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RECENT TRENDS IN ANTI-MALARIA PROGRAMMES IN THE EASTERN MEDITERRANEAN REGION - CONCLUSIONS DRAWN FROM PROGRAMME REVIEWS

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I INTRODUCTION

The most recent technical paper on Malaria[1] was presented to the Regional Committee at its Sixteenth Session in September 1966.

It is, therefore, thought pertinent at this point to inform the Committee of the changes and trends which have occurred between 1966 and 1970, and the consequences to malaria eradication and control in the Region of the reviews made by the governments concerned.

It is intended to examine the trends in the coverage of populations at risk, the quantum of malaria in these populations, and the factors aiding or hindering anti-malaria programmes.

It is hoped that by thus reviewing the achievements and setbacks of the recent past, a clearer picture may be had of what may be entailed in the coming years.

II TREND IN PROTECTION OF POPULATIONS AT RISK OF MALARIA

The total population of the Region as at the end of 1966 was estimated to be 245 million.

Taking into account the population of Afghanistan, which joined this Region in 1969, the total population rose to 286 million by the end of 1970, which represents an increase of 16.7 per cent during the five-year period from 1966 to 1970.

As regards the population living in areas where they are in danger of being infected by the malaria parasite, it is notoriously difficult to delimit such areas properly, even under favourable conditions of carefully conducted parasite and spleen surveys. Few countries had properly delimited their malarious areas in 1966, since which time there have been varying

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[1] EM/RC16/4, 15 July 1966 "Technical Problems met in Malaria Eradication Programmes of the Region" - Methodology of their studies and some scope for their solution.

degrees of readjustment. It appears, however, that overall these readjustments had not significantly affected the size of the population living in malarious areas, as between 1966 and 1970, the increase was approximately 16.0 per cent (i.e. from 199 to 231 million), which reasonably equates with the 16.7 per cent rise in the total population.

Table 1

Status of Populations Protected by Various Anti-Malaria Measures in the Eastern Mediterranean Region, 1966 and 1970
(Population in Thousands)

Year	Total	In Originally Malarious Areas	In Maintenance	By Malaria Eradication Programmes				By Other Measures	Not as Yet Protected
				Prep. phase	Attack phase	Consol. phase	Total		
END 1966	244 861	198 878	4 828	21 505	57 885	24 436	103 826	**	90 224
% Total		81.2							
% Popu.* in Mal. Areas			2.4	10.8	29.1	12.2	52.2	**	45.4
END 1970	285 942	230 996	10 921	983	84 175	77 475	162 633	41 146	16 296
% Total		80.7							
% Popu.* in Mal. Areas			4.7	0.4	36.5	33.5	70.4	17.8	7.0

* Percentage of population in originally malarious areas.
**Not recorded in 1966.

More important is the steadily increasing proportion of the population at risk from malaria who have in some way or another been afforded protection by their governments. This has been in most part due to the expansion of the malaria programme which extended its coverage from 104 to 166 million between 1966 and 1970, representing, after deduction of the 16.0 per cent vital increase, a real increase of 43.6 per cent.

To this must be added the population being protected by the vigilance mechanism of the maintenance phase (4.8 million in 1966 and 10.9 million in 1970), and also those protected by various control measures. There is no record of this latter population in 1966, but it is recorded as 41.1 million in 1970.

Thus in 1970 we had reached the point where only 7.0 per cent of the 230.9 million people at risk of malaria in the Eastern Mediterranean were not being protected by any specific anti-malaria measures. These particular populations live either in the southernmost regions of Ethiopia and Sudan or in the states comprising the Arabian Peninsula.

Matters will not be allowed to rest there. Already these governments, with WHO assistance, are making energetic efforts to plan and subsequently conduct malaria control programmes in order to give these remaining 16.3 million people the protection they need.

III TRENDS IN MALARIA INCIDENCE

Let us now examine, as far as the available data will allow, what trends malaria as a disease has followed within the populations of originally malarious areas of the Region.

