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**STATUS OF THE ANTIMALARIA CAMPAIGN
IN THE AMERICAS**

V Report

**PAN AMERICAN SANITARY BUREAU
Regional Office of the
World Health Organization
Washington, D. C.**

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V Report

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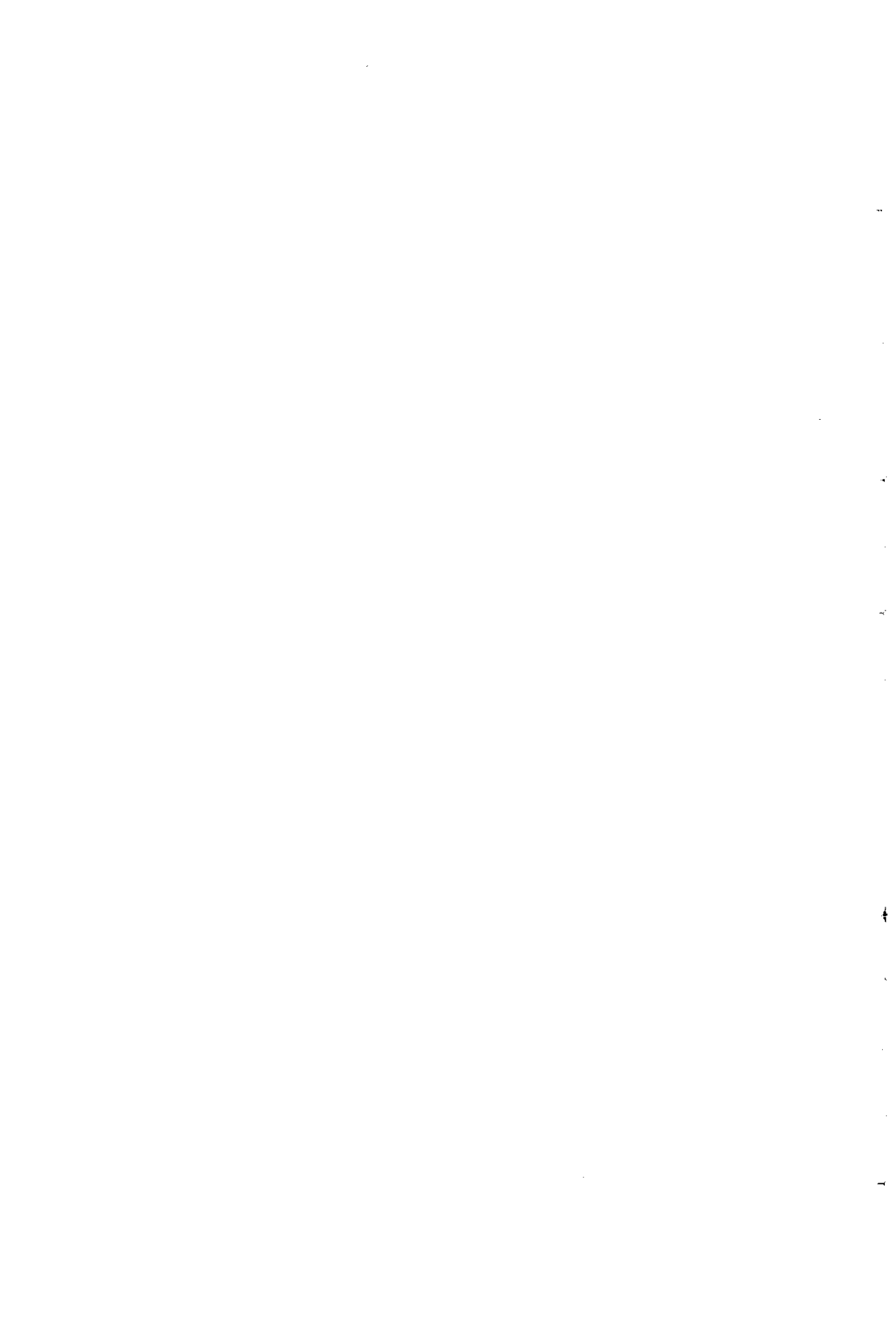


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STATUS OF THE ANTIMALARIA CAMPAIGN IN THE AMERICAS

V REPORT*

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To continue the tradition established at the XI Pan American Sanitary Conference (Rio de Janeiro, 1942), the Pan American Sanitary Bureau requested the preparation of the V Report on the status of the antimalaria campaign in the Americas. Like the last report, presented to the XIII Conference (Ciudad Trujillo, 1950), the present report consists of two parts: the first contains an over-all comparative and analytical study on the present status and the achievements of antimalaria work in the Western Hemisphere; the second refers to the urgent need for consolidating past gains through a coordinated plan on a continental scale for the eradication of malaria in the Americas. In order to give as complete a picture as possible, data were included on all political divisions of the continent, including those not responsible for the conduct of their international relations, these being referred to as "territories" for purposes of this study.

To facilitate comparison with previous data, the method of presentation used in the IV Report has, as far as possible, been followed in the present study.

PROGRESS OF ANTIMALARIA WORK IN THE CONTINENT

INTRODUCTION

The present status of the antimalaria campaign in the continent shows that significant qualitative and quantitative changes have taken place since the preparation of the IV Report. Taken as a whole, the picture may be considered favorable, although the vigorous impulse of the former period has

lagged somewhat during the last four years, and some countries have not taken full advantage of the splendid benefits obtained through campaigns using imagocides.

A well-integrated antimalaria campaign should proceed in two directions: (a) in breadth, until all malarious zones of the country are covered, and (b) in depth, until total eradication is achieved. Only four countries and two territories report that the first of these goals has been reached. The second objective has been achieved almost completely by only one country; three other countries and two territories have achieved it in some areas.

Such factors as the spectacular reduction in the number of cases, the drastic lowering of parasitic indices, and the enthusiasm awakened by the collateral action of the imagocides against other arthropods, have all exerted a negative influence on the planning of antimalaria programs, on the structure of the organizations concerned, and on the policy of health authorities. Malariology, with its out-dated malariometry, based on measures that were useful in the days of antilarval campaigns and sanitary engineering work, has not yet devised evaluation methods to suit the strategy and fast action of imagocides. As the results of campaigns were measured and evaluated with yardsticks designed for other purposes, public health responsibility was considered fulfilled when indices dropped below a certain figure or when malaria no longer appeared in first place in mortality statistics. It was not realized that this was comparable to detaching merely a segment of a tapeworm and that any parasite index below 0.0, but not absolute zero, meant the survival of the "head of the taenia." It is due to those last

* Presented to the XIV Pan American Sanitary Conference as Annex I of Document CSP14/36.

vestiges of out-dated objectives and standards that the four-year period 1950-53 has failed to keep pace and to exceed the level reached during the previous period, thus thwarting the hopes expressed in the IV Report, which said:

If it were remembered that these results have been or are about to be achieved after a three year campaign only and in an area equivalent to two thirds of the malarious region of the continent, one could appreciate the extent of the

progress made, as well as the well-founded hope that the eradication of malaria can be achieved in the Americas within a relatively short time.

STATUS AND ORGANIZATION OF NATIONAL MALARIA SERVICES

In this report, as in former ones, the term "National Malaria Service" (NMS) will be used to designate the service in charge of the antimalaria campaign. Table 1 shows the administrative status and the specific

Table 1.—*Status of the National Malaria Service (or Service Responsible for the Antimalaria Campaign) within the National Public Health Organization of each Country and Territory*

Countries and Territories	Primary Division	Secondary Division
Argentina.....	Department of Malaria and Yellow Fever Control	
Bolivia.....	Communicable Diseases Division	National Malaria Department
Brazil.....	National Malaria Service	
Colombia.....	SCISP	National Malariology Division
Costa Rica.....	Department of Insect Control	
Cuba.....	Finlay Institute	Malaria Committee
Dominican Republic.....	Division of Malariology	
Ecuador.....	National Antimalaria Service	
El Salvador.....	Division of Epidemiology	Antimalaria Service Vector Control Service DDT Campaign
Guatemala.....	Insect Control Section	
Haiti.....	Insect Control Campaign	
Honduras.....	SCISP	Division of Malariology
Mexico.....	Department of Epidemiology and Public Health Campaigns	National Campaign against Malaria and for the Prevention of Yellow Fever
Nicaragua.....	8th Division for the Control of Insects and Metaxenous Diseases	Antimalaria Campaign ¹
Panama.....	Division of Public Health ²	Campaign against Malaria and Yellow Fever
Paraguay.....	Asunción-Villarica Area Public Health Program	Division of Arthropod Control
Peru.....	Communicable Diseases Division	Vector Control Department
United States.....	Surveillance Section, Epidemiology Branch (CDC-USPHS)	National Malaria Surveillance Program
Venezuela.....	Division of Malariology	
British Guiana.....	Public Health Department	Mosquito Control Service
French Guiana.....	Malaria and Yellow Fever Control Service	
Grenada.....	Medical Department	Insect Control Program
Jamaica.....	Insect Control Service	
Puerto Rico.....	Malaria and Insect Control Section	
Trinidad.....	Malaria Division	

¹ In practice the antimalaria campaign is a primary service since it is the principal function of the 8th Division.

² The Public Health Division does not yet have a fully organized Central Office (*Jefatura*).

name of the NMS in each country or territory.

The status of the NMS within the respective National Public Health Service (NPHS) has changed somewhat since the last report. Argentina set up, in 1953, a primary service responsible exclusively for malaria and yellow fever work, although the management and administration of the service continue to be shared with the General Health Department of the North. In Ecuador the National Antimalaria Service is at present also a primary service, although it continues to be under the direction and administration of the Institute of Hygiene. In El Salvador there is no single service with complete responsibility for this work, field operations being under one service (Vector Control) and epidemiology and drug distribution under another (Antimalaria Service), both of which are coordinated within the Division of Epidemiology. In the United States, where all federal participation in the antimalaria campaign has been suspended since 1953, only a program of epidemiological surveillance (National Malaria Surveillance Program) is being carried on under a section of the Epidemiology Branch, Communicable Diseases Center (CDC), of the Public Health Service. In Guatemala, Haiti, and Nicaragua primary services were organized under the title of "Insect Control;" services were organized also in Paraguay, but these occupy a secondary position. In Peru the old and well-known Department of Malaria became the Vector Control Department. In this country, as well as in two others (Guatemala and Paraguay), the term "malaria" is no longer used to designate sections of the public health services (even though malaria continues to be a serious problem).

With regard to the territories, St. Lucia has no NMS, but the insect control program is a special service of the NPHS. There is no NMS in Dominica or in British Honduras, the antimalaria activities being included in the general functions of the Public Health Service. No data are available for Guadeloupe, Surinam, or the Canal Zone.

As to the internal organization of the NMS, some changes have occurred. Some have been profitable and others not, but the over-all picture continues to be favorable. Argentina and Mexico have established insecticide laboratories. The latter country now also has research and publications sections. Brazil has organized a library in its Malariology Institute, and Ecuador issues regular publications on the activities of its NMS. The Dominican Republic has set up sections for entomology and administration. Conversely, the NMS in Bolivia no longer has its own administration, and in Peru the entomology, parasitology, statistics, and administration sections have become part of the Division of Communicable Diseases.

Beyond analyzing the structure of the NMS, it is of even greater importance to consider whether their work covers all aspects of the malaria problem (anti-anopheles campaign, epidemiological evaluations, distribution or application of treatments, registry of patients, parasitological confirmation of clinical cases, and epidemiological investigation of confirmed cases), or whether it is limited to only a few of these activities; and also whether the NMS undertake other activities related to or coordinated with the antimalaria campaign, or completely unrelated. These activities are given in detail in table 2. Only Argentina and Venezuela approach the problem on a complete and over-all scale, since the United States (federal service) dropped from its program certain activities that it had found no longer necessary. Next in line, as regards the scope of activities, are Brazil, Ecuador, British Guiana, Puerto Rico, and St. Lucia. In other countries and territories (excepting Cuba) the basic activity is anopheles control with imogicides, and decreasing emphasis is being placed on epidemiological evaluations, registry of patients, and parasitologic confirmation of clinical cases. Only Argentina, the United States, and Venezuela, together with British Guiana in part of its territory, make epidemiological investigations of each confirmed case of malaria.

Table 2.—Activities of the National Malaria Services in each Country and Territory

Countries and Territories	Antimalaria						Not Antimalaria	
	Anti-Anophelis control (imagocides)	Epidemiological evaluations	Distribution or application of treatments	Registry of patients	Parasitological verification of clinical cases	Epidemiological survey of confirmed cases	Related or combined	Totally different
Argentina.....	X	X	X	X	X	X	YF ^h , AC	—
Bolivia.....	X	X	—	—	—	—	—	—
Brazil.....	X	X	X	X ^{e,f}	X ^f	—	CD ⁱ , FI, CS	SC
Colombia.....	X	X	X	X	—	—	YF ^h	—
Costa Rica.....	X	X	—	X ^g	X ^g	—	YF ^h , CD ⁱ , FC	—
Cuba.....	— ^a	—	—	—	—	—	MC	—
Dominican Rep....	X	X ^f	—	—	X ^f	—	—	—
Ecuador.....	X	X	X	X ^f	X	—	YF ^h	—
El Salvador.....	X	X	X ^d	X	X	—	— ^j	—
Guatemala.....	X	—	—	X ^{e,f}	X ^g	—	YF ^h	ET
Haiti.....	X	X ^e	—	X ^{e,f}	X ^f	—	YF ^h	—
Honduras.....	X	X	—	—	X ^f	—	YF ^h	—
Mexico.....	X	X ^e	X	X ^f	X ^f	—	YF ^h , AC, CS	—
Nicaragua.....	X	X	X	X ^d	X ^d	—	YF ^h	—
Panama.....	X	X	X ^g	X ^f	—	—	YF ^h , AC	—
Paraguay.....	X	X ^e	—	X ^f	—	—	YF ^h	—
Peru.....	X	—	—	X ^f	—	—	YF ^h , CD ⁱ , VP	PL
United States.....	— ^b	—	—	X	X	X	YF	—
Venezuela.....	X	X	X	X	X	X	YF ^h , CD ⁱ , FC, DD	ET, MT, RF, PL, SC
British Guiana....	X	X	X	X	X	X ^k	YF ^h	—
British Honduras..	X	X ^f	—	—	X ^f	—	YF	—
Dominica.....	X	—	X ^f	X	X	—	YF	—
French Guiana....	X	X	—	X ^f	X	—	YF, FI	—
Grenada.....	X	—	—	—	—	—	YF	—
Jamaica.....	X	X	—	X	X	—	YF	—
Puerto Rico.....	X	X	—	X	X	X [?]	YF, AC	SC, CP
St. Lucia.....	X	X ^e	X	X	X	—	YF, AC	—
Trinidad.....	X	—	X ^f	—	X ^f	—	YF, AC	—

—None.

... Data not available.

^a Imagocides or larvicides not applied; only antimalaria engineering projects.

^b No federal activity. Some states conduct activities on their own account.

^c Only in zones where measures were either not applied or were applied irregularly.

