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REVIEW OF MALARIA ERADICATION PROGRAMMES IN

JORDAN, SYRIAN ARAB REPUBLIC, LEBANON, IRAQ AND IRAN

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by

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I FOREWORD

My assignment as short-term consultant with the World Health Organization began on July 21st and terminated on 4th November, 1962. During this period of just over fifteen weeks, I had the occasion to visit and make a field study of the malaria situation in Jordan, Lebanon, Syria, Iraq and Iran. The results of my observations are contained in the attached reports in the preparation of which I have freely used the information kindly placed at my disposal by the Malaria Eradication Organization of the countries and the Malaria Eradication Unit of the WHO Regional Office. But for this valuable assistance which I have much pleasure in acknowledging, I doubt if in the short time at my disposal, I could have gained the requisite insight into the malaria problems of these countries.

In the course of my visits, however, I observed that certain problems were common to many of the countries which could collectively be regarded as regional issues. To obviate the need for repetition in the individual country reports, I have thought it proper that such issues be discussed separately here.

1. Progress of Malaria Eradication

I observed that in all the countries I visited, malaria eradication had reached the stage where an outbreak involving even a small number of cases was treated as a most serious affair. This is undoubtedly a healthy sign, provided of course, that it has not arisen from over-optimistic expectations. Such expectations must be discouraged not only on general principles, but also because the clean areas in these countries are extremely vulnerable to reinfections by the nomads. Localized outbreaks of malaria may, therefore, be expected to continue until such time as the reservoir of infection in the country has been totally liquidated by the eradication programme. This position should be made known to the higher authorities to enable them to look at these episodes in their true perspective as, otherwise, they may well lose confidence in the malaria eradication programme.

In this context, the most commendable feature of the anti-malaria effort in all these countries is that no attempt has so far been made to conceal malaria infection. Nothing should be done which would, in any way, disturb this attitude for, as long as the honest reporting of cases continues, all hidden foci of malarial infections would, sooner or later, be brought to light and eradicated.

2. Maintenance phase

Although most of the countries are approaching the maintenance phase, my impression was that none of them had, as yet, a clear idea of how to effect the change over to this phase. Most countries anticipated numerous administrative complications particularly in the field of financial support. Their fear was that, while the securing of funds for the malaria eradication programme presented no insuperable difficulties, the permanent incorporation of malaria vigilance staff into the general public health service might not be as readily accepted.

Technical integration was expected to present still more complex and difficult problems. It was fully appreciated that the maintenance phase could only be handed over to an establishment that existed on the ground and was fully geared to undertake not only the early detection of malaria infections, but also the immediate liquidation of these foci. Most countries, however, were conscious of the fact that their existing health structure was not sufficiently developed to be able to take on these additional duties. Indeed, their health organization was patently weakest at the periphery just where it should, in fact, be strongest to meet the needs of the malaria programme. The need for raising the standard of the health infra-structure was thus universally felt, but it was also feared that, at the customary slow rate of development, this would take a considerable period of time. Per contra, the malaria organization for its part could not be expected to wait indefinitely and extend its consolidation phase much beyond the allotted span of three years because of the heavy expenditure involved. The problem, therefore, is to devise ways and means which would expedite the development of the health infra-structure or, at least, those aspects required to carry out the malaria maintenance phase.

Under the conditions prevailing in most countries, the only practical solution would appear to be that the malaria organization should itself take the initiative and establish a network of malaria detection posts on the ground. This network can subsequently be handed over to the Public Health Department after it has been tested in the field and found to meet the requirements of malaria maintenance satisfactorily. In undertaking this task, the malaria organization will have to carry out an elaborate "disengagement" or "disbandment" exercise preferably during a new operational phase, which may be termed the "Pre-maintenance phase".

The organizational details of the latter phase and the extent of the area over which it would operate must necessarily vary from country to country.

As a general rule, however, its planning has to take note of the following points :

a) While the phase may be planned in the first year of the consolidation phase, it will rarely be possible to implement it before the third year.

b) It will not be necessary to wait till an entire geographical or operational unit is ready, as the phase can be implemented in a sub-division, provided this is sufficiently large.

c) The administration and financing of the phase should be undertaken by the malaria organization but the regional health officers should be closely and actively associated with the supervision of the surveillance activities.

d) Active surveillance should be gradually reduced to the minimum sufficient to meet actual field requirements. Simultaneous action should be taken to widen the scope and effectiveness of the passive surveillance by ensuring that :

   i) the maximum use is made of the existing dispensaries, hospitals and other medical institutions,

   ii) additional dispensaries or "malaria detection posts" are set up and sited at strategic points as determined by a detailed survey. These may be manned by voluntary collaborators or dressers or selected surveillance agents.

e) Progressive retrenchment should be undertaken of the non-technical staff at all levels consistent with actual needs as determined by experience in the field.

f) Active steps should be taken to create and make financial provision for a suitable service, such as rural health, environmental sanitation, anti-insect department etc., which would be capable not only of taking over the malaria detection posts and dispensaries for maintenance duties, but also of absorbing, if possible, a fair proportion of the retrenched malaria staff.

g) It may be found necessary to establish a number of mobile surveillance units at the Headquarters' level which could be used to check different areas, as and when necessary. This would particularly be useful in the earlier stages of the pre-maintenance phase, as it would facilitate the change over from active to passive surveillance.

h) Special provision should be made to arrange short re-orientation courses of trainirg for the surveillance agents to prepare them for duties in the rural health service, including dispensary service.

3. Anopheline Breeding Places

Since the transmission of malaria in this region occurs during the season when there is little or no rain, the breeding of anophelines is usually restricted to certain permanent collections of water that may be amenable to engineering methods of control. Examples of successful drainage operations of this nature which had an important beneficiary impact on the local malaria situation are those carried out in the Bakka and coastal plains of Lebanon and the Ghab and Rouje valleys in Syria. The same approach might usefully be extended to the Jordan valley and the connected wadis as well as to the coastal plain of Syria.

In this context, an important consideration would be to settle the timing for the planning and execution of these measures. Although the maintenance phase would, as a general rule, be the most suitable time, it may perhaps be possible to undertake the planning in the pre-maintenance phase. Such measures should be designed to form an integral part of the schemes for land reclamation or agricultural development. The maintenance phase will thus have to be viewed not as a passive phase of watchfulness against imported infections, but as one in which all development projects will have to be watched with two objectives in view :-

a) that they do not produce fresh breeding places for anophelines and,

b) that wherever possible, they are utilized either to abolish the existing anopheline breeding places or reduce them to the minimum.

4. Surveillance

It was a fairly common experience in most of the countries that, as malaria operations advanced to the stage of eradication, many of the routine assessment measures failed to display the same degree of sensitivity as they did in the early phases. The question, therefore, arose whether the surveillance system should, at this stage, be modified, and if so, in what direction.

In seeking an answer to this question, it has to be borne in mind that all investigatory procedures in malaria have to be designed and executed strictly in the light of prevailing local conditions. Speaking generally, however, it may be said that, in situations where the disease has receded to small isolated pockets, it usually comes out into the open only when the infection precipitates a clinical attack. In these circumstances, it should be expected that passive surveillance would grow increasingly more effective than active surveillance in ferreting out hidden infections. It follows therefore that, as the consolidation phase proceeds to the second or third year, the surveillance programme may have to be adjusted to the changed conditions by a shift of emphasis to the passive type of malaria detection. Active surveillance, on the other hand, may have to be curtailed and restricted to the highly endemic areas, or alternatively entrusted to certain mobile units located at Headquarters which could check the different areas, as and were required. Whatever decision is taken in regard to active surveillance, the guiding principle should be not to spread effort too thinly, but to concentrate it on localities that are known to be dangerous.

It may similarly be necessary to revise the location and functions of the entomological teams which should accord more and more with epidemiological requirements rather than the routine allocations based on operational sub-division.

5. Financial Provisions

In most countries, I found that financial allocations were adequate and regular, but in some, much uncertainty prevailed from year to year. This was because specific allocations were not always made at the start of the financial year. Not unnaturally, the smooth flow of eradication activity was thereby seriously disturbed, affecting the outlook of the administrative authorities as well as that of the field personnel. Moreover, it often happened that, when the allocations were ultimately announced, the sanctioned grant was cut arbitrarily on a percentage basis. This necessitated a last minute revision in the programme of work introducing obvious inconveniences and imperfections.

Considering that malaria eradication programme in most countries is now approaching the final stages, considering also that the results obtained have on the whole been well up to expectations, I would strongly recommend to the Government authorities as well as to the International aid-giving agencies to continue with their efforts for the short time required to achieve the objective. The malaria eradication department for its part should take all possible steps to enforce strict economy by undertaking bold measures of retrenchment wherever feasible. To stay on the safe side is most desirable but not if it induces an over-cautious attitude which might force the authorities to impose arbitrary cuts in the budget. This is a most unfortunate occurrence as, apart from other considerations, it connotes loss of confidence between the administration and the malaria organization.

6. Geographical Reconnaissance

The extent to which geographical reconnaissance has been carried out varies from country to country, but serious efforts have been made in all to implement this measure as widely as possible.

On studying the elaborate data so collected, I was struck with its unique character for it is perhaps the first time that an attempt has been made to make a comprehensive record of information village by village. It cannot be over-emphasized that the utility of this data goes much beyond the scope of the malaria eradication programme, not only for future country-wide campaigns against other diseases, but also for the preparation of social and economic development schemes.

II MALARIA SITUATION IN JORDAN

Itinerary

12th August : Arrived at Amman; visited Wadi-Zarqa & Jarash in the afternoon.

13th August : Called on H.E. the Minister of Health and the Director-General. Later met the Director, Malaria Eradication Programme, and the Malaria Adviser of the AID(USA). Visited Madaba area and Mount Nebu in the afternoon.

14th August : Visited Jericho and camps and villages in its vicinity and returned to Amman the same afternoon.

15th August : Proceeded to Irbed via Ajloun, then on to Umqais and down to Yarmuk Valley. Traversed the Jordan Valley from its northern end along the East Ghor Canal to the malaria centre at Deir Ala. Crossed the river at Damaya and then along the western road to Jericho and Jerusalem.

16th August : Visited the malaria centre and laboratory at Jerusalem and later proceeded to Hebron to study the southern sector of West Jordan.

17th August : Friday, no field trips.

18th August : Proceeded north to the malaria centre at Nablus, stopping on the way at 3 villages to review the surveillance operations. Returned to Amman via Wadi Farah and Damya Bridge.

19th August : Reviewed the problem of the malaria outbreak at Wadi Seir and Kharbat Turki.

20th August : Met the Director, Malaria Eradication, and later H.E. the Minister to whom I gave an outline of my findings in general terms. Left for Beirut in the afternoon.

INTRODUCTION

From the itinerary given in the preceding section, it will be observed that during my survey of Jordan, I was able to cover most of the malarious areas of the country with the exception of the region east of the Dead Sea. My comments are therefore based on my own study of these areas in the light of information contained in reports which the Malaria Eradication Department was kind enough to place at my disposal.

