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MALARIA ERADICATION PROGRAMMES IN THE EASTERN MEDITERRANEAN REGION

I INTRODUCTION

The Eastern Mediterranean Region comprises twenty-four countries and territories with an area of approximately 12,918,000 square kilometers, and a total population of 195,000,000, of which approximately 127,472,000 (almost 67%) live in malarious areas. Malaria activities during 1959 protected about 38,012,177 of the population which represents 30% of those exposed to malaria risk (see table III for breakdown). Apart from Kuwait, where malaria is not known to have existed, malaria has disappeared in Aden Colony, Cyprus, Gaza Strip, and French Somaliland, through efforts of public health workers. The total population in these areas which can be considered in the maintenance phase is estimated at 1,242,000.

The eradication programmes are being implemented in Iran, Iraq, Israel, Jordan, Lebanon, and the Province of Syria, UAR. Malaria Eradication Pilot Projects have been functioning in Ethiopia and Sudan. Pre-eradication surveys started in Libya (July 1958), in Tunisia (July 1958), Province of Egypt, UAR (February 1959) and are expected to be completed by the end of 1959. Other pre-eradication surveys are proposed for Pakistan and Saudi Arabia to start late in 1959, and in Ethiopia, Sudan and Somalia by 1960.

The above programmes in the Eastern Mediterranean Region show the progressive steps that are being taken in implementing the Eighth World Health Assembly Resolution[1] on Global Malaria Eradication. The recent acceptance of Pakistan, which has the greatest bulk of population living in malarious areas (57,087,000), to adopt the malaria eradication policy marks a new era, and raises great hopes that this Region will ultimately be freed from the malaria scourge.

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(1) WHA8.30

Very little is known about the epidemiology of malaria in Yemen, Aden Protectorate, Muscat and Oman, Trucial Oman, Qatar and Bahrein where an estimated population of five million lives under malaria risk and where very limited control activities afford protection to a few thousands in scattered areas of political importance. Efforts are being made to stimulate the local authorities to request fellowships from WHO for training at Regional Malaria Eradication Training Centres so that a corps of personnel may be developed on whom will depend the expansion of anti-malaria activities and their future evolution into eradication programmes.

II STATUS OF MALARIA ERADICATION PROGRAMMES IN THE NORTHERN COUNTRIES OF THE REGION

1. PREAMBLE

As mentioned before, there are six countries in the north-eastern part of the Region extending from Iran to Lebanon and Israel, with a total population of 36,819,000 among whom 22,905,000 live under malaria risk. Residual spraying during 1959 is protecting 11,398,000 and surveillance after discontinuation of spraying 7,180,000 (see table II for breakdown). Apart from Iran, where eradication is progressing by stages, all the other countries are undertaking field operations on a country-wide basis. Table III shows the year when eradication measures were implemented in these countries, the year eradication is expected to be declared and the anti-malaria activities integrated into the public health activities of the countries concerned. It is expected that if the projected plans and the administrative reforms are implemented, eradication of malaria will be declared in Iran in the year 1967, while in the other five countries it will be eradicated by the year 1963, or, at the latest, by 1965.

2. FUNCTIONAL STRUCTURE OF THE NATIONAL MALARIA ERADICATION SERVICES

These structures differ from one country to the other and the powers invested in the Director of the Malaria Eradication Services vary a great deal from one service to the other.

The functional structure of the Malaria Eradication Service in Iran comprises three sections, namely, operational, epidemiological and administrative, and the Director of the Service is responsible directly to the Minister of Health. The activities of this Service are technically audited by the Scientific Council of the Malaria Institute. The latter Institute itself contributes to the malaria eradication programme by offering training

facilities to professional and auxiliary staff and also carries out applied research and investigations on the technical problems such as resistance of vectors, residual effect of insecticides and nomadism.

In Iraq and the Province of Syria, UAR, the Director of the National Malaria Services are not yet invested with full powers of administration, recruitment of personnel or in the control of funds allocated to the malaria eradication programmes. It is to be regretted that these administrative difficulties will result in prolonging the period planned for completing eradication and will thus involve the governments in greater expenditures than originally visualized.

In Israel, Jordan and Lebanon, the National Malaria Services need strengthening, although the major proportion of inhabitants that used to live under malaria risk are now being protected by surveillance alone. It should be realized that a good administration is the key to success whether during the attack phase or during the consolidation phase of malaria eradication programmes.

The World Health Organization, realizing the importance of administration in malaria eradication programmes, and in order to relieve the technical staff from dealing with various administrative activities concerning logistics, personnel, accounting, etc., is now helping such programmes by providing Advisers in Administrative Methods. Such Advisers are already assigned to Iran, Iraq, and the Province of Syria, UAR. Full use cannot be made of their services unless the governments concerned realize that administrative reforms mean economy and efficiency and willingly offer their support to carry out such reforms.

3. LEGISLATION

Twenty countries and territories of this Region are known to have some form of anti-malaria legislation, although in a number of cases this is incompletely adapted to eradication requirements. In some countries there are regulations for obligatory house access for spraying of premises, but the legislative measures regarding compulsory case treatment, obligatory acceptance of treatment and the exemption of malaria supplies from customs are lacking in most countries. Table IV shows the status of the anti-malaria legislative measures in sixteen countries of the Eastern Mediterranean Region.

It should be pointed out in this connexion that the legislation should give financial and administrative autonomy to the Director-General of the Malaria Eradication Service who should be on a full time appointment.

In certain cases, the legislation should provide for the adequate remuneration of employees in the national malaria eradication services because of the nature of their work which is very exacting.

As the importance of legislation is not fully realized by some of the governments undertaking malaria eradication, the World Health Organization has felt the need to help such governments in developing appropriate legislation or adapting the existing laws to suit the malaria eradication undertakings. A Regional Legal Consultant has been recruited, and is visiting the countries where eradication is proceeding or will soon be implemented to help in reviewing the existing legislation and recommending appropriate changes or new legislative measures which will facilitate the functioning of the Malaria Eradication Services. It is hoped that the governments will give full support to the services of the Legal Adviser and expedite the promulgation of the proposed legislative measures that will ensure the execution of such programmes within the time limit and with the required exactitude and efficiency.