^d Reports that such work is done but does not give figures.

^e In official medical services only.

^f Data incomplete.

^g Only among personnel of the United Fruit Company.

^h Basically, *Aedes aegypti* eradication; occasionally, vaccination.

ⁱ Principally control of *Triatomidae*.

^j Imagocides applied solely as a measure against mosquitoes and flies.

^k Only in those cases occurring along the coastal plains.

N Activity in operation.

YF Yellow fever.

AC Anti-*Culex* campaign.

CD Chagas' disease.

FI Filiariasis.

CS Control of scorpions.

FC House-fly control.

MC Over-all antimosquito control.

VP Verruga peruana (bartonellosis).

DD Diarrheal diseases.

SC Schistosomiasis.

ET Epidemic typhus.

MT Murine typhus.

RF Relapsing fever.

PL Plague.

SC Street cleaning.

CP Construction of sanitary privies.

In fourteen countries and nine territories, the NMS have responsibility for *Aedes aegypti* eradication and thus, in an activity closely related to their regular work, are contributing toward the implementation of the important resolution adopted by the Directing Council of the Pan American Sanitary Organization at its first meeting (Buenos Aires, 1947).

TECHNICAL PROFESSIONAL PERSONNEL

The tabulation of technical professional personnel does not include part-time workers, who are few in number and of less importance. Table 3 shows the figures by country and by professional groups. The United States reports a total of 30 medical officers with specialized training (as compared with 1 in 1950), but these participate also in other activities of the Communicable Diseases Center. Not counting this group, the total is the same as for 1950. For all countries, the total number of non-specialized physicians (but who have accredited experience) has doubled (41 as compared with 20).

The total for engineers is lower, but this decrease is due exclusively to their reduction in number in the United States and Argentina. There are also fewer entomologists (34 as compared with 109 in 1950), but this sizeable reduction is accounted for by decreases in only two countries, the United States and Brazil, which had 40 and 55, respectively, in 1950.

Five countries (Argentina, Brazil, Ecuador, the United States, and Venezuela) have training facilities for all categories of personnel and these facilities can be extended to personnel from other countries. In two countries, Ecuador and Venezuela, fellowships are granted to include, in the former, room and board at the Leopoldo Izquieta Pérez National Institute of Hygiene, and, in the latter, a sum of money to cover these expenses (500 bolivars per month). In the other countries travel and study fellowships must be obtained from other sources. Colombia, Costa Rica, the Dominican Re-

public, El Salvador, Panama, Paraguay and Peru report that they have training facilities for field personnel only.

Mention should be made of the debt owed by the countries of the Americas to the School of Malariology of Venezuela, which has trained the majority of professional malariologists and malariology engineers now directing or working with the NMS of all Latin American countries (with the exception of Brazil).

MAINTENANCE OF THE ANTIMALARIA CAMPAIGN AND BUDGET OF THE NATIONAL MALARIA SERVICES

In almost all countries of the Americas the organization of antimalaria campaigns continues to be the responsibility of the national government. The most notable exception is the United States, where the responsibility rests with the states, which have the cooperation of the counties. From 1951 on, federal support for antimalaria programs in that country was gradually withdrawn, leaving only an epidemiological service to give supervision and to verify the results (National Malaria Surveillance Program). In Brazil, the state of São Paulo continues to maintain an independent program, but no specific data could be obtained on its activities.

The most significant facts for 1950 are the above-mentioned withdrawal of federal support for antimalaria campaigns in the United States and the collaboration offered by WHO/PASB and UNICEF in twelve countries and six territories. Only Cuba and Puerto Rico have reported that their antimalaria activities are supported exclusively by the National government. Elsewhere, either the states, provinces or departments, municipalities, private enterprises, or international agencies (UNICEF and WHO/PASB, SCISP)¹ collaborate in their operation and maintenance.

Table 4 presents, in detail, all the informa-

¹ Servicio Cooperativo Interamericano de Salud Pública (Inter-American Cooperative Public Health Service).

Table 3.—*Technical Professional Personnel in each Country and Territory*

Countries and Territories	Malariaologists		Engineers		Entomologists ^a	Entomological Technicians ^b
	with specialized degrees	with accredited experience	with specialized degrees	with accredited experience		
Argentina.....	2	14	—	2	2	13
Bolivia.....	3	—	—	—	—	3
Brazil.....	61	6	2	3	5	52
Colombia.....	3	5	1	—	1	3
Costa Rica.....	—	—	1	—	—	1
Cuba.....	—	—	1	—	—	1
Dominican Rep.....	1	—	1	—	1	—
Ecuador.....	6	3	—	—	—	3
El Salvador.....	1	—	1	—	—	1
Guatemala.....	1	—	—	—	—	—
Haiti.....	1	1	—	—	—	1
Honduras.....	—	—	—	—	2	3
Mexico.....	8	7	—	3	5	6
Nicaragua.....	3	2	—	—	1 ^d	—
Panama.....	—	—	—	—	1	2
Paraguay.....	1	—	—	—	1	1
Peru.....	2	2	6	—	—	3
United States.....	30 ^e	—	5 ^e	—	7 ^e	—
Venezuela.....	25	—	9	—	1	30
Countries Total.....	148	40	27	8	27	123
British Guiana.....	1	—	—	—	—	2
British Honduras.....	—	—	—	—	—	—
Dominica.....	—	—	—	—	—	—
French Guiana.....	1	—	—	1	2	2
Grenada.....	—	—	—	1	—	1
Jamaica.....	2	—	—	—	—	5
Puerto Rico.....	—	—	—	1	2	18
St. Lucia.....	1	1	—	1	1	9
Trinidad.....	2	—	—	1	2	6
Territories Total.....	7	1	—	5	7	43
Continent Total.....	155	41	27	13	34	166
General Total in 1950.....	118	20	36	17	109	c

^a Understood to be persons capable of classifying any anopheles in the country.

^b Understood to be persons capable of classifying anopheles (larvae and adults) in their own countries.

^c Participating in other activities of the CDC.

^d At present taking a specialized course in Brazil.

^e These data were not requested in 1950.

Guadeloupe, Martinique, Surinam, and Panama Canal Zone did not send data.

tion obtained on the type and amount of the contributions made toward the maintenance of antimalaria campaigns.

Table 5 gives the annual budgets for the four-year period 1951-1954, it being under-

stood that, where the fiscal year begins on 1 July, the year referred to is that beginning with the fiscal period. The budgets are given in the national currency of each country, and the last column shows the 1954 budgets

Table 4.—Participation in the Maintenance of the Antimalaria Campaign in each Country and Territory

Countries and Territories	Nation only	Independent state or district services	Nation in Financial Collaboration with:					Amount of 1951 and 1953 NMS budgets (in thousands)*	Amount of local contributions 1951-53 (in thousands)*	Percentage ratio	SCISP contributions (in thousands)*	WHO-PASB-UNICEF contributions (in thousands)*
			States ^a	Municipalities ^b	Private enterprise	SCISP	WHO, PASB, and UNICEF					
Argentina	no	no	yes	yes	yes	no	no	18,460.5	2,424.0	13.1		
Bolivia	no	no	—	—	yes	—	yes	22,845.6				c
Brazil	no	yes	yes	no	yes	no	no	640,798.4	9,400.0 ^h	1.5		
Colombia	no	yes	yes	yes	yes	no	yes	7,073.7	390.0	5.5		375.0
Costa Rica	no	no	no	no	yes	no	yes	730.0	184.5 ⁱ			j
Cuba	yes	no	no	—	—	—	—	112.4*	—			
Dominican Rep.	no	no	no	—	—	no	yes	522.9				j
Ecuador	no	—	yes	yes	yes	yes	no	19,270.2	77.4	0.4	962.3	
El Salvador	no	no	—	—	—	—	yes	1,576.6	67.0	4.2		c
Guatemala	no	no	no	yes	yes	no	yes	300.0	103.9	34.6		58.6
Haiti	no	no	no	—	no	no	yes	131.6				US\$160.0
Honduras	no	no	no	yes	yes	yes	yes	501.0	80.0	16.0	601.0	78.5
Mexico	no	no	yes	yes	yes	yes	yes ^f	5,768.2 ^k	1,256.0	21.0		
Nicaragua	no	no	no	no	no	no	yes	2,168.1				US\$127.7
Panama	no	no	—	yes	yes	yes	yes	495.0	22.9	4.6	8.7	26.0
Paraguay	no	no	—	—	—	—	yes	1,160.0				US\$ 50.0
Peru	no	no	no	no	no	yes	no	17,698.5			j	c
United States	no	yes	yes	yes	yes	no	no	1,396.0	5,780.2	414.		
Venezuela	no	no	yes	no	no	no	no	40,846.0	6,817.5	16.7		—
British Guiana	no		no	no	yes	no	no	454.2	d	—	—	—
British Honduras	no		no	no	yes	no	yes	6.5 ^a	d	—	—	c
Dominica	no		yes	—	—	—	yes ^f	8.5	d	—	—	—
French Guiana	no		yes	—	no	no	no	70,992.4	d	—	—	—
Grenada	no		—	—	—	—	yes	54.3	—	—	—	c
Jamaica	no		yes	yes	yes	no	yes	155.6	d	—	—	c
Puerto Rico	yes		—	—	—	—	—	949.9	—	—	—	—
St. Lucia	no		no	no	yes	no	yes	77.2	d	—	—	c
Trinidad	no		—	—	yes	—	yes	864.1	d	—	—	c

^a Primary division of the country or territory.

^b Secondary division.

^c Vehicles and materials by WHO-UNICEF.

^d No data given on amount contributed by states, municipalities, and/or private enterprise.

^e 1953 only.

^f WHO-UNICEF to collaborate beginning October 1954.

^g 1951 budget not included.

^h Private enterprise contribution not included.

ⁱ Local and international agencies' contributions combined.

^j No data given.

^k Other governmental agencies contribute approximately \$2,000,000 (Mexican pesos) annually.

* Amounts are shown in each country's own currency unless otherwise specified.

converted into U.S. dollars at the free rate of exchange in effect in July of the same year.

In the study of the budgets, it is evident

that, in spite of the fact that the majority of the countries report an increase in funds allocated to antimalaria campaigns, the percentage of the total public health budget

allotted to this activity in the individual countries has dropped in some countries to a considerable degree. In large part this decrease has been caused by the fact that, while other public health activities have been increasingly expanded, antimalaria programs have remained the same. It would

operations. Several NMS have taken on new responsibilities, making it necessary for the costs of administrative-technical services to be met with funds from antimalaria and other activities, with the result that the specific budget for antimalaria work is sometimes greatly reduced.

Table 5.—Budgets of the National Malaria Services in each Country and Territory, 1951-1954

Countries and Territories	Currency	National Malaria Services Budgets (in thousands)				Does Service have its own budget?	Percentage of Nat'l. Pub. Health budget 1954	1954 index 1951 = 100	Frec dollar exchange, rate as of 31-7-54	1954 budget in thousands of dollars (free exchange rate)
		1951	1952	1953	1954					
Argentina.....	peso	5,454.1	5,933.2	7,073.1	6,894.5	d	1.6	126	25	275.8
Bolivia.....	boliviano	5,455.2	5,920.4	11,470.0	18,064.0	no	3.5	331	1,400	12.9
Brazil.....	cruzeiro	220,261.5	206,471.7	214,075.3	233,892.9	yes	11.3	106	57	4,103.4
Colombia.....	peso	954.3	3,085.4	3,034.0	3,043.4	yes	7.4	319	2.5	1,217.3
Costa Rica.....	colon	259.6	323.1	147.3 ^b	157.8 ^b	no	—	—	6.65	23.7
Cuba.....	peso	—	59.2	53.2	53.2	yes	0.3	88	1	53.2
Dominican Rep.....	peso	177.0	205.7	140.2	161.5	yes	3.0	91	1	161.5
Ecuador.....	sucre	7,491.6	5,441.6	6,337.0	4,400.0	yes	20.9	59	17.5	251.4
El Salvador.....	colon	527.8	586.7	462.1	657.0	yes	17.4	124	2.5	262.8
Guatemala.....	quetzal	100.0	100.0	100.0	50.0	yes	1.3	50	1	50.0
Haiti.....	gourde	32.4 ^a	60.5 ^a	38.5 ^a	79.1 ^a	no	2.5	244	5	15.8
Honduras.....	lempira	120.0	221.0	160.0	220.0	yes	14.1	183	2	110.0
Mexico.....	peso	1,445.2	2,146.4	2,176.5	2,780.3	yes	1.4	192	12.5	222.4
Nicaragua.....	cordoba	359.4	968.4	840.3	1,256.0	yes	16.8	349	6.6	190.3
Panama ^a	balboa	135.2	202.4	157.4	150.5	no	2.2	111	1	150.5
Paraguay ^f	guarani	120.0	360.0	680.0	900.0	no	2.6	750	62	14.5
Peru.....	sol	3,743.8	4,375.5	9,579.1	11,560.8	no	3.0	309	20	578.0
United States.....	dollar	810.9	355.0	230.1	104.5	no	0.04	13	—	—
Venezuela.....	bolivar	12,074.8	14,384.1	14,387.1	14,287.5	yes	8.9	118	3.35	4,264.9
British Guiana.....	BWI \$	137.8	152.8	163.6	149.4	yes	3.83	108	1.7	87.9
British Honduras.....	BH dollar	—	—	6.5	12.0	no	53.9	185 ^c	1.43	8.4
Dominica.....	BWT \$	2.5	3.0	3.0	3.0	no	—	120	1.7	1.8
French Guiana.....	franc	18,495.0	25,247.4	27,260.0	17,281.0	yes	17.75	93	—	—
Grenada.....	BWI \$	9.4	11.3	33.6	43.5	yes	6.56	463	1.7	25.6
Jamaica.....	pound	43.2	52.3	60.1	65.8	yes	4.54	152	—	—
	sterling									
Puerto Rico.....	dollar	317.3	318.0	314.6	300.0	yes	1.04	95	1	300.0
St. Lucia.....	BWI \$	17.6 ^a	20.6 ^a	39.0 ^a	52.6 ^a	yes	19.04	299	1.7	30.9
Trinidad.....	BWI \$	268.8	289.5	305.8	332.4	yes	4.14	124	1.7	195.5

^a Includes other activities in addition to antimalaria work.

^b Salaries only; data on other costs not given.

^c Base 1953 = 100.

^d Part is its own budget and part is included in other activities.

^e In dollars.

^f Estimate for 1952-1954.

seem that the increase in funds allotted for antimalaria work in many of the countries is the result, not of actual expansion of activities, but rather of increases in the cost of material and equipment and of salaries of personnel. In some cases the NMS budget has really been decreased, as in the case of Argentina, owing to changes in the structure of the service and a reduction in the area of

The figures in table 4 are designed to show, for a considerable number of countries, the financial collaboration of the various local agencies and international organizations. It is apparent, from the extensive participation of states, municipalities, and private enterprises, that community interest in the antimalaria campaign has been kept alive. After mentioning the case of the United States,

where all activity is carried out on a local scale, it is fitting to point out that the states of Venezuela contribute the equivalent of 16.7% of the budget; the municipalities in Honduras contribute 16%; private enterprises in Guatemala contribute 34.6%; and in Mexico and Argentina the total contribution of these groups is 21% and 13.1%, respectively. In Mexico, in addition, other governmental agencies contribute each year amounts almost as large as the budget of the NMS itself. In Brazil, although the contribution of these groups represents only 1.5% of the total budget of the NMS, the sum of 9,400,000 cruzeiros, contributed by the states alone, is of considerable importance.

