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IN THE AMERICAS

IX REPORT

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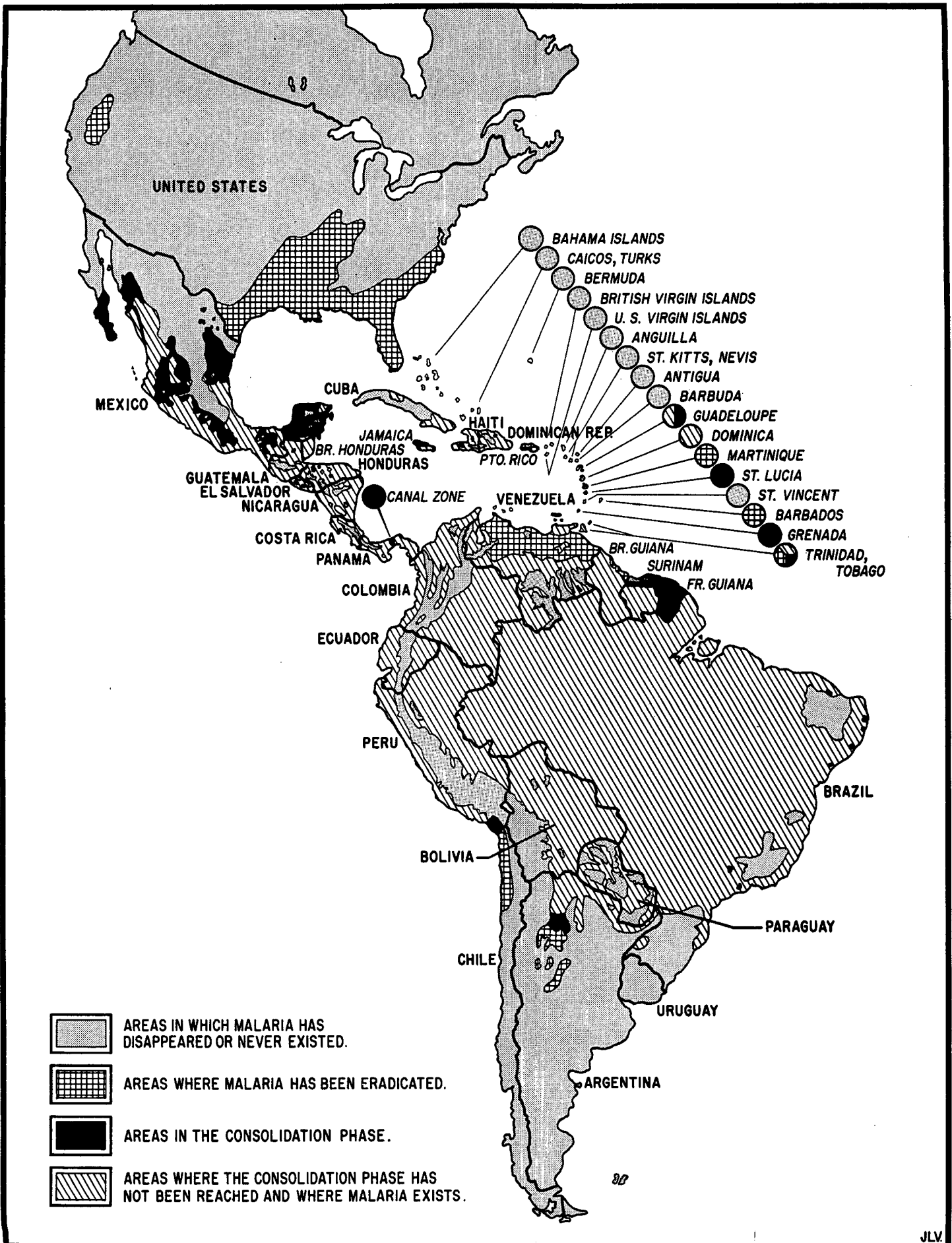
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STATUS OF THE MALARIA ERADICATION PROGRAM IN THE AMERICAS, 31 DECEMBER 1960.

REPORT ON THE STATUS OF MALARIA ERADICATION IN THE AMERICAS

IX REPORT

Introduction

Following the custom of previous years, the Director of the Pan American Sanitary Bureau has the honor to present to the XIII Meeting of the Directing Council of the Pan American Health Organization the IX Report on the status of malaria eradication in the Americas.

The document consists of three parts--a summary of the status of the program in general and of the progress made by each country; a discussion of special technical problems that have arisen and of the measures taken to solve them; and a summary of international cooperative activities in the field of malaria eradication in the Americas, with special reference to the participation of PAHO/WHO.

The report has been prepared on the basis of data regularly transmitted to the Pan American Sanitary Bureau by Member Governments. In addition to a detailed annual questionnaire, monthly statistical returns on spraying operations, surveillance operations, and movements of personnel are submitted by National Malaria Eradication Services. This information is not always complete and up-to-date, and special efforts continue to be devoted to improving the quality and timeliness of statistical reporting. Supplementary information is provided by PAHO/WHO staff in Regional and country projects. In this connection, entomology may be singled out as a subject where the field work of international staff has provided valuable information for a number of countries.

I. STATUS OF THE MALARIA ERADICATION PROGRAM

A. General picture

The last months of 1960 and early 1961 marked a turning-point in the hemisphere-wide eradication program. In the first place, the last two countries without a malaria eradication program entered the preparatory phase. In the case of Cuba this represents a completely new effort. In Haiti, where an earlier program had been interrupted because of financial difficulties, work was resumed and a new reconnaissance undertaken preparatory to the resumption of spraying operations.

Secondly, the area in consolidation increased in a number of countries, and parts of Mexico, Jamaica and Surinam entered the consolidation phase. In a number of countries in the attack phase progress was substantial, and attention turned to planning for the subsequent period of consolidation. This planning involves increasing epidemiological evaluation activities and devoting greater effort to obtaining epidemiological information on a locality basis. Plans were furnished and adapted by a number of countries for a system of visual recording of epidemiological information to facilitate supervision of progress in the whole country. Active and passive case finding was augmented by training spraymen to work in active case detection, and by increasing the number of evaluation agents and inspectors in general. Efforts were increased in many countries both to build up and to keep productive a comprehensive network of voluntary collaborators for passive case detection. In the programs where all or part of a country has only recently begun eradication work (for example, Cuba and Haiti) the malaria services are profiting from earlier experience in other areas of the Americas and are planning to develop the case detection system during the preparatory phase and thus to provide a satisfactory baseline from which to measure the subsequent trend of malaria. This will also develop a reporting system which will be ready for the greater demands of the consolidation phase at a later date.

While continuing improvement was registered in the administrative organization of a number of national services, the record is by no means perfect. Administrative and financial difficulties still impeded the full implementation of malaria eradication plans in some countries. Just as a convalescent patient often fails to obey the physician's orders, so in a number of countries where the attack on malaria is reflected in diminishing morbidity and disappearing mortality one must guard against a loss of enthusiasm on the part of governments, and the general public, for the continued support of the eradication program during the years when expenses must continue at a high level even though the disease has apparently been mastered.

The general picture can be summarized as follows: In those areas where special technical problems and financial or administrative difficulties have not arisen, substantial progress is being made towards the eradication of malaria.^{1/} In the majority of American countries, even where the attack phase has not resulted in immediate and dramatic suppression of malaria, the prognosis is generally good and attention is turning more and more to the problems of the consolidation phase. In countries where transmission of malaria persists in small foci despite well-organized and administered residual house spraying, it is expected that drug distribution in such limited areas will be adequate. In a very few countries where serious technical, financial, and/or administrative problems are encountered the outcome is not yet certain and further intensive work is needed.

B. Extent of the problem

At the end of 1960, the originally malarious area of the Americas was estimated to comprise 16,080,608 km.² with a population of 143,586,000. These figures do not correspond with those given in the VIII Report for a number of reasons: Minor revisions have been made in the figures for a number of countries; a new estimate of the malarious area of Paraguay is nearly ten times as great as the former provisional figure; and data from the 1960 censuses of population in the Americas have replaced previous estimates. Details for individual countries are shown in Tables 1 and 2, and the percentage distribution of area and population by status of malaria eradication is shown in Table 3.

Special attention should be called to the areas not included in the eradication program. In Brazil, because of the size of the country, eradication is being undertaken area by area, and the entire malarious region of the country is not yet covered. In Colombia, less than 1 per cent of the original malarious area is considered "not included" because in certain areas of internal unrest the proper execution of spraying operations has been hampered. In the Dominican Republic, the shift from a 12-month dieldrin spraying cycle to a 9-month DDT cycle exceeded available resources and some areas consequently were not sprayed. In El Salvador, new epidemiological information showed that an area provisionally withdrawn from spraying should have been maintained in the attack phase; it was sprayed in 1961, but is counted as "not included" in 1960. Finally, in the case of Paraguay, the new estimate of the malarious area mentioned above shifts areas formerly considered free of malaria into the "not included" class, and an attack on malaria in these areas is under study.

With entrance into the consolidation phase forecast for many areas in the near future, it is fitting at this time to review the dynamics of the attack phase which led to this favorable situation. Major events in the attack phase are summarized in Table 4. While many countries began with major or sole reliance on a 12-month dieldrin spraying cycle, it can be seen that numerous changes and revisions of plan occurred. By 1960, most countries had found it necessary to change from an annual dieldrin to a 6-month DDT spraying cycle, commonly based on an application of 2 grams of DDT per square meter of sprayable surface. Chemotherapy was employed as an adjunct to spraying in a number of countries, using tablets where practicable, but in Brazil and British Guiana largely through the medium of medicated salt. In areas where the vector showed resistance to both dieldrin and DDT, trials of various organophosphorus imogocides and larvicides were undertaken. Much of the success of national eradication campaigns to date has been due to the willingness of the National Malaria Eradication Services to undertake major changes in strategy when needed, even when (as in the case of a change from dieldrin to DDT with more frequent spraying) this has increased financial and manpower requirements.

C. Field operations

The changing nature of field operations is reflected in the statistics of personnel given in Tables 5-8. Table 5 provides a summary for all malaria eradication programs combined. It will be noted that total personnel and the numbers engaged in most individual occupations increased, and the exceptions merit special mention. The decrease in accountants and secretaries relates largely to occupational nomenclature. A secretary, when promoted, often becomes an "administrative assistant" and accounting functions are often handled by general administrative personnel.

^{1/} A discussion of the certification of areas from which malaria has been eradicated is presented to the Meeting separately in connection with Topic 35.

Table 1

STATUS OF MALARIA ERADICATION IN THE AMERICAS, BY POPULATION, 1960^a
(Population in thousands)

Country or other political unit	Total population	Population of originally malarious areas					
		Total	Malaria eradication claimed (maintenance phase)	Consolidation phase	Attack phase	Preparatory phase	Not included in eradication program
Argentina	21 312	2 313	179	750	1 384	-	-
Bolivia.....	3 388	908	-	-	908	-	-
Brazil.....	62 884	37 341	3 622	8 110 ^b	6 725	-	18 884 ^c
Canada	17 814	-	-	-	-	-	-
Chile	7 551	120	120	-	-	-	-
Colombia.....	14 132	9 000	-	-	8 800	-	200 ^d
Costa Rica	1 169	382	-	-	382	-	-
Cuba.....	6 565	2 105	-	-	-	2 105	-
Dominican Republic	3 014	2 446	-	-	2 030	-	416 ^e
Ecuador.....	4 573	2 405	-	-	2 405	-	-
El Salvador.....	2 610	1 900	-	-	1 500	-	400 ^f
Guatemala	3 798	1 610	-	-	1 610	-	-
Haiti.....	3 505	2 833	-	-	-	2 833	-
Honduras.....	1 943	1 359	-	-	1 359	-	-
Mexico.....	34 626	17 994	-	70	17 924	-	-
Nicaragua.....	1 479	1 411	-	-	1 411	-	-
Panama.....	1 053	969	-	-	969	-	-
Paraguay.....	1 768	1 768	-	-	884	-	884 ^g
Peru.....	10 857	3 131	-	15	3 116	-	-
United States	180 000	43 000	43 000	-	-	-	-
Uruguay.....	2 700 ^h	-	-	-	-	-	-
Venezuela.....	6 310	4 720	4 139	242	339	-	-
Antigua	54	-	-	-	-	-	-
Bahamas.....	140 ⁱ	-	-	-	-	-	-
Barbados.....	232	228	228	-	-	-	-
Bermuda.....	47 ⁱ	-	-	-	-	-	-
British Guiana	559	559	494	-	65	-	-
British Honduras.....	90	90	-	-	90	-	-
Dominica.....	59	10	-	-	10	-	-
Falkland Islands	2	-	-	-	-	-	-
French Guiana.....	32	32	-	32	-	-	-
Grenada	89	36	-	36	-	-	-
Guadeloupe.....	260	235	38	145	52	-	-
Jamaica	1 607	1 017	-	313	704	-	-
Martinique	268	170	170	-	-	-	-
Montserrat	12	-	-	-	-	-	-
Netherlands Antilles.....	195 ⁱ	-	-	-	-	-	-
Panama Canal Zone	42	42	-	41	1	-	-
Puerto Rico	2 353	2 338	2 338	-	-	-	-
St. Kitts-Nevis-Anguilla.....	57	-	-	-	-	-	-
St. Lucia.....	86	72	-	72	-	-	-
St. Pierre-Miquelon	5	-	-	-	-	-	-
St. Vincent.....	80	-	-	-	-	-	-
Surinam	302 ⁱ	202	-	90 ^j	112	-	-
Trinidad and Tobago.....	840	840	35 ^k	185	620	-	-
Virgin Islands (U. K.).....	8 ⁱ	-	-	-	-	-	-
Virgin Islands (U. S.).....	30 ⁱ	-	-	-	-	-	-
Total	400 500	143 586	54 363	10 101	53 400	4 938	20 784

- None.

(a) Population refers to 1960 census or mid-1960 estimate unless otherwise indicated.

(b) Includes the estimated population of areas where evidence indicates that transmission was interrupted by the former control program as well as areas where the attack phase has ended but surveillance operations are not yet fully organized. (c) Areas in the control program. (d) Areas not sprayed or irregularly sprayed.

(e) Temporarily not protected during change in spraying operations. (f) These areas are to be added to the attack phase in 1961. (g) Population of areas formerly considered non-malarious where attack is under study.

(h) 1958. (i) 1959. (j) Entered consolidation phase in January 1961. (k) Population of Tobago.

Table 2
STATUS OF MALARIA ERADICATION IN THE AMERICAS, BY AREA, 1960
(Area in km²)

Country or other political unit	Total area	Originally malarious area					
		Total ^a	Malaria eradication claimed (maintenance phase)	Consolidation phase	Attack phase	Preparatory phase	Not included in eradication program
Argentina.....	2 778 412	270 400	23 600	23 000	223 800	-	-
Bolivia.....	1 069 094	811 393	-	-	811 393	-	-
Brazil.....	8 513 844	7 566 774	41 164	254 666	3 739 179	-	3 371 511
Canada.....	9 974 375	-	-	-	-	-	-
Chile.....	741 767	55 287	55 287	-	-	-	-
Colombia.....	1 138 355	1 026 433	-	-	1 016 433 ^b	-	10 000 ^c
Costa Rica.....	50 900	31 526	-	-	31 526	-	-
Cuba.....	114 524	36 602	-	-	-	36 602	-
Dominican Republic.....	48 279	39 219	-	-	26 960	-	12 259 ^d
Ecuador.....	291 906	152 862	-	-	152 862	-	-
El Salvador.....	21 146	19 300	-	-	19 300 ^e	-	(e)
Guatemala.....	108 889	80 380	-	-	80 380	-	-
Haiti.....	27 750	19 098	-	-	-	19 098	-
Honduras.....	112 088	87 390	-	-	87 390	-	-
Mexico.....	1 969 367	978 185	-	36 790	941 395	-	-
Nicaragua.....	148 000	131 000	-	-	131 000	-	-
Panama.....	74 470	68 497	-	-	68 497	-	-
Paraguay.....	406 752	406 752	-	-	110 000	-	296 752 ^f
Peru.....	1 249 094	943 228	-	5 110	938 181	-	-
United States.....	9 346 751	2 257 809	2 257 809	-	-	-	-
Uruguay.....	186 926	-	-	-	-	-	-
Venezuela.....	912 050	600 000	418 842	25 429	155 729	-	-
Antigua.....	280	-	-	-	-	-	-
Bahamas.....	11 396	-	-	-	-	-	-
Barbados.....	431	430	430	-	-	-	-
Bermuda.....	53	-	-	-	-	-	-
British Guiana.....	214 970	214 970	5 180	(-) ^g	90 650	-	-
British Honduras.....	22 963	22 963	-	-	22 963	-	-
Dominica.....	790	152	-	-	152	-	-
Falkland Islands.....	11 961	-	-	-	-	-	-
French Guiana.....	90 000	90 000	-	5 000	85 000	-	-
Grenada.....	344	185	-	185	-	-	-
Guadeloupe.....	1 780	1 136	69	752	315	-	-
Jamaica.....	11 293	8 912	-	3 455	5 457	-	-
Martinique.....	1 102	300	300	-	-	-	-
Montserrat.....	84	-	-	-	-	-	-
Netherlands Antilles.....	961	-	-	-	-	-	-
Panama Canal Zone.....	1 432	1 432	-	1 432 ^h	(h)	-	-
Puerto Rico.....	8 897	8 865	8 865	-	-	-	-
St. Kitts-Nevis-Anguilla.....	396	-	-	-	-	-	-
St. Lucia.....	603	580	-	580	-	-	-
St. Pierre-Miquelon.....	240	-	-	-	-	-	-
St. Vincent.....	389	-	-	-	-	-	-
Surinam.....	143 450	143 430	-	4 692 ⁱ	138 738	-	-
Trinidad and Tobago.....	5 118	5 118	295 ^j	26	4 797	-	-
Virgin Islands (U.K.).....	174	-	-	-	-	-	-
Virgin Islands (U.S.).....	344	-	-	-	-	-	-
Total.....	39 814 190	16 080 608	2 811 841	361 117	8 850 571	55 700	3 690 522

- None.

- (a) Including a few areas not classified separately by phase.
 (b) The area in the attack phase is actually slightly less than shown, owing to termination of barrier spraying in some cities and redefinition of the altitude limit of malarious areas. (c) Areas not sprayed or irregularly sprayed.
 (d) Temporarily not protected during change in spraying operations.
 (e) Areas with 400 thousand inhabitants which are included in the attack column are to enter the attack phase in 1961.
 (f) Areas formerly considered non-malarious where attack is under study.
 (g) The remainder of the country shows no evidence of transmission, but surveillance is considered impractical and spraying is continued. (h) Spraying is continued in a limited part of the areas shown as in the consolidation phase.
 (i) Entered consolidation phase in January 1961. (j) Area of Tobago.