At one end of the scale we have those populations who had been already freed from malaria by 1966 either by natural causes or under the influence of anti-malaria measures. These include those in Cyprus and Israel.

At the other end of the scale we have those populations who are not as yet receiving protection. As has been mentioned, these live either in equatorial Ethiopia and Sudan or in the countries of the Arabian Peninsula. We can presume that the endemicity of malaria in these areas has changed little during the five years between 1966 and 1970.

The remainder of the peoples of the malarious areas were either being protected by various control measures or by malaria eradication programmes.

Table 2*

Trend of Malaria Incidence as Indicated by Microscopically Diagnosed Cases of Malaria in Selected Malaria Eradication Programmes in EMR During the Period 1966 to 1970

Countries	Phase	1966	1968	1969	1970
Afghanistan	Attack	2 518	7 473	11 740	16 917
	Consolidation	119	516	303	1 429
Ethiopia	Attack	-	2 256	20 684	41 259
Iran	Attack	6 671	51 624	37 614	23 816
	Consolidation	1 589	734	495	509
Iraq	Attack	15 380	8 526	11 563	14 242
West Pakistan	Attack	5 136	2 646	8 326	63 828
	Consolidation	147	4 062	41 770	29 088
East Pakistan	Attack	2 240	4 186	5 162	6 110
	Consolidation	196	1 356	1 312	1 444
Syria	Attack	433	1 490	1 642	1 516
	Consolidation	361	1 517	976	273
Tunisia	Attack	-	2 097	362	22
	Consolidation	-	-	105	6
T O T A L	Attack	32 378	80 298	97 093	167 710
	Consolidation	2 412	8 185	44 961	32 749
G R A N D T O T A L		34 790	88 483	142 054	200 459

* Full data and indices shown in Table 2a.

For this last group, some light can be thrown on what has actually happened to malaria, because there has been a continuity of microscopic confirmation of diagnosis, and collection and analysis of parasitological data.

Of the ten malaria eradication programmes[1], Lebanon, Jordan and Libya have succeeded throughout the whole period in retaining malaria incidence at extremely low levels, and so may be disregarded in the estimation of trends.

The remaining malaria eradication programmes of Afghanistan, Ethiopia, Iran, Iraq, Pakistan, Syria and Tunisia have provided parasitological data which can be used to show what had happened to malaria under the impact of measures taken.

Although it is not stated from what source in the surveillance mechanism the blood slides were collected, and it is possible that annual blood examination rates in some programmes have been boosted by the inclusion of slides taken during mass or serial parasite surveys, it is thought legitimate to use the data as presented to indicate the trend we wish to examine. The important point of similarity in these data is that all the malaria cases recorded were confirmed by microscopic examination.

The first and most striking conclusion to be made is that malaria still remains a grave hazard to health and development of the countries in this Region.

It will be seen that no less than 200 000 cases were detected in 1970 in the seven programmes under review. There were undoubtedly many more in the Region as a whole.

Furthermore, there appears to have been a continuing increase in the gross case incidence throughout the five years under review, from 35 000 in 1966 to 201 000 in 1970. This increase, however, may be more apparent

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[1] Afghanistan, Ethiopia, Iran, Iraq, Jordan, Lebanon, Libya, Pakistan, Syria and Tunisia.

than real, as the case detection mechanisms in the respective attack phases of most of the programmes in which the majority of cases are naturally detected was in the process of establishment and development during the first two or three years of this review.

Nevertheless, one cannot escape the fact that there has been a real and significant increase in malaria incidence in Afghanistan, Ethiopia and West Pakistan between 1969 and 1970, countries in which 40 per cent of the population under review live.

As far as the other countries are concerned there have been varying degrees of fluctuation in malaria incidence. In Iraq, for instance, where there is a delicate equilibrium between the gains made by the attack measures and the losses suffered through various types of administrative, operational and technical problems, there has been a slow but steady rise in case incidence since 1968. In East Pakistan, there had been a slow but steady progression towards eradication, and Syria appears to be successfully dealing with DDT resistance in An.sacharovi. Iran is an example of a country which, although three years ago faced with grave and widespread problems together with a very large residual parasite reservoir, has overcome its difficulties and is now in position for the final assault on malaria.