4. FIELD OPERATIONS

(a) Spraying Operations

As malaria transmission is seasonal in all the above-mentioned countries undergoing eradication, the spraying operations are planned to be completed within a limited period and before the malaria transmission season starts One cycle of spraying a year is the rule, although in certain malarious areas, such as the A. stephensi area in southern Iran, the highly infested A. sacharovi area in northern Iraq, and the A. sergenti infested valleys in Israel and Jordan, two rounds of residual spraying are made.

Table I gives details of the numbers of spraying squads, vehicles, population protected and other relevant data including larviciding activities. DDT 75% w.d.p. is the most widely used insecticide. In the DDT resistant areas of A. stephensi in southern Iran and Iraq, dieldrin is being used with success. Apart from Israel, where no UNICEF assistance is given to the anti-malaria programme, UNICEF is contributing most of the insecticides, equipment and transport needed for these programmes. In Iraq, the UNICEF contribution up to 1959 was limited to 10% of the imported supplies, but a substantial increase is pledged for coming years.

As the success of the malaria eradication programmes depends mainly on the thorough execution of spraying operations during the short operational cycle, the logistics, the training of spraymen and squad leaders, their

itineraries and the supervision of their activities have to be thoroughly planned in advance each year. Iran is fortunate to have a number of sanitary engineers who have been charged with the organization and supervision of spraying operations, while in other countries the job is being entrusted to trained national sanitarians. WHO is helping such countries as Iraq, Jordan and the Province of Syria, UAR, by providing WHO sanitarians to contribute in training national personnel as well as rendering advisory services in the planning, execution and supervision of spraying operations. It is noted that larviciding operations play an important role in the eradication programmes in Israel and Jordan where A. sergenti is not vulnerable to DDT residual house spraying because of its outdoor biting and resting habits.

As many areas in the above-mentioned countries undergoing eradication are approaching the consolidation stage, this will progressively result in a reduction in the number of inhabitants to be protected by residual spraying and a relative increase of those who will be protected by surveillance activities alone. During this phasing period which in most cases comes after the third or fourth year of total coverage by residual spraying, the supervisory auxiliary personnel are given special training so that their knowledge of the areas and of the inhabitants will enable them to contribute to the surveillance activities during the consolidation phase.

(b) Epidemiological Operations

Surveillance activities are being carried out to a smaller or larger extent in all the six countries undertaking eradication.

Table VI gives the number of those protected by surveillance alone after discontinuation of spraying. These numbers will be progressively increasing in coming years. Surveillance activities are also carried out in the last year of the attack phase as it is stressed that such activities, even if started earlier, should reach 100% coverage of the population before any discontinuation of spraying is recommended.

Organization of the surveillance is based on the assignment of one surveillance agent to every 10,000 - 20,000 population. He makes house to house visits and takes blood specimens from every fever or malaria suspected case and administers a dose of 600 mgms chloroquine (adult dose) or its equivalent of any other similar anti-malaria drug, plus one or two tablets of a sporonticidal drug like pyrimethamine. This operation is carried out on a monthly cycle and it includes also epidemiological investigations on every positive malaria case confirmed microscopically in order to trace its source of origin

and eliminate any risk of malaria transmission resulting from it, by conducting focal spraying in the positive house or the neighbourhood, and by effecting its radical cure by anti-malaria drugs.

The surveillance operation requires an adequate number of well-trained microscopists assigned to field laboratories within easy reach of the supervisory staff in order to avoid any delay in the reporting of positive malaria cases. Thus Malaria Eradication Services have to plan well in advance the training of the needed microscopists for the expanding surveillance programme and to decentralize the laboratory work by establishing field laboratories in strategic peripheral areas. It is noted here that the training of national microscopists is a responsibility of the National Malaria Eradication Services and, unless an adequate and intensive training is given to such would-be microscopists for at least three months followed by in-service training under supervision for a further period of three months, the reliability of their blood examinations will be doubted, not to mention the risks involved in missing positive malaria cases during the consolidation phase.

It has been discovered that such an active surveillance operation carried out by the personnel of the National Malaria Eradication Service costs as much as the spraying operation, and in Iran the cost per capita of this operation is estimated at US $0.50. It has also been found that through health education techniques, voluntary collaborators from villages and other rural communities can be enlisted to help in the detection of malaria cases. This type of public cooperation is regarded as essential in supplementing active surveillance, and is regrettably lacking in the eradication programmes of this Region. Its future development will certainly increase the efficiency of work and will effect savings in the per capita cost of the consolidation phase.

For this reason health education is becoming an integral activity of the Malaria Eradication Services and its aim of enlisting the collaboration of medical and other health personnel of the departments of the Ministry of Public Health as well as that of the public in the detection of malaria cases will certainly pay dividends in fulfilling the objectives of surveillance and ensuring the success of the malaria eradication programmes.

In this connexion, and as previously mentioned, success of the surveillance activities will be attained sooner if the governments implement the legislative measures concerning compulsory notification of malaria cases and list Malaria in group "A" of the notifiable diseases. This, by itself, will secure the

collaboration of the medical corps of the Ministry of Health and private practitioners, pharmacists, hospitals and private laboratories in notifying this disease, the eradication of which is involving governments in heavy expenditures.

The Regional Office, realizing the importance of health education in malaria eradication programmes, especially in the consolidation phase, is encouraging governments to include health education as an integral part of the National Malaria Eradication Service and is ready to provide experts to advise on the methods and procedures to be followed in mobilizing the public to contribute to the realization of the national goal of malaria eradication.

Other epidemiological operations are being carried out during the attack phase and also in the preparatory phase in certain zones in Iran, where eradication measures are proceeding by stages. The objectives of these epidemiological operations in areas under the attack phase involve routine malariometric surveys of various age groups, including infants, to assess the protection afforded by residual spraying operations and to ascertain the interruption of malaria transmission. During the second and third year of the attack phase as many children up to four years old as could be examined are included. This, together with the establishment of 100% surveillance coverage during the third year of the spraying operations, affords statistically reasonable epidemiological criteria to prove that successful interruption of malaria transmission has been effected for three consecutive years before a decision is taken to discontinue residual spraying.

Table VI shows the surveillance agents employed during 1958/1959, the number of slides examined by all the laboratory services of the countries undergoing eradication and the number of positive cases found. It is regretted that the number of slides collected from areas during consolidation phase are not reported separately. The numbers quoted represent those collected by active and passive surveillance during both attack and consolidation.

It is noted that in the six countries undertaking eradication, out of 722,650 blood slides examined for malaria during 1958, there were 5706 (0.78%) positives (4035 *vivax*, 1461 *falciparum*, 64 *malariae*, and 146 mixed).