Table 3

PERCENTAGE DISTRIBUTION OF AREA AND POPULATION IN THE AMERICAS, 1960,
BY STATUS OF MALARIA ERADICATION

Status	Percentage distribution	
	Area	Population
Total.....	100.0	100.0
Originally malarious areas.....	40.4	35.9
-Maintenance phase.....	7.1	13.6
-Consolidation phase.....	1.5	2.5
-Attack phase.....	21.0	13.3
-Preparatory phase.....	1.4	1.2
-Not included in eradication program.....	9.3	5.2

Table 4

DYNAMICS OF THE ATTACK ON MALARIA IN THE AMERICAS

Country or other political unit	Year attack phase began	Year and change in strategy
Argentina.....	1949 ^a	1959: eradication program in remaining malarious areas
Bolivia.....	1958	-
Brazil.....	1958	1960: total coverage of Amazon valley with medicated salt
Colombia.....	1958	-
Costa Rica.....	1957	-
Cuba.....	(b)	-
Dominican Republic....	1958	1960: change from dieldrin to DDT
Ecuador.....	1957	1960: shift from partial use of dieldrin to all DDT
El Salvador.....	1956	1960: trials of organo-phosphorus insecticides
Guatemala.....	1956	1958: change from dieldrin to DDT
Haiti.....	(b)	1961: new campaign based on 6-month DDT spray cycle
Honduras.....	1958	1959: change from dieldrin to DDT
Mexico.....	1957	-
Nicaragua.....	1957	1958: change from dieldrin to DDT
Panama.....	1957	-
Paraguay.....	1957	1961: expansion of attack area
Peru.....	1957	1959: extension of attack to fluvial area
Venezuela.....	1945	1952: supplemental mass chemotherapy introduced
British Guiana.....	1947 ^a	1961: introduction of medicated salt in interior
British Honduras.....	1957	1958: change from dieldrin to DDT
Dominica.....	1959	-
French Guiana.....	1948	1954: renewed attack on reimported malaria
Grenada.....	1957	1960: spraying ended; consolidation phase began
Guadeloupe.....	1955	-
Jamaica.....	1958	1959: change from dieldrin to DDT
Panama Canal Zone...	1956	-
St. Lucia.....	1956	1959: spraying ended; consolidation phase began
Surinam.....	1958	1961: change from dieldrin to DDT in interior
Trinidad and Tobago...	1958	1959: change from dieldrin to DDT

- Note.

(a) Control program which succeeded in interrupting transmission in some areas.

(b) Program in preparatory phase.

Table 5

PERSONNEL EMPLOYED IN MALARIA ERADICATION PROGRAMS IN THE AMERICAS
31 DECEMBER 1959 AND 31 DECEMBER 1960

Title	31 December 1959 ^a	31 December 1960 ^b
Physicians.....	245	263 (15)
Engineers.....	92	115 (1)
Entomologists.....	25	27 (1)
Entomological Assistants.....	129	151 (2)
Microscopists.....	383	470 (13)
Accountants.....	7	2
Administrators.....	81	96 (1)
Administrative Assistants.....	412	559
Statisticians and Statistical Assistants.....	51	93
Disbursing Officers.....	51	64
Storekeepers.....	90	94 (1)
Assistant Storekeepers.....	88	91
Draftsmen.....	89	105
Secretaries.....	421	379
Sector Chiefs.....	427	417
Squad Chiefs.....	1 399	1 495 (2)
Spraymen.....	7 487	7 718 (20)
Evaluation Inspectors.....	231	309 (8)
Evaluators.....	1 360	2 575 (5)
Mechanics and Assistant Mechanics.....	265	288
Drivers.....	862	1 096
Motorboat Operators.....	125	151
Boatmen.....	36	62
Laborers.....	396	473
Others.....	1 492	1 489
Total.....	16 244	18 582 (69)

(a) Including part-time personnel.

(b) Part-time personnel indicated in parentheses.

Table 6

PROFESSIONAL AND TECHNICAL PERSONNEL EMPLOYED IN MALARIA ERADICATION PROGRAMS,
31 DECEMBER 1959 AND 31 DECEMBER 1960

Country or other political unit	Total		Physicians		Engineers		Entomologists		Entomological assistants	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
Argentina.....	16	17	10	11	2	2	-	-	4	4
Bolivia.....	26	16	11	6	9	6	1	1	5	3
Brazil (excl. São Paulo)...	...	82	...	42	...	27	...	7	...	6
Brazil (São Paulo).....	41	38	18	16	9	9	1	1	13	12
Colombia.....	40	56	25	35	7	13	1	1	7	7
Costa Rica.....	8	8	1	1	2	2	1	1	4	4
Cuba.....	...	8	...	6	...	-	...	-	...	2
Dominican Republic....	5	5	2	2	2	2	-	1	1	-
Ecuador.....	19	17	10	10	2	2	1	1	6	4
El Salvador.....	12	12	3	3	1	1	1	1	7	7
Guatemala.....	9	13	4	3	1	1	1	1	3	8
Haiti ^a	-	-	-	-	-	-	-	-	-	-
Honduras.....	5	5	1	1	-	-	1	1	3	3
Mexico.....	183	166	101	86	42	38	6	3	34	39
Nicaragua.....	10	12	4	4	-	-	1	1	5	7
Panama.....	5	4	1	1	1	-	1	1	2	2
Paraguay.....	8	9	3	4	1	1	1	1	3	3
Peru.....	29	29	14	15	7	8	1	1	7	5
Venezuela.....	31	37	25	13	4	2	2	3	-	19
British Guiana.....	2	2	1	1 ^b	-	-	1	-	-	1
British Honduras.....	2	-	1	-	-	-	-	-	1	-
Dominica.....	1	1	1	1 ^b	-	-	-	-	-	-
French Guiana.....	3	3	1	1 ^b	-	-	1	1	1	1
Grenada.....	1	1	1	1 ^b	-	-	-	-	-	-
Guadeloupe.....	2	-	1	-	-	-	1	-	-	-
Jamaica.....	3	3	2	2	1	1	-	-	-	-
Panama Canal Zone ...	9 ^b	14 ^b	1	10 ^b	1 ^b	1 ^b	1 ^b	1 ^b	6 ^b	2 ^b
St. Lucia.....	1	1	1	1 ^b	-	-	-	-	-	-
Surinam.....	1	1	1	1	-	-	-	-	-	-
Trinidad and Tobago...	19	15	1	1	-	-	1	-	17	14
Total.....	491	575	245	278	92	116	25	28	129	153

... No information.
- None.

(a) Program interrupted 1959-1960; resumed in 1961.
(b) Part-time.

Table 7

FIELD PERSONNEL EMPLOYED IN SPRAYING OPERATIONS IN MALARIA ERADICATION PROGRAMS,
31 DECEMBER 1959 AND 31 DECEMBER 1960

Country or other political unit	Total		Sector Chiefs		Squad Chiefs		Spraymen		Drivers		Motorboat Operators	
	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960	1959	1960
Argentina.....	193	199	10	8	32	29	110	127	41	35	-	-
Bolivia.....	315	295	31	29	23	12	209	203	40	37	12	14
Brazil (excl. São Paulo)..	...	946	...	51	...	122	...	618	...	155	...	-
Brazil (São Paulo).....	441	798	20	18	30	95	306	492	83	190	2	3
Colombia.....	1 590	1 503	53	50	102	96	1 202	1 122	167	167	66	68
Costa Rica.....	112	112	3	3	15	15	84	85	10	9	-	-
Cuba ^a	-	-	-	-	-	-	-	-	-	-	-	-
Dominican Republic.....	210	221	6	6	28	29	142	152	34	34	-	-
Ecuador.....	313	578	16	7	43	45	227	479	31	34	6	13
El Salvador.....	419	417	12	12	65	73	295	283	47	49	-	-
Guatemala.....	528	554	16	16	72	74	386	412	53	52	1	-
Haiti ^b	-	-	-	-	-	-	-	-	-	-	-	-
Honduras.....	318	319	10	10	42	46	221	217	44	45	1	1
Mexico.....	3 279	2 455	132	120	589	473	2 519	1 820	31	31	8	11
Nicaragua.....	310	338	8	8	47	48	205	233	45	44	5	5
Panama.....	157	127	7	7	25	23	120	92	5	5	-	-
Paraguay.....	137	128	4	5	16	18	86	84	27	19	4	2
Peru.....	365	611	14	20	56	109	249	412	40	61	6	9
Venezuela.....	770	451	41	12	91	58	570	349	59	21	9	11
British Guiana.....	62	70	-	1	7	9	51	48	4	10	-	2
British Honduras.....	26	25	2	-	4	4	19	19	1	2	-	-
Dominica.....	8	5	1	-	1	-	5	4	1	1	-	-
French Guiana.....	35	43	2	-	9	4	20	32	4	5	-	2
Grenada ^c	15	3	1	1	1	-	10	-	3	2	-	-
Guadeloupe.....	40	39	1	-	6	6	30	30	3	3	-	-
Jamaica.....	387	340	17	17	56	56	266	219	48	48	-	-
Panama Canal Zone.....	24 ^d	22 ^d	-	-	2 ^d	2 ^d	20 ^d	20 ^d	2	...	...	...
St. Lucia ^e	-	1	-	-	-	-	-	-	-	1	-	-
Surinam.....	95	100	7	6	16	19	58	56	9	9	5	10
Trinidad and Tobago....	141	199	13	10	21	32	77	130	30	27	-	-
Total.....	10 300	10 899	427	417	1 399	1 497	7 487	7 738	862	1 096	125	151

... No information.

- None.

(a) Program in preparatory phase in 1960. (b) Program interrupted 1959-1960; resumed in 1961.

(c) In consolidation phase from February 1960. (d) Part-time; spraying operations are carried out for two weeks twice a year.

(e) In consolidation phase from October 1959.

Table 8

PERSONNEL EMPLOYED IN EVALUATION OPERATIONS IN MALARIA ERADICATION PROGRAMS
31 DECEMBER 1959 AND 31 DECEMBER 1960

Country or other political unit	Total		Evaluation Inspectors		Evaluators		Microscopists	
	1959	1960	1959	1960	1959	1960	1959	1960
Argentina.....	100	116	14	12	70	84	18	20
Bolivia.....	39	46	-	1	24	30	15	15
Brazil(excl. São Paulo)..	...	124	...	23	...	70	...	31
Brazil (São Paulo).....	76	50	4	-	26	-	46	50
Colombia.....	246	414	33	37	166	330	47	47
Costa Rica	28	35	3	3	18	25	7	7
Cuba ^a.....	...	18	-	-	...	13	...	5
Dominican Republic.....	12	12	-	-	7	7	5	5
Ecuador.....	57	64	2	7	36	38	19	19
El Salvador.....	23	31	3	4	16	21	4	6
Guatemala	44	64	4	4	29	49	11	11
Haiti ^b	-	-	-	-	-	-	-	-
Honduras.....	40	47	4	4	22	26	14	17
Mexico.....	514	1488	65 ^c	109 ^c	386	1288	63	91
Nicaragua	40	50	2	4	32	38	6	8
Panama	38	38	2	2	25	25	11	11
Paraguay.....	28	34	6	6	13	18	9	10
Peru.....	99	136	1	12	66	86	32	38
Venezuela	422	380	81	72	301	268	40	40
British Guiana.....	1	6	-	-	-	3	1	3
British Honduras.....	8	7	1	1	4	4	3	2
Dominica.....	5	3	-	-	4	2	1	1
French Guiana	-	-	-	-	-	1	-	-
Grenada.....	3	7	-	-	2	6	1	1 ^d
Guadeloupe	7	12	-	9 ^e	4	-	3	3
Jamaica.....	46	50	-	-	32	36	14	14
Panama Canal Zone ^f	2 ^d	20 ^d	2 ^d	3 ^d	...	5 ^d	...	12 ^d
St. Lucia.....	8	8	2	1	5	6	1	1
Surinam.....	19	36	1	1	14	30	4	5
Trinidad and Tobago....	69	82	1	1	58	71	10	10
Total.....	1974	3380	231	317	1360	2580	383	483

... No information.

- None.

(a) Program in preparatory phase in 1960. (b) Program interrupted 1959-1960; resumed in 1961.

(c) Function performed by assistant medical malariologists and field technicians. (d) Part-time.

(e) Including 5 part-time. (f) Environmental sanitation and general hospital personnel.

The decrease in the number of spray sector chiefs reflects the progress of eradication. As areas entered the consolidation phase in some countries and the attack phase began or was strengthened in others, differences in national practice with respect to the ratio of supervisory to subordinate personnel were reflected in a decrease in the number of spray sector chiefs even though the number of squad chiefs and spraymen increased.

The substantial increase in the numbers of evaluators and evaluation inspectors reflects the increased emphasis on case detection, not only in areas in the consolidation phase, but in eradication programs in general. Similarly, augmented case detection activity has increased the number of slides to be examined and called forth a comparable increase in the number of microscopists.

Means of transport, shown in Table 9, have not changed significantly from the previous year. Jeeps and light trucks which are used for spray squads can also be utilized by groups of evaluators during the consolidation phase. The use of motorcycles and bicycles is limited by road conditions, and has not proved practicable in most cases. Boats and animals respond to special requirements in given countries and types of terrain.

Details of spraying operations are shown in Tables 10 and 11. St. Lucia and Grenada no longer appear, since the entire originally malarious area of each island is now in the consolidation phase. In countries where some part entered the consolidation phase, a decline in number of houses sprayed can be noted. In Mexico, where spraying was suspended in selected areas and these were not yet classified in the consolidation phase, this decline was already evident in 1960. In Panama, the steady decline in the number of houses sprayed is associated with organizational and administrative difficulties; and it can be seen from Table 11 that special problems were encountered in Panama in connection with closed houses. In most countries, the efficiency of spraymen measured by houses per man-day was stable or slightly improved in 1960. The declining output in Dominica relates to administrative difficulties which also caused suspension of spraying in June and July 1960.

The general shift from dieldrin to DDT is clear in Table 10, while the differences in grams of insecticide applied per house for DDT relate to differences between countries in average sprayable surface and size of house. The increase in a number of countries in the per cent of houses not sprayed, while by no means of alarming proportions, may serve as a reminder that health education must be undertaken on a continuing and intensive basis so as to create an atmosphere of public support in which the spraymen can work most efficiently.

Case detection is of increasing importance in malaria campaigns in the Americas as the consolidation phase approaches, and this is reflected in the statistics of such operations shown in Table 12. A decrease in the percentage of positivity of slides examined can be observed in the majority of programs, with the problem areas standing out clearly in opposition to the general trend. More than one-third of the countries included in Table 12 reported less than 1 per cent positivity in 1960; this was twice as many countries as fell in the same class in 1959. Particularly in countries approaching or already in the consolidation phase, there has been an increase in the number of evaluators, microscopists, and notification posts, and a great increase in the number of slides. In Mexico, more than 1,000,000 slides were examined in 1960. On the island of St. Lucia, 13,716 slides were examined during the first year of consolidation, representing 19 per cent of the population of the original malarious area.

Table 13 presents details of case finding separately for active and passive case detection. As has been observed in the past, higher percentages of positivity are found in slides provided by voluntary collaborators than in slides provided by evaluators. In general, the number of slides produced by active case detection rose from 1959 to 1960 and the percentage positive fell. Passive case detection, though generally highly productive, encountered some difficulties. In Colombia, the augmented network of collaborators is reflected by their production of 21 times as many slides in 1960 as in 1959. In a number of countries, production of collaborators declined, and the decline was often accompanied (see Table 12) by a drop in the number of notification posts producing slides. Shortages of evaluators have often meant that collaborators could not be visited frequently. At times the productive collaborators were not visited or properly supplied while efforts were made to stimulate their lagging colleagues, resulting in a general decline in morale. There was also a tendency, as malaria declined, for persons with fever to attribute it to other causes and fail to visit the collaborator.

Table 9

MEANS OF TRANSPORT IN MALARIA ERADICATION PROGRAMS IN THE AMERICAS, 1960

Country or other political unit	Trucks (3 tons or more)	Other trucks and pickups	Jeeps	Automobiles and station wagons	Motorcycles	Bicycles	Motor boats	Other boats	Saddle and pack animals	Other
Argentina.....	8	81	12	12	2	12	-	-	4	5 ^a
Bolivia.....	2	30	25	1	-	3	14	-	160	-
Brazil(excl. São Paulo) ..	15	66	130	14	-	-	3	3	267	-
Brazil (São Paulo).....	11	155	27	13	-	-	5	-	267	-
Colombia.....	19	218	78	30	-	10	72	37	760	-
Costa Rica.....	1	14	7	1	-	6	6	-	-	-
Cuba.....	-	-	-	4	-	-	-	-	-	-
Dominican Republic	2	34	25	8	-	-	-	-	-	-
Ecuador.....	4	35	35	5	-	1	15	3	95	-
El Salvador.....	1	39	13	5	-	-	2	-	-	-
Guatemala.....	1	49	4	19	-	2	5	1	-	-
Honduras.....	2	35	21	5	-	-	1	-	27	-
Mexico.....	16	414	201	16	-	-	15	-	1472	-
Nicaragua.....	2	23	16	5	-	-	9	-	-	-
Panama.....	-	32	16	7	-	-	15	-	-	-
Paraguay.....	-	21	18	3	-	-	6	1	4	-
Peru.....	-	133	67	1	-	-	60	-	-	-
Venezuela.....	3	63	67	23	4	114	27	74	631	-
British Guiana.....	-	1	3	-	-	-	2	-	-	-
British Honduras.....	-	7	2	2	-	4	-	-	-	-
Dominica.....	-	2	-	-	3	-	-	-	-	-
French Guiana.....	1	4	1	2	-	1	3	-	-	-
Grenada.....	-	-	2	1	-	3	-	-	-	-
Guadeloupe.....	1	4	3	1	-	-	-	-	-	-
Jamaica.....	14	33	17	10	-	-	-	-	-	-
Panama Canal Zone.....	-	7	-	-	-	-	6	-	-	-
St. Lucia.....	-	1	3	-	5	-	-	-	-	-
Surinam.....	2	2	2	4	8	4	20	-	-	-
Trinidad and Tobago.....	14	6	9	2	-	-	1	-	-	4 ^b

- None.

(a) Tank trucks.

(b) 2 tractors and 2 bromeliad spraying machines.