West Jordan

I visited the malaria centres at Hebron, Jerusalem and Nablus, thus covering all the three districts that comprise the West Jordan Zone. Here, malaria has not been a serious problem for the reason that the great majority of the villages and towns have no springs or perennial streams, but depend on wells or rain water cisterns for their daily requirements. It was possible therefore to bring the disease in this zone of 127 villages with a population of 771,087 under complete control in a few years. Spraying and other active measures were discontinued after 1959 and the area entered the consolidation phase in 1960. It is now adequately covered by a comprehensive surveillance organization, consisting of 40 active agents, 360 voluntary collaborators and 67 clinics and dispensaries. During my visits to the villages, I checked the work of a number of these agents and voluntary collaborators and was satisfied that they fully understood their duties and responsibilities. Their records, which are exceptionally elaborate and comprehensive, were also kept up to date. In the laboratories, the slides were properly stained and the staff was fully conversant with the appearance of malaria parasites in blood films.

The appointment of a senior laboratory technician had proved particularly useful not only for checking the results of blood examinations, but also for balancing the work-load by distributing the excess of slides between different laboratories. This has eliminated the piling up of slides in laboratories as the result of which they can now communicate to the field personnel the examination results within 48 hours.

The number of proven malaria cases detected in the West Jordan zone during 1960 and 1961 was 51 and 34 respectively. In all of these cases except two, the source of infection was traced either to the Jordan Valley and neighbouring Wadis or to foreign countries, particularly Saudi Arabia. The two indigenous cases that occurred in 1960 had both P.falciparum infection, but they were neither followed nor accompanied by any other infection in the same or neighbouring villages.

Up to mid-August of 1962, only six cases had been recorded in the zone, of which four were imported from Saudi Arabia and the remaining two from the other parts of Jordan.

Future action

In the tentative Plan of Action for 1963, it is proposed that the surveillance operations beintensified in the Zone and continued for one more year. It should, however, be noted that during the years from 1960 to mid-August of 1962, indigenous infection was found only in two children who formed so sporadic and isolated a group that,at the most, they could be interpreted to indicate a freakish local transmission. Moreover, the intensity

of malaria in this region has always been hypoendemic and the risk involved in placing it in the pre-maintenance phase as described in the "Foreword" would be correspondingly low. I realize that many weighty arguments can be brought forward in favour of adopting the conservative line of action advocated in the plan for 1963, but in my opinion, the West Bank of the Jordan can safely be allowed to proceed to the next phase for two other cogent reasons. First, the West Bank has become ripe for the pre-maintenance phase well ahead of the other two zones. The trial of this phase in this zone of relatively low malaria would therefore provide valuable organizational experience which should stand the country in good stead when the time comes for similar action in the East Bank and the Jordan Valley. The trial on an untested system of case detection in the highly malarious zones might be very dangerous if it failed. Secondly, since a special function of this phase will be to strengthn the passive surveillance, it would be immensely valuable to the programme as a whole as it will reveal the hidden foci of malaria. As it is, even at the existing standard, passive surveillance had an impressive record of case detection as 32 cases were detected in 1960 (63% of the total), 23 cases in 1961 (68% of the total) and 5 cases in 1962 up to mid-August (83% of the total).

Jordan Valley

By traversing this valley on three occsions, each time from a different direction, I was able to study its problems in some detail. Although the valley has been notorious for malaria, most of the contending imperialist powers have fought for its possession since history began. This is, in part, due to the exceptional fertility of its soil and the excellence of its climate for agriculture and horticulture.

The total estimated population of the valley is 160,000 persons, all of whom are under severe malaria risk. Almost 86,000 of this population are Palestinian refugees living in camps located in the eastern and western parts of the valley, while the remaining 74,000 persons constitute its rural population spread over 127 villages.

The entire valley has been placed under surveillance since November 1961, after it had been subjected to total coverage with DDT spraying from 1959 to 1961. In the camps, one supervisor and four agents attend regularly to the dispensaries where they collect blood slides from cases of undiagnosed fever. In the rural section, one team leader and seven agents attend to the villages in the Deir Ala area, while one leader and five agents look after the rural sector of Jericho. The total coverage for the valley is thus provided by three leaders and sixteen agents who work under the immediate supervision of a Cairo-trained Assistant Epidemiologist.

There are, in addition, twenty clinics and dispensaries scattered over the Valley and sixty voluntary collaborators who keep under passive surveillance the inhabitants of their own and neighbouring villages.

In the laboratory, there are two microscopists who appeared to be well-versed in the technique of staining and examining blood slides.

The number of cases recorded in 1960 and 1961 was 69 and 133 respectively, the increase in 1961 being due to an outbreak in two refugee camps that yielded 71 cases. In 1962, the number of cases reported up to and including July was twenty, but this figure was exclusive of the rise of malaria cases that usually occurs in the autumnal months.

Future Action

The plan for 1963 provides that active and passive surveillance be continued in the valley and extended so as to achieve a more complete coverage of the villages and camps than is the case at present.

These operations will be supported by the laboratory at Jericho which will continue to function as in 1962. Spraying or larvicidal operations are not contemplated except around the residual foci of infection, if and when discovered.

While I am in full agreement with this programme, I venture to make a few suggestions with a view to strengthening these proposals.

Since anti-larval work has been found necessary in the Jordan valley and the neighbouring Wadis, a serious effort should be made to reduce, if not abolish the permanent places of breeding there. In the Jordan Valley itself, it will be necessary to keep a careful watch on the East Ghor Canal to ensure that when the irrigation starts, it does not give rise to seepage swamps more especially in the low ground East of the river Jordan. At the first signs of such a happening, a contour drain should be dug immediately and led down in a southerly direction to the nearest Wadi stream. A more ambitious scheme would perhaps be to take advantage of the steep dual slope by leading such drains eastwards, and then southwards, so that the seepage water can be used for irrigating the dry areas beyond the limit of the East Ghor Canal.

In the Wadis, the chief sources of anopheles breeding are the swamps formed by leakages from irrigation channels. To prevent these, a comprehensive project should be drawn up for cementing these channels, taking one Wadi at a time and working up from its junction with the Jordan Valley. Only the main channels need be lined and the exact section requiring such treatment should be determined after detailed study. A good example of the beneficial effect of cement lining is Wadi Farah where the risk of malaria has been reduced to allow level despite the fact that the general hydrographic conditions there are practically the same as in the Eastern Wadis.

It is realized that these recommendations entail expenditure which might be rated excessively high, if not actually prohibitive. Apart from abolishing anophelian breeding places, however, the cementing of water courses will conserve the much needed irrigation water which would become available for extending cultivation to the adjoining areas. There is, thus, a direct developmental aspect to this proposal which, it is hoped, will be given due weight in settling the issue.

From the malariologist's point of view, the main advantage would be that these schemes will create an unfavourable environment for the recrudescence of malaria in the cleaned areas and that the chances of the "bush fire" type of malarial outbreaks in the highlands would be reduced to the minimum.

Until these schemes are implemented, however, the present practice of residual larvicidal measures should be continued where indicated. Although their effectiveness is beyond question, the results would perhaps be even more assured if the water channels are kept clean and properly canalized.

East Bank

In this region, I visited the two sub-divisions of the Northern Zone, namely Irbed district and Balqa and Amman district, which together constitute the ancient Gilead. This region is mostly a high plateau traversed by numerous wadis which start as shallow, arable vales, but becomes steep and rocky ravines in their lower reaches, more particularly near their junction with the Jordan Valley.

Irbed district has been under active surveillance since the beginning of 1961 when 242 villages with a population of 132,000 have been covered by one supervisor, two team leaders and ten agents. Balqa and Amman district, on the other hand, were brought under surveillance only in April 1962. The staff employed there consists of three team leaders and twelve agents who cover 240 villages with a population of 75,000.

The duplicate surveillance card system is in use which greatly facilitates checking, a feature which I was able to test personally during my tour.

The laboratories, located at Irbed and Amman, were working efficiently and had practically cleared the accumulation of slides resulting from the last mass blood survey carried out in July.

The number of cases in Irbed district during 1960, 1961 and 1962 (up to the end of July) was 6,2 and 2 respectively; for Balqa and Amman infections, the corresponding figures were 68, 3 and 34. The proportion of falciparum infection has fallen steadily in both districts during the past three years.

In the highlands, there is little or no evidence of indigenous malaria, cases occurring there almost invariably give a history of acquiring infection either in the Jordan Valley or in the lower reaches of the Wadis. Indeed, the disease is kept alive in the plateau by the nomadic tribes who move regularly back and forth between the Jordan Valley and the highlands and by the semi-nomadic agriculturists who live on the plateau, but work daily in their fields in the Wadis. The occurrence of malaria in this region is, for this reason, somewhat unpredictable as to time and space, the outbreaks displaying the

vagaries of "bush fires". Epidemiologically, the characteristic feature of these outbreaks is that the disease is apt to remain restricted to a nomadic community or family group displaying little or no tendency to spread to the sedentary population in the neighbourhood.

An important factor involved in this phenomenon is the influence of rainfall either indirectly on the life-routine of the nomads or directly on the breeding of A.sergenti. Thus, in a year of good winter rains, the prospects of agriculture and pasture in the highlands are sufficiently bright to persuade the nomads to postpone their move down to winter quarters by a few weeks. In years of scanty rainfall, on the other hand, the move has to be advanced partly in search of pasture and partly to secure early gainful employment because of the economic stress. Needless to say, the earlier the move occurs to the Wadis, the higher is the risk of malaria to such a population.

As regards the effect of rainfall on the breeding of A.sergenti, while it is possible that, in years of draught, the species may find conditions more favourable for its breeding in the Wadis at higher altitudes than in normal years, there are no data to support or refute this rather attractive thesis.

Future Action

The programme for 1963 provides for the perfection of active surveillance operations in this region side by side with the development of passive surveillance on the same lines as in Western Jordan. I am in full agreement with these proposals but would draw attention to the following points:

a) Efforts should be concentrated on foci known to have been malarious before the eradication programme began.

b) Arrangements for the investigation of an outbreak and the subsequent follow-up measures should be perfected. Standardized instructions should be issued so that action becomes automatic and expeditious.

c) Anti-larval measures should be initiated only if the outbreak occurs in mid-August or earlier for the reason that only then would such measures be in time to become effective against the autumnal rise of malaria.

GENERAL REMARKS

In my opinion, the malaria eradication programme in Jordan is well up to schedule if not ahead of it. This statement may sound somewhat out of tune, considering the outbreaks that have recently occurred there, but I am inclined to regard the latter, not as recrudescences of malaria infection in cleaned areas as much as infections occurring in foci that had previously escaped notice, but were now exposed by the intensified surveillance operations. For this reason,

I fully expect that such outbreaks might continue for some time, but at a rapidly decreasing rate till eradication measures have abolished all the hidden foci.

An important aspect of malaria in Jordan is that it is largely disseminated by mobile population groups. It follows, therefore, that the disease may appear anywhere and at any time. In these circumstances, the most pressing need will be to maintain strict vigilance against imported infections more particularly in the Jordan Valley and the Wadis where perennial streams provide the most favourable conditions for the re-establishment of malaria. An additional advantage will be that the effective patrolling of these dangerous areas will stop the spread of infection to the neighbouring highlands. It is for this reason that I have emphasized the need for cementing the irrigation channels in the Wadis and the drainage of seepage swamps in the Jordan Valley.