Tunisia is one of the few countries where vector resistance to insecticides has not so far struck. The result has been an orderly planned progress, and a vindication of malaria eradication.

IV TREND IN DDT RESISTANCE OF MALARIA VECTORS

The resistance to DDT of malaria vectors is now affecting the progress of the anti-malaria programmes of the large majority of the countries in this Region.

The last technical paper on malaria presented to the Regional Committee in 1966, previously mentioned, described the problems arising from the DDT resistance in An.stephensi in Iran and Iraq. At that time it was believed,

from the available epidemiological evidence, that DDT resistance in anopheline mosquitoes did not achieve homozygosity and that DDT could continue to be used for its partial lethal effect against An.stephensi, provided supplementary measures were added to the attack phase. Over the next three years, however, this hypothesis gradually proved itself not so valuable as was first anticipated, and both Iran (in late 1968) and Iraq (in 1969) replaced DDT with malathion, An.stephensi being also resistant to dieldrin. At the time of writing there is no indication that An.stephensi is not fully susceptible to malathion, and Iran has recently benefitted from its application, as is seen in Table 2. In Iraq, however, the presence of other problems, such as the flooding of the Shatt-el-Arab river and the importation of malaria cases from the north of the country, has tended to delay the success enjoyed by Iran. There are indications, however, that Basrah Liwa, where malathion spraying was first instituted, will have a much lower incidence of malaria in 1971. Malathion will no doubt have to be used in certain other areas of the south and central regions of Iraq as the DDT-resistant gene of An.stephensi is extending northward.

Since our previous communication to the Regional Committee, Syria has also been obliged to discard DDT.

The anopheline vector, An.sacharovi, was first discovered to be DDT-resistant in Syria in 1968, when a sharp rise of malaria transmission in the Ghab region of Hama Province signalled its presence. This initial focus of malaria was followed in 1969 by others, but a fortunate combination of factors led to these being quickly identified and dealt with. An.sacharovi was and still is susceptible to dieldrin, and the change from DDT to dieldrin was quickly made. WHO and national entomologists had before them the lessons learnt in Iran and Iraq, and there was a high degree of co-ordination and co-operation between Syria and her neighbouring countries. Dieldrin is now being used throughout the attack phase area, and it appears from cases detected and investigated during very

intensive surveillance that the only area where transmission was not interrupted in 1970 was the two adjacent naheyets of Deir Hafar and Khafse in the province of Aleppo with a population of some 36 000. Indigenous cases continued to be recorded from June through November, but it is hard to believe that An.sacharovi was responsible, as this vector could not be found despite repeated spot checks, bait captures and extensive search of many different types of breeding places. On the other hand it is also unlikely that An.claviger is responsible, because, although this anopheline was incriminated as a vector of malaria for the first time in Syria in 1969, it is not endemic to the area where this particular transmission was persisting in 1970. It is possible that the Plasmodium vivax of these cases has a long incubation period. Blood samples containing P.vivax collected in this area have just recently been flown to the United States for injection into splenectomised Aotus monkeys and results are awaited.

The two neighbouring countries of Jordan and Lebanon have also been affected by a "spill-over" of DDT-resistant An.sacharovi. In Lebanon, An.sacharovi reappeared in 1969, after a complete absence for eight years, in a few villages along the Syrian border. There were a few indigenous cases in 1969 and continuing localized transmission in 1970, centred in three small villages in the Qaza of Akkar on the river Kobir which forms the border with Syria. These cases were in fact so close to the border that it is just as likely that the infection was introduced into Lebanon by anopheline carriers as by humans - both An.sacharovi and An.superpictus being recorded in the affected area. This area was scheduled to be sprayed with Lindane in 1970 but the programme was severely disrupted by the use of malaria personnel for cholera control.