Table 10

SPRAYING OPERATIONS OF MALARIA ERADICATION PROGRAMS IN THE AMERICAS AT THE END OF 1960

Year of total coverage	Date	Houses sprayed				Total number of sprayings in year	Insecticide used per house (grams technical)		Average No. of houses sprayed per sprayman-day
		D. D. T.		Dieldrin			D. D. T.	Dieldrin	
		Cycle	No. sprayed	Cycle	No. sprayed				
ARGENTINA. Total coverage began 1 August 1959									
1st	Aug. 59-Jun. 60	1st	55 849 ^a	-	-	146 074	263	-	...
		2nd	2 146 ^b 81 170 ^a 6 909 ^b	-	-		255	-	...
2nd	Jul. 60-	3rd	78 487 ^a 6 442 ^b	-	-	...	305	-	...
BOLIVIA. Total coverage began 1 September 1958									
1st	Sep. 58-Aug. 59	1st	116 572	1st	10 910	256 601	362	115	8.3
2nd	Sep. 59-Aug. 60	2nd	129 119	-	-	291 405	331	-	7.0
		3rd	136 601	2nd	12 268		319	118	7.6
		4th	142 536	-	-		309	-	7.2
BRAZIL (SÃO PAULO STATE). Total coverage began 4 January 1960									
1st	Jan. -Dec. 60	1st	455 219	-	-	914 145	433	-	8.4
	Jan. 60-Jan. 61	2nd	458 926	-	-		404	-	9.8
COLOMBIA. Total coverage began 29 September 1958									
1st	Oct. 58-Sep. 59	1st	1 181 235	-	-	2 357 627	466	-	6.6
		2nd	1 176 392	-	-		425	-	8.9
2nd	Oct. 59-Sep. 60	3rd	1 196 930	-	-	2 358 989	409	-	9.4
		4th	1 162 059	-	-		394	-	9.7
		5th	1 181 557	-	-		...	399	-	9.7
3rd	Oct. 60-	-	-	-	-	-	-	-	
COSTA RICA. Total coverage began 15 July 1957									
1st	Jul. 57-Aug. 58	1st	53 297	-	-	111 921	464	-	5.0
		2nd	58 624	-	-		419	-	7.4
2nd	Sep. 58-Sep. 59	3rd	60 800	-	-	123 863	465	-	6.9
		4th	63 063	-	-		531	-	7.1
3rd	Oct. 59-Sep. 60	5th	63 884	-	-	130 845	512	-	8.6
		6th	66 961	-	-		473	-	9.3
		7th	66 242	-	-		...	475	-	9.4
4th	Oct. 60-	-	-	-	-	-	-	-	
DOMINICAN REPUBLIC. Total coverage began 16 June 1958									
1st	Jun. 58-Jun. 59	-	-	1st	395 597	395 597	-	102	11.4
2nd	Jul. 59-May 60	-	-	2nd	236 579	236 579	-	119	10.5
3rd	Mar. 60-	1st ^c	263 520	-	-	...	481	-	9.4
ECUADOR. Total coverage began 28 March 1957									
1st	Mar. 57-Mar. 58	1+2nd	65 284	1st	257 697	320 981	590	114	8.0
2nd	Apr. 58-Mar. 59	3rd	50 089	2nd	271 417	404 524	490	145	6.9
		4th	83 018	-	-	435	-	8.5	
3rd	Apr. 59-Mar. 60	5th	72 370	3rd	271 729	441 809	399	122	9.3
		6th ^d	97 790	-	-	403	-	8.2	
		(e)	227 411	-	-	227 411	424	-	8.9
4th	Apr. -Dec. 60	-	-	-	-	-	-	-	

- None.

... No information.

(a) Sprayed twice. (b) Sprayed once. (c) Nine-month cycle. (d) Cycle not completed. (e) Emergency spraying.

Table 10 (Continued)

SPRAYING OPERATIONS OF MALARIA ERADICATION PROGRAMS IN THE AMERICAS AT THE END OF 1960

Year of total coverage	Date	Houses sprayed				Total number of sprayings in year	Insecticide used per house (grams technical)		Average No. of houses sprayed per sprayman-day
		D. D. T.		Dieldrin			D. D. T.	Dieldrin	
		Cycle	No. sprayed	Cycle	No. sprayed				
EL SALVADOR. Total coverage began 1 July 1956									
1st	Jul. 56-Jul. 57	1st	260 035	1st	128 839	562 411	454	158	8.5
		2nd	173 537				621		8.8
2nd	Aug. 57-Jul. 58	3rd	126 329	2nd	202 728	440 783	469	162	9.4
		4th	111 726				451		9.3
3rd	Aug. 58-Jul. 59	5th	273 788	-	-	544 507	493	-	8.6
		6th	270 719				527		8.9
4th	Aug. 59-Jul. 60	7th	265 361	-	-	541 411	573	-	7.7
		8th	276 050				545		7.7
5th	Aug. 60-	9th	279 481	-	-	...	528	-	7.6
GUATEMALA. Total coverage began 1 August 1956									
1st	Aug. 56-Aug. 57	-	-	1st	306 306	306 306	-	117	8.4
2nd	Sep. 57-Sep. 58	-	-	2nd	331 090	331 090	-	117	8.6
3rd	Oct. 58-Oct. 59	1st	301 329	-	-	658 433	427	-	8.8
		2nd	357 104				542		7.5
4th	Nov. 59-Nov. 60	3rd	368 269	-	-	746 905	541	-	7.1
		4th	378 636				561		8.1
HONDURAS. Total coverage began 15 July 1959									
1st	Jul. 59-Jun. 60	1st	236 963	-	-	479 022	406	-	9.8
		2nd	242 059				368		11.4
2nd	Jul. 60-	3rd	254 699	-	-	...	369	-	11.8
MEXICO. Total coverage began 2 January 1957									
1st	Jan. -Dec. 57	1st	2 143 023	1st	678 726	5 120 701	495	99	9.3
		2nd	2 298 952				417		9.9
2nd	Jan. -Dec. 58	3rd	2 103 570	2nd	1 217 556	5 292 683	402	111	10.3
		4th	1 971 557				423		10.5
3rd	Jan. -Dec. 59	5th	3 050 952	3rd	292 301	6 562 593	434	114	10.8
		6th	3 219 340				434		10.4
4th	Jan. -Dec. 60	7th	3 027 089	4th	22 390	5 918 572	413	93	10.9
		8th	2 869 093				387		11.1
NICARAGUA. Total coverage began 10 November 1958									
1st	Nov. 58-Dec. 59	1st	205 930	-	-	424 575	401	-	9.2
		2nd	218 645				325		10.3
2nd	Jan. -Dec. 60	3rd	230 478	-	-	469 554	367	-	9.4
		4th	239 076				396		8.9
PANAMA. Total coverage began 19 August 1957									
1st	Aug. 57-Aug. 58	-	-	1st	155 963	155 963	-	119	6.5
2nd	Sep. 58-Aug. 59	-	-	2nd	154 638	154 638	-	145	6.9
3rd	Sep. 59-Aug. 60	-	-	3rd	131 270	131 270	-	129	7.3
PARAGUAY. Total coverage began 30 October 1957									
1st	Nov. 57-Oct. 58	-	-	1st	148 626	148 626	-	105	11.0
2nd	Nov. 58-Oct. 59	-	-	2nd	161 261	161 261	-	111	14.3
3rd	Nov. 59-Oct. 60	-	-	3rd	171 086	171 086	-	119	11.7

- None.
... No information.

Table 10 (Concluded)

SPRAYING OPERATIONS OF MALARIA ERADICATION PROGRAMS IN THE AMERICAS AT THE END OF 1960

Year of total coverage	Date	Houses sprayed				Total number of sprayings in year	Insecticide used per house (grams technical)		Average No of houses sprayed per sprayman-day
		D. D. T.		Dieldrin			D. D. T.	Dieldrin	
		Cycle	No.sprayed	Cycle	No.sprayed				
PERU. Total coverage began 17 November 1957									
1st	Nov. 57-Oct. 58	1+2nd	286 764 ^a 70 266 ^b	1st	121 666	478 696	...	...	7.8
2nd	Jan. -Dec. 59	(c)	271 065	2nd	341 804	612 869	424	118	8.4
3rd	Jan. -Dec. 60 ^d	(c)	447 848	3rd	234 643	682 491	468	95	8.4
BRITISH HONDURAS. Total coverage began 4 February 1957									
1st	Feb. 57-Jan. 58	-	-	1st	17 082	17 082	-	84	...
2nd	Feb. 58-Dec. 58	1st	6 419	2nd	11 873 ^b 7 470 ^a	25 880	290	99	8.0
	(e)	2nd	118				416		8.2
3rd	May 59-Jun. 60	3rd	17 516	-	-	35 521	329	-	7.5
		4th	18 005				332		8.0
4th	Jul. 60-	5th	18 013	-	-	...	374	-	8.4
DOMINICA. Total coverage began 8 June 1959									
1st	Jun. 59-May 60	1st	2 748	-	-	5 352	258	-	8.1
		2nd	2 604				217		7.7
2nd	Aug. 60-	3rd	2 722	-	-	...	238	-	5.2
GRENADA. Total coverage began 12 February 1957, ended February 1960									
JAMAICA. Total coverage began 2 January 1958									
1st	Jan. -Dec. 58	-	-	1st	271 514	271 514	-	61	8.9
2nd	Jan. -Sep. 59	1st	88 862	2nd	181 319	270 181	226	62	9.9
3rd	Oct. 59-Sep. 60	2nd	269 225	-	-	510 271	213	-	9.9
		3rd	241 046	-	-		179		9.5
ST. LUCIA. Total coverage began 16 January 1956, ended October 1959									
SURINAM. Total coverage began 5 May 1958									
1st	May 58-Apr. 59	1st	31 299	1st ^f	7 484	78 994	310	53	5.8
		2nd	40 211				318		6.9
2nd	May 59-Apr. 60	3rd	37 563	2nd ^f	13 331	88 339	274	59	8.0
		4th	37 445				250		7.8
3rd	May-Dec. 60	5th	36 861	3rd ^f	3 378	40 239	247	55	6.2
TRINIDAD AND TOBAGO. Total coverage began 2 January 1958									
1st	Jan. -Oct. 58	-	-	1st	117 678	117 678	-	141	7.1
2nd	Jan. -Dec. 59	1st ^g	68 290	2nd	81 108	149 398	315	126	9.0
3rd	Jan. -Dec. 60	2nd	118 978	3rd	2 322	241 685	331	...	11.5
		3rd	120 385				317		9.2

- None.

... No information.

- (a) Sprayed twice. (b) Sprayed once. (c) Owing to different spray cycle timing in different regions, these data refer to the calendar year. (d) Total coverage of all malarious zones of the country began in December 1959.
(e) In the period January-April 1959 spraying was limited to emergency spraying of 210 houses with dieldrin.
(f) Houses sprayed with dieldrin are shown for dates corresponding to the DDT cycle, though in 1960 the dieldrin year was July-June. From January 1961, dieldrin and DDT cycles are synchronized.
(g) About one-third of the houses were sprayed twice during the period shown.

Table 11

SPRAYING ACHIEVEMENTS OF MALARIA ERADICATION PROGRAMS IN THE AMERICAS AT THE END OF 1960

Year of total coverage	Date	Number of sprayings	Number of houses not sprayed ^a				Per cent of houses not sprayed
			Not sprayable	Refused entry to sprayman	Closed	Total	
ARGENTINA. Total coverage began 1 August 1959							
1st	Aug. 59-Jun. 60	146 074	5 328	22	1 819	7 169	4.7
2nd	Jul.-Dec. 1960	84 929	3 013	41	998	4 052	4.6
BOLIVIA. Total coverage began 1 September 1958							
1st	Sep. 58-Aug. 59	256 601	12 482	862	19 094	32 438	11.2
2nd	Sep. 59-Aug. 60	291 405	17 039	438	14 322	31 799	9.8
BRAZIL (SÃO PAULO STATE). Total coverage began 4 January 1960							
1st	Jan. 60-Jan. 61	914 145	42 665	8 997	25 642	77 304	8.1
COLOMBIA. Total coverage began 29 September 1958							
1st	Oct. 58-Sep. 59	2 357 627	82 822	85 476	57 804	226 102	8.8
2nd	Oct. 59-Sep. 60	2 353 989	70 008	28 155	88 588	186 749	7.3
3rd	Oct. 60-Mar. 61	1 181 557	27 378	17 217	37 376	81 970	6.5
COSTA RICA. Total coverage began 15 July 1957							
1st	Jul. 57-Aug. 58	111 921	0	0	0	0	0.0
2nd	Sep. 58-Sep. 59	123 863	0	0	0	0	0.0
3rd	Oct. 59-Sep. 60	130 845	0	0	0	0	0.0
4th	Oct. 60-Mar. 61	66 242	0	0	0	0	0.0
DOMINICAN REPUBLIC. Total coverage began 16 June 1958							
1st	Jun. 58-Jun. 59	395 597	...	...	...	5 706	1.4
2nd	Jul. 59-Mar. 60	236 579	7 908	916	8 059	16 883	6.7
3rd	Mar.-Dec. 60	263 520	8 164	808	8 559	17 531	6.2
ECUADOR. Total coverage began 28 March 1957							
1st	Mar. 57-Mar. 58	320 981	...	...	...	...	...
2nd	Apr. 58-Mar. 59	404 524	3 168	4 112	9 618	16 898	4.0
3rd	Apr. 59-Mar. 60	441 889	2 430	1 587	5 123	9 140	2.0
4th	Apr.-Dec. 60	227 411	753	1 069	2 518	4 340	1.9
EL SALVADOR. Total coverage began 1 July 1956							
1st	Jul. 56-Jul. 57	562 411	...	...	...	218	0.04
2nd	Aug. 57-Jul. 58	440 783	0	0	0	0	0.0
3rd	Aug. 58-Jul. 59	544 507	0	101	355	456	0.1
4th	Aug. 59-Jul. 60	541 411	0	510	1 426	1 936	0.4
5th	Aug.-Dec. 60	279 481	0	455	739	1 194	0.4
GUATEMALA. Total coverage began 1 August 1956							
1st	Aug. 56-Aug. 57	306 306	...	...	...	758	0.2
2nd	Sep. 57-Sep. 58	331 090	...	...	...	1 518	0.5
3rd	Oct. 58-Oct. 59	658 433	...	...	...	6 541	1.0
4th	Nov. 59-Nov. 60	746 905	0	783	6 379	7 162	1.0
HONDURAS. Total coverage began 15 July 1959							
1st	Jul. 59-Jun. 60	479 022	6 519	391	1 812	8 722	1.8
2nd	Jul.-Dec. 1960	254 699	422	156	1 210	1 788	0.7

... No information.

- (a) When follow-up spraying is done, the figures represent the net number of houses unsprayed at the end of the spraying cycle.

Table 11 (Concluded)

SPRAYING ACHIEVEMENTS OF MALARIA ERADICATION PROGRAMS IN THE AMERICAS AT THE END OF 1960

Year of total coverage	Date	Number of sprayings	Number of houses not sprayed ^a				Per cent of houses not sprayed
			Not sprayable	Refused entry to sprayman	Closed	Total	
MEXICO. Total coverage began 2 January 1957							
1st	Jan-Dec. 57	5 120 701	77 537	71 619 ^b	149 156	2.8	
2nd	Jan-Dec. 58	5 292 683	102 485	90 686 ^b	193 171	3.5	
3rd	Jan-Dec. 59	6 562 593	95 178	117 107 ^b	212 285	3.1	
4th	Jan-Dec. 60	5 918 572	76 497	108 857 ^b	185 354	3.0	
NICARAGUA. Total coverage began 10 November 1958							
1st	Nov. 58-Dec. 59	424 575	6 802	2 099	7 282	16 183	3.7
2nd	Jan-Dec. 60	469 554	12 487	2 102	4 841	19 430	4.0
PANAMA. Total coverage began 19 August 1957							
1st	Aug. 57-Aug. 58	155 963	...	...	...	5 047	3.1
2nd	Sep. 58-Aug. 59	154 638	2 247	267	5 857	8 371	5.1
3rd	Sep. 59-Aug. 60	131 270	1 825	530	6 738	9 093	6.5
PARAGUAY. Total coverage began 30 October 1957							
1st	Nov. 57-Oct. 58	148 626	0	0	651	651	0.4
2nd	Nov. 58-Oct. 59	161 261	0	90	1 022	1 112	0.7
3rd	Nov. 59-Oct. 60	171 086	0	28	981	1 009	0.6
PERU. Total coverage began 17 November 1957							
1st	Nov. 57-Oct. 58	478 696	522	72	42 201	42 795	8.2
(c)	Jan. -Dec. 59	612 869	16 373	2 163	22 120	40 656	6.2
(c)	Jan. -Dec. 60	682 491	12 433	1 479	13 661	27 573	3.8
BRITISH HONDURAS. Total coverage began 4 February 1957							
1st	Feb. 57-Jan. 58	17 082	...	...	...	...	...
2nd	Feb-Dec. 58	25 880	0	0	427	427	1.6
3rd	May 59-Jun. 60	35 521	510	3	334	847	2.3
4th	Jul-Dec. 60	18 013	181	1	168	350	1.9
DOMINICA. Total coverage began 8 June 1959							
1st	Jun. 59-May 60	5 352	28	104	182	314	5.5
2nd	Aug. 60-Apr. 61	2 722	13	49	230	292	9.7
JAMAICA. Total coverage began 2 January 1958							
1st	Jan-Dec. 58	271 514	7 395	9	0	7 404	2.7
2nd	Jan-Sep. 59	270 181	5 217	29	1 834	7 080	2.6
3rd	Oct. 59-Sep. 60	510 271	17 831	141	3 916	21 888	4.1
SURINAM. Total coverage began 5 May 1958							
1st	May 58-Apr. 59	78 994	196	124	4 980	5 300	6.3
2nd	May 59-Apr. 60	88 339	166	1 126	3 838	5 130	5.8
3rd	May-Dec. 60	40 239	342	1 374	6 697	8 413	17.3
TRINIDAD AND TOBAGO. Total coverage began 2 January 1958							
1st	Jan-Oct. 58	117 678	...	...	...	2 519	2.1
2nd	Jan-Dec. 59	149 398	27	1	477	505	0.3
3rd	Jan-Dec. 60	241 685	33	0	1 301	1 334	0.5

... No information.

- (a) When follow-up spraying is done, the figures represent the net number of houses unsprayed at the end of the spraying cycle.
 (b) Including unspecified other reasons.
 (c) Owing to different spray cycle timing in different regions, these data refer to the calendar year.