III MALARIA SITUATION IN SYRIA

Itinerary

25th August	:	Arrived at Damascus and called on H.E. the Minister of Health, the Secretary General and the Director General of Health.
26th August	:	Discussion with the Director of the Malaria Eradication Department at Damascus.
27th August	:	Field visit to Ghouta and villages beyond.
28th August	:	Malaria Office.
29th to 30th Aug.	:	Visit to Homs covering Lake Qattina, Takalakh nahia and Palmyra.
1st September	:	Visit to Hama covering the malaria problems in the Ghab Valley.
2nd September	:	Hama to Lattakia. Study en route of malaria in the Allawite mountains and the coastal tract.
3rd September	:	Lattakia to Aleppo.
4th September	:	Participated as an "observer" in the regional malaria meeting at Aleppo.
5th September	:	Field visit to IFRIN Valley.
6th September	:	Field visit to Rouj Valley and then on to Homs.
7th September	:	Homs to Damascus.
8th to 9th Sept.	:	Discussions of malaria situation with H.E. the Minister of Health and the Secretary General of Health Department.
10th September	:	Departure to Beirut.

INTRODUCTION

Although the malaria eradication programme in Syria began in 1956, its operational sphere did not extend beyond Homs as malaria in the region south of it, was then taken care of by UNRWA as a part of its sanitary programme in Yarmuk and Budehar refugee camps. In the following year, the administration of malaria in the latter area was progressively transferred to the malaria eradication department which assumed full responsibility for a country-wide campaign by the end of 1957. Malaria eradication in the accepted sense may thus be reckoned to have started in 1958.

The breeding places of anopheline carriers in Syria are not only extensive but are spread out widely over several districts. In general, however, severe malaria is restricted to a crescentic tract that follows the western and northern boundaries of the country from the Yarmuk Valley in the south to the Gezira in the east. Except for narrow projections of malarious areas bugging the banks of the Euphrates and its tributaries, the central desert is free from malaria. The population at malaria risk is assessed at 1,588,354 out of a total of 4,561,000 and 38.8 per cent. The number of malarious villages is 4,986 which is 42.6 per cent of the total of 11,710 villages in the country.

Administratively, the malaria eradication department functions as a semi-autonomous organization under a director who is assisted by three regional heads stationed respectively at Damascus, Aleppo and Deir-ez-Zor. The three regions are sub-divided into eleven moafazal (districts), each of which is headed by a sanitary inspector.

From 1958 to 1960, the bulk of the malarious villages was subjected to one or two rounds of spraying per year, the population thus protected averaging 1,100,000. From 1961 onwards, spraying was applied selectively and on a progressively decreasing scale, the population protected that year being 462,499 while in 1962, it covered only 140,850. Nonetheless, it will be observed that even in the current year, 9 per cent of the total population under malaria risk was still in the attack phase.

Damascus district

In the course of my visit, I had the opportunity to study in detail the problems of only two district centres, Damascus and Hama, out of a total of four that comprise the southern region.

The major portion of the Damascus district has been in the consolidation phase since 1959, but for special reasons, the attack phase had to be continued in one half of Kunatra nahia and in the Yarmuk Valley. Although active surveillance has been the mainstay of the operations in the south, the passive case detection which was first organized in 1961, is already functioning in a large sector of the Damascus district. Indeed in four of the northern nahias, case detection is now affected solely by utilizing the existing medical institutions and voluntary collaborators.

A positive malaria case which had occurred in a village (Kafrein) in the desert area during the week preceding my arrival in the country provided me with the opportunity to observe at close quarters the procedure of epidemiological investigation. I found that the infected, as well as other villages and farm/houses in the neighbourhood, had been thoroughly searched by the surveillance team, each agent covering an average of 100 families a day. They had collected 97 slides from the immediate contacts of the malaria case and had started a mass blood survey of the area.

I was also able to check the work of a slide collector who was on his way back from visits to the voluntary collaborators and medical institutions in his allotted area. All the four reports that he had collected showed complete absence of fever in the area. Next, I visited a voluntary collaborator at Seydana who owned a hair-dressing saloon. He had fixed the usual poster outside his shop and possessed a kit box containing blood slides and anti-malarials. The collaborator, when questioned, seemed to be fully conversant with his duties and responsibilities.

In the laboratory at Damascus, I looked over the routine of staining and examination of blood slides which the centre receives from the entire southern region at the average rate of about 4,000 slides a month. The eleven microscopists had succeeded not only in dealing with the routine flow of slides, but had also disposed of all the previous accumulations. The laboratory was thus ready for the next mass blood survey which usually raised the slide receipts from 4,000 per month to about 16,000.

Homs District:

The major portion of this district is malarious, for eight out of thirteen nahias are recognized to be under malaria risk. Active surveillance which was started in the district in 1960 is still continuing with three teams located respectively at Talkalakh, Tarin Homs and KSEIR, each consisting of three active surveillance agents and a slide collector. The latter are required to concentrate on visiting only the medical institutions and the voluntary collaborators. The surveillance circuit enable the active agents to visit each village once in two months and the slide collector to complete his calls once in two weeks.

Two malaria cases of imported infection (Ghab area and Lattakia) were recorded in 1961 while the number of cases in 1962 up to the date of my visit was also two, both imported.

The most malarious part of this district is the neighbourhood of Lake Quttine and the upper reaches of the river Assi to the south of that lake. The latter is an extremely waterlogged tract which turns into a vast swamp during and after the winter rains. Some of the villages, such as those near Tell Nabo Mando have copious enough springs to operate a water-mill. In the village of Al madun, I observed a voluntary collaborator at work who seemed to take his duties seriously in contrast to another volunteer in Tahria who had somewhat lukewarm approach to malaria work.

In Talkalakh nahia, swamps arising from the central stream of Wadi Nasar are the main source of malaria. I observed, however, that the local farmers had lately installed a number of diesel pumps to carry water from the stream to irrigate the upper slopes of the valley. This trend should be actively encouraged as a multiplicity of pumps would, by carrying away the surplus water, prevent the formation of swamps.

Northern Region

I visited all the four district centres of this region starting with Hama whence I drove across the Allawite mountains to Lattakia, back over the mountains to Idlib and on to Aleppo.

Hama District

In this district, as indeed in the entire country, the attack phase is going on in certain areas side by side with the consolidation phase in others. So far, only the passive type of surveillance has been employed with the help of 290 voluntary collaborators, 29 dispensaries and seven slide collectors. This system had to undergo a fairly severe test in 1961, when 24 malaria infections occurred in the district forming almost one-third of the total cases in the country. However, provision has since been made for initiating in the near future, a mixed type of surveillance with teams each consisting of three active surveillance agents and one slide collector. These operations have been planned on a particularly liberal scale in Ghab where the active agents would be able to visit each village once a fortnight and the slide collectors would make their calls once every week.

In 1962, only four cases had been recorded up to the time of my visit, of which one case belonged to the neighbouring district of Idlib, two cases were traced to infections contracted in the Ghab area while the origin of the fourth case was in some doubt because of the complex history of his movements according to which he might equally well have acquired the infection in Lebanon or at Alqaddam near Damascus.

Reclamation of the Ghab Valley

The high degree of malaria prevalent in Hama district is traceable almost entirely to the river Assi, more particularly the section that flows through the notorious Ghab Valley. Geographically, the latter is formed by the northward extension of the rift that afflicts the Dead Sea, the Jordan Valley, Lake Tiberius and the Bakka Plain. The difference, however, is that, while in Ghab, the sinking has gone down as far as the spring water level, the rift in Jordan has penetrated much deeper leaving the springs high up in the Wadis. In Ghab, therefore, water from the spring flows directly on to the floor of the valley converting it into a huge swamp more particularly in the low lying land along the Assi river, giving the neighbourhood of Ghab an evil reputation for intense malaria and economic backwardness. The lowering of the malaria incidence with DDT stimulated the development of agricultural activity to the extent that it furnished a convincing forecast of the economic potentialities of the valley after drainage. Major reclamation works have accordingly been carried out and have now reached a fairly advanced stage. The main operative item of those engineering works are the two longitudinal collecting drains that have been sited on the two sides of the valley near the toe of the flanking hills, where

they intercept the springs and convey the water direct to the central drains on each side of the river Assi. As a result of drainage, the waterlogged and swampy ground of the valley has been transformed into a land of loose aerated soil which is suitable for, and has actually been brought under, cotton cultivation on a vast scale.

This development, which has brought considerable prosperity to the country, has been of undoubted value to the malaria eradication campaign. Nevertheless, though most helpful, it should be realized that these measures cannot be expected to solve entirely the malaria problems of the Ghab. Indeed, the wave of prosperity in the valley has brought with it a number of fresh problems that deserve to be clearly recognized. In the first place, the expansion of agriculture has led to an aggregation of assorted labour living under primitive conditions usually associated with severe malaria outbreaks. Secondly, in some areas, springs gush vertically from the ground and cannot, therefore, be intercepted properly. The resulting collections of water have to be constantly watched in case they become a source of anopheline breeding. The same caution is necessary in the case of the longitudinal collecting drains and the intervening seepage ditches which need to be properly maintained or turned into sub-soil channels. Thirdly, many of the fertile shallow valleys to the east of the Ghab escarpment, have seepage water streams running from December to April which could be a source of potential danger to the township that has sprung up there in connection with the cotton plantation project in the Ghab.

Lattakia District

Although a good proportion of the villages in this district is still under spraying, surveillance operations are also being carried out on an extensive scale. Passive surveillance has, however, received special emphasis because of the available facilities of eighteen hospitals and clinics, and forty-four private medical practitioners. These have been supplemented by the enrolment of 804 voluntary collaborators, a community development centre, and twelve slide collectors. The coastal plain, however, has a large number of isolated farm houses, the inhabitants of which do not always find it convenient to get in touch with the voluntary collaborators in distant villages. Eight agents have, therefore, been assigned to this area to carry out active surveillance. Indeed, the proposal is to extend the system of active surveillance to other areas also, once sanction to employ twenty additional agents is received.

In Lattakia, malaria seems to persist in the Al Haffa area where four cases of indigenous infection were recorded this year, out of a total of seven. In the previous year too, six out of eight cases had occurred in that same area, two of the cases being indigenous infections. On visiting this area which is located to the north of the Lattakia town and on the western face of the Alawite mountains, I found that the epidemiological surveys as well as the DDT sprayings had been carried out with commendable thoroughness. It was felt, however, that,

since the one central stream of the valley constituted the sole breeding place for anophelines, the existing measures might, without excessive expenditure of money and effort, be usefully supplemented by anti-larval measures in the hope that the concerted attack along these lines might secure the eradication of malaria from this seemingly persistent focus of infection.

Idlib District

Malaria in this district arises mainly from two valleys: first, the continuation northward of the Ghab Valley and, second, the Rouje Valley. The former traverses the entire length of Jasr-Erh-Shaghour and a portion of Harim nahia before it crosses into the Turkish territory. Its problems need not be repeated here, as they have already been discussed under Hama District.

The Rouje valley is situated to the east of and parallel to the Ghab from which it is separated by the Wastani range of mountains. The springs, however, arise not from the Wastani mountains, but from the Eastern range whence water flows down to the west and floods the valley converting it into a swamp some 50 square kilometres in extent. The malaria potential of this valley can thus be well imagined, considering that A.sacharovi has a special affinity for breeding in such swamps. Here again, extensive drainage has been carried out by means of numerous cement lined drains that collect and carry the water from springs to a large collecting tank. The latter is connected by a channel through the Wastani mountains with the Assi river in the Ghab, the level of which happens to be considerably lower than that of the Rouje valley.