In Jordan the problem of An.sacharovi which is resistant to DDT, together with An.superpictus which is susceptible, was tackled by using a mixture of DDT and dieldrin. This régime together with Abate larviciding was successful in interrupting transmission of malaria, except for a few cases of P.falciparum malaria introduced in 1970. These were all radically cured.

An.sacharovi also inhabits the north of Iraq. Entomological observations[1] made in 1970 suggest that it also is becoming tolerant, if not as yet resistant to DDT.

During the last three years, there have been quite considerable and cumulative increases in malaria transmission in Afghanistan. The affected areas are the north (Kunduz) and eastern regions (Jallalabad, Khost, Grishk). Although there are problems of operation and administration, as in every malaria eradication programme, there is no doubt that DDT-resistant vectors, An.hyrcanus in the north (incriminated in 1969), An.stephensi, An.culicifacies and An.subpictus in the east, are mainly responsible for this transmission. In West Pakistan there is some evidence that An.stephensi and An.culicifacies may be resistant to DDT. In October 1970, susceptibility testing in the Punjab allegedly revealed An.culicifacies to be resistant to DDT in forty-two and tolerant to DDT in thirty-seven of the 106 localities chosen. An.stephensi was thought to be resistant to DDT in fifteen and tolerant to DDT in two of the thirty-three localities chosen. These tests will be repeated over a wider area in more localities and with larger samples, before a definite conclusion is drawn as to the extent of distribution and degree of DDT resistance of these vectors in West Pakistan.

The above-mentioned instances of DDT resistance are in vectors affecting countries with malaria eradication programmes. There are other instances where DDT is being used to control the disease, as for instance in Sudan, where An.gambiae has become resistant to DDT in the Gezira Irrigated Area and the Guneid Sugar Estate Area[2].

These findings are of immense importance and interest not only to Sudan, but to her neighbours Ethiopia and the United Arab Republic, although as yet there is no indication of DDT resistance in An.gambiae in Ethiopia, and this vector so far remains absent from the United Arab Republic since it was eradicated in 1942. Since the High Dam at Aswan

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[1] Rishikesh & Kamal Saeed

[2] G. Davidson

was built, however, and Lake Nasser continues to expand, the Sudanese and UAR Governments are paying strict attention to this potentially grave situation.

At the end of 1970, some 80 million people of this Region were being protected by DDT in the attack phases of malaria eradication programmes, and 3 1/2 million by either dieldrin, malathion or the carbamate propoxur (OMS-33). As, however, 30 million of the 80 million mentioned above live in West Pakistan where An.culicifacies and An.stephensi are showing signs of being resistant to DDT the above picture may change considerably in the near future.

The extension of vector resistance to DDT, its costly and more toxic alternatives, and the increasing difficulty in its procurement, make it imperative that the operational and administrative mechanisms of malaria programmes should be made more efficient in order that the consolidation phase can be reached, and thus insecticides withdrawn.

V TREND IN COSTS OF MALARIA ERADICATION

In Table 3 can be seen a comparison between the costs of malaria eradication in six selected programmes of the Region as they were in 1968 and in 1970. The unit chosen is the per capita cost to the Governments and international agencies concerned, and the populations considered to be deriving benefit from the malaria eradication programmes are those which were recorded as having been in the consolidation and attack phases of the malaria eradication programmes. Those in maintenance are a responsibility of the general health services, and those in the preparatory phase are not considered as being formally protected. There is no doubt, however, that these other groups of population derive much indirect socio-economic benefit, as also those who are living in malarious areas who are being protected by various control measures, although it is difficult to make concise cost benefit analyses in their cases.

