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MALARIA SURVEILLANCE PROGRAMME IN TAIWAN

by

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I. INTRODUCTION

The objective of a malaria eradication programme is to eliminate all sources of malarial infection from a given area. It includes a complete interruption of malaria transmission and the elimination of residual malaria from the population concerned. Furthermore, it should also provide means to prevent imported sources of infection. In fact, with the remarkable properties of various insecticides, particularly DDT, a number of countries have made amazing progress towards this objective. However, it has been observed that some species of vector anophelines have acquired DDT resistance after several years' exposure to the insecticide and have not been effectively killed. If this has happened in a country or an area where malaria has not yet been eradicated, it would certainly seriously affect the malaria eradication programme even if it did render it completely impracticable. It is therefore believed that a malaria eradication programme must be planned in such a way as to obtain most benefit from the insecticides so that their application may be stopped while they are still effective against the vector. However, interruption of the application of insecticides does not necessarily mean the final objective has been achieved. Intensive and extensive follow-up activities through

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an adequate epidemiological surveillance scheme that provides machinery for the search for sources of infection and the necessary control measures are still needed. Such an epidemiological surveillance, as recommended by the Second Asian Malaria Conference, should be commenced before the discontinuation of spraying.

Taiwan's malaria eradication programme now comes to the point where an adequate epidemiological surveillance programme has to be put into full operation. The island has been sprayed three times on an island-wide scale since 1953 and, under the present planning, two more island-wide spraying coverages will be carried out in 1956 and 1957. Although the results of the current control operations have been gratifying, it is unlikely that malaria parasites will have disappeared completely from the population when the insecticide is discontinued in 1957. In order to assure the best results, an adequate surveillance has to be introduced and go side by side with the spraying operations. A pilot surveillance project was launched in December 1954, and the network of the epidemiological surveillance was set up at strategic points over the island during 1955. The scheme will be further extended to include the whole of the island in 1956 and will be carried on until the time when, to our best belief, the status of malaria eradication is reached in the light of the criteria for eradication, such as expressed by the National Society of Malaria of the USA. This paper is intended to outline the basic planning and the subsequent enforcement of the surveillance scheme adopted in the current malaria eradication programme in Taiwan.

## II.. THE PRESENT STATUS OF MALARIA IN TAIWAN

The house-haunting anthropophilic *A. minimus minimus* being the principal vector species in Taiwan, the local epidemiological and entomological conditions of malaria seem to be particularly favourable to the application of DDT residual house spraying. After the three years' island-wide DDT spraying, malaria in Taiwan has been reduced from a top-ranking disease to the level of little public health importance. Malaria, once the most debilitating endemic disease in rural Taiwan, causing an average death of 6500 people per annum, has now virtually disappeared from the former hypo- and meso-endemic areas and is rarely seen in the former hyperendemic area. The post-operational surveys, sampling 66 444 schoolchildren of 6-9 years old from all over the island late in 1955, revealed that the average spleen rate for the whole of Taiwan

was 11.7 per cent., while that of the pre-operational surveys in 1953 was 25.5 per cent. New transmission of malaria has been almost completely exterminated from the former malarious territory. The recent island-wide infant survey including a sample of 63 460 infants, which is one-fifth of the total babies born in Taiwan in a year, showed an infant parasite rate of 0.013 per cent. or eight positive cases. The eight cases were from two confined foci. Of the 14 759 pre-school children sampled from 148 townships in December 1955, only 30 cases were found to be positive for malaria parasites. Out of the 30 positive cases, 13 cases were from one single township.

From the above-mentioned figures, it is safe to assume that the malaria problem in Taiwan today is confined to some localized pockets where a low malaria transmission has been maintained since the pre-control days. The exact location of these foci can only be traced by the epidemiological investigation of microscopically confirmed cases of malaria through a sound surveillance scheme. According to the experiences to date the foci were found, without exception, in remote mountains and deep valleys.