The fertile reclaimed land produced by these drainage operations has naturally brought about an enormous expansion of agriculture attracting a large aggregation of labour force that has posed problems similar to those in the Ghab Valley.

Aleppo District and Regional Centres

Malaria in this district has reached the point of disappearance since the two major sources of the disease have been dealt with effectively. First, the Matakh swamp at the termination of the QUOEIQ river which is now dry; second, the Afrin river valley which has been kept under DDT spray since 1956 up to and including 1962. There has been no case of malaria in the latter valley since 1957, when malaria was last recorded from two villages located on the river and not far from Afrin town.

Passive surveillance

In the northern region, the most notable achievement worthy of close study was the organization of passive surveillance which has been so fully described by Dr. Y. Kiladjian in WHO/MAL/292, dated 8th May 1961, that it would be sufficient here to enumerate only its salient features. First, the network

of malaria detection posts provided by the medical institutions and voluntary collaborators was planned to cover the entire country. Villages not within easy reach of existing medical institutions were identified and earmarked for allocation to voluntary collaborators. Second, special care was taken to select only the right type of collaborators and to make adequate arrangements for training them. Third, the supervision of the malaria detection posts was effected through well-trained personnel of the malaria eradication department who collect the blood slides, and replenish the supplies and equipment of the malaria detection posts. Lastly an efficient organization was established for follow-up measures, such as the radical treatment of positive cases, epidemiological surveys of the infected and surrounding villages and, where necessary, DDT spraying.

Passive surveillance has proved so successful in the northern region that it is now being rapidly extended to the other parts of Syria. Should another country decide to raise a similar organization, an important provision, in addition to those mentioned above, would be to ensure that the scheme is planned on an adequate scale. Thus, in the northern region of Syria, 1,181 voluntary collaborators were functioning in June 1962, in addition to 28 medical institutions and 8 private laboratories. Since then, the number of voluntary collaborators has gone up even higher, judging from the fact that in Lattakia district alone, the number had reached 804 by 3rd September. Moreover, the requisite supervisory and liaison organization entails no small commitment for, in Syria, 101 surveillance agents are employed exclusively on duties connected with this type of surveillance.

CONCLUDING REMARKS ON THE MALARIA SITUATION IN SYRIA

Since my observations were limited to a section of the northern and southern regions, my remarks must necessarily have a closer bearing on those areas than on the other parts of Syria. Nevertheless, my study has left me in no doubt that the major portions of not only these two regions, but also of the rest of the country have been freed from malaria. This is reflected in the annual figures for malaria incidence in Syria which fell progressively from 196 cases in 1960 to 76 in 1961 and 24 in 1962.

In the southern region, the border areas near Lake Tiberius have been somewhat difficult to deal with but, according to the newly proposed arrangements the eradication department should henceforth be able to enforce eradication measures more effectively than hitherto.

In the northern region, despite the complexity of the malaria problem, the disease has been progressively scaled down almost to the vanishing point. Although the Ghab area must necessarily remain as the chief source of anxiety, it would be unwise to minimise the malaria potential of the Alawaite foothills and the Afrin valley which would all demand close attention for some years to come. In this context, the recent decision to place the entire Ghab area under a single operational control, instead of separate district centres should prove most helpful.

Since in the phasing of the eradication programme, Syria has not strictly followed the customary sequence, this aspect of the operations merits special mention, for both in the northern and southern regions, the policy has been to continue spraying operations in certain highly malarious foci even when the surrounding areas were placed under surveillance. In one sense, therefore, these regions cannot yet be claimed to have entered the consolidation phase proper. On the other hand, it could be argued that the spraying of progressively decreasing parts of the known endemic foci might be equated with the rounds of focal spraying which would, in any case, have been necessary for the reason that malaria in these foci was almost certain to arise after the cessation of spraying. It is doubtful, therefore, if the merits of this policy can be decided on the basis of strict eradication procedural propriety. It is, at the same time, important to note the practical implication of the policy in that the continuance of spraying makes it impossible to be sure how far malaria has actually been eradicated from a given Zone. Instead, most will fear that the cessation of spraying would open the Pandora's box of suppressed malaria. It is for this reason that I welcome the proposal in the Plan of Action for 1963 to stop all spraying operations as the true state of affairs will then become apparent.

Another question on which the eradication programme in Syria is able to throw some useful light relates to the comparison between the active and the passive types of surveillance. For, while the northern region of Syria started with passive surveillance and is now being supplemented by active surveillance, the sequence of events was just the opposite in the southern region. Although this variance came into being not from choice but from budgetary consideration, it, nonetheless, provided an invaluable opportunity to study the two types of surveillance functioning side by side under very similar, if not identical, conditions.

Judging from the results obtained in the northern region, passive surveillance may safely be claimed to have been completely successful, inasmuchas no outcrop of secondary malarial infections occurred, which could be ascribed to a delay in the detection of an original infection. Indeed, the initiation of active surveillance there at this stage seems somewhat redundant, unless it has been done with the idea that the evidence of passive surveillance alone may not be acceptable in a malaria eradication programme. Even if we accept this criterion, I should have thought that this requirement could have been met, not necessarily by organizing large scale active surveillance, but by creating a small number of assessment units at the Regional level, capable of carrying out frequent checks in different areas. The latter proposal would have the additional advantage that the integration of such units into the general public health department during the maintenance phase would be much less difficult than the absorption of the personnel of an extensive active surveillance.

To the contrary, the initiation of passive surveillance in the southern region was an inescapable necessity for the reason that the Public Health Department could not be expected to take over the active type of surveillance and keep it indefinitely. It could, however, deal effectively with the problem of imported malaria if a fully tested and well-organized network of passive

malaria detection posts was handed down to it by the malaria eradication organization.

As regards the comparative valuation of the two types of surveillance, the Syrian experience showed conclusively that both are equally reliable, provided they are spread evenly over the entire region and function under efficient supervision. Keeping in view the requirements of the maintenance phase, however, it is essential that passive surveillance be developed early in the eradication programme so that the malaria detection posts are functioning properly by the second year of the consolidation phase, if not earlier.

IV MALARIA SITUATION IN LEBANON

Itinerary

4th August	:	Arrived in Beirut.
5th August	:	Sunday.
6th August	:	Discussed the present situation with the Director, Malaria Services.
7th August	:	Interview with H.E. the Minister of Health and the Director-General of Health.
8th August	:	Visited Central Malaria Office and Laboratories.
9th August	:	Studied the malaria problem of the Bakka Plain.
10th August	:	Visited Saida and studied the malaria problem of the coastal plain.
11th August	:	The scheduled visit to North Lebanon had to be postponed because of a public holiday. This visit was instead undertaken on 23rd of August during my return visit to Lebanon.

INTRODUCTION

Malaria in Lebanon may now safely be reckoned to have reached the stage of almost complete eradication. Although the struggle against the disease has lasted a long period of time, it was only during World War II that the highly malarious localities in South Lebanon, such as Damour and Kasmije, were tackled and effectively dealt with by the drainage of swamps and canalization of water courses and irrigation channels. Beirut was similarly freed from malaria by draining an extensive swamp that used to exist in its vicinity.

The disease, however, continued to prevail in a severe form in North Lebanon down to 1953, when the WHO demonstration team began operating there. The successful results obtained with DDT spraying, as demonstrated by that team, stimulated the extension of this method to the entire country in the form of a malaria control scheme which culminated in a malaria eradication programme in 1957. The attack phase involving the total coverage of the country with DDT lasted from 1957 to 1959 and the consolidation phase that began in 1960 is still continuing.

Bakka plain

With the virtual disappearance of malaria, the most significant development in the country has taken place in the Bakka plain where extensive agricultural and horticultural activity has now become feasible. This plain, which, in ancient times used to serve as a "Granary" for the Romans, is fast developing to play the same role for the Lebanese. The large scale drainage operations undertaken

by the East Asia Foundation near Zahle and by the governmental agencies elsewhere have had the dual advantage of reclaiming large tracts of fertile land for agriculture and abolishing the breeding places of the vector, A.sacharovi. This dual purpose has been further advanced by the large scale tube-well scheme operating in the northern portion of the valley where field irrigation is carried out by piped water. In this scheme, not only is irrigation water strictly conserved, but the water logging of the soil and the formation of swamps are also reduced to the minimum.

In the littoral of North Lebanon, the drainage of swamps and the use of piped water irrigation have similarly eliminated anopheline breeding places in Nahr-el-Kalb and Nahr Ibrahim. However, around Tripoli and in El Akar region, swampy conditions are said to be persisting, although the disease has been effectively eradicated from that region with DDT spraying. In places where swamps have not been drained, larvivorous fish have been brought into use with good effect.

Surveillance

During my visit to the Zahle area in Bakka Plain and to Saida in South Lebanon, I had the occasion to observe the functioning of the surveillance system in the field. The impression I gained was that the surveillance agents knew the procedural details of their daily circuit of duties and were prompt and meticulous in the carrying out of epidemiological surveys around a positive case.

At present, malaria incidence is restricted almost entirely to the nomads who are reckoned to number above 4,000. Of these, 1,000 restrict their movements between the hills and the coastal areas of Lebanon, but the remaining 3,000 migrate annually to and from Syria. In the current year, special attention was paid to this problem and a solution sought by evolving surveillance squads exclusively to trace the movements of and sickness amongst all the nomads individually and by families. A noteworthy feature of these surveillance teams is the inclusion therein of a public health nurse who has proved especially effective in epidemiological investigations because of the ease with which she is able to secure entry into houses and tents.

Apart from nomads, blood transfusion has been the only other source of malaria in Lebanon. Indeed the occurrence of an unusually large number of induced infections in Beirut was the most notable event of the current malaria season.

Future programme

The consolidation phase in Lebanon is expected to last till the end of 1964 Arrangements are, however, already in hand to develop a permanent service for environmental sanitation and anti-insect operations which will incorporate a fair proportion of the malaria eradication personnel. As it is, the present

Director of Malaria Eradication and the Inspectorate staff in district centres carry a full load of other sanitary duties. The integration of the malaria eradication personnel into the general public health department should not therefore present the same problems as in countries where malaria eradication is carried out by a separate cadre.

As to the future, the points to which I would draw special attention are, first, the risk of malaria reappearing after the construction of the dam on the Litani river near Qaraoun. On enquiry, I was assured that the irrigation system arising from the dam will have cemented channels and that the flow of water would be under strict control so as to prevent the formation of swamps. The implementation of this policy will be most advantageous as it will not only satisfy the immediate needs but it will also safeguard the country against the dangers of "untidy" irrigation in the future.

Second, since the re-establishment of malaria in the country is likely to arise from imported infections, the development of systematic and carefully planned passive surveillance on a more comprehensive scale than at present should be given special priority.

Finally, barring unexpected developments or events, Lebanon should aim at applying to the World Health Organization for registration as a malaria eradicated member state by 1965. The eradication department should, therefore, take the necessary steps to be fully prepared for this eventuality by collecting the necessary records of surveillance in a form acceptable to the visiting team.