Table 3

Estimated Cost of Malaria Eradication in Six Selected Countries of the Eastern Mediterranean Region in 1968 and 1970

(Populations and US $ in Thousands)

Country	1968					1970				
	Cost to Government	Cost to International Agencies	Total Cost	Population Protected	US ¢ per capita	Cost to Government	Cost to International Agencies	Total Cost	Population Protected	US ¢ per capita
Ethiopia	2 560	4 046	6 606	4 476	147.6	3 876	3 151	7 027	5 612	125.2
Iran	10 867	865	11 732	23 116	50.8	11 492	593	12 085	24 552	49.2
Iraq	2 100	308	2 408	5 486	43.9	2 442	385	2 827	5 682	49.8
Pakistan	14 243	4 184	18 427	102 280	18.0	21 361	236	21 597	108 508	19.9
Syria	512	343	855	4 313	19.8	547	208	755	4 374	17.3
Tunisia	514	66	580	3 925	14.8	1 081	72	1 153	4 315	26.7
T O T A L	30 796	9 812	40 608	143 596	28.3	40 799	4 645	45 444	153 043	29.7

It can be seen immediately that recently there has been a radical change in attitude of the international agencies towards malaria eradication. Although the countries presented are still protecting the majority of their respective populations, the financial assistance from international sources to their malaria programmes has fallen by some US $ 5 million between 1968 and 1970. So far the governments concerned have borne this extra burden in addition to a further US $ 5 million required to pay for the actual increase in programme costs. Unfortunately, the phasing out of assistance to malaria eradication by such agencies as UNICEF and US AID is likely to continue. This is a very grave situation from the point of view of the governments concerned.

Although the overall per capita cost of these programmes has only risen by US ¢ 1.4 since 1968, as has been stated previously, there has been a considerable increase in DDT resistance which will inevitably lead to increased costs not only to provide more expensive insecticides[1] but also an increased sophistication necessary for their handling and application. As an illustration, the cost of discarding DDT for malathion can be seen in Iran and Iraq, where the per capita costs are running at approximately US ¢ 50, which is considerably higher than that in Pakistan and Tunisia where DDT is still being used. In the case of Tunisia, it is interesting to note that cost per capita has almost doubled itself. This is probably due to the fact that, although malaria eradication is basically the responsibility of the general health service, the use of polyvalent malaria workers did not achieve the proficiency in case detection required by malaria eradication, thus necessitating the recruitment of monovalent "agents de santé" for this important operation.

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[1] Considering that the residual effect of DDT is twice that of malathion and OMS-33 (propoxur), if DDT = 1 the cost ratios to the insecticides themselves and the operational factors are estimated for malathion and OMS-33 (propoxur) to be 5.3 and 3.1, 20.4 and 8.5 respectively. EB47/WP/14, page 14, 22 January 1971.

Table 2a

Trend in Status of Malaria as Shown by Surveillance Data from Some Malaria Eradication Programmes in EMR - 1966 to 1970