Undoubtedly, the most promising and significant development in the antimalaria campaign in the Continent is the expansion of the programs promoted by the WHO/PASB, with the financial support of UNICEF. Five countries and one territory received their assistance in 1950; the number that continued or began working with the equipment, transportation facilities, and technical assistance furnished by these international organizations increased to twelve countries and six territories.

LEGISLATION

With the exception of Cuba, El Salvador, Haiti, Nicaragua, and Panama, all the countries and territories mentioned in this report have legislation on malaria, and the majority of them deem it an obligation to combat this disease. Ecuador, in referring to the campaign against malaria, declares its eradication to be an urgent national enterprise. Argentina, Panama, and Venezuela also classify the problem as one of national interest, although not to the same extent as does Ecuador. The remaining countries do not put the same emphasis on the problem, but an analysis of the legislation in force shows the importance given to the legal aspects of the antimalaria campaign throughout the Americas.

Argentina, Brazil, Panama, Peru and

Venezuela all have exhaustive legislation on the subject, the most complete being the Argentinian law, complemented by its regulatory decree. In the other countries, measures concerning the antimalaria campaign are included in laws covering communicable diseases in general, in sanitary codes, or in laws, decrees, or statutes aimed at combating the problem through united action against noxious or vector insects. However, in these cases, all aspects of the antimalaria campaign are not covered. Unfortunately, therefore, in the majority of the countries legislation has not been adequately adapted to new concepts of antimalaria strategy. As a result of this fact, some of the indispensable activities for the conduct and evaluation of operations (such as compulsory and immediate reporting, and parasitological verification of clinical cases occurring in regions under treatment with imogocides or where malaria is presumed to be eradicated) can be carried out only with considerable effort, unless a high level of health education of the public exists.

Declaration of "malaria zones" is not compulsory in all countries and, where it is, such a declaration is made by the responsible health authority upon advice of the agency specifically entrusted with the antimalaria campaign.

Environmental sanitation works designed to physically improve the environment, combat larvae, or protect communities by mechanical means, are in almost all nations and territories under the responsibility, first, of the governments and second, of property holders, managers, tenants, etc. It is upon that subject that the most emphasis has been placed in the legal bodies concerned; steps taken have covered the most minute details. The use of imogocides in residences is covered specifically only in the legislation of Argentina and of four territories (Grenada, British Guiana, French Guiana, and St. Lucia), although that of Peru, by referring to "other insecticides," leaves the way open for the use of other types that have appeared recently. The fact that only two countries

and four territories emphasized such responsibility is easily explained in that almost all the legislation in force was passed before the discovery of the modern insecticides. The effectiveness of environmental sanitation, in every aspect, is based upon the obligation imposed by some laws to give public health personnel access to any property or residence that is to be covered.

In some countries the government and various agencies have been made responsible for the supply of drugs. Only the laws of Argentina refer to supervision of the distributing and dispensing of such drugs, which is an important measure since, when notification is lacking, cases of malaria that have not been reported in due time can be recognized and traced through this procedure.

Only Brazil and Argentina have laws referring to new or temporary dwellings and making it compulsory to report their installation, so as to make the antimalaria campaign more effective.

Special importance is now placed on the reporting of malaria cases. The majority of the countries require such reporting; some fix definite time limits and specify who should have the responsibility for reporting, to whom the report should be made, in what form and under what conditions, and if the report should be accompanied by a blood sample or any other evidence. Only Argentina, British Guiana, and Puerto Rico have made it compulsory for blood tests to be sent for parasitological confirmation. In connection with this requirement, some countries make it the duty of the patient to seek treatment and to submit to a blood test.

In order to make the afore-mentioned standards effective in practice, the majority of the countries have established various penalties for failure to comply with any of the legal requirements. Argentina imposes severe fines on those who are responsible for reporting malaria cases and fail to do so, as well as on persons who are required to submit to blood tests and refuse.

The real importance of clearly defining in

legal statutes the measures for combating and eliminating diseases is undeniable. From this brief analysis can be seen the urgent need for bringing present legislation up-to-date and for promoting such legislation in those countries where it does not exist, so as to adapt the laws to the new methods and requirements of the modern campaign to combat malaria, and, above all, to accomplish the supreme objective of eradication.

Table 6 presents comparative malaria legislation in the Americas.

SCOPE OF THE PROBLEM

Under this same heading in Report IV (1950), the extent of the malaria problem in the Americas was analyzed and discussed. The area of the malaria zone in each country and the population in that zone, facts that were important as a starting point for the initial evaluation of the problem, were taken as a basis for the discussions. In the future, the evaluation of the scope of the problem should be based on a knowledge of current conditions, and for this reason additional factors should be considered. In this report figures on inhabitants will be given for (a) "eradication zones," (b) "protected zones" (inhabitants directly or indirectly protected), and (c) "unprotected zones." These figures cover the "malarious zone." Table 7 presents this information. As a supplement, table 8 shows the corresponding areas covered. The countries, now having a better knowledge of the situation, apparently have made adjustments in the total population figures for the malaria zone, these figures being more or less different from those in the IV Report.

Not including Guadeloupe, Surinam, and the Canal Zone, which did not send data, the total population of the continent residing in the "malarious zone" is 135,000,000, of which 60,000,000 (44.4%) live in the "eradication zones," 45,000,000 (33.3%) in the "protected zones," and 30,000,000 (22.2%) in the "unprotected zones." The present extent of the problem can, then, be expressed as 55.5% of the original figure.

Table 6.—Comparative Antimalaria Legislation in each Country and Territory

Countries and Territories	1.	2.	3.	4.1	4.2	4.3	5.	6.	7.	8.	9.	10.	10.1	10.2	11.	11.1	12.
Argentina.....	x	x	x	x	x	x	x	x	x	x	x	x	1	x	—	x	x
Bolivia.....	x	x	x	x	x	x	—	—	x	—	—	x	7	—	—	—	x
Brazil.....	x	x	—	x	x	x	—	x	x	—	x	x	—	—	—	—	x
Colombia.....	x	x	x	x	x	x	—	—	—	—	—	x	7	—	—	—	—
Costa Rica.....	x	x	x	x	—	—	—	x	—	—	—	—	—	—	—	—	x
Cuba.....	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Dominican Rep.....	x	x	x	x	—	x	—	x	—	—	—	x	8	—	x	x	x
Ecuador.....	x	x	—	—	—	—	—	—	—	—	—	x	d	—	—	—	—
El Salvador.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Guatemala.....	x	—	—	x	x	—	—	x	—	—	—	x	1	—	—	—	—
Haiti.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Honduras.....	x	—	—	—	—	—	—	—	—	—	—	x	—	—	—	—	—
Mexico.....	x	x	x	x	—	—	—	—	—	—	—	x	1	—	—	—	—
Nicaragua.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Panama.....	x	x	—	x	x	—	—	—	—	—	—	x	7	—	—	—	—
Paraguay.....	—	—	—	—	—	—	—	—	—	—	—	x	—	—	—	—	—
Peru.....	x	x	x	x	x	x	x	x	x	—	—	x	7	—	—	—	x
United States ^a ^b	x	x	—	x	x	—	—	x	—	—	—	x	7	—	—	—	x
Venezuela ^b	x	x	x	x	x	x	—	—	x	—	—	x	7	—	x	x	x
British Guiana.....	x	x	—	x	x	—	x	x	—	—	—	x	d	x	—	—	x
British Honduras.....	x	x	—	x	—	—	—	—	—	—	—	x	—	—	—	—	x
Dominica.....	x	—	x	x	—	—	—	—	—	—	—	x	30	—	—	—	x
French Guiana.....	x	x	—	x	—	—	x	x	—	—	—	—	—	—	—	—	x
Grenada.....	x	x	—	x	—	—	x	x	—	—	—	—	—	—	—	—	x
Jamaica ^a	x	—	—	—	—	—	—	—	—	—	—	x	d	—	—	—	—
Puerto Rico.....	x	x	—	x	x	—	—	—	—	—	—	x	5	x	—	—	x
St. Lucia.....	x	x	—	—	x	—	x	x	—	—	—	x	7	—	—	—	x
Trinidad.....	x	x	x	x	—	—	—	—	—	—	—	—	—	—	—	—	x

1. Has legislation.

2. Obligation to combat malaria.

3. Declaration of malaria zones.

4. Obligation to carry out environmental sanitary activities:

4.1 of the physical environment;

4.2 antilarval measures;

4.3 mechanical protection.

5. Obligation to apply imogicides.

6. Obligation to permit access to houses.

7. Obligation to give drugs.

8. Control of distribution and dispensing of drugs.

9. Obligation to report the construction or renovation of dwellings.

10. Compulsory case reporting:

10.1 time limit (No. of days);

10.2 with blood sample.

11. Obligation of patient to take treatment:

11.1 obligation of patient to permit blood extraction.

12. Sanctions.

^aState legislation only. ^bData taken from IV Report (1950). ^cDid not transmit legislation. ^dImmediate reporting, but without indicating time limit.

Undoubtedly, the eradication of malaria in the United States brought about this sharp change in the continental picture. As to the present extent of the problem, three

fifths of the population are within the "protected zones." With respect to the remaining two fifths, as yet unprotected, the responsibility, in absolute and proportionate terms,

Table 7.—Total Population, Population in the Malaria Zones (in thousands), and Percentage Distribution in each Country and Territory

Countries and Territories	Year of Census	Total Population	Population of Malaria Zones		Population Directly Protected		Population Indirectly Protected		Population in Evadicated Area		Unprotected Population	
			Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Argentina.....	1947	15,893.8	1,855.0	100	750.0	40	905.0	49	200.0	11	0	0
Bolivia.....	1950	3,019.0	600.0	100	161.3	27	238.7	40	0	0	200.0	33
Brazil.....	1950	51,944.4	26,800.0	100	14,200.0	53	10,700.0	40	0	0	1,900.0	7
Colombia.....	1951	11,545.4	6,999.9	100	2,455.3	35	615.9	9	0	0	3,928.7	56
Costa Rica.....	1950	800.9	406.6	100	390.2	96	0	0	0	0	16.4	4
Dominican Rep.....	1950	2,135.9	1,040.4	100	800.0	77	240.4	23	0	0	0	0
Ecuador.....	1950	3,202.8	1,764.4	100	1,213.5	69	206.9	12	220.0	12	124.0	7
El Salvador.....	1950	1,855.9	1,282.3	100	623.1	49	142.8	11	0	0	516.4	40
Guatemala.....	1950	2,788.1	1,000.0	100	235.8	24	553.9	55	0	0	210.3	21
Haiti.....	1950	3,097.3	2,070.3	100	150.3	7	120.0	6	0	0	1,800.0	87
Honduras.....	1950	1,368.6	416.4	100	256.4	62	60.0	14	0	0	100.0	24
Mexico.....	1950	25,791.0	19,991.0	100	623.9	3	208.0	1	0	0	19,159.1	96
Nicaragua.....	1950	1,057.0	1,125.0	100	1,043.0	93	7.0	1	0	0	75.0	6
Panama.....	1950	756.6	499.1	100	199.9	40	112.9	23	0	0	187.2	37
Paraguay.....	1950	1,405.6	422.8	100	25.8	6	0	0	0	0	397.0	94
Peru.....	1940	6,208.0	3,773.1	100	1,264.9	33	1,278.3	34	0	0	1,229.0	33
United States.....	1950	150,697.4	57,790.5	100	0	0	0	0	57,790.5	100	0	0
Venezuela.....	1950	5,034.9	3,560.9	100	2,248.0	63	1,312.0	37	(1,538.4) ^a		0	0
Br. Guiana.....	1946	369.8	465.4	100	150.9	32	311.5	67	(442.0) ^b		3.0	1
Br. Honduras.....	1946	59.2	75.8	100	44.8	59	30.0	40	0	0	1.0	1
Dominica.....	1946	47.6	58.0	100	6.1	10	0	0	0	0	51.9	90
Fr. Guiana.....	1946	28.5	30.4	100	28.4	93	2.0	7	0	0	0	0
Grenada.....	1946	72.4	120.0	100	36.0	30	36.0	30	0	0	48.0	40
Jamaica.....	1943	1,237.1	208.7	100	208.7	100	0	0	0	0	0	0
Puerto Rico.....	1950	2,210.7	1,279.5	100	643.7	50	635.8	50	0	0	0	0
St. Lucia.....	1946	70.1	85.0	100	50.8	60	0.4	0.4	0	0	33.8	40
Trinidad and Tobago.....	1946	558.0	508.0	100	386.0	76	114.0	22	0	0	8.0	2

^aIncluded in the population directly protected.

^bIncluded in the populations directly and indirectly protected.

rests with the following countries:

Country	Unprotected population (in thousands)	% of total population unprotected in the continent
Mexico.....	19,159.1	63.7
Colombia.....	3,928.7	13.1
Brazil.....	1,900.0	6.3
Haiti.....	1,800.0	6.0
Peru.....	1,229.0	4.1
El Salvador.....	516.4	1.7
Paraguay.....	397.0	1.3
12 other countries....	1,050.6	3.8

reveals a close relationship between the figures for unprotected population and the area of unprotected zones:

Country	Area of unprotected zones (km ²)	% of total area unprotected in the continent
Mexico.....	1,800,000	44.8
Colombia.....	786,341	19.6
Peru.....	613,582	15.3
Brazil.....	355,000	8.8
British Guiana.....	180,556	4.5
Bolivia.....	150,000	3.7
Paraguay.....	69,500	1.7
9 other countries....	62,677	1.6

A study of the areas involved (table 8)

It can be seen, by the foregoing, that Mexico and Colombia hold first and second places; Brazil and Peru maintain practically the same position; and Paraguay continues in seventh place. But, in "unprotected zones," British Guiana and Bolivia take the places of Haiti and El Salvador.