In order to organize the reporting on surveillance activities and to evaluate the data obtained by such an operation, the Regional Office will soon be circulating standard forms. These will help both the national services and the international agencies interested to follow up the achievements of

this important operation, regarded as the best illustrative index to the progress of the programmes towards the eradication goal. Such data will also provide adequate criteria for deciding on the timing of the integration of the consolidation phase of the malaria eradication programme into the public health services of the countries concerned as the maintenance phase of such programmes.

III STATUS OF ANTI-MALARIA PROGRAMMES WHERE PRE-ERADICATION SURVEYS ARE CONCLUDED

1. PREAMBLE

As the success of the malaria eradication programmes on a regional or global basis depends on the 100% participation of all countries and territories, the WHO regional policy has been to urge governments to undertake malaria eradication programmes, not only to eliminate a major public health problem, but also as an economic investment which will relieve the governments of heavy expenditures on malaria control activities which recur annually. It has been shown also that malaria control activities, even though they may succeed in reducing the disease to a low endemicity, cannot cope with its persistence which sometimes leads to devastating epidemics. It is gratifying to note here that during 1959, Libya, Tunisia, the Province of Egypt (UAR), Pakistan and Saudi Arabia have joined the malaria eradication march and are implementing pre-eradication surveys with the objective of developing comprehensive plans of operation to serve as blueprints for the execution of future malaria eradication programmes.

It may be noted here that the development of comprehensive plans of operation is imperative before any agreement is concluded between a government and the contributing international agencies. The items to be developed in such plans of operations are referred to in the Sixth Report of the Expert Committee on Malaria[1].

The World Health Organization, realizing the importance of administration in running eradication programmes, has included in the model text of the plans of operation a paragraph which runs as follows :

> "The Government agrees to afford to the Organization all necessary facilities to enable the Organization to provide at its own cost administrative advice and assistance to the programme relating to the handling and distribution of supplies and equipment and any other administrative or financial question which may arise in the operations of the programme."

(1) WHO Tech.Rep.Ser.123. Annex III, p.75

The duration of the pre-eradication survey in any country depends on various factors: size of the country to be surveyed, availability of roads and good communications, maps and statistical data on demography, climatology, etc.; the extent of the malarious areas, and the existence of malaria reports and scientific data compiled by previous malariometric surveys.

Table I shows the countries undergoing pre-eradication surveys and it may be noted that they represent a large number of countries of the Eastern Mediterranean Region with the greatest malaria load in the Region (estimated number living under malaria risk is 78.6 million).

The Regional Office, in order to help governments to develop their comprehensive plans of operation, has been providing the above-mentioned governments with WHO pre-eradication survey teams, each consisting of a malariologist, an entomologist, a sanitarian and a technician. These, with their national counterparts, assisted by a Government Coordinating Board, are entrusted with the development of such plans. The Regional Office has also provided a list of standard supplies and two vehicles to meet the needs of each team. Apart from the technical planning of future eradication programmes, these teams are responsible for developing and stimulating the governments to pave the way during the period of the pre-eradication survey to promulgate legislation and fill the administrative and financial requirements in preparation for the eradication programme.

2. ANTI-MALARIA ACTIVITIES IN THE PRE-ERADICATION COUNTRIES

LIBYA

In Libya, where a population of 86,000 is estimated to live under malaria risk, the annual protection by residual spraying has only covered 20,000 inhabitants living in accessible malarious areas in Tripolitania and Fezzan provinces. The pre-eradication survey begun in July 1958 is expected to be completed by August 1959 and it is hoped that through WHO and ICA contributions Libya will be able to start implementing its eradication programme in 1960.

PAKISTAN

Pakistan has recently agreed to establish two WHO pre-eradication survey units - one in each province, to start work by September 1959. A National Planning Committee will be established by this time, and the programme will be provided with a high calibre WHO malariologist to act as coordinator and senior adviser. It is anticipated that these teams with the help of the National

Planning Committee will be able to develop the required plans of operation by the end of 1959 and thus start the eradication programme, possibly by stages, in 1960. Up to the end of 1958 the available data in the Regional Office shows that only a population of 150,000 in the Eastern Province, and 1.3 million in the Western Province were protected by residual spraying operations. It is expected that with the development of the plans of operation, both ICA and WHO/MESA funds and possibly UNICEF, will provide substantial help and thus Pakistan will be able to increase tremendously its target figure of protection year by year according to plan.

SAUDI ARABIA

Saudi Arabia has been conducting an expanded malaria control programme since 1950, when severe malaria epidemics with high fatality rate hit the country especially in the Red Sea Coastal strip including the Holy Places of the Islamic World. The WHO-assisted demonstration project, with headquarters in Jeddah, has been advising the Government in conducting its malaria control activities not only in the project area of Jeddah, Wadi Fatma and Mecca, but in other areas of this vast country where malaria epidemics were reported, such as in the south, near the Yemen border and in various valleys cutting into the plateau. During 1958 the control activities of the Ministry of Health offered direct protection by residual spraying to 197,325 people living in the Eastern Province, and indirect protection to 325,000 settled inhabitants mostly in Jeddah and Mecca towns and their outskirts.

In spite of the successful efforts of the WHO-assisted national malaria control programme that led to the almost complete disappearance of malaria from the 30,000 square kilometers covering the project area, and the effective control of malaria outbreaks in the most southern areas of the Red Sea coastal strip, and in the A. gambiae infested areas extending for hundreds of kilometers around the project area, the Government has been realizing the strain on its annual health budget caused by an expanding control programme having no end in view (estimated malaria expenditures in 1958-1959 amounted to $1,730,250). This has urged the Government to adopt a malaria eradication policy, and they requested the services of a pre-eradication survey team which started its work in July 1959 to develop a comprehensive plan of operation for malaria eradication by stages.

TUNISIA

Tunisia is an example of a country which has been conducting a malaria control programme based on larviciding and administration of anti-malaria drugs. Although public health activities have succeeded in maintaining

malaria at a low endemicity level, the preliminary investigations of the pre-eradication survey team show that malaria transmission is still continuing and maintaining hypo- or meso-endemicity of malaria in most of the areas surveyed. A population of almost 2.6 million out of a total population of 3.78 million are living under malaria risk. The government has been spending about $95,238 annually over the last three years and triple this amount in the previous years for malaria control operations. It is hoped that the pre-eradication survey work will be completed by the end of 1959 and eradication measures will be started in 1960.