Country	Population Protected (000)				Slides Examined (000)				Malaria Cases Detected				A.B.E.R. %				A.P.I. °/oo			
	1966	1968	1969	1970	1966	1968	1969	1970	1966	1968	1969	1970	1966	1968	1969	1970	1966	1968	1969	1970
IN THE ATTACK PHASE																				
Afghanistan	5 845	5 486	5 318	5 210	546	507	628	551	2 518	7 473	11 740	16 917	9.3	9.2	11.8	10.5	0.4	1.4	2.2	3.2
Ethiopia	-	4 476	4 691	5 612	-	84	150	348	-	2 256	20 684	41 259	-	1.9	3.2	6.2	-	0.5	1.8	7.4
Iran	5 327	10 386	10 651	10 324	381	1 413	1 554	1 246	6 671	51 624	37 614	23 816	7.2	13.6	14.6	12.1	1.3	5.0	3.5	2.3
Iraq	5 361	5 486	5 612	5 682	496	400	441	506	15 380	8 526	11 563	14 242	9.2	7.2	7.8	8.9	2.9	1.6	2.0	2.6
West Pakistan	46 349	58 377	50 070	30 231	1 067	687[1]	950	2 229	5 136	2 646	8 326	63 828	3.6	2.8	6.0	7.4	0.2	0.1	0.3	2.1
East Pakistan				22 410	612	995	2 056	3 243	2 240	4 186	5 162	6 110				14.5				0.3
Syria	451	994	475	502	75	234	219	243	433	1 490	1 642	1 516	16.6	23.5	46.1	48.4	1.0	1.5	3.5	3.0
Tunisia	-	3 952	3 560	3 829	-	189	472	370	-	2 097	362	[illegible]	-	4.8	13.2	9.6	-	0.5	0.1	0.006
T O T A L	63 333	89 130	80 377	73 476	3 177	4 509	6 470	8 736	32 378	80 298	97 093	167710	5.0	5.0	8.0	11.8	0.5	1.0	1.1	2.3
IN THE CONSOLIDATION PHASE																				
Afghanistan	1 599	2 440	2 239	2 751	180	282	183	295	119	516	303	1 429	11.2	11.5	8.1	10.7	0.07	0.2	0.1	0.5
Iran	11 281	12 730	13 014	14 228	693	841	1 147	986	1 589	734	495	509	6.1	6.6	8.8	6.9	0.1	0.06	0.03	0.03
West Pakistan	9 316	43 912	54 290	19 912	323	2 350	3 331	1 471	147	4 062	41 770	29 088	10.9	8.5	10.6	7.4	0.03	0.1	0.8	1.5
East Pakistan				41 651[2]	701	1 382	2 449	3 673[3]	196	1 356	1 312	1 444[4]				8.8				0.07
Syria	3 359	3 319	3 798	3 872	178	468	479	536	361	1 517	976	273	5.2	14.1	12.6	13.8	0.1	0.5	0.3	0.07
Tunisia	-	-	450	486	-	-	68	64	-	-	105	6	-	-	15.0	13.0	-	-	0.2	0.01
T O T A L	25 555	62 401	73 791	82 900	2 075	5 323	7 589	7 025	2 412	8 185	44 961	32 749	8.1	8.5	10.3	8.5	0.9	1.3	0.6	0.4

[1]Up to September only [2]Including 5 696 in Maintenance [3]Including 371 in Maintenance [4]Including 28 in Maintenance

Although Syria has discarded DDT for dieldrin, which costs approximately twice as much as DDT, the malaria service has somehow managed to keep its per capita cost within reasonable bounds and has even made some economy.

Ethiopia appears to be running a very expensive malaria programme indeed, but it must be said that in addition to the population in the attack phase, others are being protected in development projects, and in the preparatory phase in Area B. Nevertheless, the cost per capita after these factors are taken into account still appears to be on the high side.

VI TRENDS IN STRATEGY

Since 1966 there has been a major re-evaluation of global malaria eradication.

In 1968[1], the Twenty-first World Health Assembly requested the Director-General to re-examine the strategy of global malaria eradication and to make recommendations for the future orientation of the programme. In 1969, the Director-General submitted his report[2]. The Twenty-second World Health Assembly after considering the report, endorsed the Director-General's proposals ".....with regard to the strategy contemplated in countries where eradication programmes are already in operation and in those where areas have reached the maintenance phase, as well as in countries which have not yet commenced their eradication programme". The Assembly then proceeded to make its now well-known Resolution[3] "that the Governments of the countries with programmes under way revise them in co-operation with the Organization and other assisting agencies with a view to adapting them to a strategy calculated to give optimum results"

Since the adoption of this resolution, the malaria programmes in Afghanistan, Ethiopia, Iraq, Pakistan, Sudan and Tunisia have been reviewed by their Governments, with the assistance of WHO through this

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[1] WHA21.22
[2] WHA22.A22/P+B/8, 30 May 1969
[3] WHA22.39, 24 July 1969

Regional Office. UNICEF and US AID have also provided assistance to reviews of those programmes in which they were directly concerned.

As all malaria programmes have in-built mechanisms for self-evaluation, those administrators responsible for their execution are already well acquainted with their progress and the difficulties they have to overcome. This being so, the findings made by the review teams came as no surprise to the malaria authorities, who had been periodically advising their own governments of their administrative, operational and technical problems.