St. Vincent, Grenadines, Barbados); other islands had small endemic foci that have disappeared in recent years (Antigua, Mar-

Table 8.—Extent of the Malaria Zones in each Country and Territory
(in km²)

Countries and Territories	Total Area of Malaria Zone (as per Report IV)	Area of Zone of Eradication	Area of Operations	Area Occupied by Unprotected Population
Argentina.....	270,000	60,000	140,000	0
Bolivia.....	721,500	—	61,000	150,000
Brazil.....	7,295,000	—	6,337,271	355,000
Colombia.....	760,000	—	160,000	786,341
Costa Rica.....	39,100	—	29,738	1,788
Cuba.....	30,000	—	—	—
Dominican Rep.....	30,200	—	—	0
Ecuador.....	220,000	...	96,100	...
El Salvador.....	21,200	—	10,200	9,100
Guatemala.....	80,000	—	...	...
Haiti.....	5,600	—	700	14,000 ^b
Honduras.....	80,000	—	40,000	20,000
Mexico.....	1,800,000	—	41,800	1,800,000 ^c
Nicaragua.....	128,300	—	20,000	...
Panama.....	66,600	—	37,000	17,000
Paraguay.....	172,300	—	2,400	69,500
Peru.....	800,000	—	252,667	613,582
United States.....	2,309,600	3,016,548 ^a	—	0
Venezuela.....	600,000	180,000	600,000	0
British Guiana.....	...	5,000	83,000	180,556
British Honduras.....	22,300	—	...	...
Dominica.....	...	—	...	130
French Guiana.....	86,000	—	83,600	0
Grenada.....	...	—	76	74
Jamaica.....	3,630	—	...	...
Puerto Rico.....	...	—	5,090	0
St. Lucia.....	...	—	...	130
Trinidad.....	...	—	1,200	455

Note.—Figures in Column 1 are 1950 estimates of area of endemic and epidemic malaria zones. (Report IV, Publication No. 261—Annex B, PASB-WHO). Figures in Columns 2, 3, and 4 are those for data gathered in 1954 and refer chiefly to endemic malaria zones; this explains the discrepancy between figures in Column 1 and the sum total of Columns 2, 3, and 4.

... Data not available.

^a Data for 1954.

^b Malaria area recalculated in 1950.

^c Includes area of zone of eradication.

the same position; and Paraguay continues in seventh place. But, in "unprotected zones," British Guiana and Bolivia take the places of Haiti and El Salvador.

Special mention should be made of the Lesser Antilles. The majority of the area has a history of malaria epidemics (Bahamas,

St. Vincent, Grenadines, Barbados). The remaining areas have no record of malaria (Cayman, Turks, Caicos, Virgin Islands, Aruba, and Curaçao). Guadeloupe sent no data.

Although Chile gives no data on malaria cases, it reports an "eradication zone" cover-

ing an area of 15,000 square kilometers with 10,000 inhabitants, and a total of 102,789 persons protected with imogocides and antilarval measures. Only Uruguay and Canada have remained completely free from autochthonous malaria.

This chapter will discuss methods of malaria control based on engineering works and the use of larvicides and drugs. Because of their importance, the imogocides will be taken up under a separate heading.

Table 9 shows that four countries (Cuba,

Table 9.—Sanitary Engineering Works and Antilarval Campaigns in each Country and Territory

Countries and Territories	Anti-malaria engineering projects under way	Work projects under way	1953				
			Antilarval campaign	Localities protected	Paris green kg.	Petroleum l.	DDT kg.
Argentina.....	no		no	—	—	—	—
Bolivia.....	no		yes	—	—	2022	40
Brazil.....	no		no	—	—	—	—
Colombia.....	no		no	—	—	—	—
Costa Rica.....	no		no	—	—	—	—
Cuba.....	yes	Lined canals; piped drains; fills	no	—	—	—	—
Dominican Republic	no		no	—	—	—	—
Ecuador ^a	yes	Fills and drainage maintenance	yes	50	—	12000	40
El Salvador.....	no		no	—	—	—	—
Guatemala.....	no		yes	9	—	14080	100
Haiti.....	no		no	—	—	—	—
Honduras.....	no		no	—	—	—	—
Mexico.....	yes	Lined canals; drainage	no	—	—	—	—
Nicaragua.....	no		yes	1	—	408	67
Panama.....	no		yes	24	—	24000	—
Paraguay.....	no		no	—	—	—	—
Peru.....	no		no	—	—	—	—
United States ^b	yes	Antimalaria hydraulic control programs	yes	—	—	—	—
Venezuela.....	yes	Lined canals; piped drains; reforestation; fills	no	—	—	—	—
British Guiana.....	no		no	—	—	—	—
British Honduras.....	yes	Drainage	no	—	—	—	—
Dominica.....	yes	Lined canals; drainage	no	—	—	—	—
French Guiana.....	no		no	—	—	—	—
Grenada.....	yes	Lined canals; drainage	no	—	—	—	—
Jamaica.....	no		yes	—	50	52848	—
Puerto Rico.....	yes	Conservation and small-scale drainage	no	—	—	—	—
St. Lucia.....	yes	Lined canals; drainage	yes	8	—	2570	22
Trinidad.....	yes	Drainage; fills	yes	6	—	46267	—

^a SCISP projects. ^b Only the states and certain agencies.

ORGANIZATION OF THE ANTIMALARIA CAMPAIGN

The manner in which the antimalaria campaign is conducted depends largely on the organization of the NMS. Information has been given previously as to the way in which the different countries and territories deal with the basic aspects of the problem.

Ecuador, Mexico, and Venezuela) and six territories (Dominica, Grenada, British Honduras, Puerto Rico, St. Lucia, and Trinidad) continue carrying out the so-called "permanent control" works. In Ecuador they are carried out exclusively by SCISP. These works certainly contribute to the physical improvement of the environment,

but if the effort and investment made are weighed against the cost and effectiveness of the imogocides, it is clear that they are indeed a luxury in the antimalaria campaign. It is undoubtedly for this reason that they were abandoned in Bolivia, Brazil, Colombia, the Dominican Republic, Peru, and French Guiana, countries which in 1950 reported

Brazil has begun a far-reaching experiment of malaria prophylaxis by means of drugs, combining chloroquine with table salt (Pinotti method), at the rate of 50 mg. of chloroquine diphosphate (30 mg. base) in each 10 g. of common salt. As the quantity of this salt consumed daily by man under normal dietary conditions is from 10 to 15 g.,

Table 10.—Comparative Results of Malaria Control with Chloroquinated Salt in two States of Brazil
A—Two Adjoining Areas in the State of Maranhão

Parasitemia	Treated zone ^a			Control zone	
	March 26th	May 15th	May 25th	March 31st	May 27th
Persons examined.....	132	119	100	115	76
With positive blood.....	13	2	1	12	10
Parasitic index %.....	9.8	1.7	1.0	10.4	13.2
<i>P. vivax</i>	5	—	—	11	7
<i>P. falciparum</i>	4	2	1	1	3
<i>P. malariae</i>	1	—	—	—	—
Mixed (<i>P.v.</i> and <i>P.f.</i>).....	3	—	—	—	—

B—Two Adjoining Areas in the State of Para

Parasitemia	Treated Zone (Rio Capim)					Control Zone (Rio Guama)			
	June 1952	Aug. 1952	Nov. 1952	Jan. 1953	May 1953	June 1952	Nov. 1952	Jan. 1953	May 1953
Persons examined.....	389	331	641	477	616	204	209	247	350
With positive blood.....	33	2 ^b	0	0	1 ^c	14	11	15	89
Parasitic index %.....	8.5	0.6	—	—	0.2	6.9	3.7	6.1	25.4
<i>P. vivax</i>	15	—	—	—	1	13	4	9	45
<i>P. falciparum</i>	17	2	—	—	—	1	7	6	12
<i>P. malariae</i>	—	—	—	—	—	—	—	—	1
Mixed (<i>P.v.</i> and <i>P.f.</i>).....	1	—	—	—	—	—	—	—	1

^a Exclusive use of chloroquinated salt beginning 16 April 1953.

^b One newborn baby, breast-fed only, and one adult living in the area three days.

^c One year-old baby, breast-fed only.

that they were planning and carrying out works of this kind. In the United States water management programs continue in operation, but only under the responsibility of states and counties.

Table 9 also shows that six countries (Bolivia, Ecuador, Guatemala, Nicaragua, Panama, and the United States) and three territories (Jamaica, St. Lucia and Trinidad) apply antilarval measures, although on a very reduced scale as compared with the four previous years.

an adult would absorb daily from 50 to 75 mg. of chloroquine (30 to 45 mg. base) if chloroquine salt were all that were consumed. First experiments seem to have demonstrated the efficacy and innocuousness of this method, which would have a large field of application in regions inaccessible to imogocide campaigns or where the low population density makes these campaigns costly or uneconomical. The method might be useful also to supplement or even to replace insecticides in special situations in which

the vector is found predominantly outside dwellings. Table 10 shows the results obtained in Brazil in two localities in which chloroquine salt was used, as compared with malaria campaign in the Americas. The only exception to this is Cuba, which continues to stress sanitary drainage work and anti-larval control. However, in the near future

Table 11—*Imagocide Campaign* in each Country and Territory, 1950-1953*

Countries and Territories	DDT ^a				BHC ^b 1953	Chlord. ^a 1953	Dield. ^a 1953
	1950	1951	1952	1953			
Argentina.....	73.1	35.9	51.7	71.8	0.3	—	—
Bolivia.....	7.6	8.0	6.2	15.8	—	—	—
Brazil.....	1,430.0	802.0	1,400.0	1,207.9	—	—	—
Colombia.....	15.2	32.0	95.4	202.4	0.3	—	0.1
Costa Rica.....	8.6	17.7	20.9	23.9	—	—	—
Cuba.....	—	—	—	—	—	—	—
Dominican Republic.....	16.7	17.9	20.3	51.5	—	—	—
Ecuador.....	67.8	84.1	102.7	94.7	—	—	0.7
El Salvador.....	16.4	69.0	85.3	109.1	—	—	3.5
Guatemala.....	34.5	48.8	21.6	30.6	—	—	—
Haiti.....	—	—	—	1.1	—	—	—
Honduras.....	21.6	25.1	18.9	24.2	—	—	—
Mexico.....	24.8	20.8	11.9	72.9	—	—	—
Nicaragua.....	25.6	77.8	78.3	28.3	—	—	—
Panama.....	6.1	20.0	20.7	28.6	—	—	—
Paraguay.....	—	1.2	3.6	1.6	—	—	—
Peru.....	48.3	36.8	45.3	76.7	8.2	1.4	7.8
United States.....	429.3	191.9	73.6	?	—	—	—
Venezuela.....	314.3	407.9	408.9	383.0	20.1	1.5	12.6
British Guiana.....	13.7	12.1	10.1	9.6	—	—	—
British Honduras.....	3.2	3.1	6.1	6.2	—	—	—
Dominica.....	—	—	—	0.01	0.5 ^c	—	—
French Guiana.....	2.8	2.8	3.9	2.4	0.7 ^c	—	—
Grenada.....	0.1	0.5	0.5	2.9	—	—	—
Jamaica.....	0.4	1.9	3.8	11.4	—	—	—
Puerto Rico.....	39.2	44.7	42.9	32.0	—	—	—
St. Lucia.....	0.2	0.2	0.1	1.8	—	—	—
Trinidad.....	8.6	9.1	10.9	24.7	0.1	0.1	0.1
Totals.....	2,618.0	1,971.3	2,543.6	2,170.4	30.2	3.0	24.8

* Consumption in metric tons.

^a Reduced to pure products, technical grade.

^b Reduced to gamma isomer.

^c Consumption is not commensurate with surface sprayed, but the figures provided by the territories have been preserved.

data for two neighboring localities used for control purposes.

ANTIMALARIA ACTIVITIES WITH IMAGOCIDES

House spraying with imagocides is the principal and decisive factor in the anti-

Cuba plans to make use of imagocides in its campaign to eradicate malaria.

Table 11 shows that DDT is the most widely used imagocide. By reducing the other insecticides to a dose equivalent to 2 grams of DDT per square meter, the following distribution, by percentage of sprayed

surfaces, is obtained with:

DDT.....	91.0%
BHC.....	5.1%
Dieldrin.....	3.6%
Chlordane.....	0.3%

The DDT dose utilized averages about

has given excellent results from an economic and technical point of view.

Table 12 shows that there is a tendency toward reduction of sprayings to one a year. Only the smaller countries continue to spray twice a year. It would seem that this practice

Table 12.—*Work with Imagocides (figures in thousands) in each Country and Territory, 1950-1953*

Countries and Territories	Total No. of houses in area of operations	Number of houses sprayed regularly	Percentage of total	Total sprayed 1953	Frequency of sprayings per year	Interval between sprayings (months)	Area treated ^b	Schedule established?	Itinerary established?
Argentina.....	371.0	147.6	40	210.9	1 and 2	6-12	P	yes	yes
Bolivia.....	—	—	—	31.8	1 and 2	6	T	yes	yes
Brazil.....	2,840.0	2,415.7	85	2,724.9	1 and 2	6-12	T	yes	yes
Colombia.....	483.2	389.6	81	408.8	1 and 2	6-12	P	yes	yes
Costa Rica.....	78.4	75.7	97	75.7	2	6	T	yes	yes
Cuba.....	—	—	—	—	—	—	—	—	—
Dominican Republic.....	228.8	168.4	74	168.4	1	12	T	yes	yes
Ecuador.....	222.3	187.9	85	204.2	1 and 2	6-12	T	yes	yes
El Salvador.....	153.2	128.0	84	215.1	2	6	T	yes	yes
Guatemala.....	112.3	47.2	42	47.9	1 and 2	6-12	T	—	yes
Haiti.....	26.0	26.0	100	26.0	1	12	T	yes	yes
Honduras.....	75.0	49.6	66	51.8	1	8	T	yes	yes
Mexico.....	—	126.1	—	126.1	1	12	T	no	no
Nicaragua.....	43.0	31.7	74	63.4	1½	8	T	yes	yes
Panama.....	95.0	44.1	46	88.2	2	4½	T	yes	yes
Paraguay.....	—	2.3	—	5.4	2	6	P	yes	yes
Peru.....	541.1	269.7	50	269.7	1	12	T	no	no
United States.....	53.0	53.0	100	53.0	1	12	T	—	yes
Venezuela.....	631.0	516.7	82	877.3	1 and 2	6-12	T	yes	yes
British Guiana.....	76.8	34.5	45	34.5	"	"	T	yes	yes
British Honduras.....	?	9.7	—	19.4	2	6	T	yes	yes
Dominica.....	1.2	1.2	100	1.2	1	12	T	no	—
French Guiana.....	8.0	7.2	90	7.2	1	—	T	yes	yes
Grenada.....	12.0	—	—	—	2	6	T	yes	yes
Jamaica.....	41.7	41.7	100	83.4	2	6	T	yes	yes
Puerto Rico.....	255.9	128.8	50	128.8	1	12	T	yes	yes
St. Lucia.....	18.6	11.0	59	11.0	1 and 2	6-12	T	yes	yes
Trinidad.....	84.6	84.6	100	100.1	1	12	T	yes	yes

^a Every 18 months along the coast; every 12 months in the river areas.

^b Area treated: T = total; P = partial.

2 grams per square meter, which has been used since the very beginning and which in practice has offered a margin of safety in this work. Preparations of 75% wettable DDT powder are now the most widely used throughout the continent. The NMS of Brazil is producing and using an 80% DDT emulsifiable paste, which in the first trials

is the result of operating difficulties in the field rather than of technical considerations. Over-all house spraying is carried out in all countries, except in some areas of Argentina and Paraguay, where it is limited to sleeping rooms and living rooms.