UNITED ARAB REPUBLIC, PROVINCE OF EGYPT

The Province of Egypt, UAR, has a population of 24 million, out of which an estimated figure of 14 million live under malaria risk. The area of the inhabited land lying along the Nile River and its tributaries as well as in scattered oases in the western desert amount to 40,000 square kilometers. This country serves as an example of one that has been conducting a progressively expanding malaria control programme since the beginning of this century; nevertheless, the 1958 target figure of protection reached only 5.52 million population, (3.8 million by larviciding, about 1.7 million by residual spraying). In spite of the vast organization involving a staff of almost 2,000 persons, including 15 doctors, 41 engineers and 633 sanitarians, and an annual budget of LE.641,087 ($1,564.39) malaria still poses an expensive public health problem which could easily be eradicated if a comprehensive plan of action were implemented. Realizing the heavy annual expenditures incurred in the execution of the existing control programme, and expecting the malaria problem to become more serious following the intensive agricultural development resulting from the heightening of the Aswan Dam and from developing the water resources in the Western Oasis, the Government has decided to undertake a malaria eradication programme. Such an undertaking will not only free the country from a disease long known to be of a high morbidity rate and a decisive deterrent factor to any socio-economic development, but will prove also to be an economic investment which in the long run will save the Government heavy recurring annual expenditures on malaria control activities that have no end in view.

The WHO-assisted Pre-Eradication Survey Team started functioning early in 1959 and is being guided by a Pre-Eradication Board; it is expected to complete its work by the end of 1959. The Ministry of Health has already

taken steps to provide the required number of professional staff and has pushed their training in modern techniques and malaria eradication procedures by offering fellowships at the WHO Regional Malaria Eradication Training Centres in Cairo and in Kingston, Jamaica.

IV MALARIA ERADICATION PILOT PROJECTS IN THE REGION

1. POLICY

The policy of the World Health Organization in developing malaria eradication pilot projects is based on the need for certain countries to be convinced of the feasibility of malaria eradication under certain local conditions. This policy is different from the one adopted earlier when WHO-assisted malaria demonstration projects were planned and implemented in various countries of the Region to demonstrate the efficacy of residual spraying by modern insecticides in controlling rural malaria. In the new policy a malaria eradication pilot project is defined as a special demonstration project designed to interrupt malaria transmission as quickly and as efficiently as possible in a limited area of the country. It also involves demonstration of certain administrative and technical procedures needed to achieve this interruption. Such projects are limited to countries where there is reasonable hope that a successful demonstration will be developed into a national malaria eradication programme.

Generally such pilot projects are run on a much tighter time schedule (usually two years) involving a reasonable size of population (100,000/500,000) and planned in such a way as to concentrate the organizational and supervisory talent available to provide a continuous and thorough assessment of the progress of the project in meeting its objective of demonstrating the feasibility of interruption of malaria transmission by residual spraying, alone or in combination with other anti-malaria measures.

2. ACHIEVEMENTS OF MALARIA ERADICATION PILOT PROJECTS

In the Eastern Mediterranean Region there are three malaria eradication pilot projects in Ethiopia, Somalia and Sudan. Although A. gambiae is the main vector in these countries, different climatic, topographic and demographic factors affect the epidemiology of malaria in each of these countries.

ETHIOPIA

In Ethiopia the WHO/UNICEF-assisted pilot project established in the Awash Valley with headquarters in Nazareth Town started operations in 1957 and protected 54,000 inhabitants living in thirty villages. The ICA-assisted pilot projects that started operations in 1955 in Dembia and Kobo-Chercher

plains protected 85,000 inhabitants. These pilot projects are situated at altitudes above 900 metres, where malaria transmission follows a definite seasonal pattern. The interruption of malaria transmission by residual spraying with DDT was successfully demonstrated in both WHO and ICA pilot projects. These preliminary successes prompted the Government to expand the areas of the pilot projects (as in the case of the WHO-assisted project which during 1959 is covering a population of 130,000), and also to suggest that ICA establish a new pilot project in Gambella in a low-lying hyper-endemic malarious area where malaria transmission is perennial. This latter project will complete its preliminary surveys during 1959 and will be followed by operational measures. The anti-malaria activities during 1959 in Eritrea involving 80,000 inhabitants protected by DDT spraying or anti-larval measures, or by both (representing one-fifth of the population living under malaria risk) also claimed interruption of transmission especially where endemicity is low.

Impressed with the achievements of the pilot projects and in order to pave the way towards a future country-wide eradication programme, the Government has established a malaria eradication service in the Ministry of Health and ratified a malaria eradication proclamation decree drawn up in line with the recommendations of the Expert Committee on Malaria. The establishment of the WHO-assisted Malaria Training Centre in Nazareth which started functioning early in June 1959 will provide the Malaria Eradication Service with the required supervisory personnel and technicians needed urgently for implementing future programme.

Nomadism, the inaccessibility of certain villages due to lack of roads, the vast expanse of the country and the lack of adequate maps to locate the various rural communities, the mobility of a great bulk of the agricultural population and their habits of changing the roofs and re-plastering of the walls of their huts, and the time which it will take for the Ministry of Health to strengthen the public health structure at provincial and district levels, will necessitate the development of any future malaria eradication programme by stages. During 1960 a WHO pre-eradication survey team will be provided which, together with ICA will survey the whole country and compile all relevant data needed to draw up a comprehensive plan of operation for a future malaria eradication programme.

The Government, prompted by the successes of the pilot malaria eradication activities, and realizing the public health and economic gains that can be obtained by adopting a malaria eradication policy (especially after the experience of 1958 malaria epidemics when approximately 100,000 deaths occurred

due to malaria, and the whole economic life of the country was paralyzed) is now giving high priority to anti-malaria activities, and welcomes the international assistance offered by both WHO and ICA to enable it to plan and implement a programme having as its goal the eradication of this disease.

SOMALIA

Somalia serves as an example of a special pilot project that started operations in 1956 with UNICEF support and technical approval of WHO, but without the guidance of a WHO team.

Although DDT residual spraying operations, applied twice a year, afforded protection to almost one-fifth of the population (230,000 inhabitants) living in settled rural communities, along the valleys of the Schebeli and Juba rivers, the national organization of the Service could not so far effectively evaluate the programme to prove whether malaria transmission has been interrupted in the sprayed areas or not. In 1959 the first spraying cycle, scheduled to be carried out during the January/March period, could not be implemented due to its coinciding with Ramadan (The Islamic Fasting Month) and the general elections, but a concentrated effort is being made to assess the results of previous operations by intensifying epidemiological investigations.