The second problem is the detection and mopping-up of residual infections. Numerically, they are few, but are widely scattered over the former malarious territory throughout the island. Persistent parasite carriers have recently been reduced to such an insignificant number that it would be futile to look for them by mass blood examination of the general population. For example, the examination of 37 827 school-children of 6-9 years old throughout the island during 1955 yielded only 99 positive cases for malaria parasites. Even among fever cases the possibility of discovering a case of malaria is, generally speaking, an unlikely odds of less than 1 to 100; of a cumulative total of 8656 children with fever examined from a number of schools throughout the island in 1955, only 73 cases were confirmed to harbour malaria parasites, of which more than 70 per cent. were P. vivax. It is questionable whether such a small number of remaining parasite carriers diluted in a mass of healthy population would constitute a real danger threatening transmission under the present conditions. Nevertheless, they are the potential danger which needs serious attention particularly during the surveillance phase of the malaria eradication effort. Certainly any unusual concentration of residual infections in an area must be carefully checked as to the cause, and the peril must be promptly eliminated.

### III. SURVEILLANCE PROGRAMME IN TAIWAN

#### 1. Basic planning

It is obvious that the extensive malaria surveillance programme requires a large number of technical personnel trained in malariology especially in the malaria surveillance technique. Moreover, such personnel must be distributed to the strategic spots over the whole territory under the eradication scheme. In Taiwan much has to depend upon the local health machinery, since the public health networks here have been well established during the last five years and, besides, the underlying policy of the malaria eradication project is to have the programme integrated into the framework of the general health services. Under the Provincial Health Administration, there are 22 prefectural health centres and 355 township health stations, each with a health officer in charge, conducting health programmes in each prefecture or township. At present there are about 140 antimalaria technicians attached to these health centres and stations, who are capable of and with long experience in, malaria survey, microscopy, and treatment of malaria cases. These technicians will have to be heavily relied on in the actual implementation of the surveillance programme.

As mentioned previously, there are three phases of activities to be considered in the surveillance planning, namely the elimination of transmission foci, if any, extirpation of parasite carriers, and the prevention of imported sources of infection. However, the possibility of importing malaria from outside is remote because of the insular condition here, so it will not be considered, at least at the present stage of the surveillance planning.

For the purpose of the malaria surveillance programme, the island has been divided into three regions based on the pre-control endemicity of malaria. All the hyperendemic area plus a part of the former meso-endemic area along foothills belong to Region A, the former meso-endemic portion of the western plain to Region B and the coastal portion of the former meso-endemic area plus all the hypo-endemic area to Region C. The basic surveillance planning for the three regions are summarized in the following table.

Region	DDT spray	Malaria Surveillance	
		Date started	Phases of activities
<u>Region A</u> Population 1 500 000	in 1953 1954 1955 1956 1957	Partly in 1954 and partly in 1955	a. <u>Elimination of transmission foci:</u> i. Active search for transmission foci through infant surveys. ii. Investigation of positive infants and all <u>P. falciparum</u> infections. iii. Emergent DDT re-spray of houses and mass treatment with drugs among the population. b. <u>Elimination of residual malaria</u> i. Active search for sources of infection through village and school fever case surveys. ii. Examination of out-patient department cases suspected of malaria at health stations and private practitioners' offices. iii. Investigation of <u>P. falciparum</u> infection. iv. Treatment of positive cases.
<u>Region B</u> Population 2 000 000	in 1954 1955 1956	to be started in 1956	Same as Region A.
<u>Region C</u> Population 5 500 000	in 1954 1955 1956	to be started in 1956	b. <u>Elimination of residual malaria</u> i. Examination of out-patient department cases suspected of malaria at health stations and private practitioners' offices. ii. Investigation of <u>P. falciparum</u> infection. iii. Treatment of positive cases

In Regions A and B, the health stations are requested to organize surveillance units for the respective townships. Each surveillance unit should have a technician trained in surveillance technique and facilities for blood examination. There have been 59 units organized in Region A since December 1954. Another 80 units will be

put into operation in Region B in 1956. The health stations in Region C are not requested to organize surveillance units. However, the surveillance activities as outlined in the above table are to be carried out as a part of their public health routine. Regarding the mopping-up operations of reservoirs of malarial infection in the population, a malaria regulation on case-reporting has been proclaimed by the Provincial Government. The regulation applies to all the medical profession on the island, including health or medical services or private practitioners.

## 2. Surveillance technique

The surveillance technique adopted in Taiwan has been designed in such a way as to cope with the two main objectives of the programme, i.e., the detection of transmission foci and the elimination of residual malaria from the population.