Almost all the countries and territories, with the exception of Mexico, Peru, and

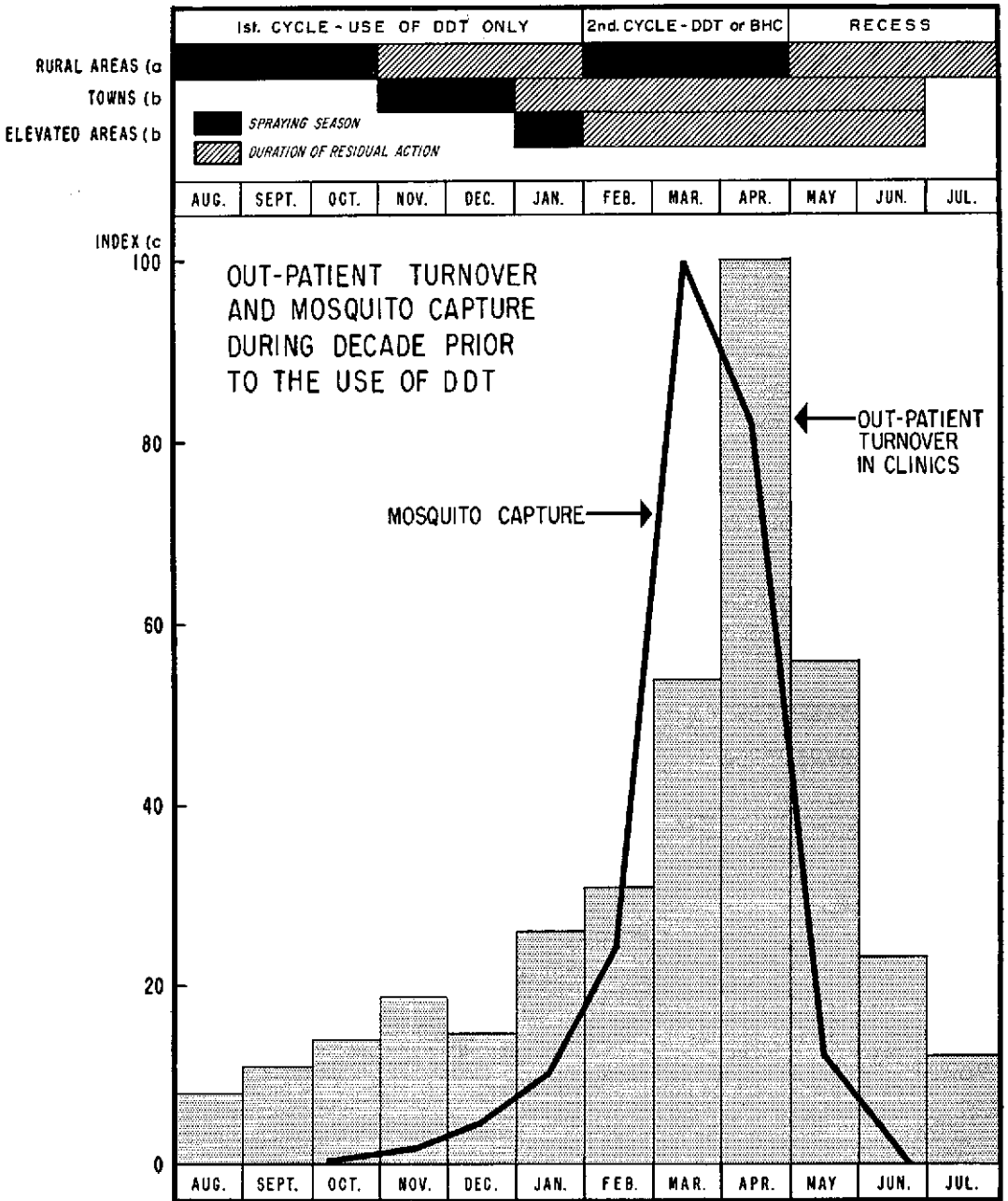


CHART A.—Antimalaria campaign schedule in Argentina

Dominica, report that imagocide applications follow a time schedule and an itinerary. Argentina submitted a table and an explanation of its time schedule, showing a strategic and economical method of field work; these are considered of sufficient interest to be reproduced in this report (chart A). This time schedule reduces operating costs, since it is based on a practical approach that takes into account the principal factors involved, i.e.:

(a) The epidemiology of malaria in north-western Argentina, where the outstanding characteristic is a period of non-transmission varying according to latitude and elevation above sea level. The chart shows the correlation between the turn over of out-patients and capture of adult anopheles, the curves having been plotted on the basis of data for the ten years prior to the use of DDT.

(b) Availability of personnel and equipment.

(c) Climate, since summer rains obstruct the work in rural areas by making the roads impassable.

Assuming that in torrid zones the residual action of DDT is of six months' duration and that of BHC three months' (250 mg. of gamma isomer per square meter), the first cycle is completed with DDT exclusively, starting with the lower and less accessible zones, where the population is far away and widely scattered, and the entire house is treated. This is followed by partial treatment of houses in villages and suburban areas (sleeping rooms and living rooms), since the complementary action of partial treatment of nearby houses is evident. Finally, the higher and temperate zones are treated, a return being made later to the first zones, but in this instance preferably using BHC, which is produced nationally and permits a savings in foreign exchange; at the same time it acts also against the *Triatomidae*.

Table 13 shows the number and type of vehicles available in each country.

The organization of field services, as stated in the previous report, depends on such local factors as economic conditions, topography,

transportation routes, and density of population. The number and type of vehicles available in each country vary widely.

In almost all the countries, sanitary engineers participate in the field work, although their responsibility is not always the same. The countries in which they hold executive positions are Argentina, Colombia, the Dominican Republic, Peru, and Venezuela.

In countries where the malarious zone is extensive, the zone has been divided into districts, where various teams operate under the direction of a chief. In the smaller zones the district coincides with the work area of one team. The composition of the team is quite varied, depending principally on the transportation facilities available. Motorized teams comprise generally a chief, a driver, and a number of sprayers, varying according to whether the teams work in rural or urban zones. The driver also acts as a sprayer, and in some cases the chief himself acts as driver. The composition of the motorized teams in some of the countries is as follows:

Country	Chief	Driv-		Auxiliary staff
		er	Sprayers	
Argentina.....	1	1	2 to 3	0
Bolivia.....	1	1	3 to 4	0
Brazil.....	1	1	3 to 6	0
Colombia.....	1	1	6	0
Dominican Republic.	1	1	3 to 4	0
Ecuador.....	1	—	4 to 6	1
El Salvador.....	1	—	5	0
Honduras.....	1	1	4	0
Mexico.....	1	—	5	0
Peru.....	1	—	8	2
Venezuela.....	1	1	3 to 8	1

Besides the motor corps, there are other teams that use several kinds of transportation such as launches, beasts of burden, "trolleys," etc., as well as those that travel simply on foot. The number of sprayers, which is also very variable, ranges from 4 to 11.

In Argentina, Bolivia, and Brazil there are, in addition to the teams, so-called single sprayers (the "zoning" method), who are assigned a fixed number of houses (varying

according to how widely scattered the houses are) which they cover systematically using their own means of transportation, such as beasts of burden, bicycles, etc. This work is supervised by special inspectors.

the characteristics common to the problem in all the countries, as well as the local conditions in each one, will it be possible to determine what should be considered the most acceptable structure for the staff. This

Table 13.—Means of Transportation Available to the National Malaria Services in each Country and Territory

(According to data provided by those services)

Countries and Territories	Auto-mob-iles	Jeeps	Station wagons	Pick-up trucks	Heavy trucks	Trailers	Laun-ches	Air-planes	Other	Total
Argentina.....	7	18	1	29	45	10	—	—	—	110
Bolivia.....	—	5	7	1	1	—	—	—	—	14
Brazil.....	30	167	56	96	157	58	33	11	102 ^a	710
Colombia.....	2	15	—	24	2	—	12	—	—	55
Costa Rica.....	—	—	—	6	—	—	—	—	—	6
Cuba.....	—	1	1	1	1	—	—	—	—	4
Dominican Republic.....	—	—	5	20	1	—	—	—	—	26
Ecuador.....	—	7	1	8	3	—	3	—	—	22
El Salvador.....	—	3	—	20	—	—	—	—	—	23
Guatemala.....	—	—	2	2	—	—	1	—	—	5
Haiti.....	—	5	3	6	—	—	—	—	—	14
Honduras.....	1	—	3	4	—	—	—	—	—	8
Mexico.....	—	4	5	11	2	—	2	—	—	24
Nicaragua.....	—	—	2	1	—	—	4	—	—	7
Panama.....	—	4	—	7	2	2	1	—	—	16
Paraguay.....	—	—	—	3	—	—	—	—	—	3
Peru.....	1	2	—	9	43	—	—	—	—	55
United States ^b	100	3	6	175	5	—	—	4	—	293
Venezuela.....	11	74	57	34	58	—	17	—	—	251
British Guiana.....	—	—	1	—	3	—	1	—	—	5
British Honduras.....	—	1	—	—	—	1	—	—	—	2
Dominica.....	—	—	—	1	—	—	—	—	—	1
French Guiana.....	1	2	2	1	1	—	1	—	—	8
Grenada.....	—	—	1	—	3	—	—	—	—	4
Jamaica.....	—	3	2	3	2	3	—	—	—	13
Puerto Rico.....	—	—	1	17	6	—	—	—	—	24
St. Lucia.....	1	1	—	2	3	—	—	—	—	7
Trinidad.....	—	2	1	5	8	—	—	—	2 ^c	18

^a Includes 2 tank trucks, 92 bicycles, 3 motorcycles with sidecars, and 5 canoes.

^b Many of these vehicles are loaned to the state public health services for insect-control programs.

^c 1 tank truck and 1 tractor.

It is impossible to present in this report a critical study on the organization of the staff that carries out the field work, since the information requested allows only a description of how such staff is constituted in the various countries. Taking into consideration this description and the lack of uniformity in the composition of the teams, it is believed that only by making special studies showing

aspect of the problem is undoubtedly one of the most important in the economic planning for malaria eradication.

COSTS AND PRODUCTIVITY

Table 14 shows the direct costs of operation that have been computed, taking into consideration the following four factors: (a) insecticides and solvents; (b) equipment

and materials; (c) transportation; and (d) field personnel. (quoted in dollars), is given below:

	Country	1949	1953
	Argentina.....	1.71	1.04
	Colombia.....	4.00	1.85
	Dominican Republic.....	0.92	0.70
	Ecuador.....	1.20	0.89
	El Salvador.....	1.58	1.13
	Honduras.....	0.95	1.44
	Mexico.....	0.82	0.84
	Venezuela.....	2.45	2.01
	Jamaica.....	0.53	0.65

Table 14.—Unit Costs and Yield of the Imogicide Campaign (figures in thousands) in each Country and Territory

Countries and Territories	Total budget of the NMS	Operating costs in national currency ^a	Percentage of total budget	Operating costs in dollars	Total spraying	Cost per spraying	Percentage of Cost			DDT dose per m ² and per application	Grams DDT per application	Man/hours per application	Man/hours per kilogram of DDT	
							Insecticides	Equipment	Transportation					
Argentina.....	7,073.1	5,485.5	78	219.4	210.9	1.04	27	6	13	54	2.12	353	1.85	5.2
Colombia.....	3,034.0	1,887.3	62	754.9	408.8	1.85	38	7	14	41	2.09	496	1.66	3.3
Dominican Republic...	140.2	118.1	84	118.1	168.4	0.70	50	6	—	44	2.00	306	1.04	3.4
Ecuador.....	6,337.0	3,162.2	50	180.7	204.2	0.89	43	3	9	45	2.00	427	1.75	4.2
El Salvador.....	462.1	607.2		242.9	215.1	1.13	56	3	4	37	2.00	538	—	—
Honduras.....	160.0	149.2	93	74.6	51.8	1.44	—	—	—	—	1.98	467	—	—
Mexico.....	2,176.5	1,319.7	60	105.6	126.1	0.84	40	60 ^b	—	—	3.20	578	0.95	1.7
Nicaragua.....	840.3	826.5	98	125.2	63.4	0.99	26	1	15	58	2.00	447	—	—
Panama.....	157.4	157.8	100	157.8	88.2	1.79	10	3	34	53	2.60	335	1.86	5.5
Peru.....	3,743.8	1,728.4	46	115.3	107.9	1.06	37	13	11	39	2.10	360	—	—
Venezuela.....	14,387.1	5,914.0	41	1,765.3	877.3	2.01	37	5	15	43	2.00	606	1.30	2.1
British Guiana.....	163.6	134.8	82	79.3	34.5	2.31	21	9	14	56	1.50	358	—	—
Jamaica.....	60.1	18.8	31	52.7	83.4	0.63	37	1	—	62	2.00	137	1.52	5.5
Trinidad.....	305.8	187.9	61	110.5	100.1	1.10	56	1	5	38	2.00	320	—	—

The countries and territories not appearing on this list failed to transmit data.

^a Direct cost, excluding administrative personnel.

^b The 60% includes material, equipment, and field teams.

^c Data for 1951.

chases of insecticides or equipment are made at preferential exchange rates; because of the salary level established by the State; or because of the terms under which personnel are contracted (permanent or temporary). Consequently, costs can be contrasted only within a single country, by comparing them in various years and places.

A comparison of the costs, per imogicide application, for the years 1949 and 1953

The above figures are only approximate, as the object has not been to make a study of costs, but rather to promote interest in the economic analysis of projects using imogicides. The same comment may be made with regard to unit productivity in terms of man-hours per application, which varies greatly according to special circumstances in each country.

PRODUCTION OF INSECTICIDES, SOLVENTS,
EMULSIFIERS, AND EQUIPMENT IN THE
VARIOUS COUNTRIES

In Argentina, a DDT plant that will have a basic annual production of 1,000 tons and will use domestic raw material exclusively, is scheduled to start production late in October 1954. With the opening of this plant, two countries of the Americas—Argentina and the United States—will be producing this insecticide.

Both Argentina and Brazil, in addition to the United States, produce benzene hexachloride and lindane, without the need to import any raw materials.

The NMS of Brazil, which has expanded its BIIC factory, is now producing an excellent 80% DDT emulsifiable paste, as was previously mentioned, in addition to its already accredited emulsifier "B-13."

Argentina, Brazil, the United States, and Trinidad all produce emulsifiers, and all the countries having petroleum industries produce kerosene, which is used as a solvent for 5% solutions.

At the present time, special sprayers are produced only in Brazil and the United States.

RESULTS OF THE CAMPAIGN

The results of the antimalaria campaign can be measured by: (a) partial or total eradication of malaria in a country; (b) decrease or elimination of malaria mortality; (c) disappearance or reduction of morbidity (clinical cases); (d) reduction of antimalaria drug consumption; and (e) decrease in the splenic and, above all, the parasite indices (concurrent surveys).

Eradication.—Four countries and two territories have reported that malaria has been eradicated in some regions.