Table 12

CASE DETECTION IN MALARIA ERADICATION PROGRAMS IN THE AMERICAS
AT THE END OF 1960

Year of total coverage	Date	No. of inhabitants directly protected by spraying	No. of slides examined	No. of positive slides				Per cent positive	Average No. of notification posts producing slides per month	No. of evaluators at end of year	No. of microscopists at end of year
				P. falciparum	P. vivax	P. malariae	Total				
ARGENTINA. Total coverage began 1 August 1959											
1st	Aug. 59-June 60	535 922	70 700	6	2 491	0	2 497	3.53	107	60	19
2nd	Jul. 60-Mar. 61	445 818	78 761	4	926	0	930	1.18	172	65	21
BOLIVIA. Total coverage began 1 September 1958											
1st	Sep. 58-Aug. 59	a) 754 635	50 980	273	1 268	302	1 843	3.62	207 ^a	23	10
2nd	Sep. 59-Aug. 60	1 295 044	99 241	124	803	179	1 106	1.11	275	24	8
3rd	Sep. 60-Jan. 61	630 612	32 989	44	156	19	219	0.66	336	29	10
BRAZIL (SÃO PAULO STATE). Total coverage began 4 January 1960											
1st	Jan. -Dec. 60	3 644 969	114 622	66	8 230	1	8 297	7.24	427	50	41
COLOMBIA. Total coverage began 29 September 1958											
1st	Oct. 58-Sep. 59	13 089 121	205 343	731	1 877	18	2 626	1.28	100	158	40
2nd	Oct. 59-Sep. 60	12 701 683	542 570	3 564	4 923	42	8 529	1.57	572	223	34
3rd	Oct. 60-Jan. 61	5 339 701	127 237	915	1 102	2	2 019	1.59	2 918	317	33
COSTA RICA. Total coverage began 15 July 1957											
1st	Aug. 57-Aug. 58	550 660	24 773	115	1 661	10	1 786	7.20	69	15	5
2nd	Sep. 58-Sep. 59	596 007	52 697	135	2 081	6	2 222	4.22	109	17	5
3rd	Oct. 59-Sep. 60	622 215	66 721	91	1 888	1	1 980	2.97	202	25	6
4th	Oct. 60-Mar. 61	307 601	35 178	23	933	0	956	2.72	286	20	8
DOMINICAN REPUBLIC. Total coverage began 16 June 1958											
1st	Jun. 58-Jun. 59	2 015 214	29 718	1 522	1 537	1	3 060	10.30	82	6	4
2nd	Jul. 59-Feb. 60	1 202 301	19 362	2 453	1 751	10	4 214	21.76	125	6	5
3rd	Mar. 60-Jan. 61	1 474 555	17 452	2 870	1 642	6	4 518	25.89	110	6	5
ECUADOR. Total coverage began 28 March 1957											
1st	Mar. 57-Mar. 58	1 777 566	47 993	1 169	1 086	3	2 258	4.70	...	...	...
2nd	Apr. 58-Mar. 59	2 171 079	69 085	2 361	2 437	4	4 802	6.95	262	37	9
3rd	Apr. 59-Mar. 60	2 080 775	108 041	2 454	3 833	4	6 291	5.82	490	43	13
4th	Apr. 60-Feb. 61	1 391 778	109 498	2 938	5 871	20	8 829	8.06	704	56	13
EL SALVADOR. Total coverage began 1 July 1956											
1st	Jul. 56-Jul. 57	2 845 568	11 829	774	1 510	0	2 284	19.31	...	...	...
2nd	Aug. 57-Jul. 58	2 102 503	42 216	4 212	4 891	5	9 108	21.57	...	...	...
3rd	Aug. 58-Jul. 59	2 570 500	59 463	4 384	9 136	0	13 520	22.74	315	17	4
4th	Aug. 59-Jul. 60	2 534 965	75 177	3 061	9 566	0	12 627	16.80	354	17	4
5th	Aug. 60-Jan. 61	1 332 348	45 731	2 440	4 575	1	7 016	15.34	423	24	5
GUATEMALA. Total coverage began 1 August 1956											
1st	Aug. 56-Aug. 57	c) 712 788	22 965	1 255	3 858	3	5 116	22.28	...	...	12
2nd	Sep. 57-Sep. 58	1 501 742	47 945	3 909	6 174	1	10 084	21.03	77	11	8
3rd	Oct. 58-Oct. 59	2 854 461	124 519	3 734	9 300	0	13 034	10.47	362	30	10
4th	Nov. 59-Nov. 60	3 099 988	126 667	400	2 967	0	3 367	2.66	633	49	11

- None.

... No information.

(a) From January-August 1959. (b) Estimated. (c) 6 months only.

Table 12 (Continued)
CASE DETECTION IN MALARIA ERADICATION PROGRAMS IN THE AMERICAS
AT THE END OF 1960

Year of total coverage	Date	No. of inhabitants directly protected by spraying	No. of slides examined	No. of positive slides				Per cent positive	Average No. of notification posts producing slides per month	No. of evaluators at end of year	No. of microscopists at end of year
				P. falciparum	P. vivax	P. malariae	Total				
HONDURAS. Total coverage began 15 July 1959											
1st	Jul. 59-Jun. 60	2 554 385	82 673	2 925	3 649	1	6 575	7.95	498	26	10
2nd	Jul. 60-Jan. 61	1 552 811	76 508	1 169	2 508	0	3 677	4.81	867	29	12
MEXICO. Total coverage began 2 January 1957											
1st	Jan. -Dec. 57	23 399 463	175 080	514	3 856	17	4 387	2.51	...	55	42
2nd	Jan. -Dec. 58	23 744 095	403 573	487	2 779	24	3 290	0.82	1 781	227	42
3rd	Jan. -Dec. 59	29 119 920	821 598	443	2 705	54	3 202	0.39	2 842	441	58
4th	Jan. -Dec. 60	25 782 965	1 212 770	245	3 251	73	3 569	0.29	4 422 ^a	573	63
NICARAGUA. Total coverage began 10 November 1958											
1st	Jan. -Dec. 59	2 352 191	38 966	619	1 256	0	1 875	4.81	248	33	5
2nd	Jan. -Dec. 60	2 535 535	74 074	4 217	3 311	0	7 528	10.16	382	38	7
PANAMA. Total coverage began 19 August 1957											
1st	Aug. 57-Aug. 58	670 000 ^b	69 429	1 717	...	...	5 634	8.11	198	15	7
2nd	Sep. 58-Aug. 59	667 095	93 338	720	4 196	5	4 921	5.27	328	25	7
3rd	Sep. 59-Aug. 60	562 514	76 984	751	4 479	2	5 232	6.80	419	25	5
4th	Sep. 60-Feb. 61	211 087	37 080	228	1 165	0	1 393	3.76	355	25	6
PARAGUAY. Total coverage began 30 October 1957											
1st	Oct. 57-Oct. 58	747 541	13 526	3	496	1	500	3.70	-	...	...
2nd	Nov. 58-Oct. 59	805 232	11 963	3	618	0	621	5.19	101	13	9
3rd	Nov. 59-Oct. 60	844 515	42 396	5	1 028	0	1 033	2.44	159	16	9
PERU. Total coverage began 17 November 1957											
1st	Nov. 57-Oct. 58	1 867 208	...	77	527	29	652 ^c	...	...	60	22
(d)	Jan. -Dec. 59	2 775 694	149 791	302	4 265	51	4 658 ^c	2.85	1 241	66	31
(d)	Jan. -Dec. 60	3 345 726	349 780	256	3 560	90	3 906	1.12	1 754	86	37
BRITISH HONDURAS. Total coverage began 4 February 1957											
1st	Feb. 57-Jan. 58	46 825	282	148	56	52	256	12.0	...	...	2
2nd	Feb. -Nov. 58	94 937	8 081	321	226	46	593	7.34	94	11	3
3rd	Apr. 59-Jun. 60	167 846	12 985	542	207	70	819	6.31	56	4	2
4th	Jul. 60-Feb. 61	115 309	9 895	10	64	0	74	0.75	89	4	2
DOMINICA. Total coverage began 8 June 1959											
1st	Jun. 59-May 60	20 830	5 233	51	0	0	51	0.97	5	4	1
2nd	Jun. 60-Feb. 61	8 516	4 950	4	0	0	4	0.08	8	5	1
GRENADA. Total coverage began 12 February 1957. Entered consolidation phase February 1960											
1st	Feb. 57-Jan. 58	52 840	3 230	123	0	0	123	3.81	...	2	1
2nd	Feb. 58-Jan. 59	58 196	10 954	50	0	0	50	0.46	9	3	1
3rd	Feb. 59-Jan. 60	59 795	5 283	2	0	0	2	0.04	14	3	1
1st consol.	Feb. 60-Jan. 61	-	8 076	0	0	0	0	0.00	17	6	1

- None.

... No information.

(a) Average January-November. (b) Estimated. (c) Including undifferentiated mixed infections.

(d) Owing to different spray cycle timing in different regions, these data refer to the calendar year.

Table 12 (Concluded)

CASE DETECTION IN MALARIA ERADICATION PROGRAMS IN THE AMERICAS
AT THE END OF 1960

Year of total coverage	Date	No. of inhabitants directly protected by spraying	No. of slides examined	No. of positive slides				Per cent positive	Average No. of notification posts producing slides per month	No. of evaluators at end of year	No. of microscopists at end of year
				P. falciparum	P. vivax	P. malariae	Total				
JAMAICA. Total coverage began 2 January 1958											
1st	Jan. -Dec. 58	1054 894	56 266	199	0	6	205	0.36	...	25	10
2nd	Jan. 59-Sep. 59	1 037 284	27 953	280	0	15	295	1.06	121	30	9
3rd	Oct. 59-Sep. 60	1 964 453	140 409	180	0	14	194	0.14	176	22	9
4th	Oct. -Dec. 60	331 285	55 898	14	0	3	17	0.03	191	36	9
ST. LUCIA. Total coverage began 16 January 1956. Entered consolidation phase October 1959											
1st	Jan. 56-Jan. 57	72 364	4 689	63	0	9	72	1.54	...	-	-
2nd	Feb. 57-Dec. 57	96 326	4 288	15	0	4	19	0.44	...	-	-
3rd	Jan. 58-Feb. 59	113 066	8 378	29	0	9	38	0.45	7	3	1
4th	Mar. -Sep. 59	62 324	8 028	3	0	0	3	0.04	10	3	1
1st consol.	Oct. 59-Sep. 60	-	13 716	0	0	0	0	0.00	18	5	1
2nd consol.	Oct. 60-Feb. 61	-	5 091	0	0	0	0	0.00	23	7	1
SURINAM. Total coverage began 5 May 1958											
1st	May 58-Apr. 59	343 373	37 292	3 356	71	120	3 547	9.51	6	12	3
2nd	May 59-Apr. 60	330 837	46 158	1 665	7	272	1 944	4.21	7	16	4
3rd	May 60-Feb. 61	162 483 ^a	38 090	773	3	50	826	2.17	8	26	5
TRINIDAD AND TOBAGO. Total coverage began 2 January 1958											
1st	Jan. -Dec. 58	571 953	26 501 ^b	318 ^b	58 ^b	0 ^b	376 ^b	1.42	...	...	...
2nd	Jan. -Dec. 59	726 681	101 400	67	29	1	97	0.10	22	53	9
3rd	Jan. -Dec. 60	1 085 051 ^c	109 000	10	3	0	13	0.01	16	74	7

- None.

... No information.

(a) May 60-January 61.

(b) January-September 1958.

(c) January-October 1960.

Table 13

COMPARATIVE RESULTS OF ACTIVE AND PASSIVE CASE DETECTION IN THE AMERICAS, 1959 AND 1960

Country or other political unit	Active case detection				Passive case detection			
	Number of slides produced		Per cent positive		Number of slides produced		Per cent positive	
	1959	1960	1959	1960	1959	1960	1959	1960
Argentina.....	18 494 ^a	89 306	2.87 ^a	0.87	3 374 ^a	7 323	16.69 ^a	17.25
Bolivia.....	53 883	62 121	1.92	0.70	29 879	25 654	3.14	1.80
Brazil (São Paulo).....	...	86 204	...	1.24	...	28 418	...	25.45
Colombia.....	323 637	390 370	1.23	1.59	5 651	119 550	3.33	1.87
Costa Rica.....	31 618	41 732	2.26	1.36	20 918	25 911	5.66	5.53
Dominican Republic....	9 748 ^b	6 646	7.49 ^b	9.90	17 104 ^b	13 691	15.94 ^b	35.66
Ecuador.....	29 626	35 187	4.33	4.71	69 351	84 375	6.64	8.80
El Salvador.....	8 839	7 019	7.89	4.33	62 456	68 362	26.94	14.20
Guatemala.....	11 590	47 252	5.66	2.40	96 458	82 489	7.50	2.73
Honduras.....	1 276	137	8.54	19.71	39 947	109 540	10.74	5.01
Mexico.....	632 983	892 590	0.27	0.27	188 615	320 180	0.78	0.36
Nicaragua.....	4 566	22 418	8.41	15.45	34 400	51 656	4.33	7.87
Panama.....	6 949	13 240	2.82	3.00	71 712	63 859	6.72	6.37
Paraguay.....	3 311	32 486 ^c	3.50	0.62 ^c	8 068	8 057 ^c	6.51	9.25 ^c
Peru.....	31 659	110 089 ^c	...	0.74 ^c	118 132	166 034 ^c	...	1.47 ^c
Venezuela.....	463 750	365 526 ^d	0.17	0.26 ^d	40 027	68 022 ^d	0.30	0.32 ^d
British Honduras.....	2 851	4 717	12.38	1.10	8 456	8 590	7.88	1.68
Dominica.....	2 572	4 560	1.56	0.04	229	1 591	2.62	0.31
French Guiana.....	-	2 096 ^{d,e}	-	0.62 ^{d,e}	1 823	1 247 ^d	0.88	1.92 ^d
Grenada.....	4 055	4 109	0.00	0.00	1 640	4 124	0.12	0.00
Guadeloupe.....	9 720	8 940 ^d	0.00	0.02 ^d	574	710 ^d	0.00	0.00 ^d
Jamaica.....	20 170	153 890	0.96	0.06	19 556	30 644	0.91	0.14
Panama Canal Zone....	1 772	750 ^d	0.28	0.40 ^d	12 825	1 906 ^d	0.16	1.26 ^d
St. Lucia.....	8 523	5 922	0.04	0.00	4 745	7 009	0.00	0.00
Surinam.....	34 288	38 219	6.12	2.11	12 399	7 177	4.87	2.66
Trinidad and Tobago....	99 965	108 183	0.07	0.01	1 435	817	1.88	0.37

- None.

... No information.

(a) August-December. (b) Excluding August. (c) January-October. (d) January-September.

(e) Malarionetric survey.

Successful field operations--whether spraying or case detection--depend on adequate financing. Table 14 shows national budgets for malaria eradication for the years 1959 and 1960, together with commitments for 1961, expressed in U.S. dollars for the sake of rough comparability. The budgets of countries in the attack phase generally remained high or increased slightly. It should be remembered, however, that price inflation can lower the purchasing power of the sums allocated. When supplies and equipment increase in price, an equal appropriation of funds can buy less. When price increases are accompanied by increases in the general level of wages, there is pressure to raise wages in malaria services so as to maintain the level of living of the staff and avoid their leaving to take up more remunerative employment (which latter, incidentally, also raises recruitment and training costs).

For countries entering or nearing the consolidation phase, the picture is somewhat different. Grenada cut its malaria budget by one-half from 1959 to 1960, maintaining the same level in 1961. In St. Lucia the current rate of expenditure is one-third of that in the attack phase. In Mexico, where large areas entered consolidation in 1961, the budget for 1961 is about 10 per cent below 1960 expenditures. Financial and budgetary policies differ from country to country, and in Jamaica and Surinam the entry of areas into the consolidation phase has not affected the national budget for malaria eradication. Since the passage of the historic Resolution XLII of the XIV Pan American Sanitary Conference (Santiago, 1954), the Governments of the Americas have responded by investing more than \$125,000,000 in their malaria eradication programs, not counting the additional sums contributed by international or bilateral agencies.

II. SPECIAL TECHNICAL PROBLEMS

A. Epidemiological problems

A number of graphs based on surveillance operations are presented on the following pages to illustrate different types of response to malaria eradication efforts in the Americas.

Figure 1 illustrates the progress of eradication in Mexico, where the fourth year of the attack phase was completed in 1960, with transmission halted over wide areas and spraying suspended in 1961 in 62 per cent of the original malarious area of the country. The over-all decline in malaria is striking, though less so for vivax cases than for falciparum. This is due in part to the high percentage of relapses among the vivax cases. For example, epidemiological investigations of cases during the first two months of 1961 resulted in classifying as relapses or imported all cases studied in the areas of consolidation, and three-fourths of those studied in areas still in the attack phase. The problem of relapses is being attacked by intensified radical treatment of proven cases, and sometimes of suspected cases as well.

One factor in the apparent leveling-off of positivity in 1960 may be the considerable expansion of case finding activities during the year, chiefly in smaller villages and rural areas of Mexico, thus creating a disproportionate increase in slides from areas where malaria is relatively more persistent. Case detection found a peak of 600 cases in November 1960 on the basis of 209,000 slides examined (0.3 per cent positivity). Finally, there was definite persistence of transmission in certain limited areas and localities. This tended to keep the country-wide average positivity from falling in 1960. Selective group chemotherapy and larviciding are being used in persistent foci of transmission, and it is expected that the attack will be successful.

Figure 2 illustrates the trend of malaria in El Salvador, a country which is confronted with the most difficult combination of technical problems in the Americas. The major problems are the following:

1. Resistance of A. albimanus to both DDT and dieldrin in wide areas.
2. The use of dieldrin, which because of resistance proved ineffective in most areas, for 18 months before change was made to DDT, which is completely effective in some areas, partially in others.
3. High population density in highly malarious lowland areas.
4. Poor housing with walls often made of cane, sticks, or simply absent.