### 2.1 Detection of transmission foci

From what we have observed to date, there may be many transmission foci still not unveiled on this island. The detection of these foci is fundamental and the subsequent control measure of no less importance. It is generally understood that the infant parasite rate is probably the most sensitive indicator of transmission. Therefore the most dependable method of detecting the foci would be the examination of all the infants born on the island and repeat such examination as frequently as possible. From the viewpoint of practicability, however, such intensive efforts are not justifiable, as malaria transmission today, if any, must be extremely rare and besides must be confined to only certain localities positively in Region A. With the presently available personnel, the most efficient way of searching for new infections would be the concentration of efforts only to the localities where they are likely to be present. Each surveillance unit in Regions A and B is instructed to make a 100 per cent. sampling of infants among 5000 to 6000 population living in the most malarious area ever recorded for that township. The schedule has been made in such a way that each technician can complete one round of the survey in three months through house-to-house visits.

Another good indicator for detecting foci of transmission, although not as decisive as the infant parasite rate, is the presence of P. falciparum infections. It is generally understood that most of the P. falciparum infection would disappear from a community if transmission is completely interrupted for a period of 9-12 months, although there might be some exceptional cases that would last longer. In principle, therefore, P. falciparum infection must have totally disappeared from Region A as the area has been sprayed for three consecutive years with the insecticide. Any P. falciparum infection in Region A at this stage is highly indicative of a transmission focus that has not been controlled by the insecticide. Upon finding any new infection among infants or P. falciparum infections in other age groups, epidemiological case investigation is to be carried out immediately in order to determine the source of infection. Under the present scheme, an investigational team consisting of TAMRI, and the concerned local health personnel, will be organized immediately for such investigational activities. After the investigation, if the area is confirmed to be in actual or potential danger of malaria transmission, technicians in the adjacent townships will be mobilized for an emergency control which includes a careful re-spray of the defined focus area and an application of a mass treatment of the entire population with antimalarial drugs.

## 2.2 Elimination of the residual malaria

Persistent parasite carriers have recently been so scarce that it would be extremely tedious, if not futile, to attempt to pick up malaria cases by mass blood examination of the general population. However, the possibility of finding cases will be greatly increased by limiting samples to such special groups as fever cases and other suspected cases of malaria diagnosed on the clinical basis. In Regions A and B, where the health station has a surveillance unit, the technician is instructed to carry out a number of short-cut methods to locate the parasite carriers in the population concerned. These include: (a) fever case surveys among the general population, while making house-to-house infant surveys, (b) blood examination of out-patient department cases diagnosed by a physician as malaria at health stations, and (c) blood examination of fever cases reported by school teachers at each primary school in the respective township.

On the other hand, all physicians on the island, either in governmental or private medical services, are requested to report to the health authorities cases of clinically diagnosed malaria and to take blood smears for confirmation of malaria parasites. Such blood smears must be sent to the respective health centre for examination. At the same time, physicians are requested to treat the suspected cases with antimalarial drugs at once without waiting for the result of the blood examination. Such a treatment must be given free of charge, as the drug used for such a purpose is reimbursable from the respective health station.

As mentioned previously, the possibility of a so-called fever case being malaria is now rare; the report from various surveillance units during 1955 indicated less than one per cent. positive among the fever cases examined. On the other hand, among the cumulative out-patient departments clinical malaria cases, of 6075 reported by various health stations during the same period, there were 263 cases or 4.33 per cent. found to be positive for malaria parasites. It seems that the examination of out-patient departments clinical malaria cases has more chance of locating residual infections of malaria than the examination of fever cases in villages and schools and much more so than the mass blood survey of the whole population.

#### IV. SUMMARY

Taiwan's malaria eradication programme now comes to the point where an adequate epidemiological surveillance programme has to be put into full operation. The surveillance activities, started in December 1954 in the former hyperendemic areas, are now being expanded to cover the whole of the island. It is contemplated that a sound surveillance network utilizing the present health facilities will be established and put into operation in 1956. The planning is based on two principles, namely the elimination of transmission foci, if any, and the elimination of residual malaria from the population. The surveillance technique adopted in Taiwan has been described in connexion with the experiences acquired to date.

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