Argentina reports that it considers malaria eradicated as an endemic disease throughout the national territory. Nevertheless, in accordance with the strict standard of the National Malaria Society of the United States (namely, three consecutive years

without a single autochthonous case), malaria has been eradicated only in the provinces of La Rioja, San Luis, Córdoba, San Juan, and Catamarca (with the exception of one department), in an area of 60,000 square kilometers with a population of 200,000 (this figure refers solely to the malarious departments of these provinces and not to the total population). In accordance with the same standard, Ecuador reports that malaria has been eradicated from the malarious regions in the inter-Andean provinces of Pichincha, Imbabura, Carchi, and certain parts of Guayas, with a population of 220,000.

The United States indicates that endemic malaria has been eradicated throughout the country, with the possible exception of Hidalgo and Cameron counties in Texas. Eradication has been accomplished over an area of 3,016,548 square kilometers with a population of 57,790,489.

Venezuela, also according to the standard of the National Malaria Society of the United States, reports that malaria has been eradicated in 30% of the malarious region, in the states of Anzoátegui (14 municipalities in the west), Aragua, Barinas (except for the southern part of the three southeastern municipalities), Falcón (34 eastern municipalities), Lara (20 eastern municipalities), Miranda, and the Federal District, in a total area of 180,000 square kilometers and a net population of 1,538,449 (estimated on the basis of the 1950 census).

With regard to the territories, British Guiana presents the most conspicuous example of eradication, not only of malaria but also of its vector, *A darlingi*, in the three coastal counties (Demerara, Berbice, and Essequibo), where 95% of the population is centered (442,000 inhabitants) in an approximate area of 5,000 square kilometers.

Finally, Trinidad, although it gives no figures or standard for evaluation, reports that malaria has disappeared in many districts.

French Guiana and Puerto Rico indicate that, although they cannot as yet speak of

eradication, malaria is no longer endemic in their territories.

Contrary to previous reports, Chile states that there is an eradication zone only in the province of Tarapacá, with an area of 15,000 square kilometers and a population of 10,000, while it reports a population of 102,789 protected by imagoicides and antilarval measures. It would thus appear that the *A. pseudopunctipennis* has not been totally eradicated in that country, as was indicated in the IV Report.

Mortality.—Perhaps the least valuable of all the malariometric information available is that obtained from mortality data, and there are various reasons to support this view.

In the first place, the malaria services normally take no direct part in the registry of deaths, a function undertaken through an independent system and, on occasion, without any direct connection with health agencies. This situation gives rise to a startling paradox: malaria services are organized to detect and verify cases of malaria, but not to verify the diagnosis in the case of death. When this occurs, the death is recorded as due to malaria and, if the death certificate so records it, there is no further action. Second, it is well known that in countries where malaria was or is still endemic it is customary to record many deaths of which the cause is undetermined as due to malaria. It is true that during the past few years, because of the progress made in imagoicide work, a large number of well-informed physicians no longer follow this practice, but even today quite a few members of the profession still do so.

Another factor that tends to lessen the value of mortality data is the procedure established by some statistical offices of classifying as malaria deaths those caused by fevers in patients coming from malarious regions (International List of Causes of Death, Sixth Revision, 1948, No. 116), a procedure that is no longer justifiable in adequately protected regions.

Finally, there is the fact that no country

has established an effective formula to determine whether deaths certified as due to malaria are in reality due to that disease.

With the sole exceptions of French Guiana, which reported that the two deaths recorded as due to malaria in 1950 were confirmed, and of Mexico and Panama, which reported, without specifying how, that a part of the deaths recorded had been confirmed, all other countries record death figures stating that there was no confirmation of the diagnosis for malaria. If the value of information on deaths diagnosed as due to malaria is only relative, of even less value is that which can be obtained from a study of the figures for deaths due to unknown causes, figures that are quite high in a majority of the countries.

In spite of the difficulties mentioned, the mortality figures for malaria bring out some quite important facts. Thus, in those countries that provided information for 1952, out of a total of 1,013,815 deaths from all causes in that year, 41,869 were presumably due to malaria; that is, 4.1 of every 100 deaths were caused by this disease. Of these 41,869 deaths, 22,050 (52%) occurred in Mexico. Countries that submitted mortality data are shown in table 15.

A study of the malaria mortality trends in the countries that have given information shows that in Argentina and British Guiana the rate reached zero. In Puerto Rico only two deaths due to malaria occurred in 1953, and the figures for Costa Rica, El Salvador, Honduras, Nicaragua, Panama, Venezuela and Trinidad show a sharp decline. From the information provided by the remainder of the countries and territories, there is no clear evidence of a downward trend in this specific mortality rate.

As can be noted in table 15, there are still a number of countries and territories in which from 5% to 10% of the total deaths from all causes are due to malaria.

Morbidity.—The record of patients is not regularly kept in all countries and territories. Only Argentina, the United States, and Puerto Rico have submitted complete re-

ports; the rest have failed to include one or more of the aspects covered by the questionnaire.

With respect to autochthonous cases occurring in zones at present under treatment with imagocides, information has been submitted by seven countries (Argentina, Colombia, Costa Rica, Mexico, Peru, the

reduction in 1953, as compared with the figures for 1950; the same is true of British Guiana and Puerto Rico.

As to autochthonous cases occurring in regions where treatment with imagocides has been suspended because it is considered unnecessary, only the United States records three cases in 1952 and three more in 1953.

Table 15.—Malaria Deaths in each Country and Territory, 1950–1953

Countries and Territories	1950			1951			1952			1953		
	Deaths all causes	Deaths causes unknown	Deaths due to malaria	Deaths all causes	Deaths causes unknown	Deaths due to malaria	Deaths all causes	Deaths causes unknown	Deaths due to malaria	Deaths all causes	Deaths causes unknown	Deaths due to malaria
Argentina.....	154,540	...	11	156,400	...	9	153,681	...	0	160,450	...	0
Colombia.....	160,378	43,529	2,697	165,169	42,509	3,091	153,738	36,873	2,873	163,653	39,112	3,090
Costa Rica.....	9,769	356	571	9,631	892	459	9,902	1,307	270	10,312	972	189
Dominican Rep.....	21,303	5,412	2,170	21,731	5,147	2,278	22,515	5,493	2,239	20,551	5,936	1,709
Ecuador.....	14,307	...	1,025	13,327	...	482	16,205	...	971	16,051	...	717
El Salvador.....	27,454	6,914	1,704	29,030	8,381	1,500	32,423	9,766	1,370	29,987 ^b	...	977
Guatemala.....	61,234	3,416	6,844	56,550	1,433	6,709	71,994	2,229	9,974	...	...	...
Haiti ^a	1,905	247	86	1,825	75	106	2,045	102	75	2,024	100	65
Honduras ^b	17,917	1,542	3,071	16,167	1,254	3,900	17,894	897	2,853	18,859	866	1,902
Mexico.....	418,430	24,959	22,968	458,238	27,538	24,681	402,542	...	22,050	...	...	...
Nicaragua.....	11,466	452	2,961	10,085	446	1,588	11,956	428	976	11,317	409	959
Panama.....	7,169	...	210	6,652	...	200	6,774	...	152	7,320	...	130
Paraguay.....	7,545	2,145	29	8,278	1,851	111	...	...	45	...	...	34
United States.....	1,452,454	13,129	76	1,482,099	13,381	64	...	...	...	...	...	...
Venezuela.....	54,374	24,247	219	56,661	23,465	145	57,085	22,970	71	55,476 ^b	22,476 ^b	60 ^c
British Guiana.....	6,239	445	66	5,874	391	31	6,037	395	17	6,187	431	8
British Honduras.....	...	...	29	801	...	7	794	...	7	...	...	...
Dominica.....	948	...	15	870	...	20	1,108	...	18	788	...	9
French Guiana.....	465	...	2	422	...	0	468	...	0	413	...	0
Grenada.....	1,056	75	45	1,276	31	61	1,255	43	54	1,084	...	45
Jamaica.....	16,556	898	495	17,233	968	545	16,717	871	724	15,465	...	...
Puerto Rico.....	21,917	1,503	57	22,371	...	33	20,504	1,836	15	17,975	...	2
St. Lucia.....	1,184	173	48	1,389	129	116	1,246	80	109	1,156	19	94
Trinidad.....	7,665	...	141	7,815	...	136	8,000	...	80	...	...	74

... No data available.

^a Deaths in hospitals only.

^b Data for fiscal year 1 July–30 June.

^c Provisional.

United States, and Venezuela) and four territories (British Guiana, French Guiana, Jamaica, and Puerto Rico). Others (Brazil, Ecuador, Guatemala, and British Honduras) report on the total number of hematological examinations made, without specifying how many patients were subjected to this test. The remainder give very fragmentary information (see table 16). The only country to record no autochthonous case from 1952 on is the United States. Argentina, Costa Rica and Venezuela show a sharp

With respect to autochthonous cases recorded in areas that have never or only irregularly been treated, little information has been obtained. A decided reduction in the number is observed in Argentina (epidemic malaria zone), the United States and Dominica. In the remaining countries that have sent in reports, the extent of the problem continues more or less unchanged.

On this occasion, information was requested also on non-autochthonous cases of foreign origin. Only Argentina, the United

Table 16.—Reported Cases of Malaria from all Sources in each Country and Territory According to Type of Zone

1950-1953

Countries and Territories	1950				1951				1952				1953			
	Total patients	Total examinations	% positive	% falciparum ^a	Total patients	Total examinations	% positive	% falciparum	Total patients	Total examinations	% positive	% falciparum	Total patients	Total examinations	% positive	% falciparum
Autochthonous cases occurring in zones being treated with imigocides																
Argentina.....	1,561	1,561	100.0	1.5	1,188	1,188	100.0	2.4	652	652	100.0	4.7	439	439	100.0	1.1
Brazil.....	...	104,677	6.6	26.4	...	195,786	2.7	17.4	...	165,933	3.1	21.0	...	209,755	2.6	21.5
Colombia.....	76,038	...	...	...	73,057	...	...	...	64,798	...	...	...	75,513	...	...	...
Costa Rica.....	20,934	20,934	5.3	0	21,370	21,370	6.3	0	13,049	13,049	5.4	0	7,840	7,840	4.2	0
Dominican Rep.....	...	...	...	...	...	...	...	...	...	...	...	...	...	6,626	23.9	66.6
Ecuador ^b.....	...	23,898	1.8	47.3	...	34,598	1.9	61.2	...	36,239	1.1	74.9	...	40,459	3.6	50.8
Guatemala.....	...	12,601	17.1	76.6	...	10,088	10.0	58.0	...	10,498	5.6	43.4	...	11,552	4.0	52.4
Mexico.....	1,155	1,155	19.7	15.0	513	513	48.5	2.8	1,100	1,100	30.6	1.2	1,634	1,634	35.8	3.1
Paraguay.....	...	...	...	...	...	...	...	...	876	...	...	...	404	...	...	...
Peru.....	12,282	...	...	...	11,763	...	...	...	11,142	...	...	...	11,448	...	...	...
United States.....	1,810	1,000	0.6	16.4	13	13	62.0	12.5	0	0	...	...	0	0	...	...
Venezuela.....	40,185	18,864	12.4	11.2	31,490	20,364	11.5	15.6	25,006	31,310	8.6	15.8	21,359	32,518	6.8	9.8
British Guiana.....	3,183	6,360	1.6	84.0	1,854	5,709	5.8	85.6	1,135	4,299	1.6	86.5	1,055	4,355	0.7	93.3
British Honduras.....	...	2,758	10.4	0	...	1,740	8.9	0	...	823	4.2	65.7	...	754	3.4	0
French Guiana.....	1,920	1,920	8.6	71.0	4,004	4,004	1.0	89.0	2,866	2,866	0.5	85.0	997	977	1.1	90.0
Jamaica.....	...	...	...	...	6,592	809	15.6	86.6	9,943	2,562	28.6	96.0	16,161	10,674	31.0	94.9
Puerto Rico.....	73	14,043	0.3	5.1	84	5,914	0.3	26.7	18	3,658	1.1	66.7	7	701	0.4	0
St. Lucia.....	...	...	...	...	...	...	...	...	...	...	...	...	3,225	1,658	4.6	77.0
Autochthonous cases occurring in zones where treatment was suspended because deemed unnecessary																
United States.....	...	...	...	...	...	...	...	...	3	3	66.6	0	2	2	50.0	0
Autochthonous cases occurring in zones never or only irregularly treated																
Argentina ^c	401	401	100.0	12.0	145	145	100.0	0	46	46	100.0	0	60	60	100.0	0
Colombia.....	5,423	...	...	...	13,080	...	...	...	9,195	...	...	...	10,346	...	...	...
Haiti.....	1,944	21,879	27.0	0	78,579	25,011	24.4	0	74,024	24,116	25.4	0	62,771	26,497	25.8	0
Paraguay.....	6,881	...	...	...	13,717	...	...	...	8,043	...	...	...	6,532	...	...	...
Peru.....	7,795	...	...	...	6,061	...	...	...	6,596	...	...	...	5,961	...	...	...
United States.....	208	...	0	...	7	7	100.0	0	48	48	66.6	0	30	28	100.0	4.0
British Guiana.....	...	...	...	...	...	...	...	...	...	...	...	...	49	49	100.0	69.5
Dominica.....	1,825	551	13.8	75.0	1,328	391	19.4	80.3	868	696	20.2	61.0	546	451	4.0	66.7
Jamaica.....	14,201	2,745	18.3	92.0	15,093	7,221	12.5	88.8	10,167	4,693	34.8	97.2	9,293	5,529	37.2	96.5
St. Lucia.....	6,141	1,310	15.4	58.9	6,571	1,354	8.6	53.8	6,234	1,860	6.7	78.4	...	...	...	...
Trinidad.....	...	3,004	70.2	75.0	...	2,064	18.8	83.6	...	1,775	30.6	80.0	...	...	...	...
Non-autochthonous or imported cases																
Argentina.....	5	5	100.0	0	41	41	100.0	2.4	16	16	100.0	0	8	8	100.0	0
United States.....	209	...	11.5	0	12,970	...	...	...	10,000	...	...	...	1,396	...	...	...
Puerto Rico.....	...	...	...	...	4	...	...	...	110	...	...	...	21	...	...	...

... Data not available.

^a Percentage over total positive tests.

^b There is no case register; investigation for malaria in all febrile diseases.

^c Only in zones of epidemic malaria.

States, and Puerto Rico have replied to this question. In the United States and Puerto Rico the majority of the cases were observed among civilian or military personnel coming from the Far East. The United States also recorded cases of Mexican origin. In Argentina the cases in question were traceable to Bolivia and Paraguay. Argentina states that the cases listed include only those for which unquestionable epidemiological documentation is available, though it is estimated that the real number of such cases is much higher, some undoubtedly being included among those reported as autochthonous.

It is significant to point out, by way of general comment, the lack of development of the case registry systems in most of the countries and territories, and the need for establishing standards and methods to ensure the effectiveness and uniformity of such records with a view toward stricter evaluation of antimalaria campaigns, especially if eradication is the objective.

Consumption and Distribution of Drugs.—Six countries (Argentina, Brazil, Colombia, Ecuador, Mexico, and Nicaragua) and four territories (British Guiana, Dominica, St. Lucia, and Trinidad) have replied to the questionnaire with regard to the quantities of antimalaria drugs distributed as curatives.