Table 14

NATIONAL BUDGETS FOR MALARIA ERADICATION IN THE AMERICAS, 1959-1961
(in thousands of U. S. dollars)

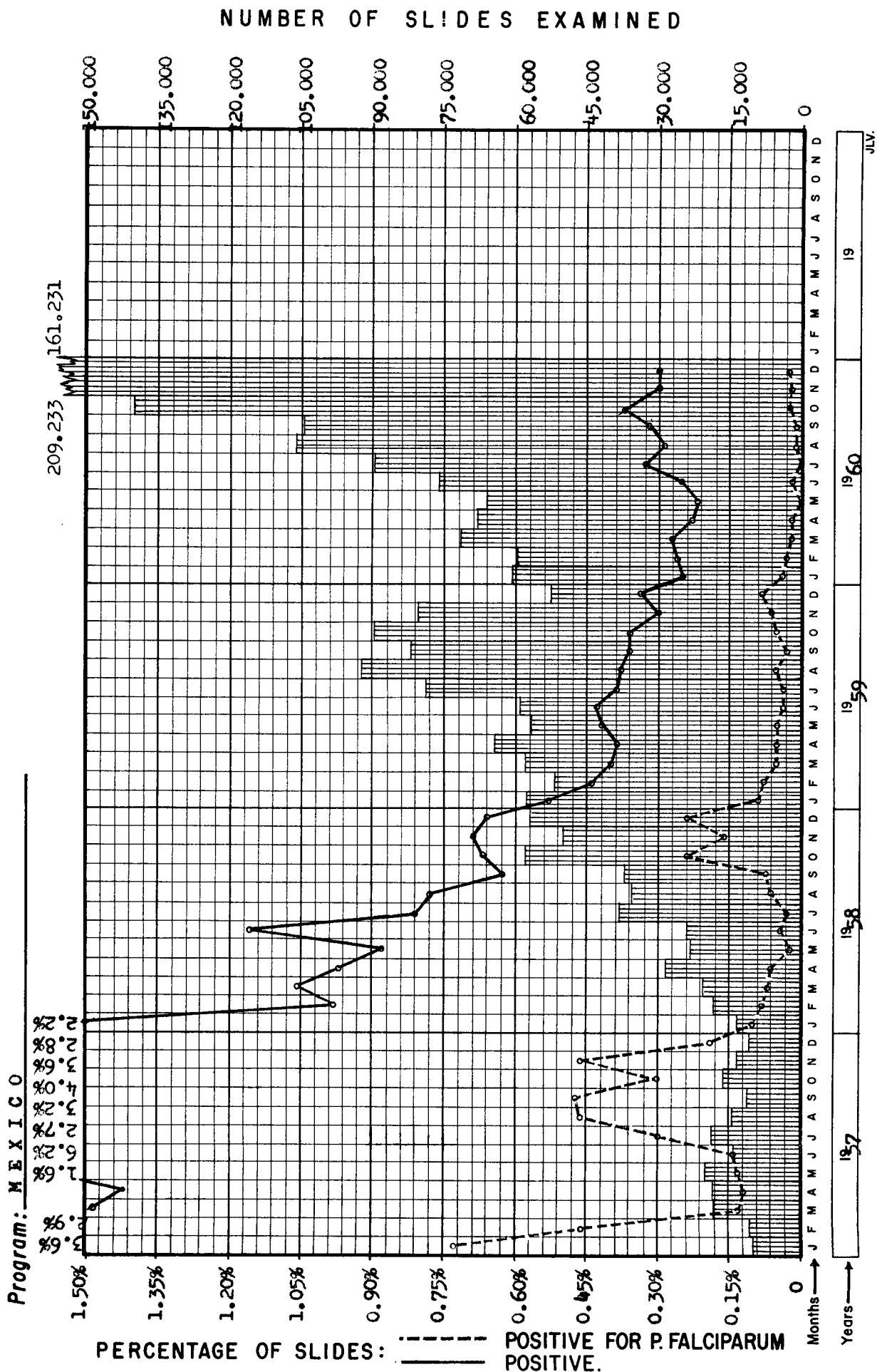
Country or other political unit	Date of initiation of program	National budget 1959	National budget 1960	National commitments 1961
Argentina.....	Sept. 1959	312	327	336
Bolivia.....	Sept. 1958	437 ^a	420 ^a	420 ^a
Brasil ^b	Jan. 1959	1310	2 222	2 373
São Paulo.....	1 Sept. 1958	645	1 336	1 197
Colombia.....	8 Sept. 1958	2 410	2 925	2 625
Costa Rica	15 July 1957	289	275	283
Cuba.....	1960	40 ^c	260 ^d	943
Dominican Republic....	1 July 1958	348	411	505
Ecuador.....	18 Mar. 1957	505	480	588
El Salvador.....	1 July 1956	543	490	600
Guatemala.....	1 Aug. 1956	485	499	485
Haiti.....	Sept. 1958	(e)	(e)	740
Honduras.....	Jan. 1958	145	175	300
Mexico.....	2 Jan. 1957	5 540	5 280	4 800
Nicaragua	10 Nov. 1958	232	331	331
Panama	19 Aug. 1957	433	425	530
Paraguay.....	30 Oct. 1957	202	228	265
Peru.....	15 Nov. 1957	704	689	893
Venezuela	1950	7 000	...	...
British Guiana	Jan. 1947	70 ^f	87	100
British Honduras.....	4 Feb. 1957	36	44	50
Dominica.....	Jun. 1959	8	8	8
French Guiana ^g	May 1948	...	...	...
Grenada.....	Feb. 1957	20	10	10
Guadeloupe	Nov. 1955	78	80	80
Jamaica.....	Jan. 1958	502	504	504
Panama Canal Zone ...	...	50	50	...
St. Lucia.....	1 Jul. 1956	35	12	12
Surinam	2 May 1958	175	175	175
Trinidad and Tobago...	Jan. 1958	293	338	345

... No information.

(a) ICA counterpart funds. (b) Excluding São Paulo State. (c) Preliminary investigation.

(d) Second semester 1960. (e) Program interrupted. (f) Coastal area only. (g) Reimportation in 1954, spraying recommenced.

MALARIA ERADICATION PROGRAM

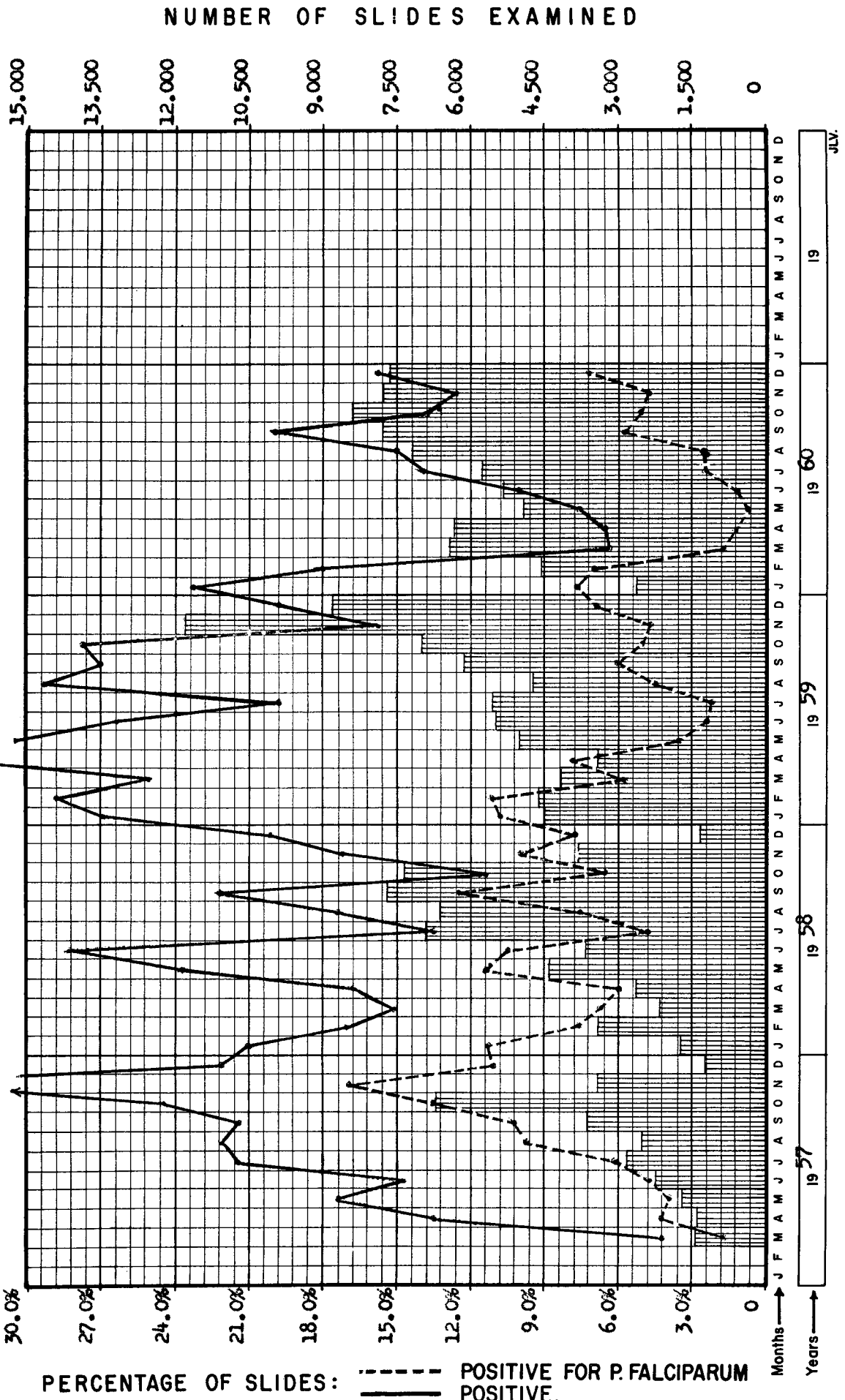


MALARIA ERADICATION PROGRAM

Program: EL SALVADOR

35.7

34.3



PERCENTAGE OF SLIDES:
 - - - - - POSITIVE FOR P. FALCIPARUM
 ———— POSITIVE.

Months → J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
 Years → 19 57 19 58 19 59 19 60 19
 JULY

5. Many new or temporary dwellings.
6. Important population movements in malarious areas with inadequate or no shelter.
7. The habit of many persons to rest or sleep outdoors at night.

It will be noted from Figure 2 that, after the change to DDT, the first full cycle of which was completed in August 1959, there was a marked drop in positivity for both falciparum and vivax malaria, with an upturn for both species of parasite in July-September 1960. The rainy season in 1960 was in fact excessively wet, with 50 per cent more rain than the long-term average. Malaria transmission normally rises during the rainy season, but the 1960 increase for both species of parasite was unexpectedly high, probably due largely to the abnormal rainfall. Another factor contributing to a rising trend in the second half of 1960 was the increased case detection activity concentrated in the most malarious areas of the country. Both active and passive case detection were intensified in these areas and in localities with outbreaks of malaria.

A small number of cases of falciparum malaria continue to be discovered each month in the northern Departments of El Salvador at higher elevations, where most mosquitoes are susceptible to DDT. Only a few of these cases were investigated, but of these a sufficient number were found to have been imported from other Departments to lend support to the assumption that transmission had been stopped in at least some of these higher areas after 2 years of spraying with DDT. The continuous movement of population between highly malarious and "clean" areas is undoubtedly part of the problem. In addition to the intensive epidemiological study of AMRO-220 (discussed in Part III below), which is evaluating the causes of continuing transmission, a pilot study of mass drug treatment, directed especially at the poorly-sheltered migratory workers, has been started in 1961.

The ideal solution would be a new insecticide--safe, long-lasting, and effective against DDT-resistant mosquitoes. While several insecticides are under laboratory study, none is ready as yet for trial in the field.

Figure 3 illustrates a situation which is epidemiologically as well as ecologically intermediate between Mexico and El Salvador--that of Guatemala. Guatemala has some areas of doubly resistant *A. albimanus* but these are much smaller than in El Salvador. The response of malaria after the change from dieldrin to DDT shows up clearly in the graph and provides dramatic evidence of the effectiveness of the measure. The failure of positivity to decline steadily after December 1959 was due to the persistence of transmission in a few problem areas. In Sanarate-El Progreso there was high double resistance on the part of the vector. In Nueva Concepcion and Montufar there was rapid colonization, with many new houses being built. At the Finca Moca, a coffee estate just outside the sprayed area, a very large epidemic occurred in September-October 1960 owing to the sudden development of anopheline breeding in a small lake and the introduction of malaria by migrants from the Nueva Concepcion area.

The problem in Sanarate was first attacked with drug therapy without complete success, and then by larviciding with marked success. The problem at the Finca Moca was handled by a combination of house spraying (the houses had previously been unsprayed), larviciding, and radical treatment of cases. Vivax cases (apparently relapses) continued to be found four months after transmission was presumably stopped.

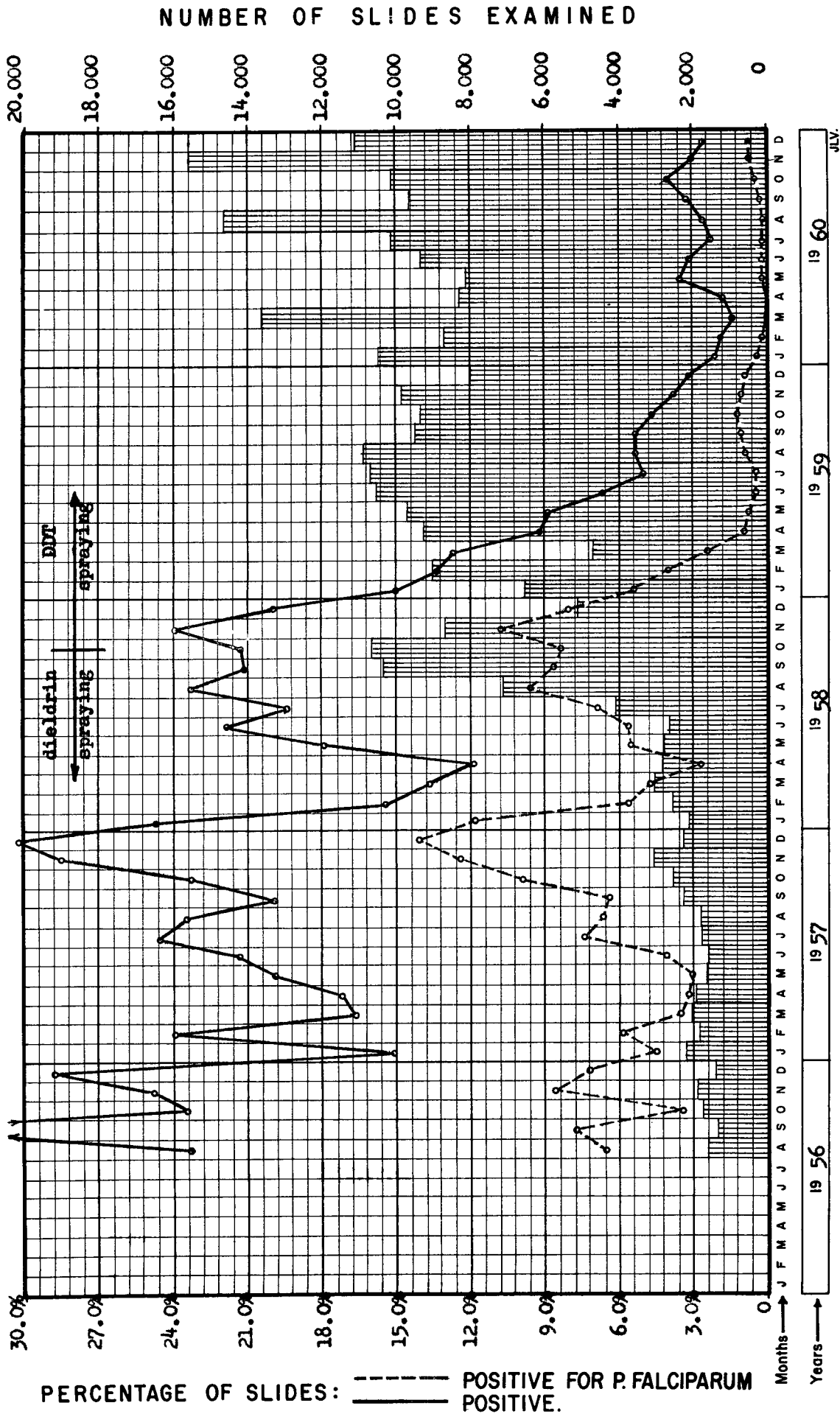
The problem at Nueva Concepcion arises from the rapid construction of new houses between spraying cycles. Here, and in other areas of Guatemala where this phenomenon has occurred, the assignment of sprayers permanently on the site to cover one or more localities has enabled new houses to be sprayed shortly after construction.

Figure 4 shows the trend of malaria in British Honduras and provides an example of what good administration can achieve in the absence of major technical problems. Malaria rates rose to a high level while dieldrin was used, owing to anopheline resistance to the insecticide. The graph shows that falciparum positivity reached zero 13 months after DDT was introduced, with vivax positivity reaching zero 6 months later. One of the few problem localities was a new town where there was rapid construction of new houses. Transmission in the town was halted completely as soon as a sprayer was assigned permanently to the locality to spray all new houses as soon as they were built. Since January 1961 intensive case finding activity has uncovered only two or three cases of malaria per month, and all have thus far been found to be vivax relapses. Radical treatment is curing these.

MALARIA ERADICATION PROGRAM

Program: GUATEMALA

32.5%



PERCENTAGE OF SLIDES: POSITIVE FOR P. FALCIPARUM POSITIVE.

NUMBER OF SLIDES EXAMINED

MALARIA ERADICATION PROGRAM

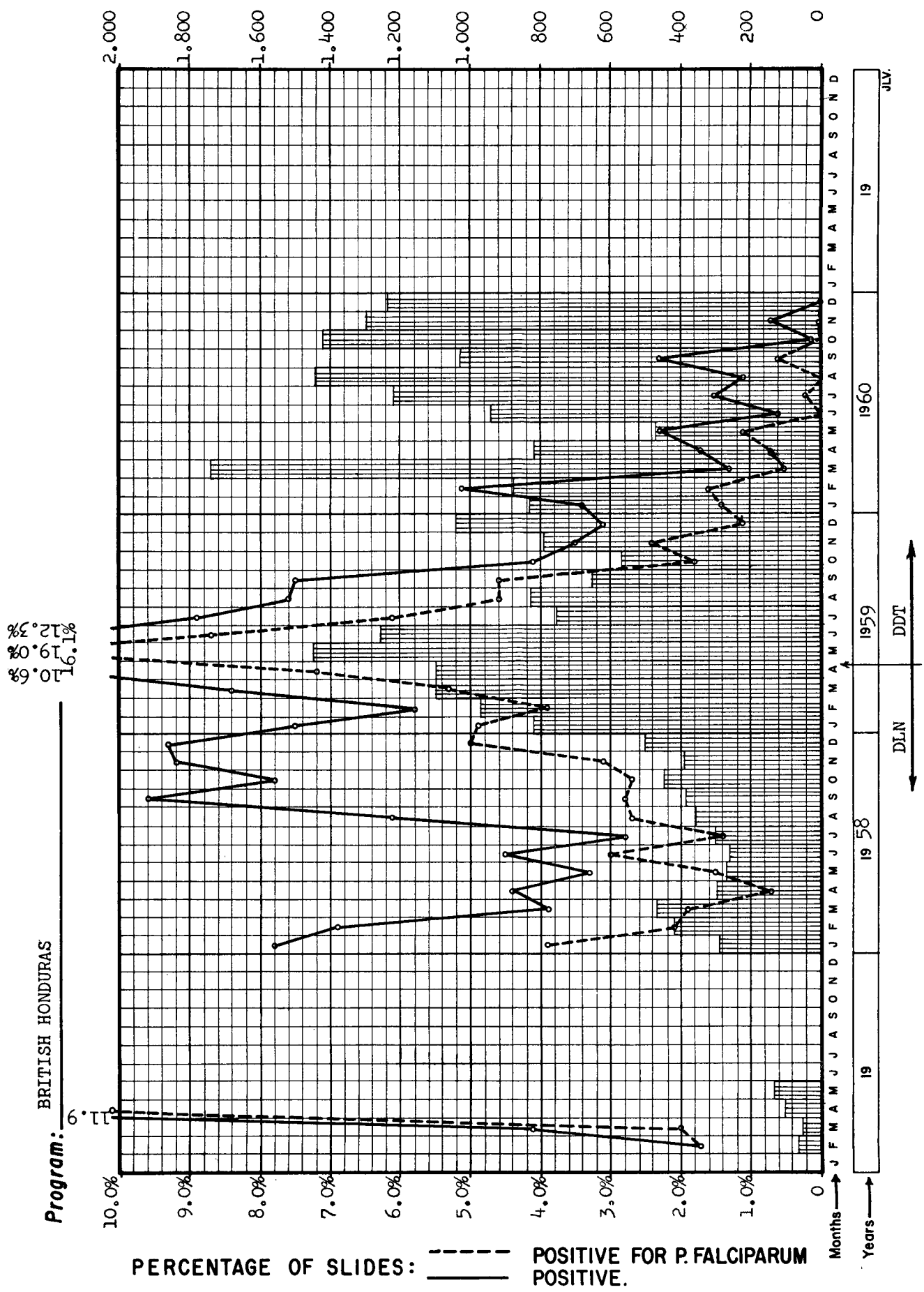


Figure 5 illustrates the trend of malaria in Trinidad (the neighboring island of Tobago has been free of malaria for more than three years and is in the maintenance phase). The principal vector in Trinidad, *A. aquasalis*, was found resistant to dieldrin, and a shift was made to DDT in 1958 with striking results.