V MALARIA SITUATION IN IRAQ

Itinerary

14th September	:	Arrived in Baghdad.
15th September	:	Called on H.E. the Minister, and the Director-General Endemic Disease after completing registration formalities. Same afternoon left for Basra by train.
16th September	:	Arrived Basra. Studied the outbreak of malaria in Basra.
17th September	:	Visited the east bank of the river and studied the outbreak in Tanooma. Same afternoon left for Baghdad.
18th September	:	Arrived at Baghdad. Discussed previous records of malaria in the malaria office.
19th September	:	Visited Malaria Centre at Hilla and Kerbala.
20th September	:	Malaria Office.
21st September	:	Friday.
22nd September	:	Attended a meeting of the Malaria Eradication Board where I presented my findings in general outline. Meeting with H.E. the Minister of Health.
23rd September	:	Left Baghdad at 06:00 hours for Teheran.

INTRODUCTION

My visits were purposely centered on the study of two specific problems:

First, the reappearance of A.stephensi in the southern region in relation to the outbreak of malaria in Basra.

Second, the organizational structure of active surveillance in the central region.

Taking the country as a whole, a synoptic view of the malaria eradication programme revealed the following dominant features:

Spraying programme:

In 1957, the entire country was subjected to spraying except the desert in Gezira and in the area south-west of the Euphrates. From 1958 to 1960, spraying was continued in the major portion of the northern and the whole of the southern region, but in the central region, certain liwas were excluded, so that spraying was confined to the liwas of Diyala, Kerbala, Hilla, Diwanaya and Kut.

In 1961, spraying was considerably curtailed in the central and southern regions where it was carried out only in the three border nahias of Diyala, in the Ain Tamir oasis in Kerbala and a ten kilometres wide barrier along the Iran border in Amara and Basra Liwas. In the northern region, however, spraying was continued on the same scale as in the preceding year.

In 1962, spraying was completely stopped in the southern region, while in the central region, spraying was carried on only in two nahias of Diyala. In the northern region also, spraying operations were drastically reduced and restricted to the two valleys of the Zab rivers and to the Tamjaro and Ranea valleys in Sulerimanyia.

Malaria incidence

The total number of malaria cases recorded each year from 1958 to 1961 are shown below with figures for falciparum infections in brackets:

1958	684(186)	1960	1088(260)
1959	551(177)	1961	813(317)

During the current year of 1962, total cases reported up to the end of August were 126, of which 39 were falciparum infections.

A study of these figures shows that the downward trend obtaining in 1958 and 1959 was reversed in 1960 and 1961, both in regard to the total cases and the P.falciparum infections. It would be premature to forecast the situation in 1962 as the available figures do not include the autumnal rise in malaria incidence.

A detailed analysis of the figures from 1958 to 1962 however, shows that the bulk of cases occurred in the northern region where a modified attack phase is still continuing, owing to the special conditions prevalent there. If these be deducted, the malaria situation in the central and southern regions emerges in its true form as follows:

	Cases
1958	375
1959	54
1960	49
1961	19
1962(up to end of August).....	24

Malaria outbreak in Basra

The southern region was subjected to systematic twice-yearly spraying in 1958, 1959 and 1960 with dieldrin using 0.6 gr per sq.m. The changeover from DDT to dieldrin had to be done for the reason that, in 1957, A.stephensi had

become resistant to DDT. As the result of spraying with dieldrin, the species disappeared completely from routine entomological collections, but re-appeared after the stoppage of spraying. It was detected first on 8th August, 1962 in the nahia of Seeba of Basra liwa opposite Abadan and from then on up to November 1961 from nine other nahias of Basra liwa. From April to May 1962, it has been reported to prevail throughout the Liwas of Basra, Amara and Nassirieh which constitute the southern region.

In regard to the re-appearance of A.stephensi, a significant fact is that the malaria department at Basra detected the species only after it had been informed of its re-appearance in Iran. This has raised a valid doubt that A.stephensi might have been present all the time, but had been missed due to oversight. On the other hand, after dieldrin spraying, its density might have gone down so low that the routine catching methods were not sensitive enough to detect it. It was only when spraying was stopped or became ineffective because of resistance of A.stephensi to dieldrin that the species built up its density to a readily detectable level. This may be an over-simplification of a complex problem but the discussion of this point need not detain us as it does materially affect the practical implications of the findings, namely:

a) the reappearance of A.stephensi is an established fact;

b) the species has again become susceptible to DDT, but only in high concentrations;

c) it is totally resistant to dieldrin; and

d) preliminary observations show that the prevalent species in mysoriensis which, as a rule, is classed as a less efficient carrier than the type species. Since this classification may not be valid for Basra region, it would be unwise to underrate its potential danger.

Incidence of Malaria

Past records show that clinical malaria accounted for about 25% to 30% of attendances in Basra hospitals and dispensaries, a ratio that declined to 10% to 15% after the start of DDT spraying. Subsequent to the commencement of the eradication programme, the case incidence declined rapidly as follows:

In 1958	67 cases	(4)
In 1959	39 "	(0)
In 1960	9 "	(0)
In 1961	10 "	(4)

(Figures in brackets indicate falciparum infections)

In 1962, there were no malaria cases until May when 24 cases occurred which fall into three distinct groups. First, a vivax infection outbreak of twelve cases which appeared in the Fourteenth July street-Monawi-Lijan area. Arranged

in the order of the dates of detection, however, five cases were detected from 12 to 25 July, and seven infections from 2 to 12 August.

The outbreak can thus be said to have begun in May, reached its peak in mid-July and declined in the first week of August. It will also be seen that the cases that became ill in May were not diagnosed till mid-July entailing a gap of at least six weeks during which they were able to produce a crop of secondary infections in a neighbouring hutment of labourers engaged on constructional work.

Once attention was focused on the disease, however, the epidemiological investigations were vigorously pursued leading to the discovery of six new infections in a total of 175 slides examined. Investigations were later extended to a wider circle involving the collection of 302 more slides, but they all proved negative.

The second group consisted of four cases of falciparum infection which occurred in the Tanooma township situated on the east bank of the Shattul-Arab river. Here, the diagnosis was made within two to three weeks of the onset of illness when immediate counter measures were enforced. As a consequence, the outbreak was effectively contained and restricted to a circumscribed group of houses located in the centre of the Tanooma town. The last case of the outbreak, detected on 29 July, gave a history of the onset of symptoms ten days earlier, i.e. on 19 July.

The third was a heterogenous group of eight cases mostly imported, though some were locally acquired without, however, any causal connection between them.

Future action

From the experience of this outbreak, the following points of importance emerge which are worthy of note in planning future action:

a) The existence of A.stephensi calls for the utmost vigilance to ensure the timely detection of malaria cases. The vivax infection outbreak in the Fourteenth July street should serve as an object lesson and emphasize the dangerous consequences of missed diagnosis. In this context, a heavy responsibility rests on the medical practitioners particularly in the urban areas where no active surveillance exists and where the early detection and notification of cases must depend entirely on their cooperation. It will be desirable, therefore, if an aide-mémoire is circularized from time to time to the practising doctors reminding them to keep in mind the possibility of malaria in the diagnosis of fever cases.

The appointment of special surveillance agents to make periodic visits to the dispensaries and private practitioners in towns should also be considered. This would be in line with what is happening in rural areas where each active surveillance agent follows a specified schedule of visits to dispensaries, as well as to villages.

b) Once a malaria case is notified, the action taken should be prompt, comprehensive and efficient. Arrangements for epidemiological investigations, treatment and follow-up of cases should be vigorously pursued but with due regard to epidemiological considerations as was done in Basra where the treatment and follow-up of cases was taken up immediately, but not the sprayings which were postponed till the beginning of September, when A.stephensi becomes active and gives rise to the autumnal wave of malaria.

c) Basra is especially vulnerable to recrudescences of Malaria, not only because it is an important sea-and air-port but also because it attracts seasonal labour from all parts of the country for the collection andpacking of dates. Furthermore, the extensive building and road construction programme now under way and that contemplated in the near future, has also led to the aggregation of labour who usually live in temporary hutments and amongst whom malaria is likely to break out and spread to the neighbourhood. Special precautions should, therefore, be taken to keep these hutments under strict surveillance.

d) The prompt control of an outbreak can best be effected if blood examinations are conducted in conformity with the dictates of the epidemiological probabilities. Thus, in the Fourteenth July street outbreak, all the positive cases were detected amongst a small circle of immediate neighbours and none amongst a larger group of individuals living at a distance.

e) In the present phase of the malaria eradication programme, when emphasis should normally shift from active to passive surveillance, mass blood surveys should be resorted to only if they are absolutely necessary. Apart from other considerations, the lowering of the number of blood slides would help in improving the accuracy of the microscopists' findings who are otherwise inclined to lose interest when they are set to examine a pile of negative slides day after day.

Central Region

I visitedthe malaria centres at two liwa headquarters in this region, namely, Hilla and Kerbala, where conditions are said to be fairly typical of those prevailing in the other liwas of the region.

Hilla

Spraying was discontinued in this liwa after 1960. In the subsequent two years of the consolidation phase (1961 and 1962), no infection has been discovered despite active surveillance carried out by eight teams made up of a total of 36 men, who, on an average, manage to collect slides from about one percent of the population every month. The staining and examination of the slides is carried out in the liwa headquarters by three trained microscopists. In addition, there is one entomological team consisting of a leader and two insect collectors for the upkeep of entomological data.

Passive surveillance through dispensaries and other health establishments, such as maternal and child health centres has not been a success so far. Thus, in the course of five months in 1962, only 645 slides were received from this source as against 11,303 slides collected over the same period by the active surveillance agents.

Geographical reconnaissance has been completed in great detail and now covers all the ten nahias of the liwa. Revised population figures are somewhat in excess of the numbers previously given but, surprisingly enough, this was not the case in regard to the number of villages and hutments. Indeed because of land reforms, an increase in the number of villages had been anticipated, but the position revealed by the detailed census was just the opposite.

Kerbala

This liwa has a much smaller staff consisting of one inspector, one leader and three surveillance agents and a complete entomological team. The programme of spraying has been the same in this liwa as in Hilla, except that in 1961, Ain Tamur oasis was sprayed once.

No indigenous cases occurred in 1961 nor in 1962 up to the date of my visit. This liwa, however, requires a constant watch because of the danger of imported infections amongst the pilgrims visiting Najaf and Kerbala. Geographical reconnaissance of this liwa is also complete, but the cards had not been issued because they were still at the printing press.

Future Action

Except for a few cases of imported malaria in Ramadi, all the liwas in the central region have reached a stage when the introduction of the maintenance phase should be actively planned. For this purpose, the decision to lay down for each surveillance agent a definite circuit of visits to dispensaries and villages on specific dates should be of immense help in facilitating the switch over from active to passive surveillance.

The introduction of a full-fledged maintenance phase may however be usefully preceded by a pre-maintenance phase as described in the "Foreword". The latter phase will have the advantage that a systematic reduction in staff and expenditure can then be brought about, which will enable the Eradication Department to adjust its activities to the reduction recently effected in its budget.

In Iraq, however, special consideration should be given to the following points:

a) Certain liwas such as Kerbala and Basra will have to be provided with staff on a relatively more generous scale than elsewhere to enable

them to detect an imported infection as early as possible and to deal with it effectively.

b) Necessary funds should be set aside and placed at the disposal of the malaria organization to enable it to undertake spraying and other appropriate measures against residual foci of infection.

c) Since the public resents repeated blood examinations except when it is taken in the course of medical aid, the active participation of dispensaries and rural health staff in this programme is immediately necessary.