From a study of the information given in table 17, it can be seen that there is no definite tendency toward a specific type of medication. In the past four years some quinine has still been used (especially in Mexico, Nicaragua, and St. Lucia), together with considerable quantities of atebrein (Colombia and Mexico). There is no doubt that in recent years paludrine and, particularly, chloroquine have occupied a preferred place among the antimalaria drugs distributed by the NMS.

The question of the drugs used in malaria control deserves special study, since the information obtained is too incomplete to permit a valid appraisal of the situation. Apparently, judging from the information

received, no reasonably adequate record of the use of these drugs is kept in the majority of the countries. Besides, it would seem that, in some, the policy followed before the introduction of imagocides still prevails, that of indiscriminate distribution of curative anti-malaria drugs to unprotected populations, thereby obscuring or distorting the means of evaluating the results of present-day campaigns. Moreover, the opportunity is lost for these drugs to be of use as a means of detecting cases of malaria not reported at the proper time.

Parasite Surveys.—These surveys have been classified in this report according to conditions in the various zones with respect to malaria control, as follows: (a) zones in which anti-anopheles measures continue to be applied regularly (concurrent evaluation surveys); (b) zones where malaria is considered eradicated; (c) zones where anti-malaria measures are not taken or have been taken irregularly (exploratory surveys); and (d) zones where drugs are utilized as the only regular method of control (not as curatives).

Table 18 shows that Argentina, Bolivia, Brazil, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Nicaragua, Panama, Peru, Venezuela, French Guiana, and Jamaica carry out evaluation surveys regularly. Honduras began them in 1952.

Only Argentina, Ecuador, and British Guiana carry on surveys in zones where malaria is considered eradicated, and Venezuela, while furnishing no data, is known to do the same. Only three territories (Jamaica, St. Lucia and British Guiana) report surveys where no antimalaria measures are taken.

Brazil is the only country that has made surveys in zones where antimalaria drugs have been used, experimentally, as a control measure (not as curatives).

It would appear, therefore, that Cuba, Guatemala, Haiti, Mexico, Paraguay, the United States, Dominica, Grenada, and Trinidad do not conduct surveys regularly,

Table 17.—*Antimalaria Drugs (in grams) Distributed as Curatives; and Persons Treated in each Country and Territory, 1950-1953*

Countries and Territories ^a	Year	Quinine	Atabrine ^b	Plasmo- quine ^b	Paludrine	Chloro- quine ^b	Other medications	Persons treated ^c
Argentina.....	50	4,064	6,195	9	2,207	3,941	—	1,890
	51	1,397	1,090	10	710	1,102	—	939
	52	544	1,709	17	808	175	—	403
	53	752	914	11	207	1,098	—	624
Brazil ^e	50	—	—	—	—	—	—	1,025,063
	51	—	—	—	—	—	—	980,829
	52	—	—	—	—	—	—	1,070,369
	53	—	—	—	—	—	—	1,027,529
Colombia.....	50	—	57,305	—	1,224	24,081	21,588 ^e	181,283
	51	—	19,078	—	—	2,839	27,972 ^e	138,487
	52	—	—	—	—	18,994	63,891 ^d	235,467
	53	—	—	—	—	—	135,869 ^e	338,495
Ecuador.....	50	—	5,849	—	2,058	—	—	4,162
	51	—	—	1,000	—	750	—	362
	52	—	680	48,000	1,290	1,250	14,880 ^f	7,199
	53	—	—	25,000	1,380	—	8,520	3,803
Mexico.....	50	88,550	32,824	—	99,642	12,017	—	110,868
	51	74,090	20,547	—	96,492	7,952	—	96,292
	52	153,300	30,913	—	137,806	7,612	—	76,205
	53	66,250	26,607	—	62,574	7,700	—	75,784
Nicaragua.....	51	1,992	923	—	—	—	—	—
	52	5,816	2,166	180	—	—	—	—
	53	4,372	3,650	975	—	—	—	—
British Guiana.....	50	—	1,416	—	—	—	—	1,114
	51	—	1,346	—	—	—	—	1,016
	52	—	1,432	—	—	—	—	1,141
	53	—	867	—	—	—	—	577
Dominica.....	53	—	—	—	3,000	—	—	—
St. Lucia.....	50	14,848	—	—	28,500	—	44,700	6,141
	51	23,040	—	—	66,500	—	99,750	6,574
	52	1,075	—	—	4,000	4,200	6,000	6,234
	53	51	—	700	—	800	—	3,225
Trinidad.....	50	—	1,750	—	1,040	—	—	—
	51	—	1,500	—	316	—	—	—
	52	—	1,300	—	93	—	—	—
	53	—	950	—	50	—	6	—

^a Only reporting countries and territories.

^b Or synonyms.

^c Guanatol.

^d Guanatol and nivaquine.

^e Guanatol, nivaquine, and camoquin.

^f Camoquin.

^g Brazil reports, in addition, having distributed 14,464,708 treatments of chloroquine during the four-year period, without indicating the amount of the drug.

while Puerto Rico did undertake them until 1951.

Of the fifteen countries and territories that carry on evaluation surveys, seven conduct them through investigations in a single

age group, these are: Bolivia, the Dominican Republic, Honduras, Peru, French Guiana, and Jamaica, for the school-age group, 6-15 years; and Costa Rica for ages 0-14 years. Only two nations use two age groups as the

basis of the surveys: Argentina, which uses the age groups 0-2 and 6-15, and Ecuador, with those under 5 and over 16 years of age.

There are five countries that take three

age groups: Brazil, Colombia, El Salvador, Nicaragua, and Panama, all of them taking the groups of under 5 years, from 6 to 15 years, and over 16 years of age. Finally,

Table 18.—*Malariaometric (Parasitological) Surveys in each Country and Territory, According to Type of Zone*
1950-1953

Countries and Territories	1950			1951			1952			1953		
	Persons examined	% positive blood tests	% falciparum ^a	Persons examined	% positive blood tests	% falciparum ^a	Persons examined	% positive blood tests	% falciparum ^a	Persons examined	% positive blood tests	% falciparum ^a
In zones where regular anti-anopheles measures continue to be applied												
<i>Under 5 years</i>												
Argentina.....	10,534	0	—	8,919	0	—	10,218	0	—	11,286	0	—
Brazil.....	14,803	1.1	13.6	11,146	0.6	23.9	5,720	0.5	—	5,839	2.5	59.1
Colombia.....	1,889	1.8	38.2	275	8.7	12.5	362	9.4	26.5	205	3.4	11.1
Costa Rica ^b	10,619	12.3	31.0	12,688	6.6	32.3	10,428	2.1	28.2	27,520	4.3	41.1
Ecuador.....	540	0.74	75.0	3,756	0.13	20.0	4,096	0.54	63.64	4,794	0.25	41.67
El Salvador.....	—	—	—	—	—	—	909	2.64	62.5	7,201	1.60	28.7
Nicaragua.....	361	7.20	3.8	762	2.60	0	538	0	0	476	0	0
Panama.....	1,078	0.8	33.3	629	2.2	57.1	1,304	1.5	45.0	1,642	2.6	34.8
Venezuela ^c	18,008	11.4	12.2	22,090	10.0	17.7	29,184	9.0	16.6	31,469	7.1	10.4
<i>6-15 years</i>												
Argentina.....	57,306	0.04	—	56,804	0.01	—	66,105	0.01	—	60,084	0.02	—
Bolivia.....	13,656	3.6	12.3	12,082	4.6	26.2	6,106	3.02	13.0	6,629	4.5	24.2
Brazil.....	36,154	0.9	10.6	35,130	0.5	25.6	19,602	0.4	34.5	17,938	1.6	17.6
Colombia.....	4,040	2.6	47.6	3,338	3.6	20.2	2,790	8.9	20.2	1,867	1.2	4.5
Dominican Rep.....	6,221	4.50	75.4	2,197	5.6	73.5	1,415	7.7	75.2	1,108	3.4	63.1
El Salvador.....	10,308	3.30	73.0	4,582	3.58	53.0	1,643	3.41	48.2	3,375	2.01	14.7
Honduras.....	—	—	—	—	—	—	4,578	0.98	42.3	940	0.31	33.3
Nicaragua.....	3,787	5.68	1.9	3,166	3.75	0	1,514	0.13	0	1,059	0	0
Panama.....	8,895	0.5	42.3	6,720	0.6	52.5	7,779	0.7	27.2	10,146	1.6	38.4
Peru.....	17,117	0.05	22.22	18,477	0.10	33.33	2,751	0.73	25.00	26,544	0.79	32.70
British Guiana.....	—	—	—	702	3.0	95.0	—	—	—	—	—	—
French Guiana.....	3,663	0.3	91	130	0	0	—	—	—	3,389	0	0
Jamaica.....	1,125	27.1	92.6	3,256	23.9	85.4	1,002	18.7	95.2	893	17.1	94.7
<i>16 years and over</i>												
Brazil.....	3,434	1.3	22.7	7,449	1.1	33.3	2,910	0.8	26.1	5,278	4.1	39.6
Colombia.....	1,488	4.8	52.8	13	15.4	50.0	360	6.9	16.0	158	1.9	—
Ecuador.....	23,298	1.82	47.75	30,842	2.08	62.30	32,193	1.23	75.76	35,665	4.10	50.96
El Salvador.....	659	40.8	52.0	4,046	25.1	45.9	5,984	17.5	44.2	11,000	6.7	23.9
Nicaragua.....	1,633	5.14	2.4	1,518	8.1	0	156	2.56	50.0	577	0	0
Panama.....	1,273	0.9	58.3	1,006	1.0	45.4	869	1.0	44.4	1,307	1.5	30.0

In zones where malaria is considered eradicated

<i>Under 5 years</i>												
British Guiana.....	1,890	0.1	100.0	—	—	—	—	—	—	—	—	—
<i>6-15 years</i>												
Argentina.....	6,823	0	—	3,061	0	—	3,779	0	—	4,422	0	—
British Guiana.....	6,243	0.3	100.0	2,799	0.6	90.0	1,484	0.5	100.0	1,404	0	—
<i>16 years and over</i>												
Ecuador.....	956	6.7	16.9	1,011	2.0	4.7	526	1.1	—	453	0.6	—

Table 18.—Continued

Countries and Territories	1950			1951			1952			1953		
	Persons examined	% positive blood tests	% falciparum ^a	Persons examined	% positive blood tests	% falciparum ^a	Persons examined	% positive blood tests	% falciparum ^a	Persons examined	% positive blood tests	% falciparum ^a
In zones where antimalaria measures are not applied or are applied irregularly												
4-10 years												
St. Lucia.....	—	—	—	—	—	—	—	—	—	2,603	75.3	72.4
6-15 years												
British Guiana.....	—	—	—	156	9.0	86.0	47	0	—	112	41.0	85.0
Jamaica.....	74	6.7	100.0	2,271	20.8	83.3	3,199	38.31	95.0	4,171	20.2	90.8

^a Of the total positive blood tests.

^b Age group 0-14 years.

^c All ages.

Venezuela uses all ages as the basis of the surveys, without preference for any one.

The number of persons examined in 1953 (all ages and all zones), the relations of this number to the population of the malarious zone, and the parasite indices are as follows:

Countries and territories	Persons examined	Proportion per thousand of population in the malarious zone	Percentage positive
Argentina.....	75,792	40.8	0.01
Ecuador.....	40,912	23.1	3.6
Venezuela.....	31,469	8.7	7.2
Brazil.....	29,055	1.1	2.3
Costa Rica.....	27,520	9.2	4.3
Peru.....	26,540	8.0	0.8
El Salvador.....	21,876	17.1	4.2
Panama.....	13,095	26.0	1.7
Bolivia.....	6,629	12.0	7.0
Jamaica.....	5,064	2.4	1.9
French Guiana.....	3,389	100.0	0
Colombia.....	2,231	0.3	3.0
St. Lucia.....	2,603	30.0	7.5
Nicaragua.....	2,112	1.8	0
British Guiana.....	1,512	3.2	3.0
Dominican Republic.....	1,108	1.0	3.4
Honduras.....	940	2.2	0.3

From the above it will be noted that Argentina, Ecuador, and Venezuela occupy

the first three places in number of persons examined, but in the ratio of this number to the population of the malarious zone the first places go to French Guiana (100 per thousand), Argentina (40.8 per thousand), and St. Lucia (30.6 per thousand).

From a study of the parasite indices shown by the surveys, it can be seen that the countries achieving the best results are French Guiana (0%), Nicaragua (0%), Argentina (0.01%), Honduras (0.3%), and Peru (0.8%). In previous years the indices for Brazil were lower than for 1953, the explanation being that, instead of repeating the surveys in the same localities, it was preferred to carry them out in regions where cases of malaria were reported.

The percentages of infection with *Plasmodium falciparum*, among the total positive hematological examinations, were the following in 1953: (a) in zones where regular anti-anopheles measures are applied: Jamaica, 94.7; Dominican Republic, 63.1; Ecuador, 49.8; Costa Rica, 41.1; Panama, 37.1; Bolivia, 34.2; Honduras, 33.3; Peru, 32.7; Brazil, 29.9; El Salvador, 24.6; Venezuela, 10.4; Colombia, 5.1; Argentina, 0; Nicaragua, 0; and French Guiana, 0; (b) in areas where no antimalaria measures are applied: Jamaica, 90.8; British Guiana, 85.0; and St. Lucia, 72.4.

Table 19.—Plans for the Control of Malaria in the Future in each Country and Territory
(Information from the National Malaria Services)

Countries and Territories	Plans for the Future	Advisability of Coordinating Activities with Neighboring Countries	Is Economic (E) or Technical (T) Aid or Cooperation Desired?		Remarks
			E	T	
Argentina.....	Reorganize the service to achieve total malaria eradication.	yes	—	yes	Information on malaria situation in neighboring countries.
Bolivia.....	Extend malaria control to the major part of malaria areas in the country.	yes	yes	yes	Collaboration of an entomologist. Provision of equipment and vehicles.
Brazil.....	Extend DDT application. Chloroquine distribution in sparsely settled areas. Malaria eradication in certain areas.	yes	—	—	—
Colombia.....	Eradication. Spraying 600,000 more dwellings in untreated regions.	yes	yes	yes	Fellowships for training key scientific personnel.
Costa Rica.....	Eradication.	yes	—	yes	Coordination.
Dominican Republic.....	Continue present campaign covering entire malaria zone in the country.	yes	yes	yes	—
Ecuador.....	Eradication	yes	yes	yes	—
El Salvador.....	Extend treatment to entire malaria zone.	yes	—	yes	One malariologist and one entomologist. Material and equipment.
Guatemala.....	Eradication.	yes	yes	yes	—
Haiti.....	Increase areas under treatment.	yes	yes	yes	—
Honduras.....	Extend treatment areas until entire malaria zone is covered.	yes	yes	—	Provision of materials.
Mexico.....	Malaria control throughout the country. Yellow fever prevention.	—	yes	yes	—
Nicaragua.....	Training of personnel (especially microscope technicians) and purchase of equipment for laboratory diagnosis.	yes	yes	yes	Personnel trained in microscopy and entomologists.
Panama.....	Extend DDT application zones and construction of drains in important towns.	yes	yes	yes	Equipment and materials.
Paraguay.....	Extend DDT application zones. Organization of entomologic laboratory. Study of malaria situation in the country.	yes	yes	yes	Equipment and insecticides.
Peru.....	Extend area treated with imagoicides. Eradication in valleys bordering with Chile.	yes	yes	—	Transportation equipment and insecticides.