Very low transmission persisted in the *A. bellator* area despite an expensive but slow attack on bromeliad breeding sites. Mass drug therapy was begun in this area in December 1959. Although public cooperation has declined somewhat, owing at least in part to the unpleasantness associated with swallowing the number of tablets of chloroquine and primaquine constituting an adult dose, the drug program was nevertheless effective. Only two autochthonous cases were found after March 1960, both in the last week of September 1960. Fortunately, the case detection operation found one of these cases even before any gametocytes had formed, and radical cure was administered to both. No subsequent cases were found in the areas where these autochthonous cases occurred.^{1/}

Figure 6 illustrates the results of a straightforward attack by residual insecticides in Jamaica. Dieldrin resistance was discovered in 1958, and a shift to DDT was made in 1959 with immediate favorable results. By mid-1960, 5 of the island's 14 parishes entered the consolidation phase, followed by parts of 5 more in January 1961; these areas contain 60 per cent of the population of the original malarious portion of Jamaica. Only a few small pockets of persistent transmission remain along the south coast, and these are being attacked with intensified spraying operations, active search for cases, and mass drug treatment of small foci.

Figure 7 illustrates the trend of malaria in Bolivia, where a number of epidemiological problems are associated with population movements. The attack with dieldrin and DDT began in September 1958, and after two years sole reliance was placed on DDT. Supervision has been good, vector response satisfactory, and epidemiological evaluation adequate. As can be seen from the graph, the initial response was excellent but progress since the end of 1959 has been at a much slower rate. There are various reasons for this decreased rate of advance:

Problems arose because of immigration and new housing built between spraying cycles. These have been met by stationing special spray squads in areas receiving large numbers of new farmers. There is some temporary migration from non-malarious to malarious areas during the growing and harvesting of crops, and the rudimentary shelters used by agricultural workers at these seasons are difficult to find and spray on time. The itineraries of spray squads have been adapted to the arrival of agricultural workers in malarious areas. In those problem areas where housing is not well suited to spraying, drug therapy is being considered as a supplementary measure.

There are also some problems related to frequent crossings of the frontier with Brazil. It is anticipated that spraying in these border areas may have to be continued for longer periods than in the remainder of Bolivia. In other parts of the country, however, it was found that at the end of the sixth spray cycle (March 1961) some areas were ready to begin the consolidation phase and spraying was suspended. In large countries with extremes of climate and altitude and a varying "malaria ecology" in different regions, the simultaneous start of the attack phase in all areas should not necessarily be expected to imply simultaneous entry into the succeeding phases of eradication.

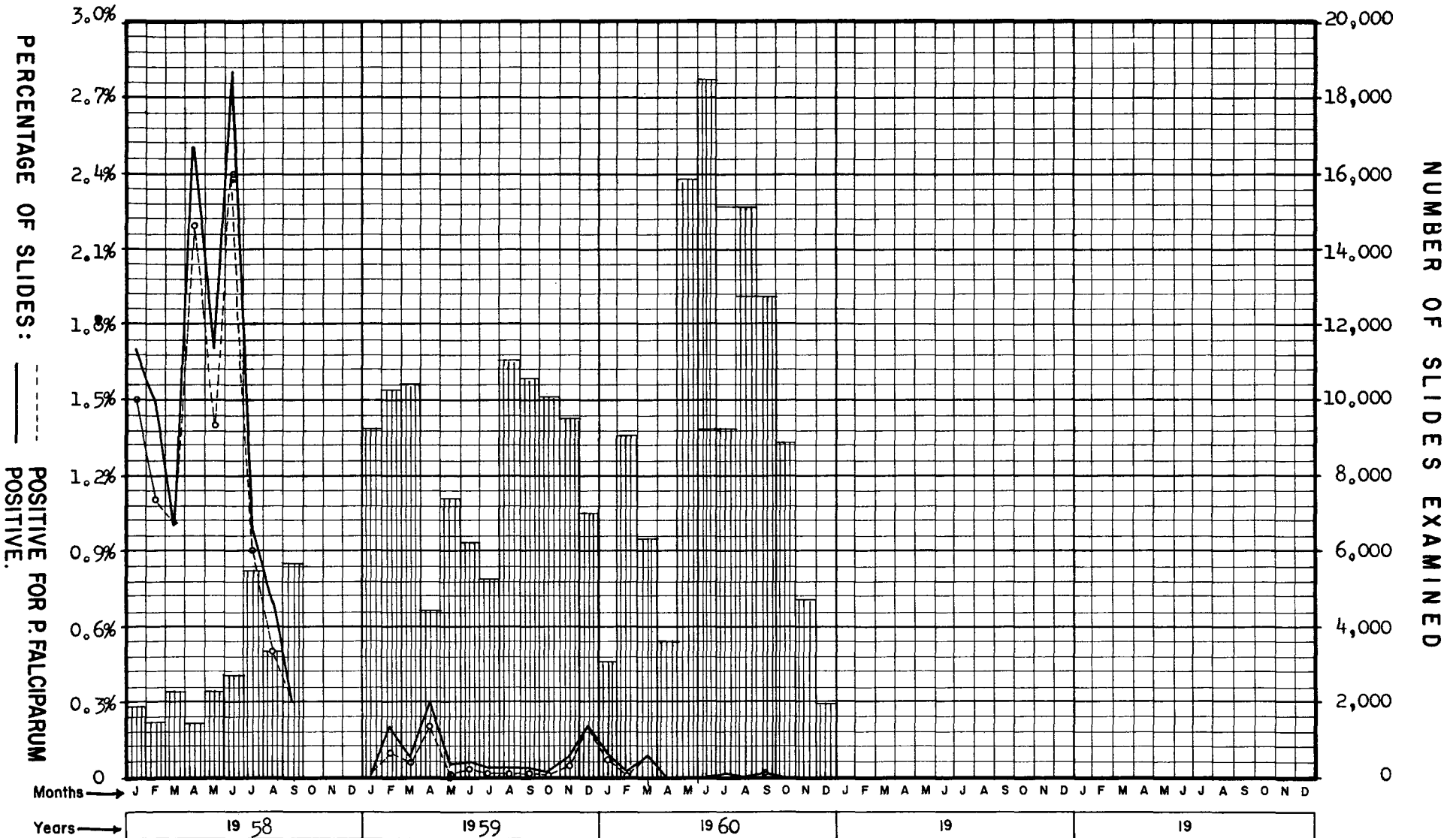
Beginning in May 1960, a few cases of falciparum malaria in the problem area of western Venezuela were noted to be responding poorly to standard doses of chloroquine, (1,500 mg. in three days for an adult). Relapses occurred a few days or a few weeks after this dose, sometimes during a period when it was fairly certain that smaller suppressive doses were being given. A number of cases, with considerable supporting evidence, were studied in the states of Tachira and Trujillo. Some of these were apparently cured by one or more repetitions of the standard dose, others by a fifty per cent increase in the amount of chloroquine given.

At about the same time 2 oil workers who contracted falciparum malaria in the Magdalena Valley in Colombia were found not to respond to 1,500 mg. of chloroquine, even in repeated attempts at treatment. Experimental transfer of the strain from one of these showed in October 1960

^{1/} In 1961, through May, only a single case imported from Africa has been found in Trinidad.

MALARIA ERADICATION PROGRAM

Program: TRINIDAD, TOBAGO.



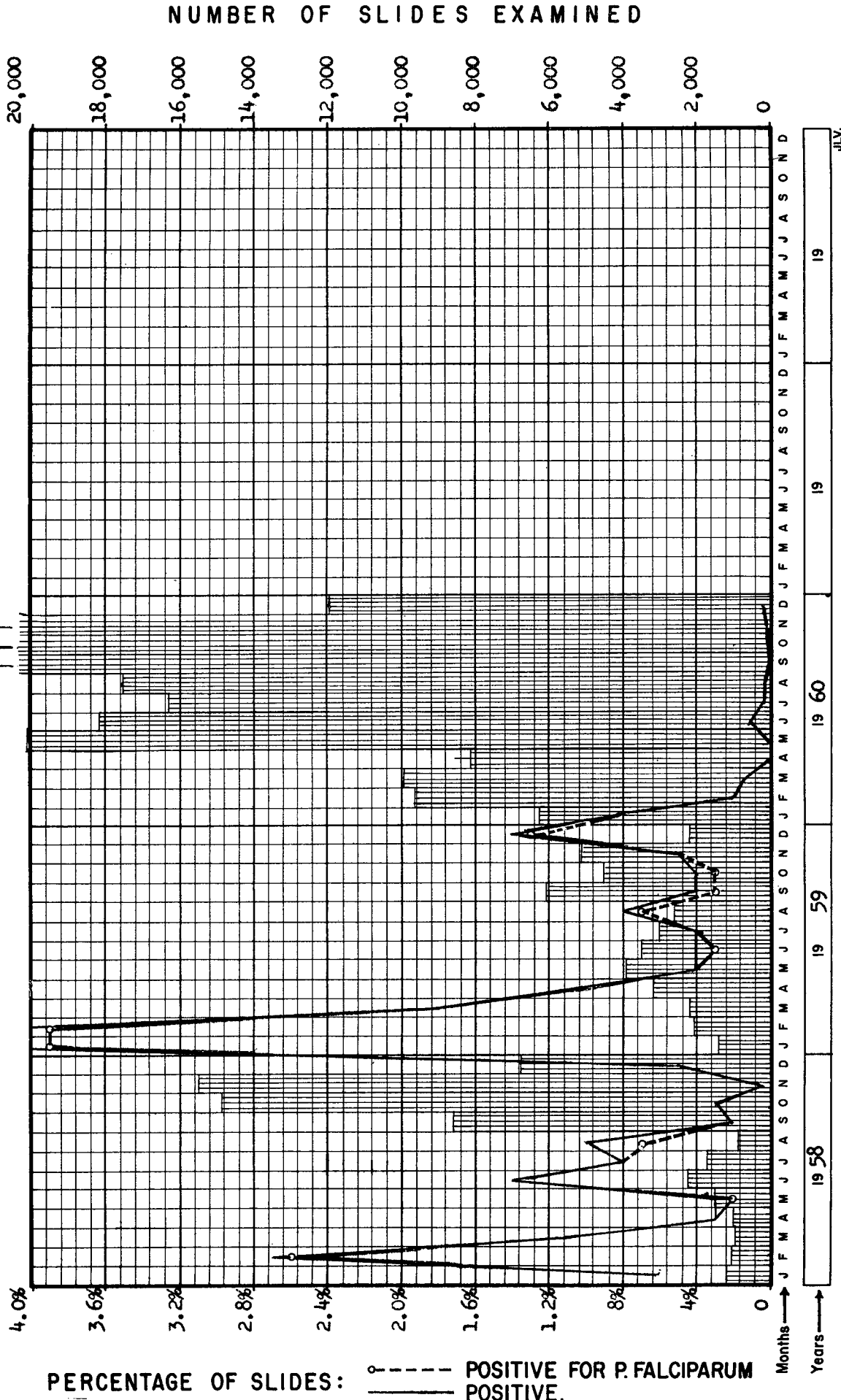
Note: Total percentage positive shown by heavy line. If the percentage positive for *P. falciparum* was less it is shown by a circle and a light broken line.

JLV.

MALARIA ERADICATION PROGRAM

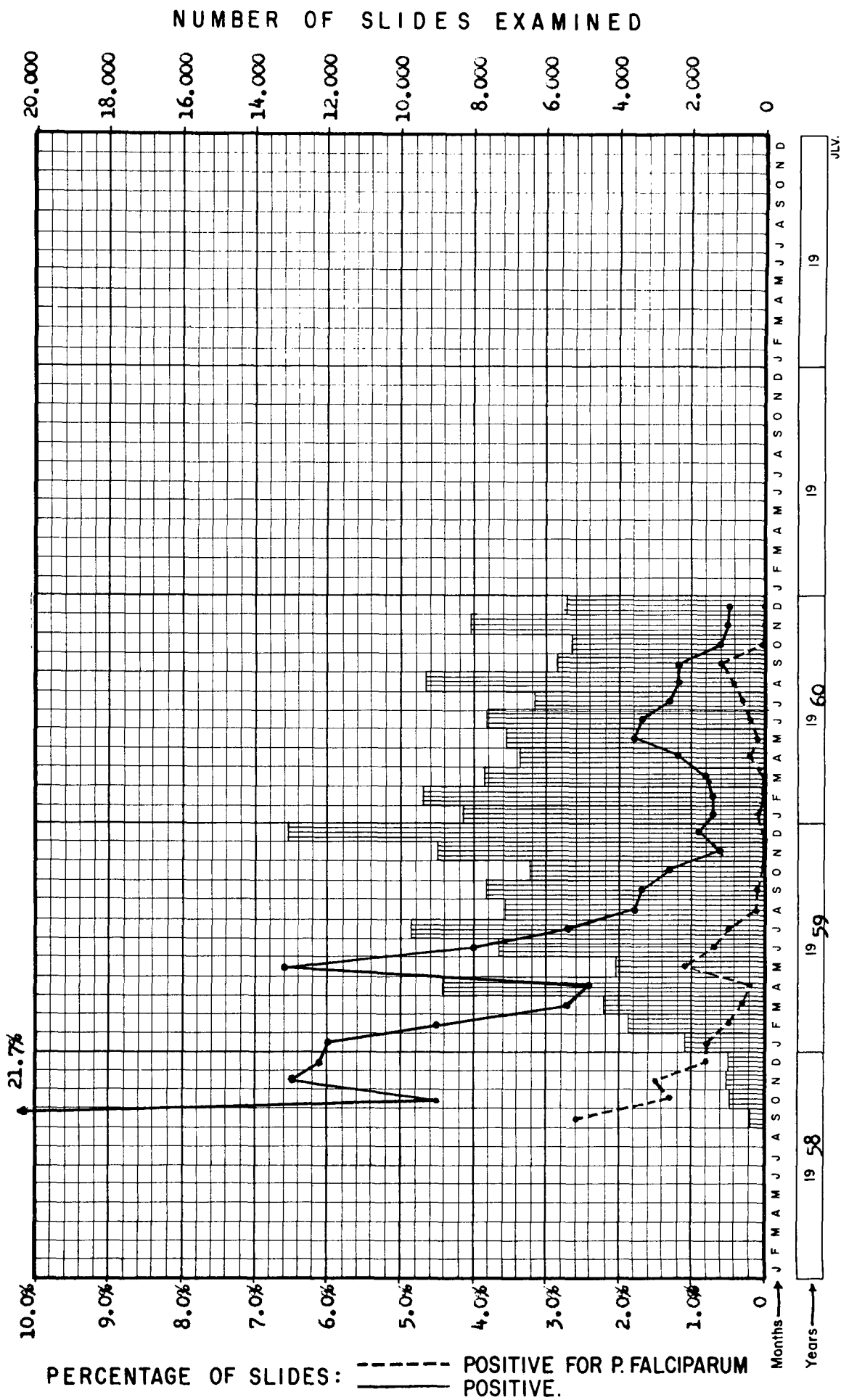
Program: J A M A I C A

21,849
24,976 22,426



MALARIA ERADICATION PROGRAM

Program: BOLIVIA



that this strain was not completely cleared from the blood of volunteers by 1,500 mg. of chloroquine, and subsequently it was shown that camoquin and hydroxychloroquine were equally ineffective. Quinine produced an immediate clinical cure. A plan for search for additional cases in Colombia was developed by the Government and the AMRO-220 project of PAHO. More recently a few cases have been reported from two localities in Brazil, and a survey of the Amazon Valley region was initiated in 1961 to study the extent of the problem and its probable effect on the chloroquinated salt program.

Special epidemiological studies are discussed in Part III below.

B. Entomological problems

During 1960, testing of anophelines for resistance to insecticides was continued with greater emphasis on DDT and reduced numbers of tests for dieldrin resistance. The total number of susceptibility tests performed in 1960 and reported to the Pan American Sanitary Bureau was 386 for DDT, and 210 for dieldrin. This represents information on 447 locality-species, some of which were rechecks but most of which were new findings. Tests were considerably increased in efficiency, and directed toward problem areas and previously untested areas.

During the course of the year, only minor changes appeared in the picture of resistance described in the VIIIth report. Areas formerly known to be resistant remained so. In view of the new areas and species tested, it is remarkable that only 5 countries showed new findings of resistance. It will be seen in Table 15 that 5 of the 6 new findings of resistance involved dieldrin, and these were in countries where dieldrin is not in use. The one new finding of DDT resistance was in A. punctimacula in Honduras.

Table 15
INSECTICIDE RESISTANCE DISCOVERED IN 1960

Country or other political unit	Department	Species of anopheles	Resistance		Month	Investigator
			Per cent	Number tested		
DIELDRIN RESISTANCE						
Colombia	Cordoba	triannulatus	55	150	June	Ferrer et al.
Costa Rica	Puntarenas	albimanus	18	40	October	Vargas and Pach
Ecuador	Guayas	punctimacula	7	100	February	Arellano and Mo
	Los Rios	pseudopunctipennis	16	200	December	Arellano
Trinidad and Tobago	St. George	neomaculipalpus	65	99	September	Omardeen
DDT RESISTANCE						
Honduras	Atlantida	punctimacula	18	65	October	Turcio and Ruiz

Furthermore, with few exceptions, the levels of resistance previously determined remained essentially the same where repeated tests were done. For example, Canton Metalio in Ahuachapan, El Salvador, showed 7 per cent of its A. albimanus resistant to DDT in July 1958, 8 per cent in October 1959, and 10 per cent in December 1960. These differences are within the limits of accuracy of the test when seasonal variation is taken into account. The details of resistance in the Americas are given in Table 16.

Serious resistance to DDT has been found to exist in only 4 countries, El Salvador, Guatemala, Honduras, and Nicaragua.

In two localities in Guatemala, Sanarate and Finca Moca, where breeding was concentrated in a limited area, larviciding with chlorthion, an organophosphorus compound, was introduced in November-December 1960. This procedure was found effective and safe, but it must be repeated at weekly intervals for long periods and, to be effective, it requires thorough coverage. Nevertheless, larviciding will be found useful under favorable conditions in limited areas.

Larviciding with granular Paris Green, and with organophosphorous insecticides, has been tried in a problem area along the shores of Lake Managua near the City of Managua with partial and temporary benefit.