The bedbug problem, which seemingly has increased following previous DDT residual spraying campaigns, and which could no longer be controlled by this insecticide due to the resistance to DDT developed by the bedbugs, (DDT dosage - 2 gms. technical and BHC - 250 mgms. per square metre) proved to be a trying problem especially as the inhabitants refuse to have their houses sprayed unless the insecticide used is also effective against bedbugs. Although DDT/BHC mixture has proved on an experimental basis (2 gms. DDT Technical + 250 mgms. Gamma Isomer per square metre) to be quite effective, it is not recommended for general use because of the fear of A. gambiae developing resistance to both. For this reason it has been decided to rely on an organophosphorus compound such as Malathion to be sprayed separately by special squads to deal with this problem. The services of a WHO entomologist were provided during 1959 to help in solving some of the entomological problems that may arise in connexion with the future malaria eradication programme. It is hoped that the 1959 epidemiological assessment of the spraying programmes carried out so far, together with the results of entomological investigations, will give a clear picture of the effectiveness of DDT in interrupting malaria transmission and will provide an adequate technical background on which an appropriate plan of operation for a pre-eradication survey team starting in 1960 can be developed.

Due to shortage of trained malaria auxiliary personnel in the newly-established Anti-Malaria Service, WHO fellowships are being granted to suitable candidates to attend the Cairo Regional Training Centre. UNICEF has promised assistance to this special pilot programme during 1960.

SUDAN

The Sudan malaria eradication project started operation in 1957 in the Fung District south of the Gezira irrigated area and afforded protection to 225,000 inhabitants living in 654 villages through dieldrin residual spraying at the dosage of 0.5 gms. per square metre. During 1958 the pilot project area was extended as far as the Ethiopian frontiers and afforded protection to a total of 480,000 inhabitants.

In spite of the various operational problems encountered, including the existence of 50,000 nomads, 20,000 seasonal migrants of cotton-pickers living in temporary huts, the shortage of water for spraying purposes in villages away from the Blue Nile, and the comparative inaccessibility of certain villages in the south, not to mention the climatic hardships prevailing in the main spraying season (March - May), the operational activities were executed in a satisfactory way.

Due to the inaccessibility of the southern villages during the long rainy season extending from June to October, a concentrated effort was made to assess the results of the 1958 spraying operation in an accessible zone near Sennar involving 100 villages with 75,000 inhabitants. The monthly malariometric surveys conducted from August 1958 until the end of that year and including monthly blood examinations of 500 infants, showed that interruption of malaria transmission was achieved in most of the villages except in a few that were bordering temporary nomadic settlements which imported into the project area both human malaria carriers and adults of A. gambiae that promptly bred and proliferated.

During 1959 the residual spraying operations reached the same protection target figure and followed the same pattern as in 1958 with a special effort to detect through the nomadic chiefs the movements of the tribes and effect a prompt spraying of their huts where they had settled. The area under continuous assessment will be gradually extended to cover the whole of the 1957 pilot project area involving 225,000 inhabitants. A system of surveillance is being established in this area that has received its third-year coverage by the 1959 spraying operation. This, apart from giving proof as to the success of the pilot project activities in interrupting malaria transmission, will demonstrate and try out the most suitable procedures to be used in surveillance.

At the start of implementing the pilot project in Sudan, Dieldrin was selected to be the insecticide of preference because of the claim that it has a longer residual effect than DDT (6-12 months) and could thus be relied upon by undertaking one cycle of spraying to protect the inhabitants living in areas where the malaria transmission season extends over almost eight months (July to February inclusive). The investigations carried out so far indicate that the residual effect of Dieldrin does not last more than four to five months. During 1959 DDT is being tried in a limited area to compare its residual effect with that of Dieldrin, and if this proves longer, DDT will be the insecticide of choice in future spraying operations. Fortunately no signs of resistance to Dieldrin or DDT have been detected to date in the main local vector (A. gambiae).

To maintain the gains obtained by the implementation of the pilot project involving a population of almost half a million, it has been decided to continue the services of the WHO team during 1960. The Government is planning to establish a Malaria Eradication Service within the structure of the Ministry of Public Health and has promised to include in its 1960/61 budget the necessary funds to meet the expenditures of a WHO-assisted pre-eradication survey project which will start its activities by mid-1960 subject to the development of an appropriate plan of operation agreeable to both the Government and the World Health Organization.

V ENTOMOLOGICAL RESEARCH PROGRAMME IN THE REGION

Detection of the early signs of resistance in local vectors as well as determination of the duration of effective lethal action of residual insecticidal treatment are essential and such entomological information is required in all phases of Malaria Eradication Programmes based on residual insecticides.

Adequate attention is being paid to these two points in all programmes in the Region. WHO entomologists working in the different countries of the Region have continued testing the susceptibility of local vectors to the different residual insecticides, DDT, BHC and Dieldrin. Standard WHO Test Kits for adults and larvae have been provided to all. WHO standard technique is followed. Bio-assay of sprayed surfaces for obtaining information about duration of effective lethal action of residual insecticidal treatment is also being developed. Routine observations of seasonal prevalence, infectivity, source of blood-meal and other relevant points in bionomics of local vectors are also continued.

In the Eastern Mediterranean Region there are nine principal malaria vectors, namely: A. maculipennis, A. sacharovi, A. labranchiae, A. superpictus, A. sergenti, A. stephensi, A. gambiae, A. funestus, A. pharoensis.

Among these, physiological resistance in A. stephensi to DDT has been now fully confirmed in three countries, Iran, Iraq, and Saudi Arabia.

In Jordan where limited residual larviciding with dieldrin had been carried out for some years due to exophilic and exophagic habits of the principal local vectors A. sergenti and A. superpictus, Garrett-Jones has recorded LC 50 of 1.4% - 2.8% to Dieldrin in the adult population of A. sergenti; in the larvae of the same species, LC 50 of 2.5 p.p.m. has been observed. Both the above values are considerably higher than in a normal population, and development of resistance to Dieldrin in A. sergenti in Jordan is suspected.