The great value of the review recommendations, therefore, was not so much their substance as the increased awareness and concern promoted among government authorities outside malaria eradication. Because the reviews were national in character, led by high national public health authorities, they were followed by a renewed sense of urgency to improve the administration and execution of malaria programmes along greatly improved and pragmatic lines. As a simple example, all these Governments immediately increased the funds earmarked for malaria, and in one case, Afghanistan, actually doubled them.

Each review team carried out their task with commendable thoroughness. The resulting reports are extremely comprehensive and will form invaluable works of reference for the governments and malaria programmes concerned, but they are far too detailed to be dealt with in depth in a paper of this nature. It is only thought necessary to indicate the factors which appeared in all the reports as common denominators of the future policy recommended to be adopted in malaria eradication in the future.

1. Planning

The first of these was undoubtedly the careful attention which should be paid to the overall planning of malaria programmes, not only for the programmes themselves, but as a component of the health

plan within the socio-economic plan of the country. Most of the review teams found that, to a greater or lesser degree, the planning of malaria programmes, having been done in isolation, had been followed by serious financial and administrative problems. Thus it was that the reviews were followed either by entirely new plans of operation, or considerably amended plans of action.

In Afghanistan, for instance, a revised plan of operation was prepared in a modified form as agreed upon during discussions between the Government, WHO and UNICEF. This revised plan had the virtue of being not only more realistic with regard to protecting populations in the worst hit areas of the country, but also envisaging the conservation of the gains made by the malaria service in the less malarious areas, with a more realistic overall use of funds.

In Sudan, even before the review, a refreshing and pragmatic accord between the Government and WHO had already resulted in a much more healthy situation than that existing prior to 1970. The pre-eradication programme and the Malaria Eradication Demonstration and Training Organization will now be amalgamated with the malaria control programme. The Ministry of Health will have a new Malaria Division, receiving the technical advice of the senior officers of the previous Malaria Service, but executed by provincial health officials. The result of this reorganization will mean the unification of malaria control under central direction, but as a responsibility of the General Health Service. The ultimate aim will still be the eradication of malaria, but without the onus of specific time limits.

The review of the Sudan programme by the Government, assisted by WHO officers, was conducted only after a long series of discussions between the Government and WHO during which a large measure of agreement was achieved. The review, however, was extremely useful as it

highlighted the requirements for future methodology and resulted in a practical plan of action.

2. Integration of Malaria Eradication into the General Health Services

The review teams in all cases carefully examined the possibility of integrating the malaria services into the general health services. Those reviewing programmes in Afghanistan and Pakistan made specific recommendations that this should be done as soon as possible, although the Afghanistan review team made an alternative recommendation that malaria eradication could be further pursued provided that their comprehensive suggestions for improving malaria service were adopted. These Governments certainly recognized the need for integration at some future date, but in view of the stage reached, the presence of severe technical problems, the complicated nature of malaria eradication, and the current status of health service development in their countries, rejected the concept of immediate and total integration. As things are one can understand their reluctance to integrate immediately and totally and their decision is a clear indication of the high trust they still place in the administrators of their malaria programmes.

The review team in Ethiopia thought that full integration would be premature, but that, as a preparatory step, the malaria service personnel should be trained in the control of other diseases such as tuberculosis, smallpox, other communicable diseases and epidemics.

3. Socio-economic Benefit

In every case the review team made the attempt to assess the socio-economic benefits gained by malaria eradication. In some cases a professional economist was a member of the team. Although each team stated in general terms that considerable benefits had been achieved, they found it difficult to express these precisely. There

was, they found, too little time to carry out cost benefit analysis studies, and the available econometric baseline data was not sufficient for accurate analysis. The economic justification for allocating funds to malaria eradication should not, however, be solely the responsibility of malaria review teams, and WHO has been collaborating with the governments to provide assessment by other means of the socio-economic implications of malaria eradication.

4. Technical Observations

Review teams laid stress on the important questions of delimitation of malarious areas, the proper timing of spraying operations to ensure complete coverage of the transmission season and proper case classification and epidemiological investigation.

It was found that insufficient attention to these important activities had been largely responsible for operational failures where these had occurred.