Table 19.—Continued

Countries and Territories	Plans for the Future	Advisability of Coordinating Activities with Neighboring Countries	Is Economic (E) or Technical (T) Aid or Cooperation Desired?		
			E	T	Remarks
United States.....	None.	yes	—	yes	Continued information on malaria situation in the continent.
Venezuela.....	Control of other vectors, especially flies.	yes	—	yes	Training fellowships for personnel and visits by experts.
British Guiana.....	None.	yes	—	—	Not immediately.
British Honduras.....	Drainage work in town of Belize.	yes	—	yes	Loan of technical personnel.
Dominica.....	Insect-control program in collaboration with WHO.	no	—	—	—
French Guiana.....	Treatment of immigrants infected with <i>Plasmodium</i> .	yes	—	yes	Facilities for training personnel.
Grenada.....	—	yes	yes	yes	—
Jamaica.....	Epidemiological studies.	no	yes	—	—
Puerto Rico.....	Increase of bilharziasis control and eradication of <i>Aedes aegypti</i> .	—	—	—	—
Santa Lucia.....	Continuation of DDT spraying work.	yes	yes	yes	—
Trinidad.....	Land fills and leveling operations in Piarco and construction of seaheads.	yes	yes	yes	Visits by experts. Fellowships.

PLANS FOR THE FUTURE

A study of the replies from each country on their plans for the future, which appear in table 19, is highly interesting.

Argentina, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, and Peru report overall or partial programs for the eradication of malaria. In a supplementary report, Cuba also mentions an eradication program.

Bolivia, Brazil, El Salvador, Haiti, Honduras, Mexico, Panama, and Paraguay describe plans to expand the control and treatment zones.

Mexico, Venezuela, Dominica, and Puerto Rico state specific plans to intensify the control of other vectors, particularly the house fly and the *Aedes aegypti*.

French Guiana, as a step forward, stresses the treatment of immigrants infected with *Plasmodium*. This objective should be given

emphasis as an initial step toward considering malaria in the future as a quarantinable disease in those countries that have already eradicated the causal agent.

Concerning the advisability of coordinating activities with neighboring countries, seventeen countries and six territories replied in the affirmative. Two territories, Dominica and Jamaica, replied in the negative; Mexico and Puerto Rico failed to reply to the question.

Twelve countries and four territories desire economic aid or collaboration. Fifteen countries and five territories indicate a desire to receive technical aid or collaboration.

The types of assistance the countries consider most necessary are: equipment and materials; fellowships and other facilities for training personnel; loans of technical personnel, particularly entomologists; and visits by experts.

Two countries (Argentina and the United States) requested collaboration in the form of information on the status of malaria in the continent, a request that emphasizes the importance now given to the malaria situation in other countries.

The following conclusions were derived from a study of the information obtained on the plans of the various countries:

(1) A number of countries are already planning programs for the eradication of malaria.

(2) Several countries feel that they have overcome the problem to the point where they are planning an expansion of activities to include other phases of control measures against other insect vectors.

(3) The other countries and territories in the hemisphere, with two exceptions, favor the coordination of activities, a fact that points to the general conviction that the malaria problem in one country can be controlled but not entirely eliminated unless joint action is carried out among neighboring countries, to eliminate the possibility of reinfection.

(4) Collaboration or aid provided to the different countries to enable them to pursue their own antimalaria programs, or to integrate them in a continental program, should be divided into four well-defined forms: (a) information and coordination; (b) facilities for training personnel; (c) provision of equipment and materials; and (d) assignment of technical personnel and visits by experts.

NEED FOR A COORDINATED PLAN FOR ERADICATION OF MALARIA IN THE AMERICAS

The latter part of the IV Report on the status of the antimalaria campaign, presented four years ago, discussed the technical and economic possibilities of coordinating a plan for the eradication of malaria in the Americas. In considering these possibilities, various aspects—epidemiology, organization, technical assistance, and cost of an over-all program—were analyzed and finally summarized as follows: five years after the

introduction of DDT, two countries (Argentina and the United States) had almost solved their endemic malaria problem; two others (Brazil and Venezuela) were on the way to an early solution; and a fifth country (Ecuador) was vigorously pursuing the same goal. These five countries accounted for 75% of the dwellings in the malarious region of the continent; and the programs started in Central America and other countries with the aid of the WHO/PASB and UNICEF would reduce the remaining figure to only 20% by the beginning of 1951. There was therefore a well-founded hope that the balance could be covered in the ensuing five years.

Shortly before the end of the five-year period, a new estimate showed that 22% of the inhabitants of the malarious zones are still without protection. It is therefore evident that the rate of progress achieved in the five-year period, 1945-1949, has slackened.

There are four apparent factors to be considered in this situation:

(1) The decline of interest and concern as regards malaria, because this disease has ceased to be the public health, economic, and social scourge it once was.

(2) The lack of financial support to expand the programs, and, in some countries, even the curtailment of funds previously allotted for this purpose.

(3) The weakening of the intellectual "drive" to solve the problem, on the part of experts responsible for the campaign, which began after the unexpected success of the first operations had been confirmed and, especially, when field work became a monotonous and uninteresting routine.

(4) The assumption of additional responsibilities by the NMS, particularly heterogeneous activities, which led to a dispersion of efforts and a lowering of the quality of antimalaria work.

If these four negative factors meant no more than a delay in the program to extend the antimalaria campaign to the whole continent, there would be, perhaps, no sub-

stantial reason to alter the policy of "patience and perseverance." However, two other extremely serious factors have appeared during the period in question: a resistance to DDT in some anopheline vectors, in different parts of the world, and another—no less serious—the reluctance of officials responsible for the disbursement of public funds, who seem less and less inclined to increase or even to maintain allotments for a campaign that, both socially and politically, would seem to have lost in timeliness.

The appearance of resistance in the anopheles was foreseeable, in view of what happened to the house fly and to other insects harmful to agriculture. It was merely a question of determining under what circumstances and when this phenomenon would occur under natural conditions. The studies on the *A. sacharovi* in Greece unmistakably demonstrated the capacity of this species to acquire, after several years of exposure to DDT, a physiological resistance abetted by the concurrent application of the same product as a larvicide. The same situation has occurred with the *A. quadrimaculatus* in some regions of the United States. The expectation of neutralizing this resistance by alternating imagogicides provides only a truce. Since all these substances (those of prolonged residual action) belong to the same chemical family (chlorinated hydrocarbons), it is reasonable to suppose that the same result will be obtained with the anopheles as with other insects which, on acquiring resistance to any member of the family (DDT, BHC, chlordane, dieldrin, etc.) develop at the same time a capacity to acquire resistance against the rest of the family much more quickly.

Observations on the *A. albimanus* in Panama show a yet more serious type of resistance; namely, that of changes in behavior (behavioristic resistance) which make the insect capable of eluding to some extent the surfaces on which the imagocide has been applied. Although no specific studies have been made on this subject, four countries and three territories have reported observing the presence or increase of anopheline vectors

in houses that have been sprayed, or some changes in the vectors' behavior. If there are no other confirmations of well-established resistance, it is probably not because such resistance does not exist to some degree, but rather because no precise investigations have been carried out, or because in most countries the time period required before such symptoms start to appear has not yet elapsed.

Very little imagination is necessary, then, to determine the prognosis of malaria in the continent in future years, when DDT and other insecticides begin to lose their "virtue," unless the sources of infection are eliminated by that time. To support this view, it is appropriate to quote a paragraph from the 1953 Annual Report of the Director-General of WHO:

... the fact that in some countries in 1953 the local malaria vectors had developed DDT resistance after several years of spraying campaigns suggests that programmes of malaria control for a country or group of countries should be planned so that the application of the insecticides could be withheld before the time when resistance might develop (never less than five years, so far as has been reported). Obviously, when malaria transmission has ceased, this does not imply that the anopheline vector species has been eradicated; indeed, the anopheles density may even be nearly as high as before control. If subjects carrying malaria parasites come into the country, the transmission may be started again, but the danger would decrease in direct proportion to the number of neighbouring countries from which malaria was also eradicated. When active malaria control is interrupted, it will have to be replaced by a policy of defence against the reintroduction of malaria, and the prevention—or immediate suppression—of transmission. For this purpose, it will be necessary to ensure the adequate and immediate notification of new cases of malaria and the decentralization of facilities for diagnosis and for epidemiological research; and, in case of an epidemic it may be necessary to resume the insecticide spraying (which is why the campaign should be withheld when the insecticide is still active on the vector species) and the use of chemotherapeutics.

The other resistance mentioned previously, that of those administering public funds, has already begun to appear in several countries in which malaria has lost the power to attract the attention it previously evoked when it produced such disastrous effects. Thus, it is also of the greatest importance to eradicate all sources of infection before this type of resistance has become deeply rooted.

As a bright side to the dark picture given above, some events have taken place that should be pointed out and discussed.

(1) Four countries and two territories have demonstrated that malaria can be eradicated and that this possibility implies immense public health, social, and economic benefits, the latter being all the more obvious when the point is reached where operations can be suspended or discontinued.

(2) Seven other countries indicate as goals for the future the development of total or partial eradication programs, a fact that demonstrates the mature and widespread awareness of the need for eradication now existing in the Americas. This is in sharp contrast to the aspirations of little less than ten years ago, when the NMS still spoke of the "sanitation" of given localities, which represented mere pinpoints of conquered territory on the malaria map of the country.

(3) A revolutionary change has been brought about in the position of malaria in the field of international health. Until less than a decade ago, the assumption was that malaria constituted a local problem, one of purely local importance that should be approached and solved by means of local *formulae*. At present, this problem and its repercussions, now beyond the sphere of national concern, have become a problem of international proportions. Two countries have already shown their interest by keeping up-to-date with the epidemiological situation of the rest, a trend observable in the case of plague, cholera, or smallpox at the beginning of this century. And one territory has announced its intention of keeping a parasitological check on immigrants. The

word "imported" already figures in malaria terminology, and it is logical to foresee that countries that have eradicated the disease, or are in process of doing so, will find that they are obliged to protect themselves by demanding from persons entering the country certificates attesting that they come from immune regions, or by imposing compulsory treatment.

(4) New residual-action insecticides have been discovered, improved knowledge of the qualities and failures of those in use has been obtained; and it is possible to determine which insecticide is most suitable and in what manner it should be applied in accordance with the bionomics of the vector, the environmental conditions under which transmission takes place, and the economic factors present.

(5) New drugs have appeared and new methods of treatment and of chemical prophylaxis (chloroquinated salt) have been tested, by means of which not only a radical cure is possible but also the prevention of new infections in communities covered by mass prophylaxis programs.

(6) New and more accurate knowledge of the epidemiological situation of malaria in the various countries and territories has been acquired, and tactical and strategical methods of achieving eradication have been perfected. It can therefore be asserted that an "eradication technique" is now available.

(7) Seventeen countries and six territories have declared themselves in favor of the coordination of activities in the antimalaria campaign.

To summarize: There is now an awareness of the need for malaria eradication in the Americas, as well as a general desire to coordinate activities on the regional or zone levels; and better means of waging the campaign and improved working techniques have been discovered. Yet with all this, there is the risk of losing all these gains if we do not take advantage and make adequate use of them now. This is a serious responsibility for the present generation.

Should a decision be taken to coordinate

a continental plan for the eradication of malaria in the Americas, the following suggestions are formulated:

1. *At the national level:*

(a) To reorganize the NMS, entrusting them with the entire responsibility for the antimalaria campaign and equipping them with technical and administrative personnel to carry out nation-wide eradication programs.

(b) To ensure the necessary financial resources to permit coverage of the entire country.

(c) To promote adequate coordination of activities among all the medical care and public health services, to ensure accurate recording and identification of malaria cases and direct reporting to the NMS.

(d) To enact up-to-date antimalaria legislation, establishing as basic provisions: authorization to the public health service to spray imogocides inside dwellings; immediate reporting to the NMS of deaths due to malaria; immediate reporting of clinical cases and their parasitological confirmation on the basis of compulsory blood tests; and adequate treatment (radical cure) of the patient or carrier.

(e) To make it possible for the personnel of the NMS to attend advanced training courses and international meetings of the heads of NMS.

(f) To provide training facilities for technical, auxiliary, and field personnel coming from neighboring countries.

2. *At the continental level:*

To embody the decision of the countries in the form of an agreement, with definite pronouncements on:

(a) Objectives: over-all campaign; eradication; prevention of the exportation of malaria.

(b) Means of achieving these objectives: coordination; cooperation; information; technical and economic assistance.

(c) Responsibility of the Pan American

Sanitary Bureau for the preparation, promotion, and supervision of a coordinated plan for the eradication of malaria in the continent.

3. *In the international organizations (WHO/PASB):*

(a) To provide, to those countries that require it, technical assistance for the organization of their NMS and for the preparation of operational plans, over-all or progressive, to permit effective action as regards both area covered (breadth) and exhaustiveness of the coverage (depth).

(b) To promote collaboration at the regional level by means of agreements between bordering countries or groups of countries having common interests.

(c) To encourage economic participation by other international organizations interested in similar or related objectives.

(d) To standardize and distribute, on a permanent and periodic basis, comprehensive reports on the malaria situation in each country or territory, and on operational developments and the results obtained in terms of public health.

(e) To select and distribute on a permanent basis, technical and scientific information on activities and developments of practical interest in the antimalaria campaign.

(f) To organize regional meetings of those officers responsible for the antimalaria campaign, in areas of the continent where the Pan American Sanitary Bureau considers it appropriate, to discuss uniformity of techniques, coordination of border activities or improvement of the strategy of antimalaria work.

(g) To promote, in collaboration with such schools as offer facilities, refresher courses for administrative personnel, planned to cover eradication techniques.

Since the International Sanitary Conference of the American Republics, held in Washington in 1902, fifty-two years ago, the countries of this continent have continued to display at all Pan American public health meetings a united interest in the

problem of malaria. With the first report of the Pan American Malaria Committee, submitted at the XI Pan American Sanitary Conference in Rio de Janeiro, in 1942, there have been periodic appraisals of the status of the antimalaria campaign in the hemisphere. The present report, No. V, is the latest in the series.

No group of nations in the world has shown, for more than half a century, such a constant interest in malaria nor can it pre-

sent, over a period of twelve years, so complete and current a history of the status of the disease and the campaign to combat it. Neither is there any other group that has been advocating, over the years, coordinated action and the exchange of information as have the peoples of this hemisphere.

At the present time, the coordination of a plan to eradicate malaria in the Americas is not merely a technical, public health, and economic need but also a mandate of history.