VI MALARIA SITUATION IN IRAN

Itinerary

23rd September	:	Arrived at Teheran.
24th - 25th September	:	Called on H.E. The Minister and the Secretary General. Met Director and staff of Malaria Eradication Programme and Director and staff of Institute of Malariology and Parasitology.
26th - 27th September	:	Visit to Mazandoan Ostans in Caspian Region.
28th September to 4th October	:	Attended conference at Ramsar and visited Gilan Ostan.
5th to 6th October	:	Visited Eastern Azerbaigan Ostan.
7th to 9th October	:	Teheran.
10th to 14th October	:	Visited Abadan. Ahwaz, Ram Hormoz, Baibahan, Kazrun and Shiraz.
15th to 23rd October	:	Attended Regional Conference on Medical Education at Teheran.
24th October to 4th November	:	Regional Office, Alexandria, Assignment terminated on 4th November.

INTRODUCTION

Iran has been fighting against malaria continuously for just over a decade through a malaria control scheme from 1951 to 1956 and subsequently through a malaria eradication programme in force since 1957. This prolonged and persistant struggle is a true index of the anxiety of the Government to do away with this disease which is known to act as a serious impedement to the country's progress. For no development, indeed no life, is possible in this arid land without water and yet, wherever water is, there malaria and ill health abound. Except in the waterless desert and in the valleys in very high mountains, the disease is uniformly intense all over the country. With the use of DDT during the control phase, however, a precipitous fall in malaria occurred even in the hyperendemic areas of the Caspian region and the Central Plateau. Despite this favourable response, systematic spraying with total coverage was carried out once again during the three years of the attack phase from 1957 to 1958. In Fars, this phase began one year later and continued up to 1960, whereas in the Eastern Provinces and Khorassan, spraying is still going on.

I have described in some detail the results of the attack phase in the problem areas in the main body of the report. These need not, therefore, be repeated in this section which could instead be more usefully devoted to a brief outline of the organizational structure.

The Headquarters of the Malaria Eradication Programme at Teheran enjoys a fair degree of administrative autonomy under the general supervision of the Plan Organization and the Ministry of Health. On technical matters, guidance is given by an advisory council board based on the Institute of Malariology and Parasitology. The latter institute has also undertaken many valuable research projects which are of immense help to the Malaria Eradication Programme, such as the study of the incidence and control of malaria amongst nomads, resistance of anopholines to insecticides, search for new vectors in problem areas, etc.

The Eradication Programme in the field is conducted through fourteen Ostan Headquarters each of which has ample provision of staff separately for each of its activities such as epidemiology, entomology, field operations, transportation, administration, finance, stores and procurement. In each Ostan, are located a number of Shahristan headquarters, the chief of which has under him a few microscopists, a computor, an accountant, drivers and office staff. Each Shahristan Headquarters has, in turn, a number of nahias each with a chief and three to four agents for surveillance work and also for supervising spraying operations, as and when required. Spraying is carried out through a number of teams each consisting of a leader, five spraymen and one mixer. Transportation required for all these activities is provided by the Shahristan Headquarters out of its pool of six to seven cars.

It will be seen that malaria eradication has an elaborate and well-articulated organization in which all the functions are allocated to separate sections represented at all Headquarter levels from the field up to the Teheran main office. The entire pyramid is made up of about 3,600 officers and men exclusive of temporary spraying staff. To this total number, the Teheran Headquarters contributes about 150 persons and each of the Ostan Headquarters about 155, while each of the 75 Shahristan in the country has a staff of about thirty persons.

Admirable as this organizational structure is, it will be seen that the different sections are so intimately inter-linked that its disbandment will present an equally difficult and complex problem. It is for this reason that I have suggested in the "Foreword" the institution of a "pre-maintenance" phase in which each disbandment could be carefully carried out.

Ostan Mazandaran

I began my survey of the malaria situation in Iran with this Ostan, where I was able to visit five out of a total of six Shahristan organizations. This programme proved particularly fortunate as I soon found that each Shahristan had its own distinctive epidemiological features that had to be studied separately in the field.

Taking the two adjoining Shahristans of Ghumbaz and Gurgan, their common problem was that the infected villages had not responded to DDT spraying as quickly as would normally be expected. Thus, in Gurgan after the discontinuance of spraying in 1948, cases appeared around Ramian the very next year to reach a total figure of 188. This necessitated the application of focal spraying to 202 villages out of a total of 501 villages in the Shahristan. In 1960, the infection spread to a still larger area and that year and in subsequent years, spraying had to be carried out in a belt of 382 villages. Despite such a comprehensive spraying programme, however, the decline in malaria occurred only gradually from 188 cases in 1959 and 123 cases in 1960, 60 cases in 1961 and 28 cases in 1962 (end of September). This slow response to spraying was due to the fact that the majority of these infections occurred amongst labourers imported from Zabul. As was to be expected, spraying, though ineffective against imported infections, succeeded in keeping down the secondary cases which numbered only five in 1961 and three in 1962.

The situation in the southern nahias of Gumbaz was almost identical. Indeed, infection in this sector began amongst the Zabuli labourers residing in a locality across the Shahristan border but not far from the focus in Gurgan. In Gumbaz, however, an additional focus showed up in Maraveh Tapeh in the north amongst Turkeman nomads who migrate annually to and from north Khorassan. The story of malaria in this Shahristan began in 1959 with the occurrence of 66 cases, of which 13 cases were in the northern (Maraveh Tapeh) focus and 53 in the southern (Kalale and Manudasht) focus. In 1960, the total number of cases went up to 76, but only one of these was recorded in the north. In 1961, the outbreak assumed serious proportions comprising 91 cases in the north, and 93 cases in the south. In 1962, the cases recorded up to the end of September were 131 but to these the northern focus had contributed only 12 cases. This was because the northern focus was sprayed for the first time only in 1962, to which it responded promptly and favourably in sharp contrast to the southern focus, where malaria incidence was unaffected by an extensive spraying programme covering 448 villages in 1960, 328 villages in 1961 and 353 villages in 1962 out of a total of 484 villages in the Shahristan. Here again the reason was the influx of infected labour, the number of indigenous infections being none in 1960, four in 1961 and seven in 1962.

Proceeding westwards to the Shahristan of Sari, the malaria situation improved considerably. In 1960 and 1961, there had been sharp outbreaks in 30 and 24 cases respectively, but these were restricted to a small group of 53 villages in the foothills which, after spraying, showed no further infections. In 1962, five positive cases were discovered after examination of 10,600 slides but these were all traced to infections acquired in Zabul and Amol.

I did not visit the next Shahristan of Shahi, but its story, as related to me, was almost the same as that of Sari. A small foothill area contiguous to the one in Sari was sprayed after the occurrence of twenty cases in 1960. It has since remained free from local infections and recorded only two cases of relapses in 1961 and none in 1962 up to the end of September.

The study of malaria in the last two Shahristans served particularly to focus our attention on the role of the foothills in the recrudescence of malaria. Our suspicions were confirmed by our study of the adjoining Shahristans of Babol and Amol. Thus, in Babol, despite the spraying of 98 infected villages out of total of 430 villages, malaria rose progressively from seven cases in 1959 to 60 cases in 1960, 121 cases in 1961 and 168 cases in 1962. The rise in 1961 and 1962 might undoubtedly be ascribed in part at least to the intensification of active surveillance, but this factor alone could hardly account for the high incidence in 1960. More direct evidence implicating foothill areas was, however, forthcoming in Amol where a severe outbreak occurred amongst workers engaged on the construction of a road through the hilly and forested area. A detailed analysis showed that in 1961, 100 out of 122 cases had occurred in those camps which served the length of road in the forested foothill area. In 1962, although malaria was scattered over a large number of villages where infected workers had returned from Amol, 24 out of a total of 82 cases occurred in camps sited in the foothill area.

Ostan Gilan

Fresh confirmatory evidence implicating foothills came to hand in this Ostan. It was observed that, if spraying were confined to villages in the plains, it did not exercise the same limiting influence on malaria incidence as was the case when it was extended to the forested foothills or to the newly cleared sub-montane areas. In the latter event, the number of malaria cases fell promptly and precipitately.

Thus, in the Shahristan of Nawashahr, 95 to 100 villages had been kept under spraying out of a total of 314 villages from 1960 to 1962, but in certain key villages in the foothills, total coverage could not be enforced because of the silk worn industry. However, when the latter villages were included in the spraying programme in 1962, the case incidence that had risen from 80 cases in 1960 to 155 cases in 1961 fell precipitously to 17 cases in 1962.

In Nawashahr Shahristan, the development of "activated" passive surveillance during 1960 and 1961 undoubtedly influenced the discovery of a large number of infections as the following figures show:

1960	Active Surveillance	24 slides positive out of	644	examined
	Passive Surveillance	14 -"-	19	"
	Activated Passive Surveillance	42 -"-	431	"
	TOTAL	80 -"-	1094	"

1961	Active Surveillance	36 slides positive out of ...	8843	examined
	Passive Surveillance	49 "	230	"
	Activated Passive Surveillance	95 "	2481	"
	Epidemiological Investigations	1 "	5280	"
	TOTAL	183 "	1 .354	"

In "activated passive surveillance", a number of surveillance agents are earmarked to collect blood slides from fever cases in hospitals and dispensaries. It will be observed that the adoption of this procedure led to the discovery of more than 50% of the total positive cases. Indeed, the superiority of the simple as well as the "activated" passive surveillance over the active type of surveillance is quite apparent from a study of this table.

In Shah Savar Shahristan, there was no spraying from 1956 to 1959 nor were there any positive cases till 1959 when eleven infections were recorded in two small foci of 50 villages in the plains which were sprayed in 1960. Despite spraying, however, the number of cases jumped to twenty eight of which twenty six cases were reported from the villages that had received spraying that year. In 1961, spraying was extended to 08 villages but the incidence went up still further to a figure of 62. In 1962 spraying was extended to the foothill areas and the incidence of malaria declined to nineteen cases of which two had been infected in Amol, thirteen were classed as "relapses" and four were still under investigation.

A certain proportion of the rise in malaria during 1960 and 1961 was certainly due to "activated" passive surveillance that produced 39 cases as against 23 cases detected by the routine active surveillance whereas in the preceding year, more cases were discovered by active than passive surveillance. A more potent cause of the rise, however was the intensification of agricultural and horticultural development especially in the foothills south of Khorramabad, which had not only entailed a large scale programme of forest clearance, but also a radical change in the life routine of the forest dwellers as explained in a later section of this report.

In the adjoining Shahristan of Rud Sar, out of a total of 418 villages, 157 to 158 villages had been under spraying from 1955 to 1960 covering the foothills and the plains with the exception of villages in the hilly portion of

Chabuk Sar nahia. No cases occurred from 1958 to 1959, while in 1960, one positive "relapse" infection was detected in 31,117 slides examined. In 1961, when spraying was stopped, twenty-two cases appeared of which eighteen were in Chabuk Sar that had not been sprayed since 1957. In 1962, spraying was undertaken in the infected villages but the number of cases went up to thirty-five of which twenty-eight were contributed by Chabuk Sar, where, as already stated, the "barrier" spraying of foothill villages had not been carried out. Although this experience may not be sufficient for a definite causal relationship, the coincidence is nevertheless so striking that it deserves special mention.