Although it is fair to say that the large majority of population at risk were found to be properly protected these were those who lived in areas excluded from protection due to delimitation of malarious areas having been done by improper and imprecise methods.

The teams in each country reviewed found that nomadism made the proper delimitation of malarious areas more difficult. The supposition that nomads always leave their winter quarters before the beginning of the transmission season was also found in some cases to be erroneous.

Teams also pointed out that the arbitrary selection of a 2 000 m altitude level as the upper limit of transmission sometimes led to a breakthough of transmission, and found that this level had been chosen upon very scanty and inconclusive evidence. In some cases malaria organizations were anxious to economise by lessening the areas to be covered, and in others to avoid conducting operations in difficult terrain.

There was reference to improper delimitation of the transmission season, particularly with regard to early spring transmission. Pre-review preparation, entomological and parasitological data evaluation had indicated both that the first sporogonic cycle could have been completed and that fresh indigenous cases had actually occurred, long before the assumed date for commencement of transmission, resulting in the late application of the first round of spraying. The reason was again usually found to be a desire to economise by attempting to interrupt transmission with one round of spraying instead of two.

All the review teams were adamant that the epidemiological evaluation of malaria programmes should remain in the hands of experienced malariologists, even after either partial or total integration, and this is one recommendation that governments have readily accepted. As for evaluation itself, teams pointed out that classification and epidemiological investigation of malaria cases should be done by experienced personnel. The bare fact of unavailability of sufficient medical officers made it difficult for them to recommend the ideal in this case, but they reiterated the need for close supervision of case investigators in order that these personnel did not pass their responsibility on to lower echelon workers and that they used the recommended entomological and epidemiological criteria.

VII CONCLUSIONS

This review of the efforts and achievements of Regional governments in their fight against malaria during the five-year period 1966 to 1970 clearly indicates the following conclusions.

Although malaria remains a disease of great epidemic potential and is still a threat to health and life and a hindrance to socio-economic development, the governments concerned have nevertheless succeeded in the main in containing its transmission and have afforded to their peoples a remarkable degree of protection against it.

At the end of 1970, 93 per cent of the people living in malarious areas of the Region were being protected against malaria, and active steps were being taken to extend this protection to the remainder. This represents an outstanding achievement in the field of health, and is due almost entirely to the high priority which governments have consistently given to their malaria programmes.

However, the resilience and dynamism of malaria as a disease and the numbers of cases still being detected, albeit generally in low endemicities, are reason enough to indicate that there should be no relaxation of effort, if our considerable gains are not to be dissipated and large scale disaster overtake us.

It is evident, and to be expected in such a large undertaking involving living organisms such as the plasmodia, the vectors and man himself, that problems have arisen and will continue to arise, but this is not to say that these problems have not been, or will not be solved. We have ample evidence to prove our ability to overcome even the most difficult of such technical problems as insecticide resistance. Solving these problems may not have come to us easily, and have cost us much time, money and technical ability, but in the process we have sharpened our epidemiological discrimination and trained a large cadre of personnel capable of dealing with difficult health problems, both in malaria and in other communicable diseases.

We have seen from review team reports, that the methodology we use is in general the best, but that it should be adequately financed in good time, properly planned within the health and socio-economic contexts, and modified or strengthened to suit local epidemiological conditions if it is to be effective. There is also a continuing need to improve this methodology by continuous evaluation and research.

We have also seen from review reports that both governments and international agencies are becoming increasingly aware of the need for wider-based health services capable of accepting the responsibility for

the prevention of the re-introduction of malaria into areas already cleared by the malaria services. The review teams, however, have strongly emphasized that international agencies should not transfer their assistance from malaria eradication programmes to basic health service development if this means the destruction of all their achievements so hardly won. In effect there is an equal need for both these important health enterprises, each complementary to the other until such time as it is possible to integrate the two.

Finally each individual man, woman and child should be entitled to protection from malaria, and whatever method is used in the campaign against this disease the ultimate aim should be its eradication.