Against DDT-resistant A. stephensi in Iran and Iraq, Dieldrin has been successfully used. A WHO advisory team carried out observations on susceptibility to Dieldrin of A. stephensi in Iraq. LC 50 varied from 0.076% to 0.107% when plastic tubes were used as recovery cages while LC 50 was found between 0.121% to 0.195% when paper cups were used as recovery cages. These different levels of LC 50 with use of the two different types of recovery cages are being studied to evolve a standard. However tests indicated that a satisfactory level of susceptibility to Dieldrin still exists.

Increased vigour tolerance in A. maculipennis in Iran has also been suspected. As regards the remaining species, no signs of any development of resistance have been observed in the course of the routine susceptibility tests, and an encouraging situation prevails so far for residual insecticides. A. sacharovi has nearly been eliminated in Lebanon and Jordan with DDT.

Bio-assay of surfaces sprayed with Dieldrin was carried out in Iraq, Iran and Sudan, and the preliminary findings showed that four to five months can be taken as the effective duration period of insecticidal action of Dieldrin applied on various types of surfaces.

Experiments are being carried out in the Sudan pilot project to determine the residual effect of DDT as compared with dieldrin which has been used since 1957.

Observations were carried out in Somalia on the efficacy of a combination of DDT and BHC for the cimex problem. In this country the residual spraying of houses was much hampered due to apathy and lack of cooperation from the public when relief from bedbugs did not follow indoor residual spraying with DDT in doses usual in anti-malaria work. The use of an organo-phosphorus insecticide to deal with the bedbug problem seems to be the solution for the time being.

VI TRAINING IN MALARIA ERADICATION

As the success of the malaria eradication programmes depends principally on the availability of well trained personnel, the Regional Office has stimulated the governments to assess their needs for various categories of technical and administrative personnel well in advance and afford them adequate training facilities.

The training of auxiliary technical staff such as supervisors, technicians, surveillance agents, is a responsibility of the national malaria eradication services. Iran has a well-developed national malaria eradication training programme conducted by the Malaria Institute. This gives adequate training to all professional as well as auxiliary personnel needed in the various phases of the malaria eradication programme. Field training is also offered by the Institute to WHO trainees and to those awarded WHO intra-regional fellowships.

The WHO personnel attached to pilot projects or to running eradication programmes contribute to the organization of these training courses and share, together with their national counterparts, in the training itself. In Ethiopia, where an urgent need was felt to develop an adequate number of trained auxiliary personnel, WHO helped in establishing a malaria training centre which started functioning early in June 1959. This centre will give six-month training courses, each to train 20 to 25 malaria supervisors, blood and entomology technicians. Three WHO staff members (a malariologist, a sanitarian and a technician) are assigned to this Centre, and the WHO pilot project area around Nazareth is serving as the field training area for this project.

The WHO Regional Malaria Eradication Training Centre in Cairo established during December 1958, is progressing well. Its first three-month course for malaria supervisors (Junior Course) ended early in May 1959 and was attended by two from Jordan, two from Libya, three from Saudi Arabia, two from Sudan and eleven from United Arab Republic (Province of Egypt). Another junior course is proceeding. The objective of the junior course is to graduate malaria eradication supervisors, who could substitute for professional personnel in charge of malaria eradication units (especially in countries where these personnel - like medical officers or public health engineers - are lacking) or act as their deputies. The other type of course given by this Centre is the Senior Course which will start in October 1959 and continue for three months. This will be attended by professional personnel (medical

officers, public health engineers or entomologists) who will later be assigned as malaria eradication officers in charge of District or Provincial units. The above courses are given both in Arabic and English.

It will be noted too that in every WHO-assisted malaria eradication project, there are funds earmarked from the Malaria Eradication Special Account for intra-regional and inter-regional fellowships. Most of the latter are granted to professional personnel to attend the course given in Kingston, Jamaica, and to have field training in Mexico and other Latin American countries where the organization of malaria eradication services is well established. Twenty-six such fellowships have already been awarded during 1958 and up to July 1959, to candidates from Iran, Iraq, Lebanon, Pakistan, Somalia and the United Arab Republic (Provinces of Egypt and Syria).

VII THE REGIONAL MALARIA ERADICATION COORDINATION UNIT (MECU)

As may be seen in Document EM/RC9/3, this unit has been strengthened during 1959 by the addition of another Regional Malaria Adviser, a Regional Entomologist, a Regional Administrative Methods Adviser, a Technician and additional secretarial help.

This strengthening has been necessitated by the expanding malaria eradication programmes in the Region and by the need to offer technical and administrative guidance to such programmes in their various stages of development and the various phases of operational activities.

Almost fifty WHO staff (malariologists, entomologists, sanitary engineers, sanitarians, administrators and technicians) are engaged during 1959 in malaria field operations in the various countries of the Region. These, together with the Regional Office staff of MECU, form an advisory body to governments implementing malaria eradication programmes. Technical advice and guidance is provided in planning, operational activities, epidemiological assessment, administrative procedures and training activities at country level and on a regional basis. This international body of professional personnel helps also in contributing to or stimulating research on certain technical problems such as nomadism and other customs, resistance of vectors to insecticides, the residual effect of applied insecticides and the degree of their absorption on various mud walls.

The Regional Malaria Eradication Coordination Unit, apart from its review and comments on all the technical reports that come from the field, acts as the disseminator of technical information on malaria eradication progress, and

as a medium in standardizing the technical and administrative procedures of malaria eradication programmes among all professional personnel. This Unit is also responsible for stimulating the production of technical papers on malaria by scientists in the Region and their discussion in the Regional Malaria Eradication Technical Meetings, such as the one that was held in Baghdad in 1957, and the one scheduled to be held in Addis Ababa in late 1959.

One of the main concerns of MECU during this year is to develop standard forms for the reporting of operational activities, including surveillance, to be submitted regularly on a monthly and quarterly basis by the National Malaria Eradication Services. In this way, both governments and contributing international agencies which incur initial heavy expenditures on eradication programmes, could follow up the progress of these projects towards their goal of eradication, and detect in time any shortcomings or defects which would risk the successful issue of these programmes or prolong their duration with concomitant waste of money and effort.

The rôle of the new post of Administrative Methods Adviser in MECU was referred to when discussing the functional structure of the Malaria Eradication Services. It is being increasingly realized that eradication of malaria cannot be achieved with success unless a large degree of administrative and financial autonomy is given by governments to their malaria eradication services. The advisory services of this Administrative Methods Adviser could be fully utilized in establishing the administrative and financial procedures necessary for coping with a time-limited programme aiming at the total eradication of the disease. The rôle of health education in malaria eradication programmes has also been referred to previously and the Regional Health Educator cooperates actively with MECU in developing the rôle of Health Education in all the National Malaria Eradication Services.