In Lahija Shahristan, out of 466 villages, those located in the foothill areas have been kept under spraying from 1958 to 1960. There was no spraying in 1961 and only focal spraying of 22 villages was undertaken in 1962. Malaria incidence was confined to the hill area, where two cases occurred in one village in 1958, fourteen cases in 7 villages in 1959 and four cases in 3 villages in 1960. In 1961, spraying was stopped, sixteen cases occurred of which fourteen were in the same foothill villages as in previous years. In 1962, focal spraying brought the number of cases down to six but these were mostly in and around the focus first observed in 1958 and 1959.

This experience left me with the impression that, although spraying of foothills had not completely eliminated the incidence of malaria in the area, it certainly had prevented the "spill over" of infection from the forest with the result that no local infection usually occurred in the plains even when the latter was not sprayed.

The Shahristan of Rasht has 548 villages but from 1958 to 1961, it was only in the southern nahias that spraying operations had been carried out, covering 159 to 170 villages. Despite spraying, a small number of cases have continued to occur in a group of villages in the Loshan area. These infections are connected partly with the construction of a dam in this area and partly with the fact that the inhabitants of these villages migrate to the Kazvin area for agriculture in the summer months. As already stated, the number of cases is not large, 30 in 1959 and 1960 coming down to 16 in 1961 and 1962. To root out the focus, however, I fully endorse the proposal that the infected focus of Loshan area in Rasht be combined with the focus in Pachmian area in Kazvin so as to form a single endemic focus for treatment by one Shahristan organization.

In Hasht Par Shahristan, there had been no spraying in the plains for four years and in the foothills for two years. Out of a total of 493 villages, 301 villages were sprayed in 1958, some in the plain and others in the foothills, but in 1959 and 1960, only the foothill villages numbering 150 were sprayed. There have been no positive cases in 1960 and 1961, despite the fact that 14,267 slides were studied in 1961. In 1962, three positive cases have been detected in villages near Astra but these were all imported infections, two from Amol road and the third in a soldier, just returned from service elsewhere.

A review of the problems at the Ostans of Mazandaran and Gilan

In Mazandaran out of a total of 3,163 villages, 862 are under spraying, i.e. just over one quarter. In Gilan, on the other hand, 289 villages are under spraying out of a total of 3,116 i.e. about one eighth. Taking the two Ostans together, malaria can thus be said to have been cleared from at least 82% of the villages. This is no mean achievement, considering the well-established notoriety of the tract for malaria, traceable even to the times of Shah Abbas the Great, who failed to establish a colony of Armenians in Mazandaran in the early seventeenth century "in consequence of the malarious climate which killed off the Armenians by hundreds".

The number of villages under spraying, however, gives a somewhat exaggerated idea of the amount of residual malaria for the reason that spraying has necessarily to be extended to a number of normal villages around each focus of infection. Figures for positive malaria cases are perhaps more truly indicative of the situation. These are given below:

	1960	1961	1962
Mazandaran	16	121	165
Gilan	114	281	99
M & G Ostans	130	402	264

Considering that the total rural population inthe two Ostans approaches the figure of 1,750,000, the case incidence even in the worst year of 1961 comes to 0.23 per 1,000 population.

In an eradication campaign, however, even a satisfactory situation as portrayed by the above analysis is totally unacceptable and my object in bringing it forward has been merely to emphasize what still remains to be done. The first step in this direction would be to define the exact epidemiological factors that are responsible for the re-appearance of malaria in clean areas and its persistence in other areas. From the survey at the Shahristan level, it is clear that the reappearance of malaria in clean areas was caused either by the re-introduction of infection by nomads as in the northern focus of Gumbaz or by seasonal labour engaged in developmental work as in the southern focus. Examples of the latter also exist in Gurgan where after malaria eradication, the cultivation of cotton on a vast scale has become a practical proposition and has attracted a vast army of labourers from other areas. In the Shahristan of Amol, the outbreak was due to the aggregation of labour engaged on a road construction project.

A different epidemiological pattern is revealed in areas where considerable agricultural advancement has taken place not so much with the help of imported labour as by the extended efforts of the local population itself. This has opened up such profitable avenues of employment to the semi-nomadic tribes living in the forest areas that they have taken to leaving behind a large proportion of their family members during the annual summer migration to the hills. These conditions are noticeable in all the Shahristans, but the outstanding examples are the new orange gardens in the foothills areas of Babol and the new tea plantations in Lahijan. The effect of these activities is that the villagers

living in the plains are no longer isolated from those in the forest as used to be the case in the past. It is not surprising therefore that the intermingling of the two types of population would lead to the dissemination of malaria from the forests to the plains.

Future action

Since the problems in the two Ostans have grown directly out of the successful prosecution of the malaria eradication campaign since 1957, it would be a mistake to look upon the persistence of residual infections as indicative of operational failure. In actual fact, the reverse has been the case and the malaria organization would be justified in regarding itself as a victim of its own success. This view needs to be emphasized so that the Authorities concerned place a correct valuation on the situation and agree to one final effort to eradicate the residual foci by employing all possible counter measures.

In the case of seasonal labour, it would be an advantage if active surveillance agents were especially earmarked to make a systematic search for the incoming individuals and families so that infection in them is neutralized on arrival and before they have the opportunity to give rise to secondary infections. Radical treatment should also be extended to immigrant families who have settled in Mazandaran so that, on relapse, they do not become a source of infection. For this purpose, it may be necessary to re-arrange the surveillance system, by creating special mobile search units who would work around and in conjunction with a number of fixed malaria posts scattered throughout the Shahristan. This re-arrangement is justified as it is anticipated that the present conditions for some years will continue until malaria eradication measures become fully effective in Zabul and Khorassan.

A more difficult question is posed by the infections that arise in the submontane region. Under normal conditions, owing to the scattered nature of the population in the forest and their annual move to the hills, the development of infection in these communities is a slow and prolonged affair with the result that it usually takes years for malaria originating in the forest areas to take root in the plains. With the change in the life routine of forest dwellers, however, infection foci can now be implanted in the plains much more rapidly than before. The main difficulty in dealing with this situation is that it is almost impossible to locate all the pastures and hutments scattered in thick forests which, in places, is almost impenetrable. Even when detected, spraying is unlikely to succeed as the dwellings are open structures that remain most of the time without a roof, chiefly because the inhabitants are on continual move either to the mountains or to the plains. Epidemiological observations, however, show that if the belt of villages adjoining the forested sector is sprayed, it forms an effective barrier against the "spill over" of infection. This policy is therefore recommended for adoption and should be continued until the forest areas have been thoroughly searched and the role of A.plumbius clarified by the eradication department and the Institute of Malariology.

My impression is that infection foci generally arise not where a steep hill rises from the plain, but in villages located at the mouths of gently sloping valleys. If detailed observation confirms this view, the extent of spraying would be considerably reduced as the "barrier" could then be restricted to these valleys only.

In rapidly developing areas such as in Babol, spraying should be extended to cover not only the "barrier" belt, but also the recently cleared areas and the newly planted farms.

Finally, the malaria department should be actively associated with all major engineering works in this region such as road or dam construction and should be given an opportunity to organize the necessary anti-malaria measures in labour camps before the engineering work begins.

Ostan Khuzistan

In this Ostan, out of a total of seven Shahristans, only five belong to Khuzistan proper, the remaining two being in Luristan. In the course of my visit, I had the opportunity to study four of the Shahristans at close quarters.

Since the same spraying programme has been followed in all the Shahristans, it would be convenient to describe it here to avoid repetition. After two years of incomplete coverage, systematic spraying with one round of DDT a year was carried out from 1952 to 1956. By 1957, there were indications of the almost complete arrest of transmission even to the extent that the possibility was seriously considered of placing under surveillance the Abadan Township and surrounding villages. Instead, however, a severe epidemic struck this area that gave rise to over 32,000 cases of malaria. The same year, it was also noticed that A.stephensi had become resistant to DDT and a change over to dieldrin had to be effected to fight the epidemic. In the succeeding three years of 1958, 1959 and 1960, all areas where the carrier is A.stephensi were treated with two rounds of dieldrin a year as a routine. This change did not, however, apply to the mountainous sectors which continued to receive one round of DDT spraying combined with surveillance of 10% of villages.

In 1961, A.stephensi became resistant to dieldrin but as it had, in the meantime, developed a certain degree of susceptibility to DDT, it was possible to use this substance for one round of spraying that year.

In 1962, this policy was revised inasmuch as no spraying with DDT was undertaken in the A.stephensi area which was instead placed under 100% surveillance.

A careful watch was maintained for the detection of malarious foci which were dealt with by DDT spraying only when the disease threatened to assume alarming proportions. This was undoubtedly a very wise decision and I endorse it whole-heartedly.

In the mountainous region, one round of DDT spraying was continued but without any surveillance activities which, as already stated, had to be concentrated on the A.stephensi areas in the plains. Abadan Shahristan has a rural population of 130,000 living in 640 villages located mostly around the two townships of Abadan and Khoramshahr.

During the period of two years of 1958 and 1959 when dieldrin was fully effective, there was neither a case of locally acquired malaria infections, nor was A.stephensi recorded in the routine entomological catches. In 1960, the network of catching stations established by the Institute of Malariology recorded the reappearance of this species in August, first in the foothill areas, and then at progressively lower altitudes down to the plains.

In 1961, four cases of locally acquired malaria infection were recorded in Hindijan which is situated in the section of the coastal plain that adjoins the foothills i.e. more or less the area which corresponds to that where A.stephensi first reappeared.

In 1962, apart from the Hindijan focus where the number of cases reported increased to 24 (13 falciparum and 11 vivax), a second focus appeared in the villages in the date palm groves near Khurramshahr where 27 cases (18 falciparum and 9 vivax) had occurred up to the date of my visit. I was able to study the palm grove focus in some detail and found that, while some of the villages had malaria infections, others located in their immediate neighbourhood had none. This striking epidemiological feature could not be explained either on the basis of differences in the age of the palm trees, or the state of maintenance of the irrigation channels. Close to two of the positive villages, however, there was an extensive temporary hutment occupied by immigrant labourers engaged on the packing of dates. Since no such encampments existed near the negative villages and since most of the immigrants belonged to Bahbahan and other infected localities, it was reasonable to infer that the reappearance of malaria in the date palm villages was probably occasioned by infection imported by such labour.

I did not visit the Hindijan focus but I was informed that the conditions there did not differ materially from those prevailing in Ram-Harmouz or Behbahan which were included in my schedule of visits.

Dezful Shahristan has 541 villages of which 139 are in the mountainous area under DDT spraying, while the remainder are in the plains which have been placed under 100% active surveillance. During 1960 and 1961, only a few cases of malaria occurred and those only in the mountainous areas, where transmission is continuing because of incomplete spraying coverage due to the inaccessibility of certain areas and of the outdoor resting and biting habits of A.fluviatilis. In the plains, malaria was totally absent in those years, but in 1962, apart from five isolated cases on Shuster area, an extensive outbreak occurred in Shoush where a total of 91 cases were recorded from thirteen villages. The most notable epidemiological feature of the infected villages in this focus was the presence of an extensive patch of rice fields and the existence of extreme water logging of the land between the Shahur and Karkhe rivers.