With the progress of the spray program, the size and nature of problem areas have become progressively clearer. In most of these, the failure to halt transmission has been due to a combination of factors, among which are resistance to insecticides, poor housing with incomplete walls accompanied by a high anopheline density, the habits of the people who rest or sleep out of doors, migration, new land development, and alteration of sprayed surfaces.

One locality in Nicaragua (Condega) provided nearly a third of the known cases for the country during the year 1960. It is located in an area in which A. albimanus is highly resistant to both dieldrin and DDT. For highway improvements in the area, gravel was taken from the flood plain of the Esteli River in front of town. Water from the river infiltrated the borrow-pits, with a marked increase in anopheline breeding, and an explosive epidemic resulted. Chemotherapeutic measures, larviciding, and filling of the borrow-pits brought the situation under control.

In several countries problem areas centered in rural regions where many new houses were built between spray cycles. As mentioned above, the assignment of permanent spraymen or squads to spray new houses as soon as they are built has been effective in some of these areas.

With the delineation of areas that are not responding well to programs of wall spraying, it has become necessary to examine more closely all facets of mosquito ecology and insecticide performance in the problem areas. For this reason increased attention has been paid to other aspects of mosquito behavior in addition to resistance. Entomologists are being encouraged to measure anopheline density, biting rates inside and outside of houses, wall and outdoor resting habits, manifestations of irritability to DDT, etc.

Reports have been received from Nicaragua and El Salvador that resistant A. albimanus were often found resting with impunity for many hours on sprayed surfaces. On investigation, very few mosquitoes could be found resting on surfaces which had certainly been sprayed, while much larger numbers were found in unsprayed houses or on unsprayed or altered surfaces. DDT has been having a considerable effect even here, and there is reason to think that, under many conditions, DDT resistance alone will not prevent the successful outcome of a spray program.

Irritability to DDT is another factor of potentially serious importance, particularly where walls are incomplete, or full of wide cracks, as many are in rural America. Observations on irritability and wall conditions have been made in the course of bio-assay work and are continuing. A special study in Nicaragua showed that of 125 highly resistant mosquitoes, 39 left a DDT sprayed room in the first 8 hours, and 35 of these survived. Five of the 125 were still on the walls alive after 20 hours, and 81 were either dead or unaccounted for.

An irritability study in Panama was completed during the year, with a conclusion that irritability had not changed as a result of the spray program, but was present initially. Although irritability exists in most mosquito populations, from a practical standpoint it has not prevented eradication of

Table 16

SUMMARY OF RESISTANCE TO INSECTICIDES OF AMERICAN ANOPHELINES, TO 31 DECEMBER 1960;
RESULTS IN MAJOR ADMINISTRATIVE SUBDIVISIONS, BY COUNTRY AND SPECIES

Country or other political unit	Number of major administrative subdivisions in the malarious area ¹										
	Total	No. tested	Species of anopheline	Number of major administrative subdivisions showing test results with:							
				Degree of resistance to DDT				Degree of resistance to dieldrin			
				None (0-3%)	Low (3-10%)	Mod. (11-40%)	Marked (41-100%)	None (0-3%)	Low (3-10%)	Mod. (11-40%)	Marked (41-100%)
Bolivia	8	6	darlingi pseudopunct. others ^a	3 3 3	- - -	- - -	- - -	3 3 3	- - -	- - -	- - -
Brazil	25	9	aquasalis darlingi others ^b	6 1 4	- - -	- - -	- - -	3 1 -	- - -	1 - -	- - -
Colombia	17	8	albimanus albitarsis darlingi triannulatus others ^d	2 2 2 3 4	- - - - -	- - - - -	- - - - -	1 - 2 2 3	- 1 - - -	1 - - - -	- 1 - 1 ^c -
Costa Rica	7	3	albimanus punctimacula	3 1	- -	- -	- -	2 1	- -	1 ^c -	- -
Cuba	3	5	albimanus	5	-	-	-	2	-	1	1
Dominican Republic	23	12	albimanus crucians	12 4	- -	- -	- -	1 -	2 -	- -	5 -
Ecuador	17	8	albimanus pseudopunct. punctimacula	5 3 3	- - -	- - -	- - -	1 3 2	- - 1	1 - -	4 1 ^c -
El Salvador	14	12	albimanus pseudopunct.	2 1	1 -	2 -	6 -	- -	- -	- -	5 -
Guatemala	20	12	albimanus pseudopunct. vestitipennis	9 1 2	- - -	- - -	3 - -	1 1 1	- - -	- - -	6 1 ^c -
Haiti	5	4	albimanus	3	-	-	-	-	3	-	1
Honduras	17	12	albimanus pseudopunct. punctimacula others ^e	7 3 - 3	- - - -	3 - 1 ^c -	2 - - -	- - - -	- - - -	1 - - -	3 - - -
Mexico	28	18	albimanus pseudopunct. quadrimacul. others ^f	12 16 1 2	- - - -	- - - -	- - 1 -	10 6 1 1	- 1 - -	1 3 - -	1 2 1 -
Nicaragua	17	12	albimanus pseudopunct.	5 3	- 1	1 -	5 -	- 3	3 -	- -	6 1

- None.

(a) Albitarsis, noroestensis, oswaldoi, rangeli, and triannulatus. (b) Albitarsis, bellator, cruzii, galvaoui, intermedius, rondoni, and strodei. (c) New finding in 1960. (d) Braziliensis, nufeztovari, oswaldoi and punctimacula.

(e) Darlingi and vestitipennis. (f) Aztecus and vestitipennis.

Table 10 (Concluded)

SUMMARY OF RESISTANCE TO INSECTICIDES OF AMERICAN ANOPHELINES, TO 31 DECEMBER 1960,
RESULTS IN MAJOR ADMINISTRATIVE SUBDIVISIONS, BY COUNTRY AND SPECIES

Country or other political unit	Number of major administrative subdivisions in the malarious area										
	Total	No. tested	Species of anopheline	Number of major administrative subdivisions showing test results with:							
				Degree of resistance to DDT				Degree of resistance to dieldrin			
				None (0-3%)	Low (3-10%)	Mod. (11-40%)	Marked (41-100%)	None (0-3%)	Low (3-10%)	Mod. (11-40%)	Marked (41-100%)
Panama	10	5	albimanus	3	-	-	-	4	-	-	-
			aquasalis	-	-	-	-	1	-	-	-
			pseudopunct.	-	-	-	-	1	-	-	-
			others ^a	2	-	-	-	2	-	-	-
Paraguay	11	13	albitarsis	5	-	-	-	9	-	-	-
			darlingi	2	-	-	-	2	-	-	-
			others ^b	3	-	-	-	6	-	-	-
Peru	23	22	albimanus	4	-	-	-	5	-	-	-
			pseudopunct.	14	1 ^c	-	-	9	2	2	1
			others ^d	3	-	-	-	3	-	-	-
Venezuela	23	12	albimanus	1	-	-	-	1	-	-	-
			albitarsis	3	-	-	-	-	2	-	1
			aquasalis	4	-	-	-	3	-	-	1
			strodel	-	1 ^c	-	-	-	-	-	1
			triannulatus	1	-	-	-	-	-	-	1
			others ^e	5	-	-	-	5	-	-	-
British Honduras	6	5	albimanus	5	-	-	-	-	-	1	1
French Guiana	1	1	aquasalis	1	-	-	-	1	-	-	-
Jamaica	12	10	albimanus	3	-	-	-	3	3	2	1
Surinam	7	1	aquasalis	1	-	-	-	1	-	-	-
Trinidad and Tobago	2	2	aquasalis	2	-	-	-	-	-	1	1 ^f
			neomaculipalp.	1	-	-	-	-	-	-	1 ^f

- None.

- (a) Apicimacula, neomaculipalpus, punctimacula, strodel, and triannulatus. (b) Braziliensis, parvus, rangeli and triannulatus. (c) Vigor tolerance. (d) Benarrochi, darlingi, noroestensis, rangeli, and triannulatus. (e) Apicimacula, darlingi, nuñeztovari, oswaldoi, and rangeli. (f) New finding in 1960.

malaria by means of DDT. Eradication is progressing well, e.g., in Jamaica, British Honduras, and parts of Guatemala where irritability is known to exist. The combination of irritability and resistance does reduce the efficacy of wall sprays, so that there is less margin of effectiveness to compensate for other obstacles, such as outdoor biting, incomplete spraying, new houses, wall alterations, etc. The relationship between irritability and acquisition of a lethal dose of DDT is under study.

Indubitably, the most difficult problem areas are those parts of El Salvador, Nicaragua, Honduras, and Guatemala where vectors not only show high resistance to DDT, but where there is considerable migration and construction of new housing. Research on new insecticides to replace DDT in resistant areas was stimulated and coordinated by WHO and PAHO during the year. Several new discoveries in this field show promise and, if toxicity studies are satisfactory, one carbamate compound may be put into field trials by the end of 1961.

Other entomological developments within country programs include a highly successful pilot study of insecticidal treatment of mosquito bed nets in Peru, a method which produced a very sharp reduction in malaria rates.

III. INTERNATIONAL COOPERATION

Table 17 shows the number and type of personnel of the Organization assigned to country, inter-country, and inter-zone projects. The increased number of medical officers, entomologists, and other personnel over the four years shown reflects increased activity in epidemiological evaluation.

Entomological research has been undertaken by a regional insecticide testing team (AMRO-196) which was organized in 1960. Work is going on in El Salvador and Bolivia under the direction of an entomologist in each country. Each country section is available to test immediately any new insecticide that shows promise. The El Salvador section has begun controlled studies to determine more accurately the duration of residual effectiveness of DDT against A. albimanus at doses of 1 and 2 grams per square meter on various types of wall surface. Tests are performed with susceptible and resistant strains of this vector on both fresh and previously sprayed surfaces. By mid 1961 1715 wall tests had been performed and it was already evident that 2 grams of DDT per square meter could not be counted on to maintain residual effect for more than six months on certain types of mud walls.

The El Salvador section also made basic observations of the characteristics of resistant mosquitoes, their biology, and their response to selection pressure. Two colonies are maintained for continuing large-scale wall tests, one susceptible and one resistant. Numerous observations were made of the density and resistance of wild mosquitoes.

The Bolivia section of the team was planned to study the effect of various doses and cycles of DDT on two other important vectors, A. darlingi and A. pseudopunctipennis. Its headquarters and laboratory were set up in Santa Cruz in November 1960. Four experimental areas, each containing houses of different types of building material, were selected and are currently receiving wall tests to measure existing toxicity prior to experimental spraying. Attempts to colonize the two vector species have not yet been successful. A. pseudopunctipennis has never been colonized successfully, but new methods are to be tried out.

In addition to organizing AMRO-196, the Organization has provided financial support under contract for research conducted in the laboratory of the School of Hygiene and Public Health of the Johns Hopkins University. The studies have been concerned principally with the genetic aspects of resistance in A. albimanus. Hybrids of resistant and susceptible strains were studied, together with back-crosses of the hybrids with pure stock. Dieldrin resistance in A. albimanus appears to be fully dominant over susceptibility. The laboratory also maintains a source of several strains of A. albimanus for supplying other research workers.

As countries approach the consolidation phase, epidemiological investigations of scattered cases, and of foci of persisting transmission, assume an increasing importance for the successful completion of eradication. It is desirable that personnel become familiar, as rapidly as possible, with the techniques employed in such investigations, and that they have early opportunities to gain experience in making the types of epidemiological judgments which will be so critical in the later phases. Following

Table 17

PASE/WHO FULL-TIME PROFESSIONAL AND TECHNICAL STAFF ASSIGNED TO COUNTRY, INTER-COUNTRY AND INTER- ZONE MALARIA ERADICATION PROJECTS IN THE AMERICAS, 1958 TO 15 JUNE 1961

Country or other political unit	Medical Officers				Sanitary Engineers				Sanitary Inspectors				Entomologists				Other			
	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961	1958	1959	1960	1961
Bolivia.....	1	1	1	2	1	1	1	1	3	4	4	4	-	-	-	-	-	-	-	-
Brazil ^a	1	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
São Paulo.....	-	-	-	-	1	1	1	1	2	3	3	3	-	-	-	-	-	-	-	-
Colombia.....	1	2	2	2	1	1	1	1	4	6	6	5	-	-	-	1	1 ^b	1 ^b	1 ^b	1 ^b
Costa Rica.....	1	1	1	1	-	-	-	-	1	1	1	2	-	-	-	-	-	-	-	-
Cuba.....	-	1	1	1	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-
Dominican Republic.....	1	1	1	1	1	1	1	1	2	3	3	3	-	-	-	-	-	-	-	-
Ecuador.....	1	1	1	2	1	1	1	1	2	4	4	4	-	-	-	-	-	-	-	-
El Salvador.....	1	1	1	1	1	1	1	1	1	2	2	2	-	-	-	-	-	-	-	1 ^c
Guatemala.....	1	1	1	1	-	1	1	1	2	3	2	3	-	-	-	-	-	-	-	-
Haiti.....	2	-	-	1	1	-	-	1	3	2	2	2	-	-	-	-	3 ^d	2 ^e	1 ^f	-
Honduras.....	1	1	1	1	-	1	1	1	1	2	2	2	-	-	-	-	-	-	-	-
Mexico.....	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	-	-	1 ^g	2 ^h
Nicaragua.....	1	1	1	1	-	1	1	1	1	2	2	2	-	-	-	-	-	-	-	1 ^c
Panamá.....	1	1	1	1	1	1	1	-	1	2	2	2	-	-	-	1	-	-	-	-
Paraguay.....	1	-	1	1	1	1	1	1	1	2	2	2	-	-	-	-	-	-	-	-
Perú.....	1	1	1	1	1	1	1	1	3	5	5	5	-	-	-	-	-	-	-	-
British Honduras.....	-	1	1	1	-	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-
Jamaica.....	1	1	1	1	1	1	1	-	2	1	2	2	-	-	-	-	-	-	1 ⁱ	1 ⁱ
Surinam.....	1	-	1	1	-	-	-	-	1	2	2	2	-	-	-	-	-	-	-	-
Windward Islands ^h	-	-	-	-	-	-	-	-	2	2	2	2	-	-	-	-	-	-	-	-
Inter-zone or Inter-country projects.....	6	9	9	9	3	4	3	3	2	3	1	1	3	4	6	7	3	11 ^j	14 ^k	13 ^l
Total.....	24	25	27	31	16	19	18	18	35	52	49	51	4	5	7	10	7	14	18	19

- None.

(a) Excluding São Paulo State. (b) Malaria statistician. (c) Entomological aid.

(d) One health educator and two administrative officers. (e) Administrative officers. (f) Entomological assistant.

(g) Assistant engineer. (h) One assistant engineer and one health educator. (i) Health educator.

(j) Three administrative officers, one laboratory technician, two parasitologists, and five entomological assistants.

(k) Six administrative officers, two parasitologists, two assistant entomologists, and four entomological assistants.

(l) Six administrative officers, two parasitologists, one assistant entomologist, two entomological assistants, one laboratory technician and one statistician.

the Seminar on Malaria Eradication Evaluation Techniques held in Brazil, November 29-December 7, 1959, all medical officer advisors of PAHO were directed to begin field epidemiological investigations as a training technique, and to submit reports for critical review. National staff were encouraged to do so as well. The review of such reports has permitted comments of benefit to the individual programs, and, where applicable to all, has led to the issuance of a series of information bulletins during 1961.

Special epidemiological research has been carried on by the regional team AMRO-220, which began its activities in May 1960. The team studied a problem area in Costa Rica, relating continuing transmission there to the construction of new houses and to the open-type construction of the houses. It also made a preliminary analysis of epidemiological data in El Salvador, participated in the planning of a program for the study of chloroquine-resistant strains of *P. falciparum* in Colombia, and analyzed the results of special work directed by the Zone III entomologist in Nicaragua.

In February 1961 groundwork was started for a comprehensive one-year study of the factors relating to continuing transmission of malaria in El Salvador. Two study areas were chosen, one with resistant and one with susceptible vectors. A field laboratory was established in Sonsonate, and personnel were recruited and trained. Observations began in April 1961, and included a detailed study of the inhabitants of the study areas, their houses, and the entomological situation. Individual records are kept on every illness of each person, and frequent blood surveys are made together with regular weekly observations of the mosquito population.

Table 18 shows the number of persons trained in malaria eradication techniques at international centers. Owing to previous efforts made in the Americas (from 1949 through 1960 a total of 443 persons from the Region were trained at the centers shown) the number of persons from this Region presently receiving training is rather low, and none were trained in Mexico and Brazil during the first half of 1961. At present the Jamaica malaria eradication training center is the most active. It is supported cooperatively by the Government of Jamaica, the Pan American Sanitary Bureau, and ICA, and--since instruction is given in English--the majority of students come from other WHO Regions. Venezuela continued in 1961 its tradition of offering fellowships to professionals from the countries of the Americas for whom the Pan American Health Organization provides the costs of international travel.

It should be noted that formal training in malaria eradication work is usually followed by visits to operating eradication programs for field observation. In the organization of these study visits, the various National Malaria Eradication Services of the Americas have offered excellent and continuing cooperation to the international agencies concerned.

Table 19 shows fellowships for study travel awarded by the Pan American Health Organization. These are usually granted to senior officials in malaria eradication for the purpose of visiting other national services. In addition to formal fellowships and study visits, it should be noted that the Organization encourages border meetings and regional conferences which provide numerous opportunities for exchanges of views at an international level. Border meetings between Surinam and French Guiana; El Salvador, Guatemala, and Honduras; Mexico and Guatemala; Argentina and Bolivia; Colombia and Venezuela; Peru and Bolivia, as well as a meeting of Directors of Malaria Services of Mexico, Central America, and Panama in El Salvador were held in 1960.

Table 20 shows the antimalarial drugs distributed by the Pan American Health Organization. Chloroquine, primaquine, and pyrimethamine continued to be supplied in separate tablets, and in 1961 some tablets containing camoquin and primaquine were provided for mass drug therapy in Trinidad. In 1960 and early 1961, the Bureau also provided a total of 1,520 pounds (690 kg.) of chloroquine diphosphate powder for the medicated salt program of British Guiana.

Table 21 shows equipment and supplies other than drugs contributed by the Pan American Health Organization to malaria eradication programs in the Americas. These are generally of modest importance, and serve to supplement the major contributions of UNICEF and ICA. Requirements vary with the operational status of the eradication campaign in the different countries, and as more and more areas approach the consolidation phase the need for protective equipment and insecticides tends to decline, while laboratory supplies become correspondingly more important. In addition to supplying laboratory equipment, the Organization has continued to give wide distribution to its Manual of the Microscopic Diagnosis of Malaria (Scientific Publication No. 46) which was published in March 1960.