The coordinative activities of MECU with other agencies giving international assistance, such as ICA and UNICEF, have been maintained at regional as well as at country level. Close contact and cooperation exists between this Unit and the Malaria Eradication Division at Headquarters. The Regional Office was represented by the Regional Director and the Senior Regional Malaria Adviser in the ICA/WHO Inter-regional Public Health Conference in Manila in November 1958. At this meeting the inter-agency relationships were discussed at global, regional and country levels and recommendations for improvement were made.

In order to stimulate coordination of activities between neighbouring countries of the Eastern Mediterranean or those adjoining other regions, governments concerned are invited to send representatives, at WHO cost, to

Regional Malaria Eradication Meetings as well as to inter-regional conferences such as the Third Asian Malaria Conference held in New Delhi in March 1959 and the Eastern-European Malaria Conference held in Bucharest in June 1958. These, together with the WHO programme of exchange of scientific workers, and the exchange of courtesy visits of professional malaria personnel, through bilateral agreements between neighbouring countries, all contribute to the coordination of effort in the malaria eradication programmes and bring a consciousness to malaria workers that they are members of one team persevering in an international public health undertaking of great magnitude and importance to the welfare of mankind.

TABLE I

STATUS OF SPRAY OPERATIONS IN EMR COUNTRIES (1959)

TYPE OF PROJECT	COUNTRY	NO. OF SQUADS		NO. OF VEHICLES (All Kinds)	NO. OF POPULATION PROTECTED		INSECTICIDES "SPRAYING"						LARVICIDES	
		Spraying	Larviciding		Spraying	Larviciding	Type	Formulation	Wall Dosage	No.Spr. Cycles One	No.Spr. Cycles Two	Total Amt. Kgs.	Name	Amount Litres
ERADICATION	IRAN	466*	?	630	5,879,000	350,000	DDT	75% ww	2(1)	x		975,000	Gasoil and Oil	2,527,000
							DLD	50% ww	0.5		x	150,000		
	IRAQ	483	24	220	2,864,936	1,835,000	DDT	75% ww	2	x	x	535,200	Fuel Oil and Gasoil	4,461,840
							DLD	50% ww	0.6	x	x	78,000		
							DLD	18.2 ww	0.6		x	20,000		
	ISRAEL	3	25	15	150,000	2,025,000	DDT	Technical	2	x	x	7,395	Malariol or Solar Oil	628,000
	JORDAN	20	17	21	230,000	200,000	DDT	75% ww	2	x	x	36,000	DDT Techn. in Solar Oil	Kg.12,000
	LEBANON	14	?	9	112,000	?	DDT	75% ww	2	x		14,000	DDT TECH.	Kg. 5
							DDT	25% ww	2	x		5,600		
	UAR SYRIA	98	3	55	1,255,000	5,000	DDT	75% ww	2	x		208,000	Paris Green Dusting	Kg. 500
							DDT	25% ec	2	x		13,000		
PRE-ERADICATION	LIBYA	?	-	3	50,000	-	DDT	75% ww	2	x		5,000	-	-
							DDT	50% ww	0.6	x		1,000		
	PAKISTAN	62	100	8	1,450,000	?	DDT	50% ww 75% ww	2.2	x	x	162,200	Malariol Kerosn. Oil	544,588 15,176
	SOMALIA	8	-	16	230,000	-	DDT	75% ww	2	x	x	56,500	-	-
							BHC	6.5 Ga. Is.	2	x	x	4,500		
	TUNISIA	-	8	14	-	590,000	-	-	-	-	-	-	Malariol with DLD	40,000
	UAR EGYPT	67	191	50	1,850,000	3,677,300	DDT	Tech.	2	x		1,028	Crude solar oil	945,631
							LDT	75% ww	2	x		206,081		
							DDT	50% ww	2	x		11,081	DDT Oil	68,180
							BHC	12% Ga. Is.	0.2			121,986	Paris Green Dusting	Kg. 924
							BHC	6.5%Ga. Is.	0.2			32,229		
PILOT	ETHIOPIA	27	-	22	250,000	-	DDT	75% ww	2	x		112,116	-	-
							DLD	50% ww	0.5	x		308		
							BHC	12% ww	0.4	x		1,103		
	S. ARABIA	24	12	20	197,300	325,000	DDT	75% ww	2	x		3,814	Diesel Oil + DDT Tech.	21,600
							DLD	50% ww	0.6	x		11,066		
							DLD	18.2% ec	0.6	x		5,584		
	SUDAN	480	Inhabitants	209	3,843,000	500,000	BHC	6.5%Ga.Is.	0.2		x	454,550	Diesel Oil	-
							DLD	50% ww	0.2	x		15,000		

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PROGRESS OF MALARIA ERADICATION IN THE NORTHERN COUNTRIES OF EMR

TABLE II

Ser. No.	COUNTRY	Total Population	No. of Pop. Under Malaria Risk	1958 Activities				1959 Activities			
				Population Protected by				Population Protected by			
				Residual Spraying	Larviciding	Surveillance*	Total	Residual Spraying	Larviciding	Surveillance*	Total
1	IRAN	21,000,000	12,500,000	5,729,000	350,000	2,448,700	8,527,700	5,879,000	350,000	3,770,000	9,999,000
2	IRAQ	6,500,000	5,500,000	2,547,000	1,835,000	1,253,000	5,635,000	2,864,936	1,835,000	460,000	5,159,936
3	ISRAEL	2,025,000	2,025,000	150,000	2,025,000	1,875,000	2,025,000	150,000	2,025,000	2,025,000	2,025,000
4	JORDAN	1,654,000	980,000	25,000	678,000	-	703,000	230,000	200,000	550,000	980,000
5	LEBANON	1,500,000	300,000	112,000	-	188,000	300,000	112,000	-	100,000	212,000
6	UAR SYRIA	4,140,000	1,600,000	1,241,000	5,000	120,000	1,366,000	1,255,000	5,000	275,000	1,535,000

* Population figures given show those protected by surveillance after discontinuation of spraying.