Ahwaz Shahristan has 778 villages with a rural population of 150,000. As in other Shahristans, the malaria incidence touched high figures here only in 1961 when a total of 82 cases was reported. In 1962, the incidence went higher and by the end of September, 353 cases had been recorded. Out of these, the majority of infections prevailed in the nahia of Ram Harmouz which contributed no less than 253 cases in 36 positive villages. A study of Ram-Harmouz served to confirm the importance of the malariogenic role of rice fields combined with flooding during the rainy season. Indeed, severe malaria prevailed in villages that occupied low lying and intensely water-logged sites riddled with seepages and secondary springs rather than in villages located on the relatively high ground along the rim of the valley.

An additional epidemiological factor in this region is the population movement which is of two types. First, the true nomads who are continually on the move and who pass through Ram-Harmouz during their journey up to and down from the mountains. During transit, these nomads establish their camps in fallow fields close to the villages to which they are able to impart infection readily. The second type of nomadism pertains to the inhabitants of the fixed local villages, a proportion of whom moves up to the hills in summer leaving behind in the villages a few members of the family to look after the fields. Since it is not the same members that migrate to the hills each year, the entire family is in turn by turn exposed to malaria infection in the plains.

Behbahan Shahristan extends over a number of valleys in the folds of the Zagros mountains which, despite their high altitudes, fall within the terrain range of A.stephensi. The exception of this rule is a group of about 300 villages in the northern-most nahia which is wholly mountainous and which, for operational control, has been handed over to the Shahristan of Shiraz.

Behbahan township itself is located in an attractive, profusely watered vale 3 to 4 miles wide full of fruit gardens, rice fields, cereal crops and most varieties of vegetables. The local population begins its annual migration in April but they confine moves to the mountains within their own territory. Each family, however, leaves behind it in the plains some members as in Ram-Harmouz.

Malaria incidence figures show that whereas in 1959 and 1960, the number of recorded malaria cases was only 71 and 169 respectively, the initiation of passive surveillance in 1961 uncovered a large number of other cases which raised the total to 1446. In 1962 up to the end of September, i.e. before the high incidence months of October and November, 705 cases had already been recorded of which 643 cases were reported from the Behbahan town dispensary. It would appear, therefore, that the low malaria figures for 1959 and 1960 do not necessarily imply years of low transmission as these could have equally well been due to deficient surveillance.

Fars Ostan

This Ostan has six Shahristans of which three (Bushire, Kazerun and Jahrum) fall in the A.stephensi area, two (Shiraz and Fassa) are partly mountainous partly in the A.stephensi area, while the sixth Shahristan of Abadeh is wholly mountainous.

During my visit, I was able to study in detail only the Shahristan of Kazerun especially during my journey from Behbahan when the road traversed many of the valleys that comprise the western Nahias of this Shahristan. The topographical features of these valleys resemble so closely those of Behbahan that it would be unnecessary to repeat them except perhaps to point up once again the presence of extensive rice fields.

The Shahristan of Kazerun contains 700 villages of which about one half are high up in the mountains beyond the range of A.stephensi. The eradication spraying programme in Kazerun as well as in the other Shahristan of Fars began in 1958 i.e. one year later than in Khuzistan. In 1958, 1959 and 1960, all the low altitude villages were sprayed twice a year with dieldrin while the mountainous area received one round of DDT. During 1961 and 1962, spraying was restricted only to the latter sector.

The results of spraying have been disappointing in the sense that its beneficial effects on the incidence of malaria have been far less than expected as the following figures show:

Year	Cases in Kazerun	Total cases in Ostan
1958	887	1349
1959	339	1538
1960	678	3062
1961	249	2480
1962 (up to end of September)	1158	Not available

The sharp rise in malaria cases in 1962 was however largely due to the initiation of extensive passive surveillance through the collaboration of six dispensaries, four tribal teachers and nine members of the Agricultural and Development staff. All the same, it must be admitted that, neither in the Shahristan of Kazerun nor in other Shahristans of this Ostan, has malaria transmission been arrested completely by spraying as infection in infants continued to occur up to 1960. Moreover, when spraying was discontinued in Abadeh Shahristan and the mountainous portion of Shiraz and Fassa, new cases appeared soon after the arrival of nomadic tribes. Thereafter, malaria increased rapidly till it assumed almost epidemic proportions in Fassa necessitating the resumption of spraying in the mountainous areas in 1961 and 1962. In the latter year, however, 10% active surveillance was replaced by passive case detection through dispensaries. Observations are also carried out once a month on five representative villages in each Shahristan personally by the operational chief of the Shahristans.

Problem of the Ostans of Khuzistan & Fars

The problems of these two Ostans are, epidemiologically speaking, almost identical. In the coastal plain where malaria is carried by A.stephensi, the chief causative factor is the system of tidal irrigation channels in the date palm groves. North of these plains are the foothill valleys where the same

vector prevails but where seepages, springs, irrigation channels and rice fields provide its favoured breeding habitats. The foothill belt follows the south western curve of the Zagros across Shoush, Ram-Harmouz and Behbahan in Khuzistan and Kazerun and Tahrom in Fars. North of the foothill belt is the mountainous mass of Zagros disposed in a series of parallel ridges with intervening valleys that occur at progressively higher altitude. Malaria carriers in the valleys are A.fluviatilis and the maculipennis-elutus group of anophelines that find favourable breeding places in springs, seepages, swamps and irrigation channels.

The persistence of malaria in the two Ostans is ascribed to the following three factors :

a) The resistance of A.stephensi to DDT and dieldrin.
b) The outdoor biting and resting habits of A.fluviatilis, and
c) The population movements of nomads and semi-nomads.

While the joint responsibility of these three factors is universally recognized, the relative importance of each is yet to be determined. This applies more particularly to the spread of malaria by the nomads on which the current investigations undertaken by the Institute of Malariology should throw considerable light by providing answers to such questions as:

a) the exact amount of infection acquired by the nomads during their stay at winter and summer quarters and while they are on the move from one set of quarters and the next;

b) the phase of migration during which the nomads are most effective in passing infection back to the sedentary population in the course of their annual move.

Future action

While the details of nomadic migrations are being worked out, the most immediate and pressing need is to enforce practical measures for the eradication of malaria from the A.stephensi area. For as long as this focus remains, the nomadic population will not only carry infection to the northern region, but will also continually reinfect the southern region each autumn. Nor can the present expedient of keeping malarial infections in the north suppressed by yearly spraying with DDT be relied upon to remain effective indefinitely.

The problem of eradicating malaria from these areas is, however, extremely complex because of the limitations on the use of insecticides. Not only is it desirable that spraying be kept in reserve for emergencies but that this measure would inevitably increase the degree of resistance in anophelines. Attention will, therefore, have to be turned to the other recognized anti-malaria measures. In this context, chemotherapy, as employed in Kazerun, is admittedly a useful expedient, but given the present series of anti-malarials, the achievement of eradication with this measure alone is a doubtful proposition.

It will therefore be necessary to supplement chemotherapy by a direct anti-mosquito measure, such as the use of Paris green dust in the infected foci as an anti-larval agent. I consider this to be a perfectly feasible proposition at least in Shoush, Ram-Harmouz, Behbahan and Kazerun which I studied expressly from this point of view. Here, the anopheline breeding places are confined to certain well-defined sites which, in the absence of rain, vary but little during the transmission season. Anti-larval work may possibly be further curtailed if spleen rate assessment confirms the suspected epidemiological relationship between malaria and rice fields in this region. To be effective, however, the operational routine of the anti-larval measures must be placed under the guidance of a strong assessment unit headed by an experienced malariologist at the Shahristan level.

It is realized that this recommendation will entail not only a radical departure from the established routine of eradication technique, but also a considerable strengthening of the staff at the Shahristan level. The situation in these problem areas is, however, so desperate that none can afford to rule out of consideration any method of attack. Indeed, apart from chemotherapy and anti-larval measures, it may even be felt necessary to employ thrice weekly space spraying with pyrethrum extract during a limited period of say four weeks so timed as to neutralize the autumnal rise of malaria.

In regard to the date-palm groves area in the coastal tract, anti-larval measures are already in force there and should be continued in addition to the judicious use of anti-malarials. These efforts may usefully be strengthened by creating special "date packing" surveillance units which would concentrate on the detection and prompt treatment of malaria infections in the seasonal labour camps.

Finally, a word of caution. Sincethis area is liable to recurrent epidemics at intervals of five or six years, it would be most unwise to relax vigilance even though malaria may appear to have disappeared completely.

East Azerbaijan Ostan

All the six Shahristans that comprise this Ostan have been under active surveillance since 1961.

In Ardbil Shahristan, 52 malaria cases were detected in 1962, but all of them were imported from Amol. Miskin Shahr was similarly free from locally acquired infections in 1961 and 1962, the last malaria case recorded there being in 1960. In this Shahristan, there has been no spraying since 1959. In Ahar Shahristan, the last case was a relapse infection recorded in Garma Duz near the river Aras on the Russian border. This territory is low lying and used to be intensely malarious before it was cleaned up in the course of the eradication programme. Since then, considerable development has occurred in Garma Duz when cotton cultivation has been taken up on a large scale.

In Tabriz Shahristan, spraying operations were last carried out in 1961. This year, five local infections had been detected, but they all appear to be relapse cases as extensive epidemiological search failed to reveal any other infection in the neighbourhood. Tarqahe Shahristan had also five relapse cases this year along with twenty-one cases of infection imported from Amol.

Miane is the only Shahristan in which there is definite evidence of indigenous infection but this is confined to the group of villages located near the Qazal Auzan river. The rest of this Shahristan as well as the remainder of the Ostan may safely be regarded as clear of malaria and ready for the maintenance phase by 1964.

In fact, the chief problem requiring our attention was to study ways and means of initiating the maintenance phase in this Ostan in the light of discussions on an integration plan which the Chief Health Officer of East Azerbaijan had presented to the Ministry of Health. This plan, as I understood it, visualized a process of integration step by step of the administrative structure of the malaria organization with that of the Ostan covering in the first instance such sections as statistics, accounts, personnel and health education. Although under a single Administrative Chief, it was anticipated that activities in these fields would continue to be dealt with in separate sections because of the differences in book-keeping procedures.

This proposal was indeed a praiseworthy effort at integrating the activities in the different fields of health. Unfortunately however it did not go far enough in that it failed to tackle the complex problems of technical integration which, from the malaria point of view, are of greater and more immediate importance.

It is felt that the latter purpose would best be served by introducing in 1963 the pre-maintenance phase, the general principles of which have been enunciated in the "FOREWORD". In the case of the East Azerbaijan Ostan, however, the planning of this phase may have to be modified to suit the Iranian programme with particular reference to the following points:

a) Operational control in this phase may have to be decentralized to the Shahristan headquarters so as to accustom them to their future responsibility in this field.

b) The development of the "activated" passive surveillance may have to be expedited. The possibility of creating "malaria posts" with the help of surveillance agents will also require immediate attention.

c) It may be necessary to delimit the residual foci and earmark them specifically for operational control by Ostan Headquarters until they have been effectively cleared and can be managed by the Shahristan. Villages along the Qazal Auzan river in Miane Shahristan may be cited as a suitable example of such a focus.