection was initiated in 1984 in a number of villages, selected on the basis of parasitological or entomological data (2500 smears in 1986). Epidemiological spot surveys have been carried out among the households and contacts of patients since 1985.

The results of antimalaria activities are evaluated every year using random surveys in a number of “sentinel” villages together with the parasitological and serological data that have been regularly collected since 1984. Systematic study of group immunity among the various communities of Mayotte serves as an indicator of overall trends.

**Evolution of the malaria situation**

Malaria was responsible for considerable mortality in former times and was the most important public health problem. The introduction of a sensible and orderly control programme in 1976 rapidly reduced...
the impact of the disease until by 1980 it was no longer a public health problem, except in a few sensitive areas.

From 1981 to 1983, after control activities were relaxed, the malaria situation took a turn for the worse. In 1981, active case detection confirmed a resumption of transmission, though it was scarcely perceptible in a population that was still immune and still largely protected by chemoprophyaxis.

At the end of 1983, comprehensive active case detection in certain sensitive villages revealed a prevalence of 3-8%, predominantly among the younger age groups. The outstanding gains achieved were nevertheless maintained in certain areas, especially the island of Petite Terre. Steps were immediately taken to inform all personnel of the continued existence of this latent problem, to provide further training in epidemiological surveillance, to increase suppressive treatment, and to improve vector control.

In May 1984 entomological indicators reached alarming levels following heavy rainfall in the wake of a cyclone, and it was confirmed that transmission had resumed in the southern part of the island of Grande Terre. In spite of the measures that had been introduced, there was a veritable epidemic outbreak between May and August. Clinically, this outbreak was characterized by the sudden appearance of several serious forms of the disease with loss of consciousness.

The first action carried out was a search for febrile bedridden patients in the villages, and this was followed by an exhaustive parasite survey in these areas. Fifty-one passive cases were found, mainly in May and June, and 227 active cases were detected between May and August. Seventy-one per cent of the passive cases and 84% of the active cases were children and young people less than 15 years of age. This confirmed the continued existence of a certain level of premunition in adults. It also demonstrated the low effectiveness of chemoprophyaxis.

Since 1985, the monthly number of cases detected by active and passive case-finding has once again fallen very low, but slight transmission has continued at the beginning and end of the rainy season. The parasite rate, which had fallen from 26% in 1972 to 0.9% in 1980, rose to almost 3% between 1981 and 1984 and then fell again to 0.3% in 1985. The number of cases in 1986 was not even sufficient to establish a parasite rate. Serological tests, which have been carried out since 1984 (1), show a general decline in antibody rates for the whole of Mayotte. The level of vector capacity that can now be observed is also very low. Hence the overall picture from the "sentinel" villages appears to confirm that transmission has been interrupted in almost all parts of the island.

**Future prospects**

Malaria control in Mayotte, which admittedly benefits from its island
situation, has succeeded in achieving rapid results at a reasonable cost (40 francs (US $6.60)/person/year in 1986) and holds out the prospect of eliminating the disease.

Active case detection, the overhaul of vector control activities, and the greater involvement of the population as a result of the reappearance of clinical malaria have led to a spectacular regression in incidence in less than two years. The revision of vector control activities involved the reorganization of circuits, the verification of dosage, the motivation of supervisory personnel, and the training of field personnel. The measures carried out in the temporary farming villages, which are the source of reinfestation, undoubtedly helped to reduce the volume of parasites in circulation during the rainy season of 1984-85.

The integration of malaria control into the other activities of the rural sectors has also facilitated the task of creating awareness among control personnel and the population (who live together) and has made it possible to intervene rapidly and very effectively. Mass chemoprophylaxis is an attractive idea, but it gave rise to a false sense of security for some years. Even with the distribution of medicines by teachers in schools and by primary health workers in the villages, the rate of coverage was never quite good enough.

Successful maintenance of the status quo very much depends on keeping up the pressure of vector control and case detection, together with the surveillance of immigrants. But the danger that transmission may be resumed remains.

There are still effective vectors in all parts of the island where climatic conditions are favourable for transmission, though fortunately the density is low. But the present situation could be altered by a reduction in the efficacy of present activities, by natural disasters, or by environmental changes connected with socioeconomic development. Hence, in carrying out the socioeconomic activities that are vital for the future development of Mayotte, steps must always be taken to prevent any adverse impact on major endemic vector-borne diseases.

Moreover, there is still a high level of endemic malaria in the other islands of the Comoros, with which Mayotte is constantly in contact, and in Madagascar, which means that there is always a risk that the parasite may be reintroduced. Should any of these risks materialize or should control measures lapse, transmission of P. falciparum is likely to resume.

In malaria, the man/parasite/vector complex remains fully stable only under natural evolutionary conditions. Any intervention affecting one of these components or the environment in which they have been evolving naturally introduces an element of imbalance, which may have adverse effects if the activity in question is broken off.

The suppression of repeated parasite inoculations means that the population receives no antigenic stimulation, which leads to the disappearance of immunity. A resumption of transmission could then have serious consequences for a population that
will have become very vulnerable. It is therefore essential for malaria control activities to be maintained permanently.

The risks of parasite resistance to chloroquine and of vector resistance to insecticides cannot be ignored; moreover, people are beginning to tire of house spraying and evaluation surveys. So it is becoming even more important to involve the population in the control campaign, since the disease in itself is no longer a sufficient motivation.

The decentralization of resources for malaria control activities is part of this rationale, for the constant concern of health personnel is more readily understood when they live among the population. But other concepts involving real commitment on the part of the population (2) should also be put into practice. Research is at present being carried out to test alternative methods of vector control that are compatible with local cultural traditions and will enlist the participation of villagers in the protection of their own health. Insecticide-impregnated mosquito nets and curtains for protection against adult mosquitoes seem likely to meet this objective. But the most effective instrument for resolving the problems posed by the particular situation of Mayotte would be a malaria vaccine, if it could be achieved.

References


CORRECTION

Tuberculosis: a six-month cure
by Pierre Chauvet


Would readers kindly note the following corrections to the above article.

1. Table 1 (page 117)
   Daily maximum dose of Rifampicin (column 3, line 2) should read “600 mg” and not “60 mg”.

2. page 118
   First column, penultimate line: read “less” in place of “more”.
   The correct sentence now reads: “Because of the intermittent drug administration, regimens that are both short and fully supervised can be applied in special situations— as, for instance, those in which patients live less than an hour’s journey from a health unit or are mentally ill or drug-addicted and not therefore capable of complying with instructions.”