Table 18

PERSONNEL TRAINED IN MALARIA ERADICATION TECHNIQUES AT INTERNATIONAL CENTERS, 1949-1960 AND FIRST SEMESTER OF 1961^a

Country or other political unit	Total	Venezuela				Mexico			Jamaica							Brazil					
		1949-1960		1961		1957-1960			1958-1960 ^b				1961			1958-1960					
		Physicians	Sanitary Engineers	Physicians	Sanitary Engineers	Physicians	Sanitary Engineers	Sanitary Inspectors	Physicians	Sanitary Engineers	Sanitary Inspectors	Entomologists	Other	Physicians	Sanitary Engineers	Sanitary Inspectors	Entomologists	Other	Physicians	Sanitary Engineers	Entomologists
Argentina.....	19	2	1	-	-	4	3	7	-	-	-	-	-	-	-	-	-	-	1	-	1
Bolivia.....	33	8	6	1	1	3	6	5	-	-	-	-	-	-	-	-	1	-	-	-	2
Brazil.....	61	10	1	1	-	19	16	13	1	-	-	-	-	-	-	-	-	-	-	-	-
Chile.....	6	1	-	-	-	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
Colombia.....	68	26	5	3	-	11	7	5	-	-	-	-	-	-	-	-	-	4	3	-	4
Costa Rica.....	11	3	1	-	-	1	1	4	-	-	-	-	-	-	-	-	-	-	-	-	1
Cuba.....	13	3	1	-	-	5	1	2	-	-	-	-	-	-	-	-	-	-	-	-	1
Dominican Republic.....	5	2	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ecuador.....	14	5	-	1	1	1	-	4	-	-	-	-	-	-	-	-	-	-	1	1	1
El Salvador.....	13	1	-	-	-	2	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Guatemala.....	23	2	1	1	-	2	3	12	-	-	-	-	-	-	-	-	-	-	-	-	2
Haiti.....	21	4	1	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	-	-	-
Honduras.....	15	-	2	-	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	1
Mexico.....	29	14	10	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Nicaragua.....	11	2	1	-	-	2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Panama.....	13	1	-	-	-	1	1	9	-	1	-	-	-	-	-	-	-	-	-	-	-
Paraguay.....	17	3	-	1	1	2	-	9	-	-	-	-	-	-	-	-	-	-	1	-	-
Peru.....	38	3	2	-	-	9	7	12	1	-	1	-	-	-	-	-	-	-	-	-	3
Puerto Rico.....	14	-	1	-	-	-	-	1	-	-	12	-	-	-	-	-	-	-	-	-	-
United States of America...	30	-	-	-	-	-	2	1	1	7 ^c	9	2	2	1 ^d	-	2 ^d	3 ^e	-	-	-	-
Uruguay.....	3	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Venezuela.....	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
British Guiana.....	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
British Honduras.....	6	-	-	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-	-	-	-
Dominica.....	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Surinam.....	6	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-
Other W. H. O. regions...	167	2	-	-	-	1	-	-	58	35	17	20	24	5 ^f	3 ^d	-	2 ^g	-	-	-	-
Total.....	639	93	33	8	3	66	51	137	62	43	42	22	26	6	3	8	4	4	5	5	18

- None.

(a) Excluding nationals of the host country. (b) 74 sponsored by ICA and 72 by WHO. (c) Five sponsored by ICA.

(d) Sponsored by ICA. (e) Two sponsored by ICA and one by PASB. (f) Sponsored by WHO.

(g) One sponsored by WHO and one by ICA.

Table 19

FELLOWSHIPS FOR STUDY TRAVEL IN MALARIA ERADICATION, 1957-1960^a

Country or other political unit	Total	Physicians				Engineers		Entomologists			Other		
		1957	1958	1959	1960	1957	1960	1957	1958	1959	1958	1959	1960
Brazil.....	20	-	9	2	3	-	2	-	3	1	-	-	-
Chile	1	-	-	-	1	-	-	-	-	-	-	-	-
Colombia.....	5	1	1	-	1	1	-	-	1	-	-	-	-
Costa Rica.....	2	-	1	-	-	1	-	-	-	-	-	-	-
Cuba.....	3	-	-	1	2	-	-	-	-	-	-	-	-
Dominican Republic.....	1	1	-	-	-	-	-	-	-	-	-	-	-
Ecuador.....	1	-	-	-	1	-	-	-	-	-	-	-	-
El Salvador.....	2	-	-	-	-	1	-	-	-	-	-	-	1 ^b
Guatemala	2	-	-	-	-	-	-	2	-	-	-	-	-
Haiti.....	7	-	2	-	2	-	-	-	-	-	2 ^b	-	1 ^c
Honduras.....	4	1	-	-	-	1	-	1	-	-	1 ^d	-	-
Mexico.....	9	1	3	-	1	2	-	1	-	1	-	-	-
Nicaragua.....	2	1	-	-	-	1	-	-	-	-	-	-	-
Panama	1	-	-	-	-	1	-	-	-	-	-	-	-
Paraguay.....	2	-	-	-	-	1	-	-	-	-	1 ^e	-	-
Perú.....	3	-	-	-	-	1	-	2	-	-	-	-	-
Venezuela.....	4	-	3	-	1	-	-	-	-	-	-	-	-
British Guiana.....	4	-	-	-	-	-	-	-	-	-	-	4 ^f	-
Dominica.....	2	-	-	-	-	-	-	-	-	-	1 ^b	-	1 ^b
Grenada	2	-	-	-	-	-	-	-	-	-	1 ^b	-	1 ^b
Guadeloupe.....	1	-	1	-	-	-	-	-	-	-	-	-	-
Jamaica	2	2	-	-	-	-	-	-	-	-	-	-	-
Surinam	3	1	-	-	-	-	-	-	-	-	2 ^g	-	-
Trinidad and Tobago.....	2	1	-	-	-	-	-	-	-	-	1 ^b	-	-
Total	85	9	20	3	12	10	2	6	4	2	9	4	4

- None.

(a) In the years not shown, no fellowships were awarded. (b) Laboratory technicians. (c) Statistician. (d) Chemist. (e) Accountant. (f) Three laboratory technicians and one pharmacist. (g) One sanitary inspector and one laboratory technician.

Table 20

DRUGS PROVIDED FOR MALARIA ERADICATION PROGRAMS IN THE AMERICAS BY PAHO, 1958-1960
(In thousands of tablets)

Country or other political unit	1958-1959				1960				Total			
	Chloro- quine 150 mg.	Primaquine		Pyri- thamine 25 mg.	Chloro- quine 150 mg.	Primaquine		Pyri- thamine 25 mg.	Chloro- quine 150 mg.	Primaquine		Pyri- thamine 25 mg.
		15 mg.	5 mg.			15 mg.	5 mg.			15 mg.	5 mg.	
Argentina.....	1 144	20	-	97	-	15	15	200	1 144	35	15	297
Bolivia.....	1 270	25	20	76	349	-	-	-	1 619	25	20	76
Brazil ^a	18 853	270.5	130	-	-	-	-	-	18 853	270.5	130	-
São Paulo.....	2 143	37.5	-	184	-	-	-	-	2 143	37.5	-	184
Colombia.....	7 837	137.5	-	664	-	-	-	-	7 837	137.5	-	664
Costa Rica.....	589	9	6	28	-	2	-	70	589	11	6	98
Cuba.....	50	-	-	-	-	8	2	-	50	8	2	-
Dominican Republic.....	2 234	39	164	10	-	-	-	-	2 234	39	164	10
Ecuador.....	2 129	48.5	20	140	-	100	100	-	2 129	148.5	120	140
El Salvador.....	1 520	76.5	50	128	-	-	-	-	1 520	76.5	50	128
Guatemala.....	1 088	34	30	92	1 400	248	-	-	2 488	282	30	92
Haiti.....	3 277	57.5	-	280	-	-	-	-	3 277	57.5	-	280
Honduras.....	1 026	21	6	88	-	10	8	-	1 026	31	14	88
Mexico.....	3 000	42	70	300	4 500	210	90	100	7 500	252	160	400
Nicaragua.....	827	17.5	6	72	-	-	-	-	827	17.5	6	72
Panama.....	1 128	32.5	20	60	200	5	-	50	1 328	37.5	20	110
Paraguay.....	560	10	-	48	-	15	5	-	560	25	5	48
Peru.....	2 302	55.5	30	196	830	25	10	-	3 132	80.5	40	196
British Guiana.....	-	-	-	55	10	1	-	205	10	1	-	260
British Honduras.....	96	3	2	6	89	4	-	-	185	7	2	6
Dominica.....	50	1	-	4	-	-	-	41	50	1	-	45
Grenada.....	23	0.5	-	30	20	-	-	15	43	0.5	-	45
Jamaica.....	1 030	18	-	88	-	-	-	200	1 030	18	-	288
St. Lucia.....	48	1	-	60	20	-	-	10	68	1	-	70
Surinam.....	301	7	10	35	325	2	-	212	626	9	10	247
Trinidad and Tobago.....	2 300	1 000	970	100	470	408	-	20	2 770	1 408	970	120
Total.....	54 825	1 964	1 534	2 841	8 213	1 053	230	1 123	63 038	3 017	1 764	3 964

- None.

(a) Excluding the State of São Paulo.

Table 21
EQUIPMENT AND SUPPLIES, EXCLUDING DRUGS, CONTRIBUTED BY PAHO TO MALARIA ERADICATION
PROGRAMS IN THE AMERICAS, 1958 TO DECEMBER 1960

Country or other political unit	Protective equipment						Laboratory supplies						Others				
	Helmets	Bands	Visors	Gloves	Ponchos	Life-jackets	Mailing tubes	Surgi-tubes	Plastic tubes	Microscopes	Slides (gross)	Giemsa (grams)	Vehicles	Motors	DDT (lbs.)	Dieldrin (lbs.)	Kerosene (imp. gallons)
Argentina.....	-	-	-	-	-	-	6 000	10	20	-	-	-	-	-	-	-	-
Bolivia.....	50	180	160	40	80	55	10 000	10	20	-	-	-	3 ^a	-	-	-	-
Brazil.....	-	-	-	-	-	45	83 000	20	40	71	-	-	2 ^a	-	-	-	-
Colombia.....	-	-	-	-	-	450	100 000	10	20	1	-	-	-	-	-	-	-
Costa Rica.....	-	-	-	-	-	35	500	10	20	-	-	-	-	-	-	-	-
Cuba.....	-	-	-	-	-	-	5 000	20	20	10	-	-	1 ^a	-	-	-	-
Dominican Republic.....	166	332	664	166	166	-	2 000	10	20	-	-	-	-	-	-	-	-
Ecuador.....	206	412	824	206	206	151	50 000	10	20	-	-	-	1 ^a	-	-	-	-
El Salvador ^b	230	476	952	238	238	30	10 000	10	20	-	-	300	1 ^a	-	-	-	-
Guatemala ^b	330	500	1 000	250	255	24	25 000	10	20	1	1 340	-	1 ^a	-	-	-	-
Haiti.....	341	682	1 364	341	341	-	-	-	-	-	-	-	2 ^a	-	-	-	-
Honduras ^b	165	330	660	165	165	10	10 000	10	20	-	70	2 835	-	-	-	-	-
Mexico.....	-	-	-	-	-	75	250 040	-	-	-	-	-	-	-	-	-	-
Nicaragua ^b	117	234	468	117	117	-	10 000	10	20	-	22 680	-	1 ^a	-	-	-	-
Panama.....	137	274	548	137	137	50	10 000	20	20	1	35	-	-	-	-	-	-
Paraguay.....	174	808	408	102	773	40	20 000	18	20	-	-	-	2 ^a	-	-	-	-
Peru.....	618	1 236	3 672	368	668	200	75 000	10	20	-	-	-	-	1 ^c	38 877	7 533	-
British Guiana.....	36	72	144	96	36	-	-	-	-	-	-	-	-	-	-	-	-
British Honduras.....	38	38	76	19	19	10	900	10	20	-	-	-	1 ^a	-	-	-	-
Dominica.....	-	-	-	-	-	-	130	-	-	-	-	-	1 ^d	-	-	-	-
Grenada.....	-	-	-	-	-	-	120	-	-	-	-	-	-	-	-	-	-
Jamaica.....	25	200	400	194	209	-	7 500	10	20	-	-	-	1 ^a	-	-	-	210 000
St. Lucia.....	-	-	-	-	-	-	110	10	20	-	-	-	1 ^a 2 ^d	-	-	-	-
Surinam.....	5	10	20	5	5	-	550	10	20	-	-	-	1 ^a	4 ^c	-	-	-
Trinidad and Tobago.....	-	-	-	-	-	-	1 150	10	20	-	-	-	-	-	-	-	-
Total.....	2 638	5 784	11 360	2 444	3 823	1 175	677 000	238	420	84	24 125	3 135	21	5	38 877	7 533	210 000

- None.

- (a) Station wagons. (b) Owing to the change from Dieldrin to DDT in spraying operations, the protective equipment has been transferred to other projects.
(c) Marine motors. (d) Motorcycles.

Table 22 summarizes the direct contributions of international organizations and ICA in terms of dollar expenditure on personnel, equipment, supplies, fellowships, etc. The World Health Organization funds (from UN/TA) are expected to remain fairly constant for 1960-1961. Expenditures from the Special Malaria Fund of the Pan American Health Organization have increased. However, the figures shown represent expenditures only in country projects. Inter-country, Regional and Headquarters expenditures are not included. UNICEF contributions to the malaria eradication program are shown by year of implementation, and are expected to remain fairly constant during the period 1960-1961. It should be noted that the decline in ICA contributions from 1960 to 1961 estimated level arise principally from a decreased contribution to Brazil. This came about because of the delay in commencing eradication operations in certain States of Brazil, and it is understood that the needed funds will be forthcoming when operations start in those states.

In conclusion, it should be emphasized that the level of contribution of the international agencies and ICA is the result of cooperative planning to meet the needs of malaria eradication in the hemisphere. The Pan American Health Organization, in its dual role as an inter-American health agency and the American Regional Office of the World Health Organization, is in constant consultation with both UNICEF and ICA on technical and financial aspects of the eradication campaign, and a continuous interchange of views is also encouraged between the three organizations and the National Malaria Eradication Services. The successes registered to date in the fight against malaria in the Americas are due in no small part to the spirit of cooperation that perfuses the eradication program at the national and international level.

Table 22
INTERNATIONAL CONTRIBUTIONS TO MALARIA ERADICATION PROGRAMS IN THE AMERICAS, 1959-1961
(U. S. dollars)

Country or other political unit	Date of initiation of program	1959				1960				1961 (estimated)			
		PAHO/SMF (a)	WHO/TA	UNICEF ^b	ICA(USA) (fiscal year) ^c	PAHO/SMF (a)	WHO/TA	UNICEF ^b	ICA(USA) (fiscal year) ^c	PAHO/SMF (a)	WHO/TA	UNICEF ^b	ICA(USA) (fiscal year) ^c
Argentina.....	Sept. 1959	13 691	-	230 000	-	7 543	-	80 000	-	32 818	-	45 000	-
Bolivia.....	Sept. 1958	59 754	11 931	143 000	437 000 ^d	83 868	18 033	137 000	420 000 ^d	98 096	16 351	60 000	420 000 ^d
Brazil ^e	Jan. 1959	110 693	-	-	2 577 000	18 284	-	-	4 000 000	107 189	-	-	-
São Paulo.....	Sept. 1958	39 246	-	-	-	56 119	-	-	-	77 488	-	-	213 000
Colombia.....	Sept. 1958	112 960	-	755 000	366 000	161 691	-	686 000	460 000	164 873	-	680 000	430 000
Costa Rica.....	July 1957	27 486	-	42 000	-	37 316	-	57 000	-	51 277	-	49 000	-
Cuba.....	1960	31 470	-	-	-	25 749	-	-	-	76 522	-	-	-
Dominican Republic...	July 1958	76 920	-	103 000	-	60 897	-	109 000	-	68 644	-	53 000	-
Ecuador.....	Mar. 1957	52 411	23 494	148 000	100 000	62 381	17 559	218 000	200 000	94 427	16 510	252 000	340 000
El Salvador.....	July 1956	47 973	7 955	249 000	-	48 647	-	291 000	-	119 909	-	270 000	-
Guatemala.....	Aug. 1956	44 047	24 360	158 000	350 000	73 305	-	215 000	485 000	95 266	-	304 000	485 000
Haiti.....	Sept. 1958	151 263	1 329 ^f	-	-	35 366 ^f	-	-	-	97 690	-	180 000	740 000
Honduras.....	Jan. 1958	25 134	25 825	98 000	550 000	53 636	-	195 000	345 170	76 633	-	190 000	230 000
Mexico.....	Jan. 1957	38 887	56 619	2 420 000	-	43 186	51 278	1 005 000	-	97 256	61 440	1 000 000	-
Nicaragua.....	Nov. 1958	44 236	-	247 000	200 000	51 679	-	180 000	200 000	79 350	-	163 000	300 000
Panama.....	Aug. 1957	26 632	21 985	146 000	-	54 437	-	100 000	-	89 776	-	210 000	-
Paraguay.....	Oct. 1957	14 102	17 943	86 000	75 000	49 666	-	125 000	50 000	76 834	-	224 000	65 000
Peru.....	Nov. 1957	72 370	23 148	500 000	-	68 837	23 403	314 000	100 000	78 524	23 850	261 000	-
Venezuela.....	1945	1 291	-	-	-	643	-	-	-	-	-	-	-
British Guiana.....	Jan. 1947	5 043 ^g	-	-	-	6 880	-	-	-	9 432	-	8 000	-
British Honduras.....	Feb. 1957	24 126	-	1 300	-	30 504	-	35 000	-	27 764	-	18 000	-
Dominica.....	June 1959	5 934	-	11 500	-	6 200	-	-	-	6 500	-	2 000	-
French Guiana.....	May 1948 ^h	-	-	-	-	-	-	-	-	-	-	-	-
Grenada.....	Feb. 1957	5 053	-	9 500	-	6 100	-	-	-	6 500	-	-	-
Guadeloupe.....	Nov. 1955	-	-	-	-	-	-	-	-	-	-	-	-
Jamaica.....	Jan. 1958	52 270	-	130 000	15 000	75 038	-	178 000	15 000	61 155	-	42 000	15 000
Panama Canal Zone...	....	-	-	-	-	-	-	-	-	-	-	-	-
St. Lucia.....	July 1956	10 711	-	2 000	-	10 703	-	-	-	11 489	-	-	-
Surinam.....	May 1958	33 860	-	40 500	-	36 904	-	36 000	-	60 155	-	25 000	-
Trinidad and Tobago..	Jan. 1958	18 146	-	31 000	-	3 972	-	-	-	8 433	-	69 000	-
Total.....		1 145 709	214 589	5 666 000	4 670 000	1 169 551	110 273	3 961 000	6 275 170	1 774 000	118 151	4 105 000	3 238 000

... No information.

- None.

(a) Excluding inter-country project and headquarters expenses. (b) UNICEF contributions are listed under year of implementation even though allocation may have been made in a previous year. (c) ICA fiscal year does not necessarily coincide with fiscal years of the countries shown.

(d) Counterpart funds. (e) Excluding São Paulo State. (f) Program temporarily interrupted. (g) Coastal area only. (h) Reimportation in 1954, spraying recommenced.