STATUS AND DEVELOPMENT OF MALARIA ERADICATION PROGRAMMES IN COUNTRIES OF THE EASTERN MEDITERRANEAN REGION

TABLE III

	Country and Territory	Country Population	No. of Popul. Under Malaria Risk	No. of Popul. Protected by all Methods	ERADICATION Date Commencement (attack)	Date Completion (Consolidation)	TYPE
ERADICATION	IRAN	21,000,000	12,500,000	9,999,000	1957	1967	by stages
	IRAQ	6,500,000	5,500,000	5,159,936	1957	1964	Country wide
	ISRAEL	2,025,000	2,025,000	2,025,000	1950	1963	Country wide
	JORDAN	1,654,000	980,000	980,000	1959	1965	Country wide
	LEBANON	1,500,000	300,000	272,000	1956	1963	Country wide
	UAR SYRIA	4,140,000	1,600,000	1,535,000	1956	1965	Country wide
PRE-ERADICATION	LIBYA	1,340,000	86,000	50,000	1961	1967	Country wide
	PAKISTAN	93,603,000	57,086,824*	5,500,000	1960	1977	By stages
	SOMALIA	1,300,000	1,070,000	230,000	1961	1968	Country wide
	TUNISIA	3,783,000	2,016,000	590,000	1961	1967	Country wide
	UAR EGYPT	23,410,000	18,315,000	5,527,300	1961	1968	by 2 stages
PILOT	ETHIOPIA	21,000,000	8,000,000	250,000	1961	1971	by stages
	S. ARABIA	6,500,000	6,000,000	476,000	1961	1971	by stages
	SUDAN	11,037,000	10,263,000	4,343,000	1962	1972	by stages
LIMITED CONTROL	ADEN	800,000	660,000	100,000			
	BAHREIN	120,000	?	?			
	QATAR	40,000	?	?			
	TRUC.STATES	60,000	?	?			
	YEMEN	4,500,000	35,000	-			
ERADICATED OR NORMALLY FREE	ADEN COL.	138,441	138,441	138,441	malaria eradicated since 1950		
	CYPRUS	529,000	529,000	529,000	malaria eradicated since 1949		
	FR.SOMAL.	67,500	67,500	67,500	malaria eradicated since 1957		
	GAZA STRIP	300,000	300,000	300,000	malaria eradicated since 1954		
	KUWAIT	207,000	-	-	Free from Malaria		

* According to the Questionnaire.

ANTI-MALARIA LEGISLATION FOR THE EASTERN MEDITERRANEAN REGION

TABLE IV

COUNTRY	SPECIFIC NATIONAL ME LEGISLATION (1)	OTHER RELEVANT (2)	INCLUDED IN (1) OR (2)			
			OBLIGATORY HOUSES ACCESS	COMPULSORY CASE REPORTING	OBLIGATORY ACCEPTANCE TREATMENT	SUPPLIES: CUSTOMS EXEMPTION
CYPRUS	Yes	Yes	Yes	Yes	Yes	Yes
ETHIOPIA	Yes	-	Yes	Yes	Yes	Yes
FR. SOMALILAND	No	Yes	Yes	No	No	No
IRAN	No	Yes	No	Yes	No	Yes
IRAQ	No	Yes	Yes	Yes	Yes	Yes
ISRAEL	No	Yes	Yes	Yes	Yes	?
JORDAN	No	Yes	?	Yes	Yes	?
LEBANON	No	Yes	Yes	Yes	No	Yes
LIBYA	No	No	No	No	No	?
PAKISTAN	No	Yes	Yes	No	No	No
SAUDI ARABIA	No	No	?	?	?	?
SOMALIA	No	Yes	Yes	No	No	Not all
SUDAN	No	Yes	Yes	Yes	No	No
TUNISIA	No	No	No	No	No	No
UAR (EGYPT)	No	Yes	Yes	Yes	Yes	No
UAR (SYRIA)	No	Yes	Yes	No	No	No

TABLE V

NATIONAL PERSONNEL OF ANTI-MALARIA SERVICES

EMR - 1958

COUNTRY AND TERRITORY	Professional	Tech.(1) Auxiliaries	Administrative	(2) Seasonal	Drivers and Mechanics	Others
CYPRUS	9	45	?	200	-	200
ETHIOPIA	5*	13	16	232	8	-
FRENCH SOMALIA	1	6	3	10	2	17
IRAN	72	870	129	3221	438	111
IRAQ	6	226	132	4395	251	27
ISRAEL	1	27	2	-	15	190
JORDAN**	4	32	15	170	17	130
LEBANON	2	19	5	114	10	-
LIBYA	2*	2	?	?	2	?
PAKISTAN	23	116	15	580	16	31
S.ARABIA	6	37	15	157	25	85
SOMALIA	3*	13	2	178	17	-
SUDAN	2	240	-(4)	1500	309(5)	495
TUNISIA	-	44	-	360	10	30
UAR (EGYPT)	48	258	84	1229(6)	56	58
UAR (SYRIA)	7	53	15	787	17	59

(1) Technical staff working all year round (including surveillance agents and microscopists).

(2) Temporary spraying crews mainly.

(3) Guards, Janitors, Messengers, etc. (including larviciding crews).

(4) Programme administered through P.H.Service.

(5) Government transport Department.

(6) (Spraymen - Larviciders) all year round.

* All foreign advisers

** UNRWA Personnal included.

STATUS OF SURVEILLANCE PROGRAMMES

TABLE VI NORTHERN COUNTRIES OF THE EASTERN MEDITERRANEAN REGION - 1958

Country	No. of Surveillance Agents	Blood Examination and Results							No. of Micro-scopists	No. of Labora-tories	Population protected by Surveillance only
		Total examined	Total +	Rate (%)	Plasmodium Classific.						
					Vivax	Falcip.	Malar.	Mixed			
IRAN	1196	439,584	4556	1.03	3327	1059	57	113	161	54	2,448,700
IRAQ	118	189,152	642	.33	472	163	-	7	72	17	1,253,000
ISRAEL	? **	1,370	30	2.19	20	10	-	-	- *	? **	2,025,000
JORDAN	-	17,928	348	1.94	179	137	6	26	7	7	-
LEBANON	4	45,583	14	.03	13	-	1	-	5	4	188,000
U.A.R. (SYRIA)	25	29,033	116	.04	24	92	-	-	10	4	120,000

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* Examination performed by Government and 100 private laboratories.

** 27 Inspectors of the Malaria Service.

The blood slides collected for areas under surveillance whether during attack or consolidation.phase.